



Zero-Rating and Sponsored Data:

Best Practices under Net Neutrality

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EXECUTIVE SUMMARY

Innovative Internet offerings are rapidly emerging, globally. Many of these offerings use zero-rating (unlimited usage of certain applications or content are bundled “for free” into data plans) and sponsored data (a third-party pays for certain data usage, like an Internet toll-free call) techniques to achieve the innovation.

Increasingly we are seeing innovation occur in both developing and developed markets. In some cases, Network Neutrality rules have been defined and are currently being interpreted, or are in the process of being defined. In many markets, Network Neutrality is still not part of the conversation, though that is likely to change over time.

This whitepaper explores developments in Network Neutrality rules and laws, as they impact zero-rating and sponsored data plans. It also recommends Best Practices based on commonalities amongst Network Neutrality rules, Sandvine’s direct experience with service innovation, and what makes sense for communications service providers (CSPs) and their subscribers.

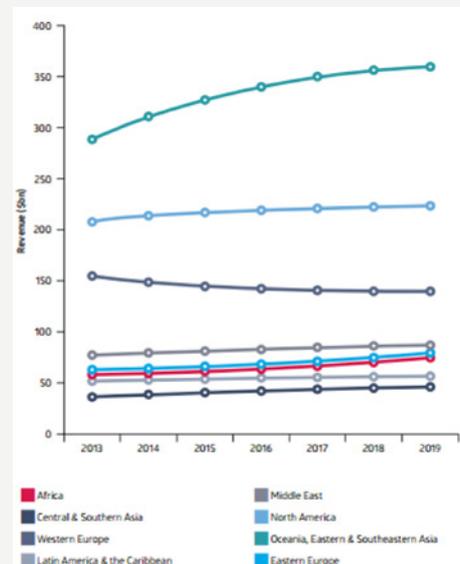
INTRODUCTION

While penetration of Internet access is extremely high in developed countries, subscriber and revenue growth has flattened. In fact, according to Ovum Telecoms’ Media & Entertainment Outlook 2015, retail connectivity and VAS revenues in Western Europe are already slowing, and the trend is expected to continue.

Figure 1

Retail Connectivity and VAS revenues by region

Source: Ovum





Accordingly, CSPs must increasingly look to grow by attracting new subscribers from competitors' networks. An increasingly important basis for such competition will be the differentiation of Internet service offerings. Such differentiation also has the benefit of improving choice for Internet subscribers.

Another challenge facing CSPs is that their traditional services have been disrupted by over-the-top (OTT) applications. For example:

Table 1

Traditional Service from CSP	Replacement OTT Applications
Local and long distance voice services	Skype, Vonage, Facetime, WhatsApp, Viber, etc.
Broadcast television	Netflix, Amazon, Hulu, HBO Go, BBC iPlayer, etc.
Text messaging	WhatsApp, WeChat, Viber, LINE, etc.

This disruption is great for consumers but a challenge for CSPs. Traditionally, these lines of business have funded network improvements to sustain delivery of both CSP services and the replacement OTT applications that now threaten CSP revenue. New revenue sources are necessary, including through service differentiation, such as achieved through zero-rating and sponsored data.

For the most part, Internet access offerings have been relatively simple: pay a fixed amount (pre- or post-paid) for a given access speed and, possibly, a data quota. The notion of service differentiation is relatively new, but the tools now exist to offer a wide variety of new services based on application, device, time of day, and a myriad of other factors in isolation or combined. However, it's important to understand the impact of Network Neutrality, various concepts of which continue to become embedded in the regulations that cover CSPs' businesses globally.

GLOBAL DEVELOPMENTS IN NETWORK NEUTRALITY

Despite the common misconception, there isn't a universally accepted definition of Network Neutrality. Increasingly, rules are being established or slowly clarified in various jurisdictions around the world, with significant differences between them. We'll review some of them here, but the key point to take away is that CSPs must be familiar with the rules in their own jurisdiction before moving forward with any plans that incorporate zero-rating or sponsored data.

