C H A P T E R **6**

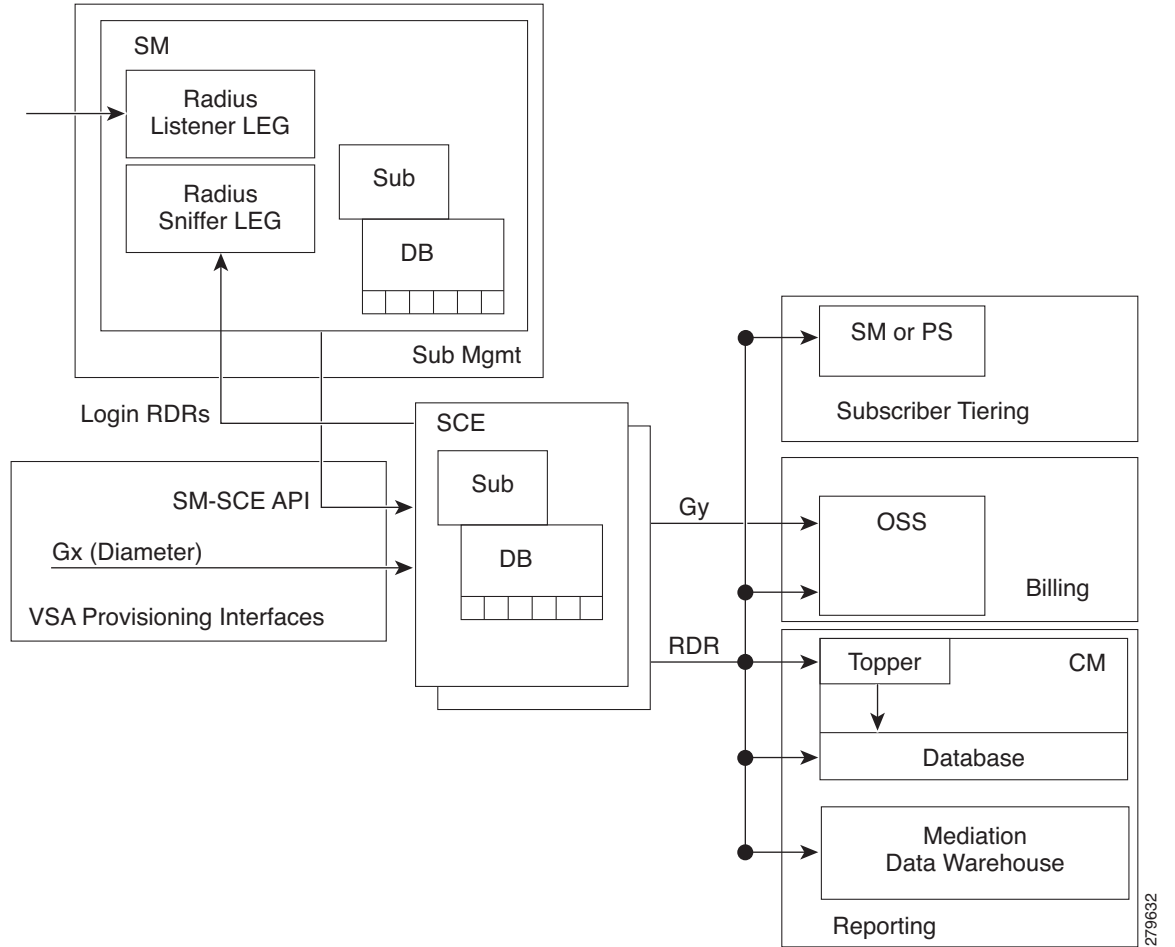# Capturing and Reporting Subscriber Attributes

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Introduction

Vendor Specific Attributes (VSA) are RADIUS or Diameter attributes that are sent mostly in mobile environments. They can be captured from the traffic processed by the SCE and then reported to the billing server. They can also be sent to the Collection Manager in various RDRs to be used to generate a number of common mobile reports.

Figure 6-1 shows a high-level diagram of the Cisco Service Control mobile solution including capturing and reporting subscriber attributes.

Figure 6-1   System Block Diagram

Capturing Subscriber Attributes

VSAs can be captured by using either of the following entities:

- The Cisco SCE platform
- The RADIUS Login Event Generator (LEG)

Only the VSAs that you select are captured. You can choose which attributes are relevant, and store and process only those attributes. You can select a maximum of 20 attributes from the list of available VSAs. The list of attributes to capture can be modified while the system is running.

The following data structures are used to capture and store VSAs:

- Dictionary table—A table that contains all the supported attributes, with the following information for each attribute:
  - Attribute name
  - Protocol (RADIUS/Diameter/GTP-C)
  - Input type
  - Type used in the database (usually the same as input type)
  - Attribute ID
  - VSA (yes/no)
  - Vendor ID (if used by VSA)

  The local attribute table reads the attribute details from this table.

- Local attribute table—A global table (for all the subscribers and all the packages) that holds all the details for the selected attributes and parameters.

  The Gx interface, Gy interface, and the subscriber database use this table to obtain information for each configured attribute.

- Subscriber attribute database— A table of captured attributes per subscriber. A subscriber attribute database is maintained in both the SCE and the SM. Information captured by either entity is provisioned from that entity to the other entity so that the subscriber attribute database is always current in both the SCE and the SM.

Constraints and Limitations

- Only one session per subscriber is supported. A subscriber with multiple Access Point Names (APN) or multiple devices used at the same time can be separated into separate subscribers by adding the APN or device into the subscriber ID.
- Scale limitations—When supporting VSAs, the system would support approximately 256K subscribers per SCE platform.
- Up to 20 subscriber attributes can be selected.

