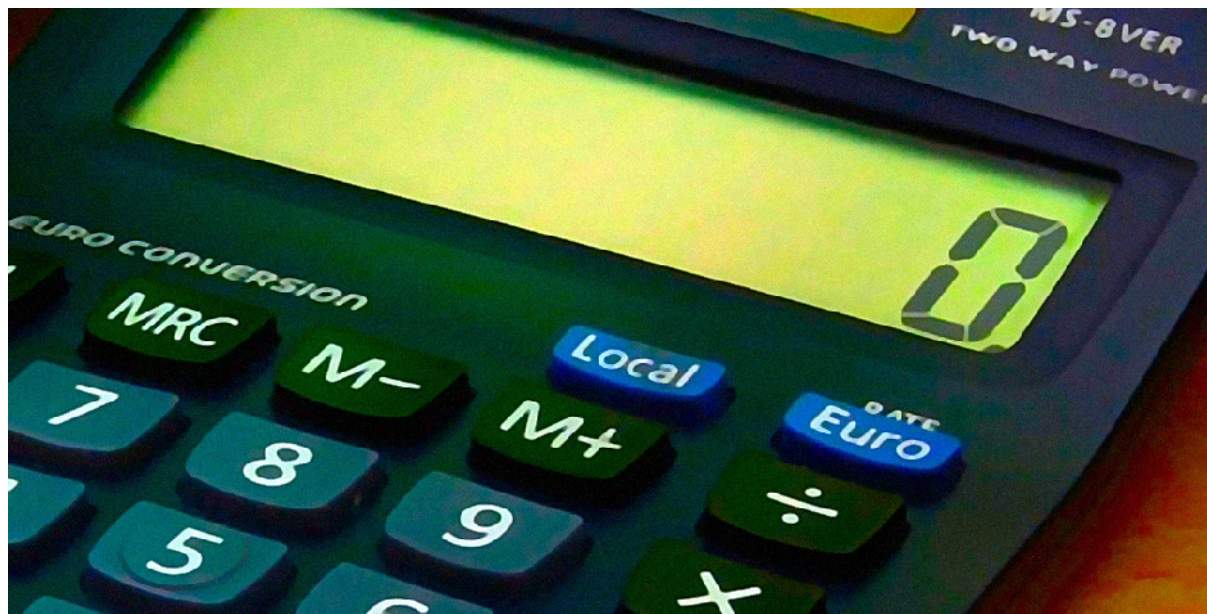# Zero-rating: short-term evil, long-term good?

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I previously wrote an essay on Why Our Digital Future Needs Unlimited Data, something that is not likely to happen quickly, and before it does happen there will undoubtedly be many small steps towards that ultimate goal. You might assume that the most obvious path to unlimited data would be for Internet Service Providers (ISPs) to slowly but steadily increase monthly data-download allowances, also known as data caps, on a month by month, quarter by quarter, basis until they become 'effectively' unlimited. Strangely, this does not seem to happening, and any growth that does exist is occurring at an incredibly slow and somewhat sporadic pace, such that we will all be old and grey long before such allowances become 'effectively' unlimited. Even when an ISP generously doubles existing allowances, they are only doubling an allowance that was pitifully small to begin with, and so even a doubled allowance is still very far from being 'effectively' unlimited. In fact, some ISPs have even reduced allowances on their wired Internet connections. Nevertheless, I suspect that the move towards 'effectively' unlimited data is actually happening, but in a non-obvious way, through the use of zero-rated services; a problematic approach, to be sure, but one that may, in the long run, deliver the 'effectively' unlimited data we will need to realise our bright and shiny science fiction future.

I previously defined 'effectively' unlimited data in my essay, Why Our Digital Future Needs Unlimited Data: *When you can download data at your purchased communications bandwidth, on a continuous and unrestricted basis, for a whole month, I like to refer to this as an 'effectively unlimited monthly data allowance'. It is 'effectively unlimited' because*

you will never hit a data download limit, because such a limit does not exist (or only in a notional sense), because access is unmetered. Of course, it is not actually unlimited; it just behaves like it is, at your purchased bandwidth. Effectively unlimited Internet access is more commonly known as unmetered Internet access.