The United States

In the United States, an order dated March 12th, 2015 finalized "Open Internet" rules; this order included three "bright line rules":

No Blocking. A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not block lawful content, applications, services, or non-harmful devices, subject to reasonable network management².

No Throttling. A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not impair or degrade lawful Internet traffic on the basis of Internet content, application, or service, or use of a non-harmful device, subject to reasonable network management.

No Paid Prioritization. A person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not engage in paid prioritization.

Additionally, a "general conduct" rule – particularly relevant to service differentiation – states:

"Any person engaged in the provision of broadband Internet access service, insofar as such person is so engaged, shall not unreasonably interfere with or unreasonably disadvantage (i) end users' ability to select, access, and use broadband Internet access service or the lawful Internet content, applications, services, or devices of their choice,



or (ii) edge providers' ability to make lawful content, applications, services, or devices available to end users. Reasonable network management shall not be considered a violation of this rule."

According to the Open Internet order, the FCC will only formally opine on whether an Internet access plan violates its rules if someone files a complaint.

However during May 2017, after a change in leadership, the FCC launched a new Notice of Proposed Rulemaking entitled In the Matter of Restoring Internet Freedom. In essence, this notice proposes to roll back all of the "Open Internet" rules and redefine the Internet as an "information service" -- its classification until the March 2015 order. Note, that the March 2015 order classified the Internet as a "Title II" service for the first time and in so doing gave the FCC broad rulemaking authorities over it. If such a reclassification occurs there is not a well-defined path for the FCC to create rules over Internet services.

Canada

In Canada, section 27(2) of the Telecommunications Act, discusses "unjust discrimination" and states:

"No Canadian carrier shall, in relation to the provision of a telecommunications service or the charging of a rate for it, unjustly discriminate or give an undue or unreasonable preference toward any person, including itself, or subject any person to an undue or unreasonable disadvantage."

In April 2017, the Canadian Radio-television and Telecommunications Commission (CRTC), as part of its review of differential pricing practices concluded that "such practices, when they are content-specific in nature, generally raise concerns of undue or unreasonable preference or disadvantage with respect to Canadian subscribers and content providers."

With this conclusion, application or content-specific plans, whether they highlight individual applications or content or classes of applications or content, are forbidden in Canada.

European Union

In October 2015, the European Parliament approved a Regulation concerning Net Neutrality and roaming in the EU, applicable to all Member States from April 2016 forward. In August 2016, BEREC, the Body of European Regulators for Electronic Communications, issued "Guidelines on the Implementation by National Regulators of European Net Neutrality Rules," which allows for zero-rating under certain circumstances. However BEREC noted that a comprehensive assessment of commercial and technical conditions may be required, which could take into account a number of factors, such as:

- The goals of the regulations
- The market positions of the CSPs and application/content providers involved
- The effects on end-users choice of application/content, including financial incentives that may impact that
- The effects on application/content providers
- The scale of the practice and the presence of alternatives

BEREC did specifically note, however, that zero-rating a class of applications is better than select applications within a class.

"The ISP could either apply or offer zero-rating to an entire category of applications (e.g. all video or all music streaming applications) or only to certain applications thereof (e.g. its own services, one specific social media application, the most popular video or music applications). In the latter case, an end-user is not prevented from using other music applications. However, the zero price applied to the data traffic of the zero-rated music application (and the fact that the data traffic of the zero-rated music application does not count towards any data cap in place on the IAS) creates an economic incentive to use that



music application instead of competing ones. The effects of such a practice applied to a specific application are more likely to “undermine the essence of the endusers’ rights” or lead to circumstances where “end-users’ choice is materially reduced in practice” (Recital 7) than when it is applied to an entire category of applications.”