Note By default, the SCE platform converts the **3GPP-SGSN-Address-Code-6** VSA sent by Gx to **3GPP-SGSN-Address** VSA. Therefore, when using the SGSN address, both these attributes should be selected. The same behavior applies to the GGSN address VSA pair (**3GPP-GGSN-Address-Code-7** and **3GPP-GGSN-Address)**.

Capturing Subscriber Attributes Using the SCE

Capturing Subscriber Attributes

Attributes are received only from the Gx interface. The attributes selected by the CLI command are stored in the local attribute table and also copied to the SM. Any time one of these attributes is input for a subscriber by Gx, it is stored in the subscriber database for that subscriber.

When an attribute is deleted from the attribute table, all the entries for that attribute are also removed from the subscriber database.

Transmitting Subscriber Attributes

Attributes are transmitted only on the Gy interface. Three modes of output are supported:

- Always—Output the subscriber attributes on all the messages.
- On-change—Output the subscriber attributes any time a change is detected in at least one of the attributes.
- On-initial (default)—Output the subscriber attributes only on the first Gy message.

Subscriber Attribute CLI Commands

Table 6-1 lists the CLI commands used to configure and monitor the capture and sending of subscriber attributes.

Table 6-1   Subscriber Attribute CLI Commands

CLI Commands	Description
sub-attribute add-attribute <a*ttribute-name*>	Configure the capture of the specified attribute. Up to 20 subscriber attributes can be captured. The attribute name is selected from the list of VSAs with auto completion.
no sub-attribute <*attribute-name*>	Stop capturing the specified attribute and remove the entry from the attribute table. Also remove entries for the specified attribute from the subscriber database.
no sub-attribute all	Stop capturing all the VSA attributes and clear both the attribute table and the subscriber database.
show sub-attribute dictionary <*attribute-name*>	Show the entry in the dictionary table for the specified attribute.
show sub-attribute dictionary	Show the complete dictionary table.
show sub-attribute configuration	Show the attribute table, which contains the attributes currently selected to be captured, as well as the information from the attribute dictionary for each one.

Table 6-1   Subscriber Attribute CLI Commands (continued)

CLI Commands	Description
diameter Gy send-attributes (on-initial | on-change | always)	Configure when to transmit subscriber attributes.
no diameter Gy send-attributes	Disable transmitting subscriber attributes.

Example for showing the VSA dictionary:

show sub-attribute dictionary

```
    VSA name                        Vendor-ID  Attr-ID  Data Type    Protocol Interfaces
----------------------------------------------------------------------------------------
Acct-Multi-Session-ID                  -         50     UTF8String   Radius
Acct-Session-ID                        -         44     UTF8String   Radius
Acct-Session-Time                      -         46     Uint32       Radius
Called-Station-ID                      -         30     OCTETString  Radius
Calling-Station-ID                     -         31     OCTETString  Radius
Class                                  -         25     OCTETString  Radius
CUI                                    -         89     UTF8String   Diameter
Framed-IP-Address                      -          8     Address      Radius
NAS-Identifier                         -         32     OCTETString  Radius
NAS-IP-Address                         -          4     Address      Radius
NAS-Port-Type                          -         61     Uint32       Radius
User-Name                              -          1     OCTETString  Radius
User-Equipment-Info-Type               -        459     Uint32       Diameter
User-Equipment-Info-Value              -        460     OCTETString  Diameter
3GPP-Charging-Characteristics        10415       13     UTF8String   Diameter
3GPP-Charging-Gateway-Address        10415        4     Address      Diameter
3GPP-Charging-ID                     10415        2     Uint32       Diameter
3GPP-GGSN-Address-Code-7             10415        7     Address      Diameter
3GPP-GGSN-Address                    10415      847     Address      Diameter
3GPP-GGSN-MCC-MNC                    10415        9     UTF8String   Diameter
3GPP-GPRS-Negotiated-QoS-Profile     10415        5     UTF8String   Diameter
3GPP-IMEISV                          10415       20     UTF8String   Diameter
3GPP-IMSI                            10415        1     UTF8String   Diameter
3GPP-MS-Timezone                     10415       23     OCTETString  Diameter
3GPP-NSAPI                           10415       10     UTF8String   Diameter
3GPP-PDP-Type                        10415        3     Uint32       Diameter
3GPP-RAT-Type                        10415       21     OCTETString  Diameter
3GPP-Selection-Mode                  10415       12     UTF8String   Diameter
3GPP-SGSN-Address-Code-6             10415        6     Address      Diameter
3GPP-SGSN-Address                    10415     1228     Address      Diameter
3GPP-SGSN-MCC-MNC                    10415       18     UTF8String   Diameter
3GPP-User-Location-Info              10415       22     OCTETString  Diameter
CG-Address                           10415      846     Address      Diameter
WiMax-Active-Time                    24757       39     Uint32       GTP-C
WiMax-BSID                           24757       46     UTF8String   GTP-C
Sub-OS-Info-Map                          9     1071     UTF8String   Diameter
3GPP2-Home-Agent-IP-Address           5535        7     Address      Diameter
3GPP2-ESN                             5535       52     OCTETString  Diameter
3GPP2-MEID                            5535      116     OCTETString  Diameter
3GPP2-BSID                            5535       10     OCTETString  Diameter
3GPP2-IP-Technology                   5535       22     Uint32       Diameter
3GPP2-PCF-IP-Address                  5535        9     Address      Diameter
```

Example for selecting a VSA to capture and then showing the attribute configuration.

```
sub-attribute add-attribute 3GPP-Charging-Characteristics
do show sub-attribute configuration

     VSA name                         Vendor-ID  Attr-ID  Data Type   Protocol Interfaces
-------------------------------------------------------------------------------------------
3GPP-Charging-Characteristics        10415      13       UTF8String  Diameter  Gx
```

Capturing Subscriber Attributes Using the RADIUS LEG

A LEG usually listens to signaling data and provisions subscriber-based attributes. The SCE supports RADIUS Listener and Sniffer LEGs. The subscriber attributes are configurable and customizable in the SM. The LEGs are responsible for providing the configured data to the SM and the SM provisions the data to the SCE platform.