However, before we consider just how zero-rating might help in achieving 'effectively' unlimited data, we need to understand a little bit about the zero-rating approach and how it fits in to the concept of net neutrality. Under normal circumstances, each customer that purchases an Internet access service from an ISP is allocated a monthly data-download allowance, which is the maximum quantity of data that can be downloaded from the Internet, via that ISP, each month. Internet access over wired communications links often has relatively high data caps, sometimes hundreds of gigabytes per month, whilst Internet access over mobile (wireless) communications links often has relatively low data caps, perhaps as low as a few gigabytes per month. In general, regardless of whether you have a wired or wireless connection to the Internet, the more you pay for Internet access the higher will be your data cap. If a customer needed to download more data than their monthly data-download allowance permitted then they would either have to buy more allowance from their ISP or pay a penalty fee for exceeding their allowance. Some digital services, such as cloud gaming, hosted applications, hosted desktops, social networking, streamed music, streamed video, and video conferencing can consume a lot of data, and can quickly exhaust a typical mobile monthly data-download allowance. Some users are even able to exceed their monthly data-download allowance on their wired Internet connections, particularly if they play a lot of cloud-based computer games or watch a lot of high-definition streamed video.

In simple terms, zero-rated services are digital services, delivered by an Internet Service Provider (ISP) over the last-mile communications link between the ISP and a customer's Internet access device, which are either provided on a totally free-of-charge-basis or are provided at a very low cost. When zero-rated services are provided on a totally free-of-charge-basis they are usually provided as part of a totally free-of-charge Internet access service. Such Internet connectivity only allows access to a limited set of digital services and no others. It is a highly restrictive way to access the Internet, but one that can allow people that are wholly new to the Internet, and might not, under normal circumstances, be able to afford the relatively high cost of Internet access, to investigate whether or not they would like to make the Internet a part of their lives at some point in the future, without incurring any costs. However, most commonly, access to zero-rated services is provided as part of a paid-for Internet access service, and because the data required to access such services is excluded from the Internet access service's monthly data-download allowance such access is provided at a very low cost.

Given that the communication of data always incurs some sort of cost (there is no such thing as a free lunch, let alone free data), someone, somewhere, must ultimately pay for the delivery of zero-rated services. The delivery of such services, certainly in developed countries, is almost definitely being paid for by the customer, on an indirect basis, because the cost of providing Internet access has actually become so low (and profitable) that providing zero-rated access to a number of digital services, even if they are used extensively, incurs only trivial additional costs for an ISP. Alternatively, the zero-rated services may be paid for by the originator of those services, as a way to differentiate their particular offering from their competitors. Zero-rated services may

also be paid for by global Internet companies, which want to expand the reach of their highly-profitable digital services into hitherto untapped markets. Finally, zero rated services may be paid for by governments, charities, or philanthropists that wish to help bridge the digital divide, connect the unconnected, and bring the Internet, personal computing, and Web to the next billion people.

Because zero-rating is only applied to some digital services, and not all digital services, it is considered, by some, to be highly controversial. This is because zero-rating, when applied selectively, is a form of price discrimination that gives the selected services a very real advantage over the services that are not selected. If the selection process is based purely on an ability to pay then businesses that can afford to zero-rate their services will be able to offer a better value proposition to their customers than businesses that cannot afford to zero-rate their services. If the selection process is not based on purely commercial grounds, i.e., an ability to pay, and is, instead, controlled by the ISP then the ISP can become a 'king-maker', effectively choosing which businesses should succeed or fail, based on whether or not a zero-rating advantage has been bestowed. However, regardless of how the services that are to be zero-rated are selected, the end result is always the same; an unfair playing field. So, it is purely the selective application of zero-rating that is considered problematic. If all digital services were zero-rated then the potential for bias would not exist, and all services would be treated equally. Any ISP that provided zero-rated access to all digital services would simply be offering Internet access without data caps, i.e., without imposing a monthly data-download allowance, which is also known as 'unlimited data'.

The globe-spanning network of computer networks, now known as the Internet, was born out of research, which started in the early 1960s, into packet switched computer networks. Some of the earliest users of such networks were the military and academia in the United States of America. However, over time, it became clear that packet switched networks could be used to connect not just the military and academia, but the whole world. All traffic on the early Internet was considered equal, and was treated equally, regardless of application, content, destination, platform, mode of communication, source, type of attached equipment, user, or website. It was all very egalitarian *(très francais, non?)*, and, in simple terms, if you could connect to the Internet then you could use it just like any other user. This concept of traffic equality became known as Net Neutrality, a term that was coined in 2003 by Tim Wu, professor of media law, at Columbia University. Net Neutrality is an extension of the common carrier concept as it relates to telecommunications service providers. A common carrier typically transports goods or people, but in the United States of America this term can also be applied to public utilities and telecommunications service providers. Common carriers provide their services under license, or authority, provided by a regulatory body. In simple terms, net neutrality is now taken as meaning that no data carried over the internet should be advantaged or disadvantaged over any other data carried over the Internet, regardless of how such an advantage or disadvantage may be determined or implemented.