These guidelines are currently being interpreted by CSPs and regulators in each EU country. Some developments of note through May 2017, include:

- **Netherlands, April 2017:** The court decided that T-Mobile’s zero-rated music streaming offer was consistent with the EU rules, overturning the opposite decision by the Dutch regulator.
- **Germany, April 2017:** T-Mobile launched “Stream On” zero-rated video service.
- **United Kingdom, November 2016:** Virgin Media launched 4G mobile service with free messaging on WhatsApp and Facebook Messenger, claiming that the rules and BEREC’s guideline don’t prohibit such zero-rating.
- **Sweden, March 2017:** Swedish regulator is investigating Telia’s zero-rated social media and music services. The Swedish court suspended the regulator’s initial decision in January 2017, which asked Telia to stop distributing the services, on the basis of its violation of the “traffic management” requirements of the rules.
- **Spain, April 2017:** Vodafone Spain launches a zero-rated chat plan
- **Eastern Europe:** Sandvine customers Vivacell Armenia zero-rating Skype on select plans and zero-rating all traffic on select plans between 2:00 a.m. and 8:00 a.m.

India

In February 2016, the Indian regulator, TRAI, published its PROHIBITION OF DISCRIMINATORY TARIFFS FOR DATA SERVICES REGULATIONS, 2016, which bars discriminatory pricing of data services. The initiative started based on complaints against Facebook Free Basics and Airtel Zero offers in the country.

“Prohibition of discriminatory tariffs:

- 1 No service provider shall offer or charge discriminatory tariffs for data services on the basis of content.
- 2 No service provider shall enter into any arrangement, agreement or contract, by whatever name called, with any person, natural or legal, that has the effect of discriminatory tariffs for data services being offered or charged to the consumer on the basis of content:

Provided that this regulation shall not apply to tariffs for data services over closed electronic communications networks, unless such tariffs are offered or charged by the service provider for the purpose of evading the prohibition in this regulation.”

Brazil

In 2014, Brazil passed its Network Neutrality laws, which fundamentally forbade discriminatory pricing.

“The agent in charge of transmission, switching and routing is obliged to treat any data packets with isonomy, regardless of content, origin and destination, service.”

“In the event of discrimination or degradation, as foreseen in paragraph 1, the aforementioned agent in charge must provide services on a non-discriminatory trading and refrain from anticompetitive practice.”

Other Emerging Markets

In many emerging markets globally there are no rules around the zero-rating of traffic or sponsored data, and frequently the practice has flourished.

Summary

Table 2 on the following page, summarizes the developments above, which are not necessarily comprehensive of all developments globally, but demonstrate the variety of rules and laws that are emerging.



Table 2

Country	Rules/laws OK app-based Zero-rating?	Zero-rating happening?	Recent development
United States	✓	✓	April 2017
Canada	✗		April 2017
Europe	✓		
Netherlands		✓	April 2017
United Kingdom		✓	Nov 2016
Germany		✓	April 2017
Sweden		✓	March 2017
Spain		✓	April 2017
Eastern Europe		✓	
India	✗		Feb 2016
Emergin markets		✓	
Brazil	✗		2014

RECOMMENDED BEST PRACTICES

Based on the variety of rules or laws that have developed or are developing in various parts of the world, it is critical that the CSP familiarize itself with its local regulatory and legal landscape before planning any offers that incorporate zero-rating or sponsored data. That said, there are some similarities amongst some of the rules and laws. Based on those familiarities and Sandvine's direct experience with what has been successful for CSPs, their subscribers and application and content providers globally, Sandvine has created a set of Best Practices.

Sandvine understands that in many markets around the world, the topic of Network Neutrality has not yet been addressed. In these markets, CSPs can theoretically implement any zero-rated or sponsored data service imaginable. However, Sandvine feels that Network Neutrality will ultimately be an issue everywhere and recommends that CSPs adhere to best practices that could apply universally across all markets.