RADIUS Sniffer LEG

Capturing subscriber attributes using the RADIUS sniffer LEG works as follows:

1. The user configures the set of subscriber attributes to extract (up to 20), which are provisioned to the RADIUS sniffer module in the SCE.

2. When the SCE detects a RADIUS accounting message, it extracts the attributes from the message and sends it to the SM in the RADIUS/Login RDR.

3. The RADIUS Sniffer LEG in the SM receives the RADIUS RDR and stores the attribute values in its local database.

4. The SM updates the subscriber attribute table in the SCE with the subscriber attributes learned.

Note   The RADIUS sniffer module can be in a different SCE platform from the one that processes the traffic.

RADIUS Listener LEG

Capturing subscriber attributes using the RADIUS Listener LEG works as follows:

1. The user configures the set of subscriber attributes to extract (up to 20).

2. The RADIUS Listener LEG listens to RADIUS accounting messages received in the SM and extracts the attributes configured.

3. The RADIUS Listener LEG in the SM stores the attribute values in its local database.

4. The SM updates the subscriber attribute table in the SCE with the subscriber attributes learned.

Configuring the Attributes to Be Captured

You specify which subscriber attributes to capture by editing the relevant configuration file:

- RADIUS Listener LEG configuration file is at **sm-inst-dir/sm/server/root/config/p3sm.cfg**

- RADIUS Sniffer LEG configuration file is at **sm-inst-dir/sm/server/root/config/rad_snif.cfg**

Note   For more information about configuring the RADIUS LEGs, see the *Cisco Service Control SM LEGs User Guide*.

For each attribute you want the LEG to capture, add a section to the appropriate configuration file, as follows:

[Radius.Field.Attribute_name]

radius_attribute = <ID> [(<radius_attribute_vendor_id>, <radius_sub_attribute>)]

radius_attribute_type = <type>

Table 6-2   [Radius.Field.] Field Descriptions

Field	Description
Attribute_name	Name of the attribute to be captured.
ID	Attribute ID.
	If the attribute is a VSA, the ID is set to 26 and the attribute vendor ID and subattribute are set as well.
	If the attribute is not a VSA, enter the ID (there is no default). The attribute vendor ID and sub-attribute fields are not used.
radius_attribute_vendor_id	Set when the attribute is a VSA.
radius_sub_attribute	Set when the attribute is a VSA.
type	Attribute type. Possible values are string or integer. There is no default value.

This example shows how to edit the configuration file to add the 3GPP-SGSN-Address (VSA) attribute:

```
[Radius.Field.3GPP-SGSN-Address]
radius_attribute = 26(10415;6)
radius_attribute_type = integer
```

Provisioning the SCE with SM Subscriber Attributes

When the SM (RADIUS LEG) captures the subscriber attributes, it provisions them to the SM over the SM-SCE API. The SM provides a list of attributes with the following information for each attribute:

- Attribute code. If attribute is a VSA, this is the VSA code.
- Flags. One bit indicates whether this is a VSA.
- Attribute vendor ID (if attribute is a VSA).
- Attribute-type
- Attribute length
- Attribute value

If the SM attribute definition (type, size, and so on) does not match the SCE attribute definition, the attribute is discarded, and an appropriate error message is sent.

Note The SCE copies into its local database only the attributes from the 20 attributes configured in the SCE and present in the SCE database, regardless of what attributes are defined to be reported in the RDRs.

Generating Mobile Reports

Subscriber attributes that have been captured by either the SCE or the SM can be used to generate mobile reports. The subscriber attributes are appended to the RDRs and sent to the CM, where the reports are generated.

Use a mediation data warehouse device for full flexibility and long period granular data.

Appending Subscriber Attributes to SCE RDRs

SCE provides subscriber attributes as part of the following RDRs:

- Subscriber Usage RDR (TAG: 4042321920)
- HTTP Transaction Usage RDR (TAG: 4042323004)
- Video Transaction Usage RDR (TAG: 4042323072)

You can enable or disable reporting subscriber attributes in these RDRs either from the SCA BB console or by a CLI command.

Table 6-3   Subscriber Attributes Reported in RDRs

Attribute	Type	Max Size [B]	Attribute ID	VSA	Vendor-ID
Acct-Multi-Session-ID	String	32	50	N	
Acct-Session-ID	String	253	44	N	
Framed-IP-Address	Address	4	8	N	
Called-Station-ID	String	253	30	N	
3GPP-IMEISV	String	16	20	Y	10415
3GPP-IMSI	String	15	1	Y	10415
3GPP-RAT-Type	String	1	21	Y	10415
3GPP-SGSN-Address	Address	4	6	Y	10415
3GPP-SGSN-MCC-MNC	String	6	18	Y	10415
3GPP-User-Location-Info	String	253	22	Y	10415
WiMax-BSID	String	30	46	Y	24757
3GPP2-MEID	String	—	116	Y	5535
3GPP2-ESN	String	—	52	Y	5535
3GPP2-PCF-IP-Address	Address	4	9	Y	5535
3GPP2-Home-Agent-IP-Address	Address	4	7	Y	5535

General Information:

- The SCE reports in the RDRs only the attributes which exist in its local database.
- If an attribute defined for the RDR is not in the database, the attribute is appended to the RDR with a NULL value.
- The attributes structure in the RDR is constant, with each attribute always at the same location, and appearing in the order that they appear in Table 6-3.
- The format of the attributes in the RDR is the same as the "type" specified in the RADIUS attribute (integer or string).

Control Field

A control field is defined in the RDR providing the following information:

- Indicating that subscriber attributes are appended
- SPECIFYING which of the attributes in the message are valid

The control field comes after the original RDR parameters and before the first VSA data.

