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## Mobile Operator Service Package Case Study

This case study describes how mobile operators can implement innovative revenue-generating application-based data services as an alternative to data access quotas or speed. It will show how service providers can create value-added data services that target average customers' needs, thus maximizing revenue per data bit. As mobile service has evolved from traditional voice and messaging, more of what customers demand is the application access that data enables. Smart phones—such as the Blackberry, Android and especially the iPhone—have caused the mobile application access market to explode. Sandvine's Usage Management product enables development of application-access-oriented value-added services compared to the traditional service provider data bit pipe access.

The case study presented illustrates how a Sandvine customer realized a business case with Usage Management and support from Sandvine's consulting solutions services team. The customer's business case was to price-segment the market to get better low-end subscriber penetration; this was achieved with Usage Management to offer subscribers relevant data service and develop it at correspondingly lower delivery costs to yield even better margins than high-end data access plans.

The network implementation of the customer solution is described and the integration of the solution into the existing Sandvine customer network deployment is shown. Alternative implementations are also presented.

## Sandvine Usage Management Enabled Mobile Service Creation

Usage has exploded with the advent of smart phones providing the capability of accessing many mobile applications. Additionally, the mobile service provider market has been maturing and bit pipe service has become a commodity. Consequently, service providers need to don their marketing hats and increasingly segment their markets and develop services that apply to those targets. Sandvine Usage Management provides the tools to enable service provider development of the targeted services.

Introducing wireless data access to applications like ringtone downloads has been one strategy to increase average revenue per user (ARPU). Usage Management provides the capability of furthering this strategy by monetizing popular online applications like banking, social networking and streaming video. Applications can be offered as standalone packages or in conjunction with traditional pre- or post-paid data access. Like traditional data access, application access can be offered as an unlimited or limited service within a billing period. Providing application access packages delivers value to subscribers in new ways, while also controlling the data usage cost required to provide the services. A Sandvine customer has very successfully implemented a set of application packages.

## Sandvine Customer Case Study

Figure 1 shows the recent history of service provider ARPU vs. data usage. Traditionally, voice is a low-data-usage application, with a high ARPU. With data, as can be seen in Figure 1, ARPU has decreased tremendously compared to average subscriber data usage. Technology has allowed for rapid cost reductions in delivery of data, but in spite of that, service providers have been under pressure to deliver greater value from the data pipe. Service providers have started to break the trend shown in Figure 1 by capping data usage or bandwidth delivered to customers by creating service tiers. The tiers create various levels of data usage, (e.g., 250 MB, 500 MB, 1 GB, 2 GB, etc.) bandwidth (128Kbps, 256Kbps, 512Kbps, 1Mbps, etc.) or some combination of the two. Usage Management also enables implementation of service tiering, however an alternative is service creation based on access to applications rather than on data usage or bandwidth.