General Recommendations: Transparency and Subscriber Notification

Confusion and experiences that are perceived to be overly complex are responsible for a large proportion of subscriber complaints, in general. Therefore, our first few recommended best practices concern transparency, and apply to both sponsored data plans and zero-rating plans:

- 1 For both zero-rating and sponsored data offers, all significant terms must be communicated to subscribers transparently, including but not necessarily limited to: commercial terms, a detailed description of the zero-rated/ sponsored applications and content. Any technical requirements/limitations to participate in the offering (for both subscribers and content/application providers) should also be communicated transparently.
- 2 To improve the openness and inclusiveness of a zero-rating offer, CSPs should include a simple, public mechanism for customers to suggest new services to include in a zero-rated class. For instance, if a CSP launches a video streaming plan, then the mechanism should let consumers suggest new OTT video providers for inclusion.
- 3 CSPs should consider notifications to users when a user accesses zero-rated/sponsored content, to provide confirmation that the offer is operating in accordance with the plan. Similarly, CSPs could alert those who aren't subscribed to a zero-rated offering about that offering when they access content within the zero-rated class (e.g., when a T-Mobile subscriber who has not opted into the Binge On plan – described below – accesses a streaming video service like Netflix). Optimally, the notification itself would allow non-subscribers to click a button to engage in a workflow for opting into the zero-rated plan.



Recommendations for Sponsored Data Plans

Sponsored data is the case when a third party (neither the CSP nor subscriber) sponsors some or all of the cost of the bandwidth to deliver content or applications to the end user. Think of sponsored data as the Internet equivalent of a toll-free number.

CSPs who implement sponsored data use cases should ensure that:

- 1 The ability to become a sponsor should be equally available to all who provide Internet content, applications or services, at a consistent unit price (e.g., per megabyte, per 15-minute period, per click) for the data, allowing for potential volume discounts.
- 2 The sponsored data should not be prioritized beyond what would otherwise be done for purposes of reasonable network management.
- 3 There is a streamlined set of open APIs and documentation to join the sponsored data plan, to ensure maximum accessibility to all potential sponsors.

Real-World Examples of Sponsored Data

CSPs and application and content providers globally have been offering sponsored data for some time.

Application and Content Providers: Tesla, GM OnStar, Amazon

Application and content providers have been offering products and services by sponsoring the related data. For example, Tesla has been sponsoring remote diagnostics for its car owners on an opt-in basis for some time. Under the arrangement, Tesla can troubleshoot any issues with its cars in real time and pick up the bill for the data! GM OnStar has been offering a similar service for many years.

Amazon has also been offering free 3G wireless connectivity by sponsoring the data charges for downloads from its book library to the Amazon Kindle and other e-reader products. Amazon ultimately pays the operator for the bandwidth.

Examples of Verizon's FreeBee Data



Video Clips FreeBee Data for Mobile Video Streaming.

In 30 seconds, a great product video can convert a mobile user into a customer. Many people are selective about when and how they use their mobile devices. With FreeBee Data for mobile video, you can encourage greater mobile engagement by offering sponsored data streaming.

FreeBee Data for mobile video lets your customers enjoy video clips without incurring data usage charges. Because you sponsor the data, your mobile viewers are able to enjoy:

- Your product videos and ads with no data charges
- Brand video highlights with no data charges
- Mobile trailers with no data charges

[Learn more](#) about how you can sponsor mobile video streaming and get more return on your mobile marketing investment with FreeBee Data.



Audio Streaming FreeBee Data for Mobile Audio Streaming.

Between music streaming, podcasts and audiobooks, people spend a lot of time listening on their smartphones and tablets. FreeBee Data for mobile audio is a sponsored data service that frees your mobile audio content from data usage charges. When you sponsor data, your mobile listeners are able to enjoy:

- Podcasts with no data charges
- Music streaming with no data charges
- Audiobooks with no data charges

[Learn how](#) you can treat your customers to 30 minutes of sponsored streaming enjoyment with FreeBee Data for mobile audio. Now that's a sound mobile marketing investment!