Each bit in the control field corresponds to one of the subscriber attributes listed in Table 6-3. Bit "0" corresponds to Acct-Multi-Session-ID, bit "1" corresponds to Acct-Session-ID, and bit "10" corresponds to WiMax-BSID.

Value 0 means that the data is not present, and value 1 means that data pertaining to the corresponding VSA is present and valid. See the control fields provided in the two examples in "Examples: Reporting the Subscriber Attributes in Enabled RDRs" section on page 6-9.

Configuring Reporting Subscriber Attributes in RDRs from the SCE

Table 6-4   Reporting Subscriber Attributes in RDR CLI Command

CLI Commands	Description
rdr-formatter sub-attribute send-attributes	Enable reporting subscriber attributes in RDRs.
no rdr-formatter sub-attribute send-attributes	Disable reporting subscriber attributes in RDRs

Examples: Reporting the Subscriber Attributes in Enabled RDRs

Subscriber usage RDR with all 15 VSA fields presented:

```
#4042321920:
rdrParty        // Subscriber ID
10              // Package ID
1               // Service Usage counter ID
0               // Breach State
1               // Reason
60              // Configured Duration
60              // Duration
1275330073      // End Time
100             // Upstream Volume
100             // DownStream Volume
5               // Sessions
5               // Seconds
1               // Up VLink
1               // Down VLink
32767           // Control Field (0b111111111111111) (15 fields enabled)
Subscriber1     // Acct-Multi-Session-ID   (bit 0)
lkjhgfdsa       // Acct-Session-ID         (bit 1)
```

```
10.1.2.3        // Framed IP Address      (bit 2)
abcdefg         // Called Station ID      (bit 3)
000000000000    // 3GPP-IMEISV            (bit 4)
000000100000    // 3GPP-IMSI             (bit 5)
700300100050    // 3GPP-RAT-Type          (bit 6)
10.1.1.1        // 3GPP-SGSG-Address      (bit 7)
mhutexcfvkli    // 3GPP-SGSN-MCC-MNC      (bit 8)
abc             // 3GPP-User-Location-Info (bit 9)
3p3p3           // WiMax-BSID             (bit 10)
A0000020D92AAA  // 3GPP2-MEDI                (bit 11)
80dc47ed        // 3GPP2-ESN                 (bit 12)
10.222.202.5    // 3GPP2-PCF-IP-Address      (bit 13)
68.28.57.76     // 3GPP2-home-Agent-IP-Address (bit 14)
```

Subscriber usage RDR with partial VSA fields presented:

#4042321920:

```
rdrParty        // Subscriber ID
10              // Package ID
1               // Service Usage counter ID
0               // Breach State
1               // Reason
60              // Configured Duration
60              // Duration
1275330073      // End Time
100             // Upstream Volume
100             // DownStream Volume
5               // Sessions
5               // Seconds
1               // Up VLink
1               // Down VLink
27541            // Control Field (0b110101111111001 - Acct-Session-ID, Framed IP Address,
                    WiMax-BSID, and 3GPP2-ESN are not valid)
Subscriber1     // Acct-Multi-Session-ID  (bit 0)
                // Acct-Session-ID        (bit 1)
0               // Framed IP Address      (bit 2)
abcdefg         // Called Station ID      (bit 3)
000000000000    // 3GPP-IMEISV            (bit 4)
000000100000    // 3GPP-IMSI             (bit 5)
700300100050    // 3GPP-RAT-Type          (bit 6)
10.1.1.1        // 3GPP-SGSG-Address      (bit 7)
mhutexcfvkli    // 3GPP-SGSN-MCC-MNC      (bit 8)
abc             // 3GPP-User-Location-Info (bit 9)
                // WiMax-BSID             (bit 10)
A0000020D92AAA  // 3GPP2-MEDI                (bit 11)
                // 3GPP2-ESN                 (bit 12)
10.222.202.5    // 3GPP2-PCF-IP-Address      (bit 13)
68.28.57.76     // 3GPP2-home-Agent-IP-Address (bit 14)
```

Configuring Reporting Subscriber Attributes in RDRs from the SCA BB Console

You can enable appending VSA fields in RDRs from the SCA BB console.

Step 1   Choose **Configuration > Policies > System Settings > Advanced Options**.

Step 2   Click **Advanced Service Configuration Options**.

Step 3   Scroll down to the **Reporting** section.

Step 4   Set the value of 'Enable VSA Fields for Subscriber, HTTP Transaction, and Video Transaction RDRs' (first line) to '**True**'. (See Figure 6-2.)

Figure 6-2   ***Enabling VSA Fields in RDRs***
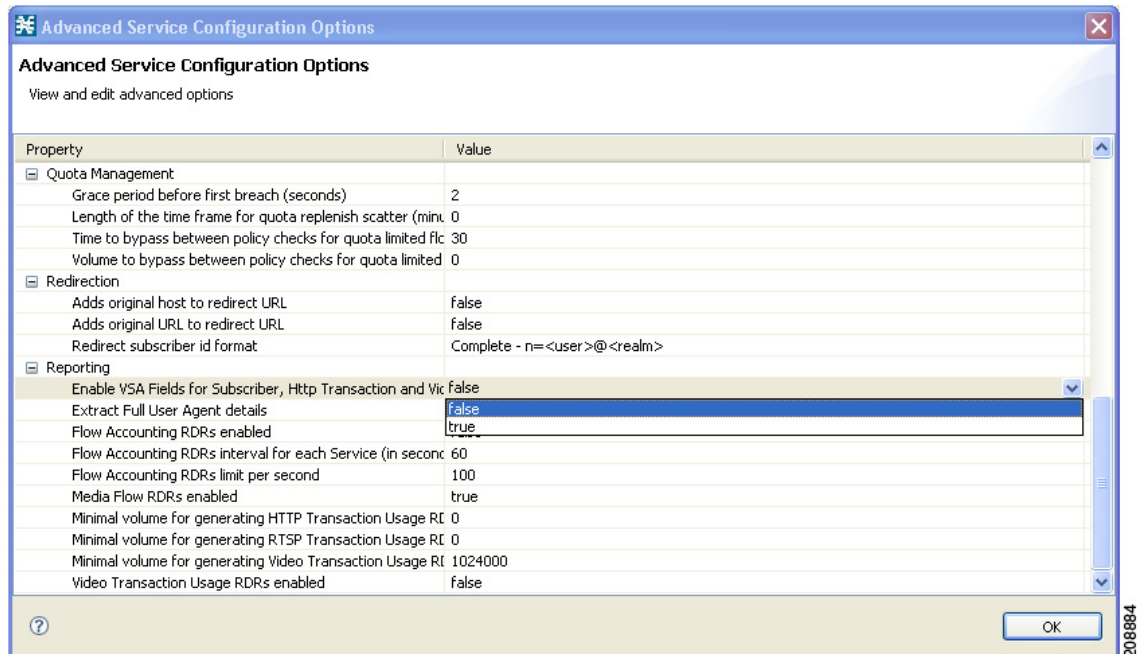
Step 5   Click **OK**.