The importance of net neutrality was brought to widespread public attention in 2008 when the Federal Communications Commission (FCC) of the United States of America formally censured Comcast, a cable-based network operator, for its blocking, discovered in the fall of 2007, of peer-to-peer Internet traffic that was being carried over its Tier 3

computer network. The FCC asserted that it had jurisdiction over Comcast's network management policies under the Communications Act 1934, hence the censure. This assertion was subsequently overruled by the United States Court of Appeals for the District of Columbia in 2010. Nevertheless, Comcast did, subsequently, modify its network management policies, adopting a far more focused and non-discriminatory network management approach that no longer included the blocking of peer-to-peer network traffic. This matter was widely reported in the media as a violation of net neutrality, and public opinion was strongly against Comcast's reported behaviour. *Further information on this subject can be found here (http://bit.ly/2lxFJUE).*

In 2010, Comcast was again in the news, for its attempt to charge Level 3 Communications, an American multinational telecommunications and Internet service provider that operates a Tier 1 communications network, part of the Internet's primary communications backbone, in the United States, for communicating data traffic, from the Netflix streaming video service, over its Tier 3 network. In actuality, the charge that Comcast attempted to levy was more likely a reduction in the fees that it already paid to Level 3 in order to access its Tier 1 network. The disagreement between Comcast and Level 3 ran for 3 years, until it was resolved in 2013, under an agreement, the terms of which were not made public. Again, the media reported this as another violation of net neutrality, and public opinion was, again, strongly against Comcast's reported behaviour, particularly as it appeared to be a potentially-precedent-setting step toward the paid-prioritisation of Internet traffic that would disadvantage businesses that could not afford to pay, particularly start-ups. *Further information on this subject can be found here (http://bit.ly/2mr1Ae0).*

Zero-rating is widely considered to violate net neutrality, because it allows certain (select) Internet traffic flows to be treated differently from all other Internet traffic flows, when all flows should be treated equally. Globally, the use of zero-rated services has received a mixed reception. A relatively large number of (mainly) developing countries, such as Angola, Anguilla, Antigua, Aruba, Bangladesh, Barbados, Benin, Bermuda, Bolivia, Bonaire, British Virgin Islands, Cambodia, Cape Verde, Cayman Islands, Colombia, Curaçao, Democratic Republic of the Congo, Dominica, East Timor, El Salvador, Fiji, French Guiana, Gabon, Ghana, Grenada, Guadeloupe, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Indonesia, Iraq, Jamaica, Jordan, Kenya, Kosovo, Kyrgyzstan, Liberia, Madagascar, Malawi, Maldives, Martinique, Mauritania, Mexico, Moldova, Mongolia, Montenegro, Montserrat, Morocco, Mozambique, Myanmar, Nauru, Nepal, Niger, Nigeria, Pakistan, Panama, Peru, Philippines, Republic of Congo, Rwanda, Saint Lucia, Senegal, Serbia, Seychelles, South Africa, Sri Lanka, St Kitts, St Vincent, St. Lucia, St. Vincent & the Grenadines, Suriname, Tajikistan, Tanzania, Thailand, Timor-Leste, Tonga, Trinidad and Tobago, Tunisia, Turks and Caicos Islands, Vanuatu, and Zambia, have embraced the use of zero-rated services supplied by well-known Internet companies such as Facebook, Google, and Wikipedia. Whilst a relatively small number of (mainly) developed countries, such as Chile, Estonia, Finland, Iceland, India, Japan, Latvia, Lithuania, Malta, Netherlands, Norway, and Slovenia, have either completely banned zero-rated services, or severely limited their use.

In the United States of America, a number of digital entertainment services have been zero-rated on the Internet access services provided by their owners for quite some time, including the DirecTV service owned by AT&T, the Stream service owned by Comcast,

and the Go90 service owned by Verizon. As of February 2017, AT&T, Sprint, T-Mobile, and Verizon all offered 'unlimited' mobile service plans that included zero-rated third-party video streaming. Shortly after T-Mobile launched its first zero-rated video streaming service in 2015, the Electronic Frontier Foundation (EFF) asked the FCC to investigate the service on the basis that it violated net neutrality. However, under Tom Wheeler, the previous head of the FCC, no action was taken against T-Mobile. The new head of the FCC, Ajit Pai, apparently sees zero-rated services as a way to help bring Internet-based digital services to low-income Americans. So, in terms of America, it looks like zero-rated services are very much here to stay. However, regardless of the FCC's somewhat laidback views on the subject, many people continue to express concerns over the use of zero-rated services and their long-term implications.