App Downloads FreeBee Data for App Downloads.

Making your mobile app stand out from the crowd can be a challenge - especially in a world where millions of apps are vying for the same limited space. With FreeBee Data for app downloads, you can increase your chances of getting noticed on consumers' mobile devices through sponsored app downloads.

Here's how it works: When Verizon subscribers see your app in the store, they also see the bee telling them they can download the app with no data charges.

[Learn more](#) about how FreeBee Data for app downloads can help boost your mobile app audience.



Mobile Websites and Apps FreeBee Data 360.

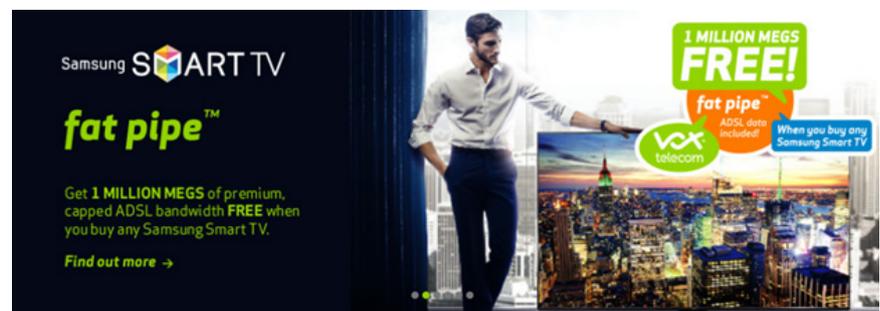
With FreeBee Data 360, you can sponsor some or all of the mobile content on your website or app so consumers will be able to access your content without incurring their data plans. This service is billed on a per gigabyte pricing model.

Discover the power of FreeBee Data 360, now available to all Verizon postpaid subscribers. Get in touch with a Verizon representative to [learn more](#).

CSPs: Verizon and Vox Telecom

Verizon has announced a sponsored data program: FreeBee Data. According to Verizon, the pricing model is based on the type of content being sponsored. Every time someone clicks on sponsored content (active content is marked by a FreeBee Data icon), the sponsor is charged a per-click fee. Each sponsored click includes a fixed amount of data depending on the content type (video, audio, etc.). Other pricing packages and models, such as usage-based pricing, also exist.

Vox Telecom in South Africa has teamed up with a local electronics retailer on a sponsored promotion that offers one million megabytes (or one Terabyte) of free data on Vox Telecom's Fat Pipe Premium ADSL service with the purchase of a Samsung Smart TV.



Subscribers in Vox Telecom's serving area who purchase a new Samsung Smart TV simply enter the MAC address of their new television through an online Vox Telecom portal and a Terabyte of premium Fat Pipe ADSL service is theirs - simple as that.

This bonus Terabyte of data is good for a full year and can be consumed on the Samsung Smart TV or any other device in the home to stream YouTube videos, watch movies, connect with social media, email, chat, or surf, for example.



Recommendations for Application Zero-Rating Plans

Another way to differentiate services is through “zero-rating”. Some people use the terms “sponsored data” and “zero-rating” interchangeably, but there is a key distinction. With zero-rating, the CSP creates a price for a service tier that it believes is sufficient to include unlimited use of certain data (such as messaging, streaming radio or streaming video), and receives no additional reimbursement from a third-party.

From the subscriber’s perspective, unlimited usage of an application or class of applications is bundled into a fixed price plan, without the chance of additional charges related to usage of the application or application class. Accordingly, users get price certainty around the usage of their favourite applications.