Step 6   Click **OK** in the System Settings dialog box.

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Supported Mobile Reports

The following information is derived from specific attributes sent to the CM in RDRs and used to generate mobile reports:

- Device type:
  - RADIUS device type—Located as part of the 3GPP-IMEI (RADIUS attribute 20)
  - Diameter device type—Encoded in the User-Equipment-Info AVP (code 458)
- APN—Mapped from the RADIUS/Diameter Called-Station-ID field
- User location—Mapped from 3GPP-User-Location-Information
- Network type—Mapped from 3GPP-RAT-Type

Based on the above attributes, the common mobile reports are generated in the CM/Reporter (see Table 6-5). Examples of some of the reports that can be generated are displayed in the "Mobile Report Examples" section on page 6-13.

Table 6-5   *List of Mobile Reports*

Report	X	Y	Filters
Device Type Distribution (IMEI)	Device Type (IMEI)	Number of unique subscribers per device type	Time window, Top devices
Usage per device type	Device Type (IMEI)	Total usage per device	Time window, Top usage
Application usage for specific device	Time	Application usage	Time window
Usage Per Network Type	Network Type	Total usage per network	Time window, Top networks
Application usage for specific network type	Time	Application usage	Time window
Usage per APN	APN Name	Total usage per APN	Time window, Top APNs
Application Usage for Specific APN	Time	Application usage	Time window
Number of subscribers per location	Time	Number of subscribers	Time-based
Usage per location	Location ID	Total usage for location	Time-based, Top locations
Usage per SGSN	SGSN	Total usage for SGSN type	Time-based, Top SGSNs