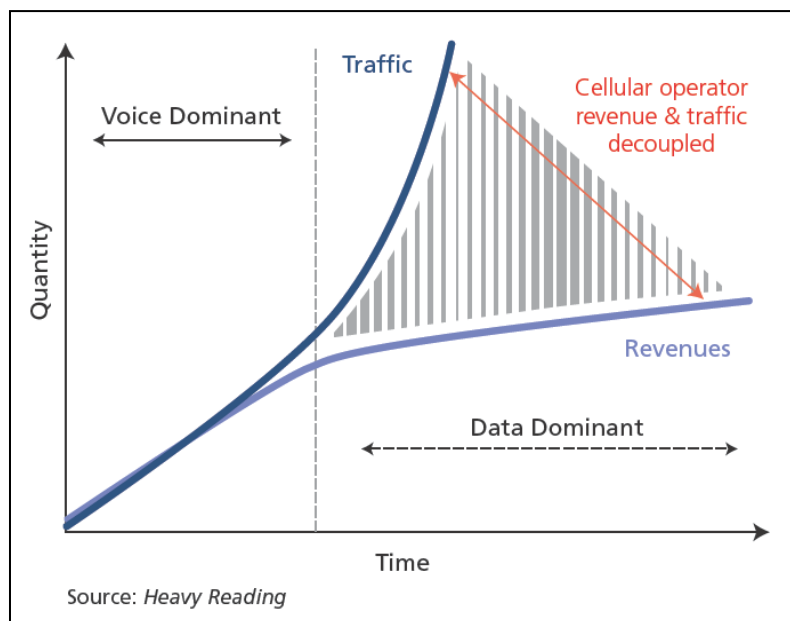


Figure 1 - Historical Wireless ARPU vs Data Usage

This alternate strategy of creating services based on access to applications is used to break the trend shown in

Figure 1 by delivering services that decouple from delivery of raw data access. With the assistance of Sandvine and Usage Management, a customer was able to create service packages that price-segmented their market to achieve higher penetration, resulting in an increase in network usage each quarter by over 200%, while delivering the service packages at a much lower cost relative to the service revenues.

Sandvine’s consulting solutions services team worked with a customer to take the application access service package concept (shown in

Figure 2) to elicit requirements for network operations and then created a PCEF policy for the five different application packages shown. The solution was then integrated in the customer’s existing network infrastructure. The Sandvine end-to-end project implementation of the customer concept resulted in the launch of a successful set of services that augmented the service provider’s offerings to medium-to-high tier and low-tier customers.