For CSPs launching zero-rating plans, we recommend that:

- 1 The “unlimited” offer applies to all content/applications in a zero-rated class (e.g., all streaming radio services, not just Pandora or Spotify), rather than just picking individual applications, content or services. Operator-owned (in whole or in part) services should only be zero-rated if all other services in its class are also identically zero-rated. Alternatively, the subscriber could pick a limited quantity of applications/content providers’ data to zero-rate, from a menu that represents the full class (e.g., pick one video streaming service for zero-rating from a menu that best represents the full class of video streaming services. Or pick one service from each of three separate classes, for example, such as video streaming, music streaming and messaging.)
- 2 The zero-rated data should not be prioritized in the network, beyond what would otherwise be done for purposes of reasonable network management.
- 3 The CSP should not be compensated by the content/application provider per unit of zero-rated data.
- 4 When the zero-rated data includes data from different service categories (e.g., Facebook includes HTML, video, chat, voice, photos, etc.), zero-rate all of the data (i.e., not just the HTML and photos). Subscribers find the alternative (e.g., a “Facebook” service includes some Facebook traffic, but not all) difficult to understand, which could lead to transparency issues and frustration. Additionally, for services (like Facebook) in which a user might click on a link and be taken to a different (i.e., not zero-rated) site, then - in accordance with the transparency principles - the CSP should alert the subscriber to that fact (e.g., a message along the lines of “You are now accessing content that will be billed at your regular data rate of ___/GB”).

Commercially speaking, zero-rated plans have worked best with high-value, low-bandwidth applications and content, as the combination allows for broad adoption of a service in an unlimited fashion at a reasonable price.

It’s also feasible to make zero-rated application bundles time-specific as well, so as to shift network usage to offpeak hours when network capacity is generally more available and to reduce opportunities for network congestion. This would benefit all users, and the CSP.

Alternatively, a combination of application and time-specific zero-rating is also possible. An example of this is a plan that zero-rates peer-to-peer file sharing, cloud storage, and file storage during “overnight” hours (e.g., 1:00 a.m. to 8:00 a.m.). Once again, the purpose of this type of offering is to shift bandwidth-intensive, “unattended” activities to times when there is excess capacity available in the network.



REAL-WORLD EXAMPLES OF ZERO-RATING

Sandvine has supported a wide variety of subscriber plans that zero-rate certain data, for a significant portion of its global customer base. Many of the plans have been launched in parts of the world where the topic of Network Neutrality has yet to be addressed but where zero-rating has flourished. Accordingly, the plans vary significantly in the degree to which they conform to these Best Practices.

In 2014, T-Mobile (not a Sandvine customer) launched their Music Freedom plans that zero-rate popular music services. The plans launched with seven streaming services (Pandora, Rhapsody, iHeartRadio, iTunes Radio, Slacker, Spotify, Milk Music and Beatport) but have expanded based on user demand. Today T-Mobile includes over 40 services in the plans and is open to adding more.

T-MOBILE IS SETTING MUSIC FREE.

Music has never liked limits, and now with T-Mobile, music has no limits. On the network built for data, you can stream music as much as you want.

We're setting music free.

[SHOP PLANS](#)

Music services include:

- Apple Music
- Pandora
- iHeartRadio
- Rhapsody
- Beatport
- Spotify
- Slacker
- Radical.FM
- iRadio
- Samsung Milk Music
- Black Planet
- Songza
- Rdio
- Radio Paradise
- AccuRadio
- SoundCloud
- Slavn
- Digitally Imported
- JAZZRADIO.com
- ROCKRADIO.com
- RadioTunes
- radioPup
- radio.com
- Mast Genius Radio
- Groove Music
- Live365
- Fresca Radio
- Google Music
- Fit Radio
- SiriusXM
- Tidal Music
- MaRadio
- BandCamp

Tell us how you like to jam.
If your go-to music streaming service isn't part of the program, tweet us your favorite service @TMobile, along with the hashtag #MusicFreedom.

In 2015, T-Mobile launched its unlimited streaming video plan, Binge On.

INTRODUCING BINGE ON™

Video now streams **FREE** without using your data, only from T-Mobile.