Mobile Report Examples

Device Type Distribution

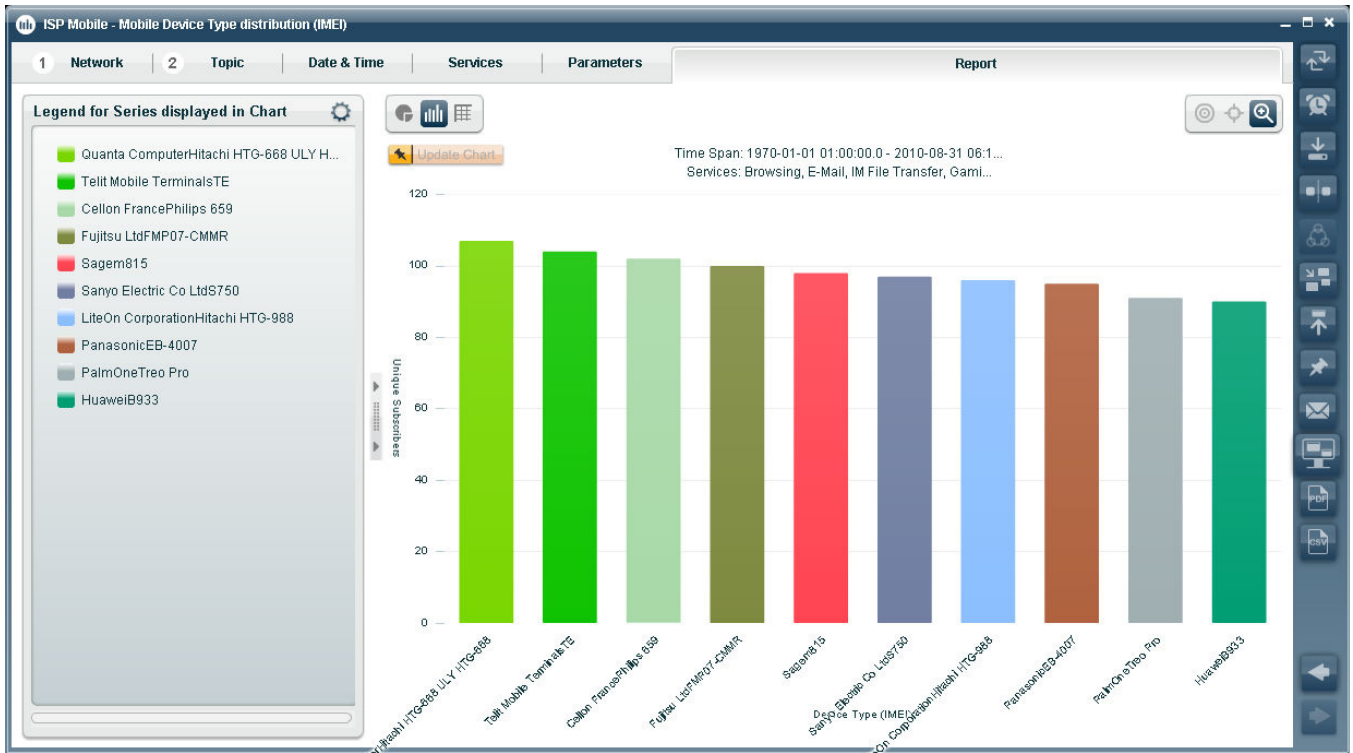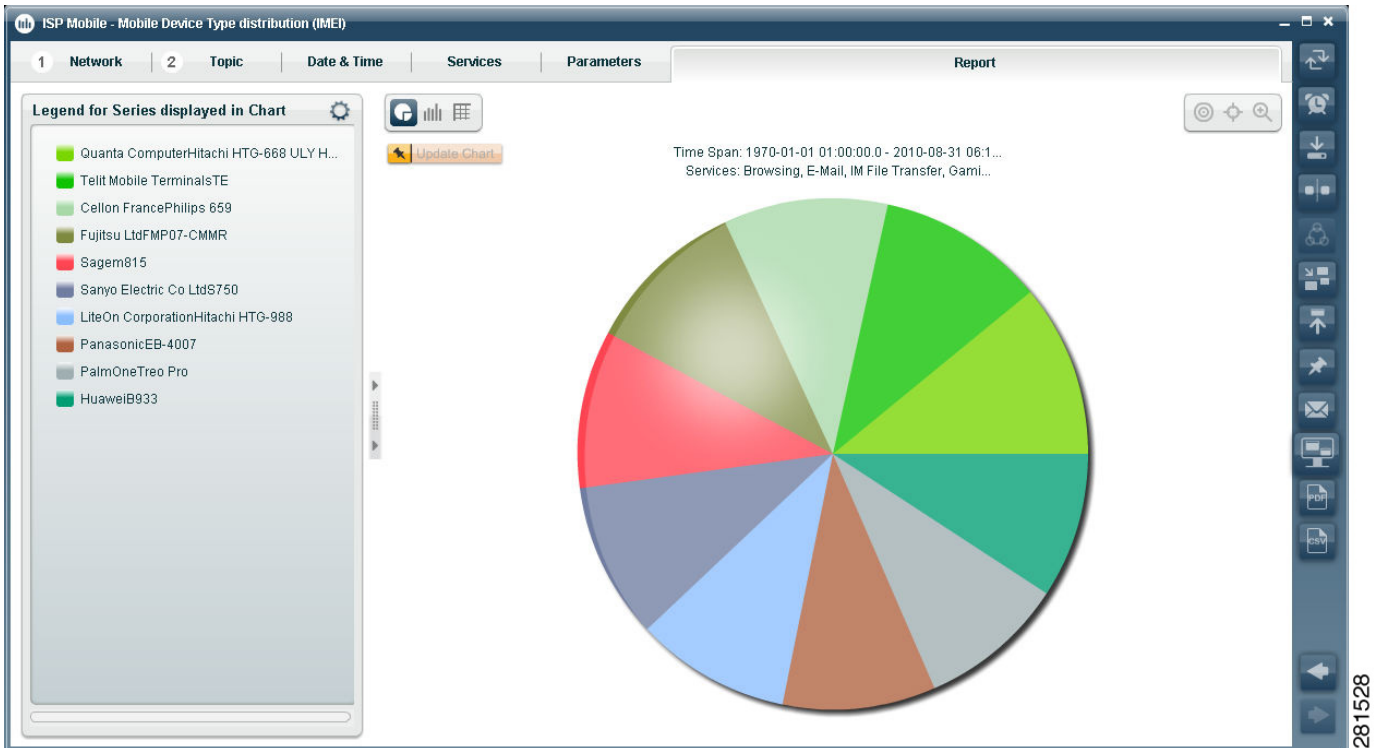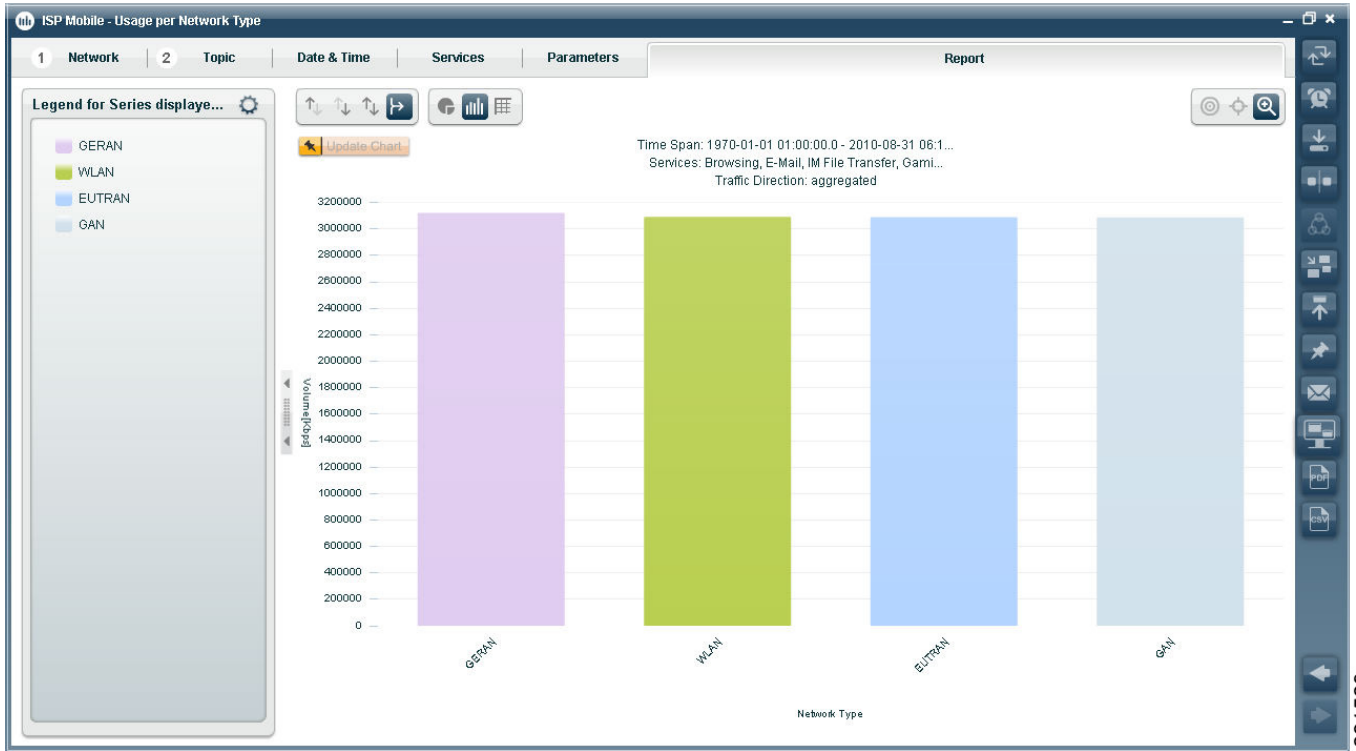*Figure 6-3   Device Type Distribution by Unique Subscribers (bar)*