## Sandvine Customer Application Packages Ad

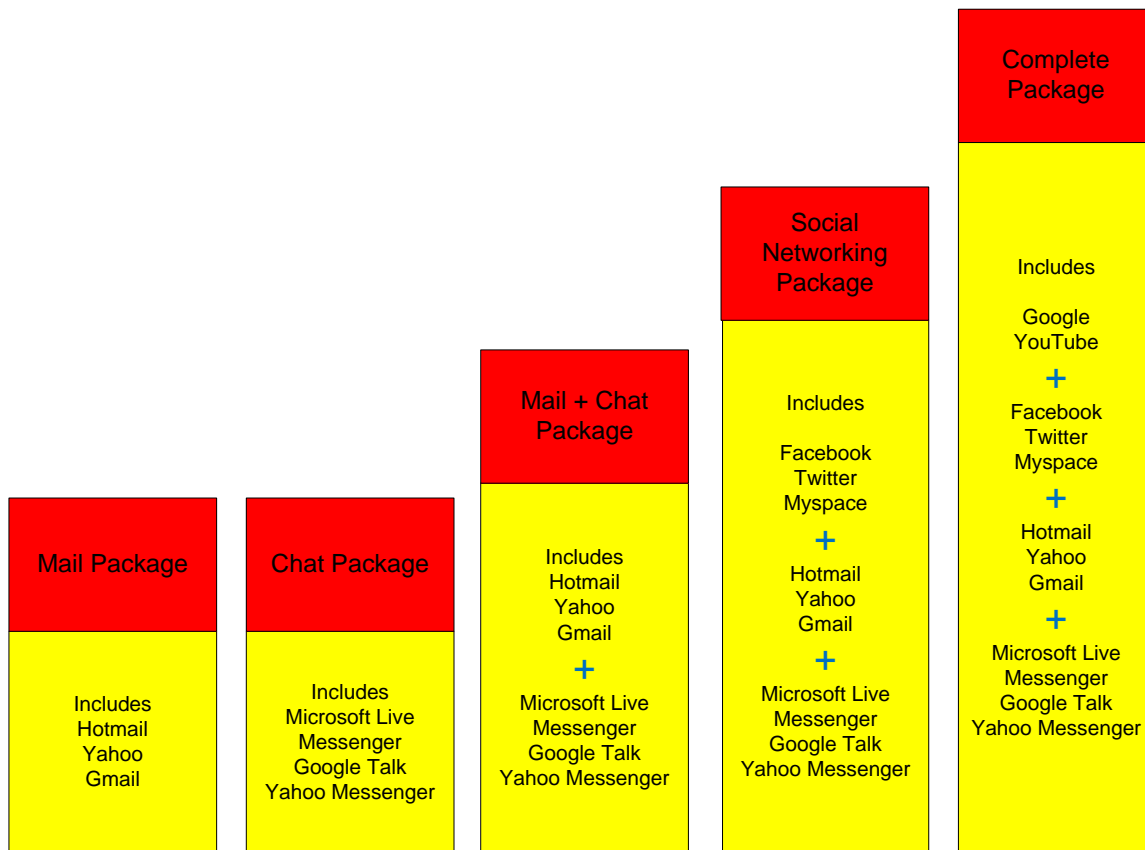


Figure 2 - Sandvine Customer Application Package Advertising

Application types per category listed in Table 1:

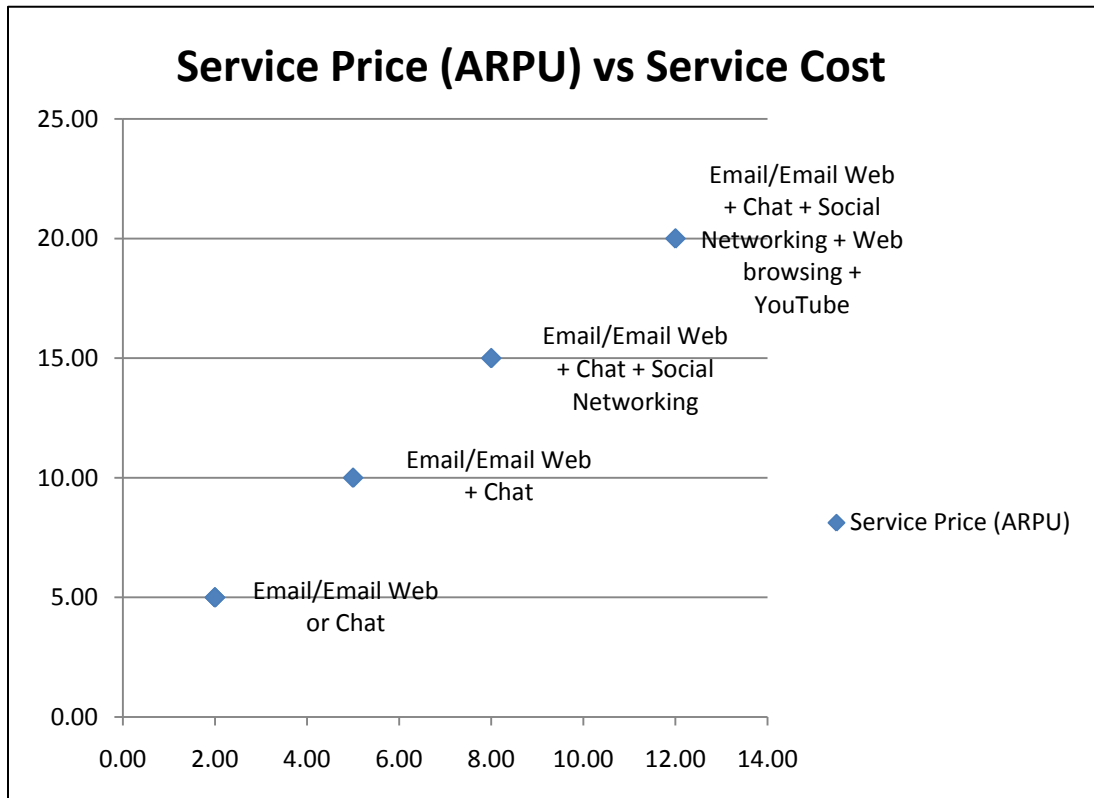
Email/Email Web	Chat	Email/Email Web + Chat	Email/Email Web + Chat + Social Networking
Gmail Hotmail Yahoo Microsoft Exchange POP3 SMTP	AOL Instant Messenger ICQ Google Talk Microsoft Live Messenger Yahoo Messenger	Allows Nokia specific mail to Email/Web Email + Chat	Allows social networking sites to Email/Email Web + Chat + Nokia mail

**Table 1: Service Package Application List**

Web browsing and YouTube access allows all http/https traffic, as well as YouTube streaming. All other P2P and streaming traffic is blocked.