Available on November 15th

Game of Thrones and Last Week Tonight with John Oliver available on HBO NOW. 3rd party subscriptions charges may apply.

Like Music Freedom, the Binge On offering is open to all services in the streaming video category that can meet the technical specifications required for implementation. Today there are over 130 services available under the plan.

In many (though not all) respects both Music Freedom and Binge On conform to Sandvine's Best Practices.

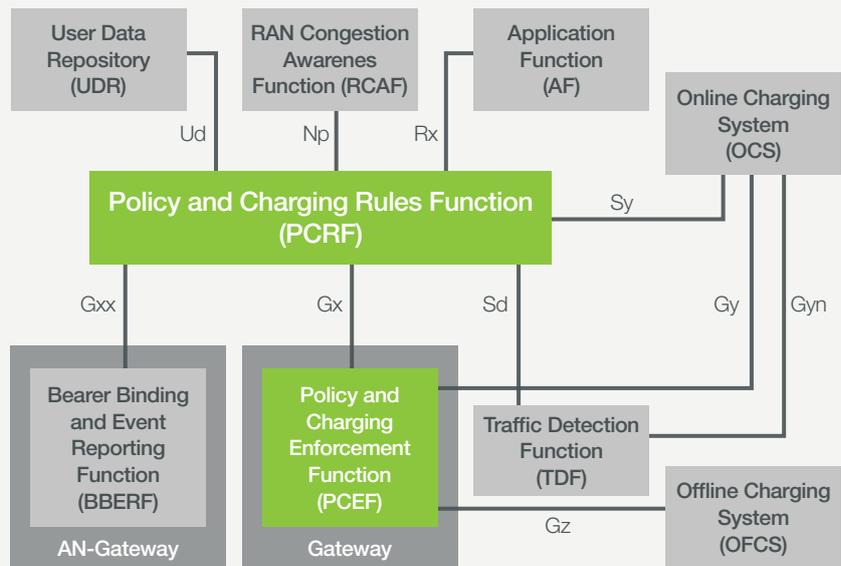


REFERENCE IMPLEMENTATION

For maximum accuracy, zero-rated and sponsored data plans must take advantage of billing-grade traffic detection capabilities. Misclassification of traffic could lead to significant subscriber billing errors, including over-billing, which has regulatory implications. Additionally, for maximum flexibility and speed to market, the implementation should be based on pre-integrated, standardized products that conform to broadly adopted network standards for the Policy and Charging Rules Function (PCRF) and the Policy and Charging Enforcement Function (PCEF).

Figure 2

3GPP Standards-based PCC Architecture (from 3GPP TS 23.203v13.5.1)



Many systems claim to be 3GPP Gy-compliant but fail in real-world deployments because the implementation does not match the standard specification. To illustrate this, we can examine just the relationship between the PCEF element and the OCS as specified by 3GPP standards.¹

1 Non-standard, custom development dramatically increases implementation time and risk, and decreases the flexibility to quickly experiment with new plans. By contrast, Leon De Fleuriot, head of Group Broadband and OTT Services for Econet Wireless, reports that using standards-based features the time to implement zero-rated plans was only two weeks.

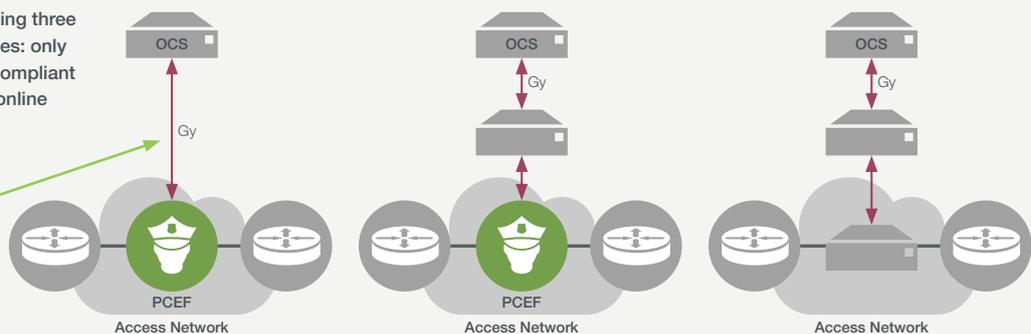
Figure 3, below, shows three diagrams of charging architectures:

- between the measurement component in the data path and the OCS is direct and in real-time
- The middle figure is not compliant: the introduction of an intermediate processing node breaks the direct connection and breaks the real-time nature of the usage reports
- The right-most figure has an identical architecture to the middle figure, but the diagram has a superficial box misrepresenting two separate components as one: this box does not rectify the indirect, none real-time nature of the architecture

Figure 2

Three diagrams representing three implementation approaches: only the left-most diagram is compliant with 3GPP standards for online charging

Direct, real-time connection between charging mechanism and data measurement





From the communication service provider's perspective, failure to adhere to the strict 3GPP standards for online charging results in revenue leakage and unreliable billing for all online charging use cases. The degree of revenue leakage varies by use case based upon a handful of factors, so each must be considered separately.²

If there was no difference in charging accuracy and reliability between these deployments, then non-compliance would not be of significant importance – but that is not the case. The only way for a CSP to achieve minimum revenue leakage and maximum reliability is by adhering to the 3GPP requirements.

CONCLUSIONS

With this whitepaper we hope we have communicated a few key points.

A growing number of CSPs globally are offering service plans that feature sponsored data and application zero-rating. The plans have been successful, beneficial to subscribers, and have created a viable form of competition amongst CSPs.

Furthermore, while concepts of Network Neutrality are proliferating globally, there is no single definition and one is unlikely to emerge any time soon, so CSPs must understand the landscape in their own markets. Based on global developments and Sandvine's direct experience with what has been successful for CSPs, their subscribers and application and content providers globally, Sandvine has created a set of Best Practices, which may evolve as ongoing experimentation and regulation occurs.

Amongst those Best Practices, a few themes emerge:

- 1 Openness:** Ensure the sponsored data plan or zero-rating plan is open to all members of a sponsored/zero-rated data class – not just available to selected content/application providers.
- 2 Same commercial terms:** The CSP should offer substantially the same commercial terms to all data sponsors (allowing for volume discounts, etc.), and for zero-rating the CSP should not be compensated by the content/ application provider per unit of zero-rated data.
- 3 No prioritization:** Sponsored/zero-rated data should not be prioritized in the network.
- 4 Transparency:** The terms and availability of the plans should be transparent to subscribers. Notifications to subscribers when they are accessing sponsored or zero-rated content/ applications would aid in transparency. To the extent there are terms required of content/ application providers to participate in a plan, those terms should be transparent as well.

² The Sandvine whitepaper [Online Charging with Diameter Gy: Considerations for Accuracy and Reliability](#) includes an examination of the risk of revenue leakage for a range of use cases when using incorrect deployment architectures such as the two shown in Figure 3.

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Invitation to Provide Feedback

Thank you for taking the time to read this whitepaper. We hope that you found it useful, and that it contributed to a greater understanding of subscriber services, and in particular what services are possible within the spirit of network neutrality. If you have any feedback at all, then please get in touch with us at whitepapers@sandvine.com.

ABOUT SANDVINE

Sandvine helps organizations run world-class networks with Active Network Intelligence, leveraging machine learning analytics and closed-loop automation to identify and adapt to network behavior in real-time. With Sandvine, organizations have the power of a highly automated platform from a single vendor that delivers a deep understanding of their network data to drive faster, better decisions. For more information, visit sandvine.com or follow Sandvine on Twitter at [@Sandvine](https://twitter.com/Sandvine).



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