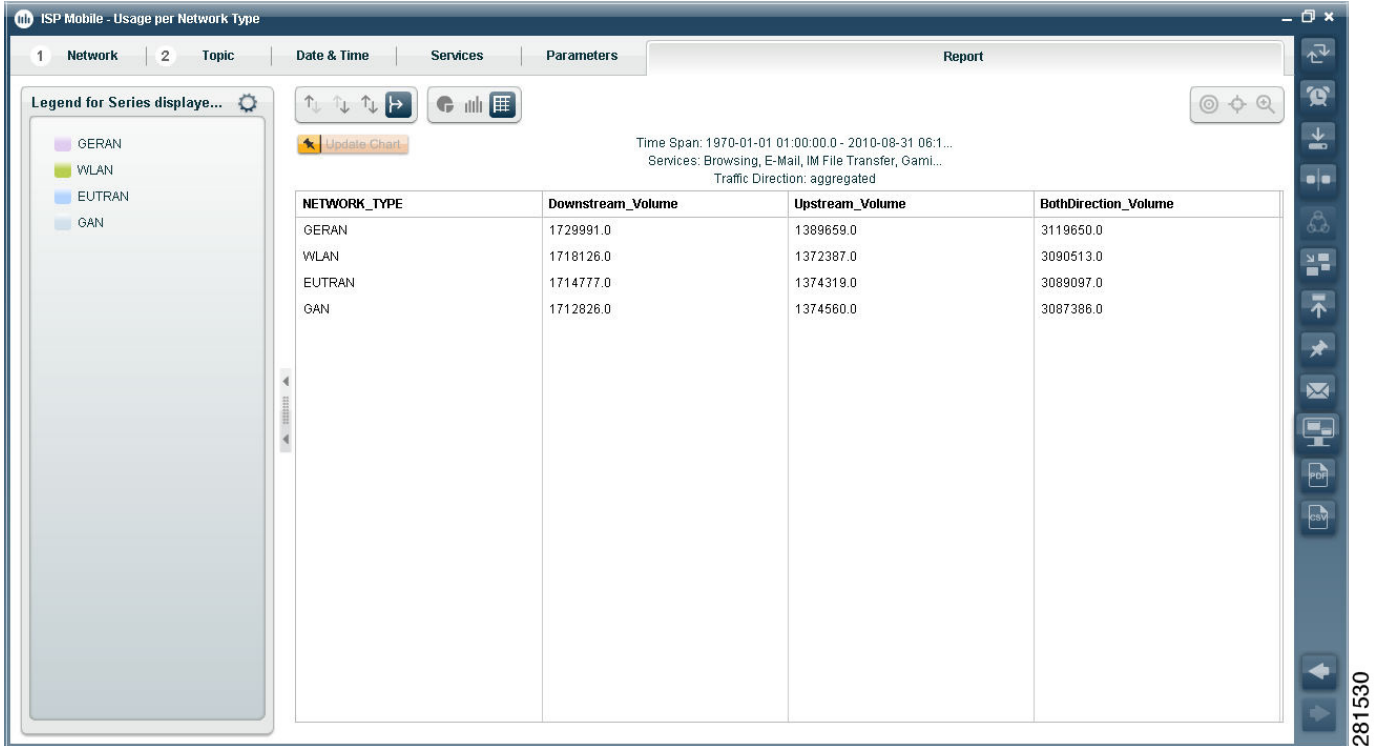*Figure 6-4   Device Type Distribution by Unique Subscribers (pie)*