Based on these applications, the cost of services can be managed and the service priced accordingly. As can be seen from Figure 3, creating services that utilize the Sandvine PCEF to manage data usage allows service providers to break the trend shown in

Figure 1, and allows service providers to tie the service cost with the ARPU, permitting consistently good margins, based on the value delivered to the customer.

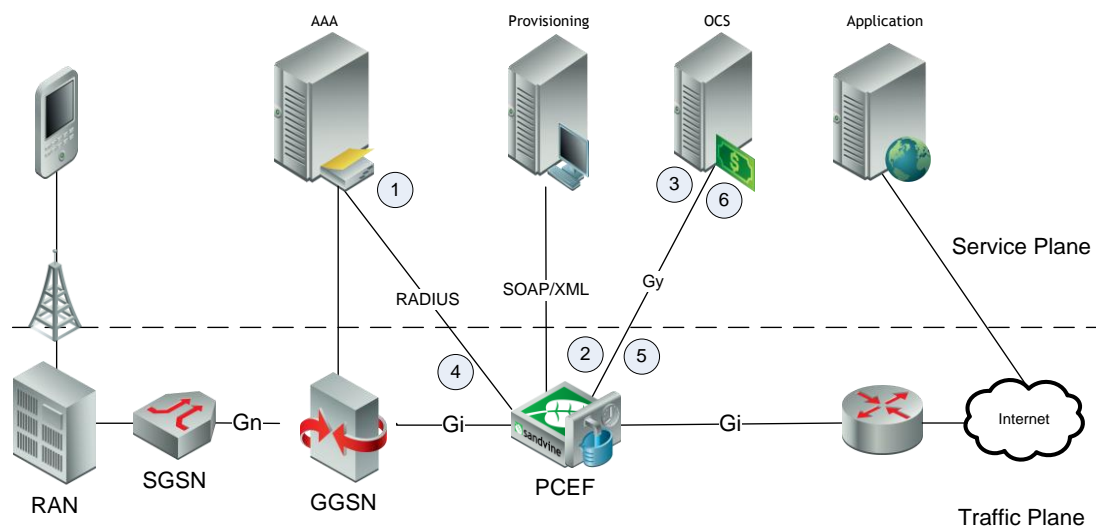


**Figure 3 - Wireless Application Access Package ARPU vs. Service Usage/Cost**

An implementation of the above service packages by a Sandvine customer is shown in Figure 4. The customer GSM/UMTS network includes the RAN, access packet gateway (SGSN) and Internet gateway (GGSN) on the traffic plane. The service plane includes the data services AAA and the Online Charging System (OCS). The desired applications are retrieved from application servers in the service plane.

As the service implementation requires control of the application access, the Sandvine Policy Control Enforcement Function (PCEF) is located at the Gi interface to the Internet. The AAA is used for basic subscriber authentication and authorization.

All of these application attempts are classified as one Gy rating group, and the OCS then automatically provides the Sandvine PCEF with the required quota. The Sandvine PCEF examines all traffic between the GGSN and the Internet, identifies the applications accessed, then allows or blocks the application access based on the subscriber package list. All other IP traffic is blocked.