Usage Per Network Type

Figure 6-5   *Usage per Network Type (bar)*
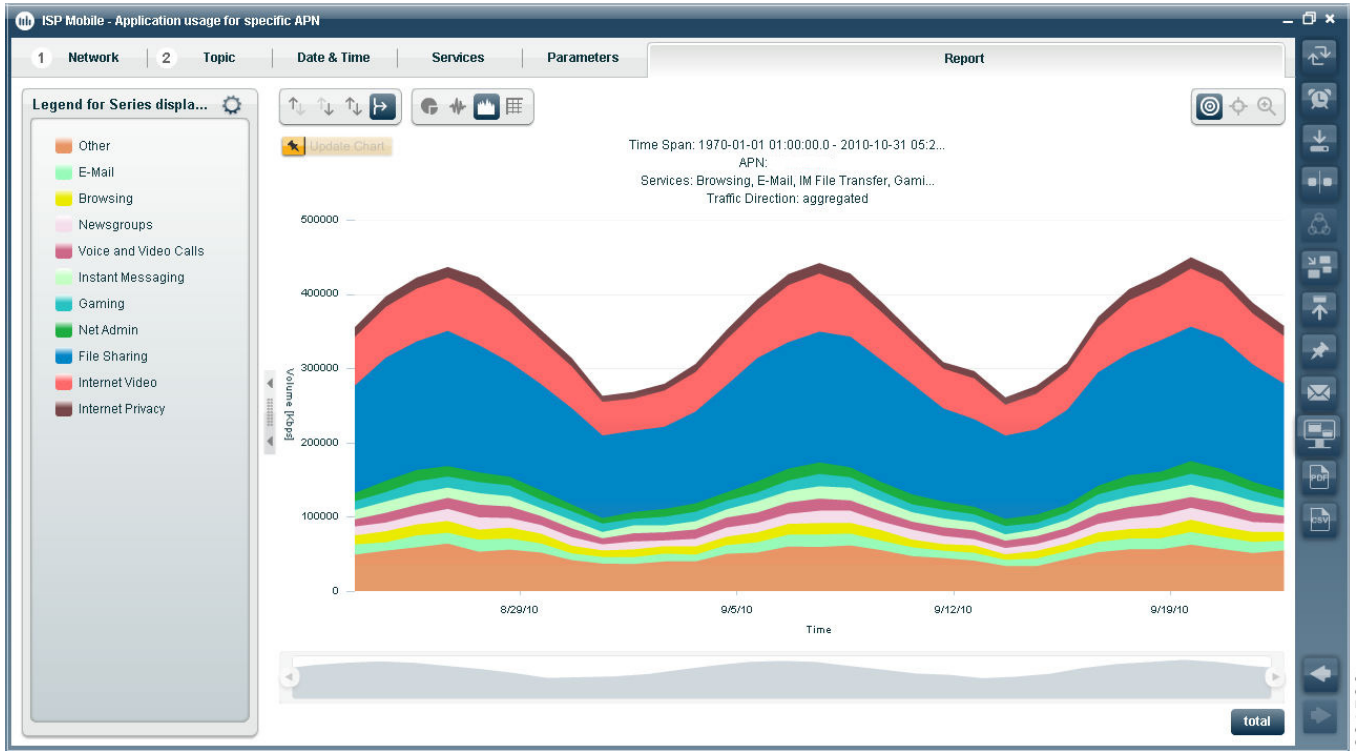
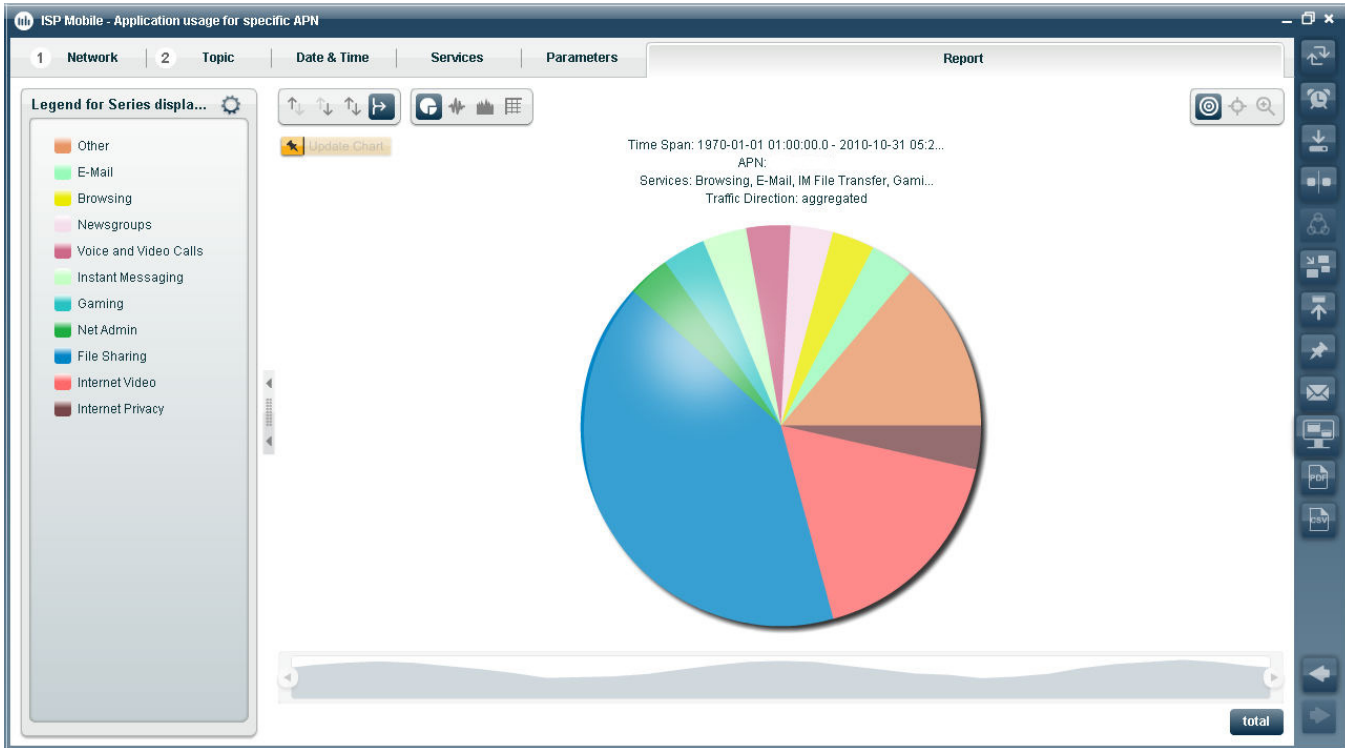*Figure 6-6*   *Usage per Network Type (table)*

Application Usage for Specific APN

Figure 6-7   *Application Usage for Specific APN (stacked area)*

Figure 6-8   *Application Usage for Specific APN (pie)*