**Figure 4- Sandvine Customer Usage Management Gy Application Access Architecture**

The high-level event sequence is as follows:

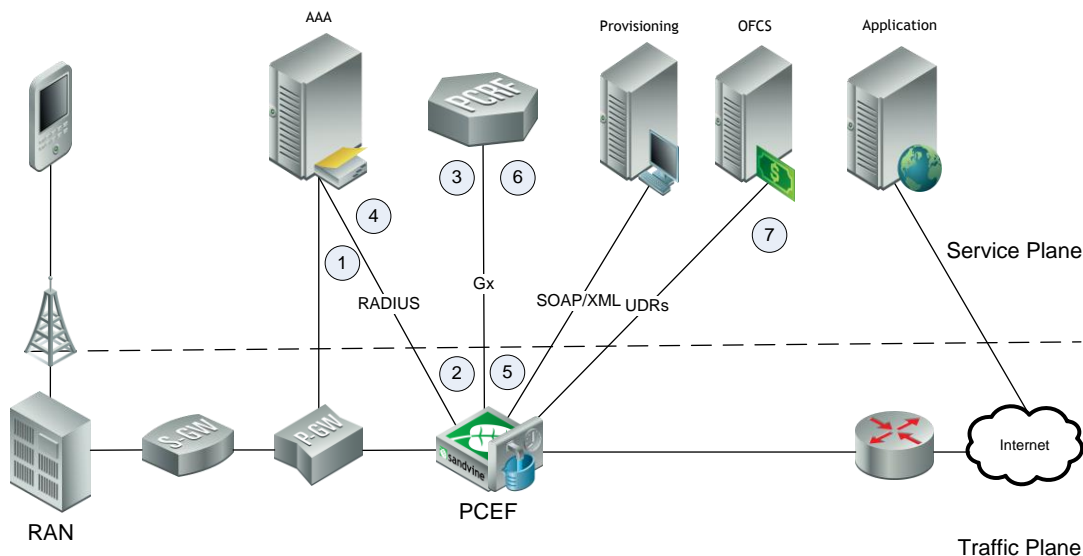
1. Subscriber with one of the five application access packages attempts the initial access to the desired application. This results in the AAA sending the Sandvine PCEF a request for service accounting. Until the subscriber stops their data session (PDP context deletion at the SSGN), this event is sufficient for all their application accesses allowed in their service package. The service accounting message from the AAA lets the PCEF know that Online Charging is required. The PCEF Radius/Diameter interface is used for this message.
2. The PCEF then pings the OCS to start a rating session and determines if the subscriber has this application access as part of their package.
3. The OCS responds to the PCEF with a grant for the service request. Optionally, the granting of service may also include a time or volume usage quota. Sequence 2 and 3 keeps occurring until the subscriber is ready to close their session.
4. Once the subscriber closes their session, the AAA sends that session termination information to the PCEF.
5. The PCEF then updates the OCS to terminate the rating session.
6. The OCS responds that the subscriber rating session has terminated.

If a service provider has (or will select) an OCS that is not currently a Sandvine partner, interoperability certification of the new OCS vendor would be a prerequisite for the integration of an OCS Gy for the application access service packages implementation.

For advanced business intelligence of subscriber data management in addition to the Sandvine PCEF, Network Analytics is also required, providing Usage Management detailed scenario analysis, in addition to the Sandvine PCEF.

## Implementation Options

Although the Sandvine customer example solution was for a GSM/UMTS network with use of an Online Charging System, this solution can also be used with CDMA, LTE or WiMax where the Sandvine solution example SGSN/GGSN is replaced by a PDSN/HA, S-GW/P-GW or ASN-GW/HA respectfully. Use of a Gx interface (for un-rated application access) with policy enforcement instead of Gy (online charging for rated application access) can also be used. The Sandvine customer used the Gy solution as they had already implemented the Gy interface for their pre-paid solution.



**Figure 5 - Sandvine Customer Usage Management Gx Application Access Architecture**

An alternative solution for developing application access packages is to not use Online Charging Systems (OCS) and use the AAA Gx interface to implement Policy Enforcement. The implementation selected would depend on the service provider preference based on factors such as already having a Sandvine OCS Gy implementation (as was the case with Sandvine customer example). Another reason for using the Sandvine OCS license instead of Policy Enforcement license is if a data usage cap is desired, for example in high data usage apps such as video streaming. In any case, the Sandvine UM provides software licensing for either solution. OCS Gy uses the UM Online Charging license, and AAA Gx uses the UM Policy Enforcement license.

Figure 5 shows a generalized Gx solution where the previous Gy solution SSGN and GGSN (Figure 4) are replaced with a S-GW and P-GW. Since the OCS is not required, an OFCS is used instead.

The high-level event sequence for the Gx solution shown in Figure 5 is as follows:

1. Subscriber with one of the five application access packages attempts the initial access to the desired application. This results in the AAA sending the Sandvine PCEF a request for service accounting. Until the subscriber stops their data session (PDP context deletion at the S-GW), this event is sufficient for all their application accesses allowed in their service package. The service

- accounting message from the AAA lets the PCEF know that policy rules are required. The PCEF Radius/Diameter interface is used for this message.
2. The PCEF then pings the PCRF to request the session policy rules and determines if the subscriber has this application access as part of their package.
  3. The PCRF responds to the PCEF with a list of policy rules to install for enforcement. Unlike for the OCS implementation, the policy rules are only requested once per subscriber session, and are valid unless the mobile service provider changes the subscriber policy (e.g., subscriber no longer has the application access package service).
  4. Once the subscriber closes their session, the AAA sends that session termination information to the PCEF.
  5. The PCEF then updates the PCRF to terminate the policy session.
  6. The PCRF responds that the subscriber rating session has terminated.
  7. Since the Gx solution does not dynamically create billing sessions on service access, the Gx solution has the PCEF generate Usage Detail Records (UDRs) that are uploaded to the Offline Charging System (OFCS). The mobile service provider can use the UDRs for any subscriber billing customer care questions.

The mobile service provider has the flexibility of using the Gy or Gx solution, depending on what infrastructure and services they have already implemented, what they plan on implementing in the future, and their architectural preferences. It is also possible to have a Gy and Gx combination based on the needs of the application access service packages (e.g. most services only need policy enforcement, while others need rating).

## Conclusion

Implementation of Usage Management equips mobile service providers with additional marketing tools to address the increasing consumer need for mobile access and allows for market segmentation with value-added services.

The use case herein illustrates an example of an operator that successfully implemented service packages with the result of greatly increasing the value of their network infrastructure.

## Glossary

### Glossary of Terminology

<b>AAA</b>	Authentication, Authorization and Accounting
<b>ARPU</b>	Average Revenue Per User
<b>ASN-GW</b>	Access Service Network Gateway Router
<b>CDMA</b>	Code Division Multiple Access
<b>GPRS</b>	General Packet Radio Service
<b>GSM</b>	Global System for Mobile Communications
<b>GW</b>	Gateway Router (SSGN, GGSN, PDSN, HA, ASN-GW...)
<b>LTE</b>	Long Term Evolution
<b>OCS</b>	Online Charging System
<b>OFCS</b>	Offline Charging System
<b>PCEF</b>	Policy and Charging Enforcement Function
<b>PCRF</b>	Policy Charging Rules Function
<b>PDP</b>	Packet Data Protocol
<b>P-GW</b>	Packet Gateway
<b>RAN</b>	Radio Access Network
<b>SGSN</b>	Service GPRS Support Node
<b>S-GW</b>	Serving Gateway
<b>SSGN</b>	Service GPRS Support Node
<b>UDR</b>	Usage Detail Record
<b>UM</b>	Usage Management
<b>UMTS</b>	Universal Mobile Telecommunications Systems

### Glossary of Interfaces

<b>Gi</b>	Interface between GGSN and the internet.
<b>Gx</b>	Interface between PCRF and PCEF (GGSN). Diameter based protocol with 3GPP defined AVPs.
<b>Gy</b>	Interface between PCEF and OCS. Diameter based protocol with 3GPP defined AVPs.