My own views on zero-rating are not clear-cut, and vary based on the context of its use. For example, in developing countries where the Internet, personal computing, and Web are still largely mysteries to many people, zero-rated services can be used to give people their first taste of the wondrous information technologies that many of us, particularly those of us that live in developed countries, take for granted. As the use of the Internet grows within such developing countries, the use of zero-rated services should then be slowly phased out, or restricted to only the poorest members of society. So, in this particular context I can definitely see how zero-rating can make a very positive contribution to the world. However, I must also note that when it comes to using zero-rated services to help bridge the digital divide, connect the unconnected, and bring the Internet, personal computing, and Web to the next billion people, particularly those living in developing countries, that someone, somewhere, must be paying for those services, and that it would probably be a far better solution if the money that was being spent on zero-rated services was instead used to subsidise normal Internet access such that it would then be affordable to even the poorest citizens of a developing country. In developed countries, I see that the potential exists for wealthy companies, that use the Internet to deliver digital services and can afford to zero-rate their services, to easily sweep aside their less-wealthy competitors, and by so doing create a highly-unbalanced (inequitable) Internet. So, in this particular context I very much see zero-rating as an existential threat to the Internet as we currently know it. Of course, I could be being overly dramatic with this particular viewpoint. Nevertheless, I can definitely see both good and bad in zero-rated services. However, if I was forced to decide one way or the other then I would greatly prefer to err on the side of caution and see them completely banned. Why? Because the Internet is just too important to allow it to become fragmented into fiefdoms of overtly conflicting commercial, personal, or political self-interest, which is a definite possibility when Internet traffic is selectively carried on a paid-for basis. The Internet is fragile enough as it is, so why even chance damaging this critically important global resource with the unchecked use of something like zero-rated services. Ultimately, my hope is that zero-rated services are just a temporary salve for a digital ill that will soon be cured by a dose of good old-fashioned commonsense (bandwidth-based pricing). *Please see my essay on Why Our Digital Future Needs Unlimited Data for more information on bandwidth-based pricing.*

However, before today's zero-rated services do finally disappear, which they surely will at some point, there is one way in which they could be very useful; by proving, once and for all, beyond a shadow of a doubt, that monthly data-download allowances, also known as data caps, are wholly unnecessary, and that we could all have affordable flat-fee

Internet access with 'effectively' unlimited data tomorrow, if only our ISPs would give it to us.

In the past we were told that monthly data-download allowances were a necessary evil, and that they were put in place to control our voracious use of an ISP's finite computer networking resources. I am sure that many years ago that this was absolutely true, and that there were undoubtedly many commercial and technical limitations that prevented ISPs from offering 'effectively' unlimited data to their customers. However, any such limitations are long since gone, because over the years ISPs have continually upgraded their systems until they are now more than capable of supporting 'effectively' unlimited data, certainly at modest bandwidths. Of course, even though it is now possible the ISPs do not currently offer such services because it is simply not in their interest to do so. There is still good money to be made from charging us for Internet access on a data-download basis. Nevertheless, I believe that this will soon change, and a possible catalyst for this change will be the arrival of highly affordable, high bandwidth, low latency, highly reliable, and ubiquitously available next-generation communications technologies, starting with *true* Fifth-Generation Mobile Communications (5G), which are due to launch around 2020.

Digital data is digital data, and regardless of what that data is used to represent, it is all just ones and zeroes. So the zero-rated data that is now available through mobile ISPs, such as T-Mobile in America, could actually be used for anything, including downloading applications, sending emails, and surfing the web, and not just for watching streamed video. By providing zero-rated data, the mobile ISPs are conclusively proving that they can easily give their customers 'effectively' unlimited data. I do not think that this is their intent but that is, nevertheless, what they are doing. ISPs are now offering zero-rated data because they are trying differentiate their offerings in a highly competitive, and, in the case of America, highly saturated, telecommunications market. Zero-rating is part of the inevitable 'race to the bottom' that is currently taking place within the telecommunications industry, and it is just one of the ways that we will eventually get to the point where petabytes (millions of terabytes or billions of gigabytes) of data will be downloadable for mere pennies. In the long run, it is services that are going to be important, not the pipes that carry those services. So, pure-play ISPs had better wake up, smell the roses, and diversify into content creation and distribution before it is all too late.

Now, before you get all excited, and start running around, waving your hands in the air, like you've just won the lottery, there is an inherent limitation to these zero-rated video streaming services, and that is that they do not, in general, require very much communications bandwidth in order to operate. Typically, a high-definition (HD) video stream, with a resolution of 1280 pixels by 720 pixels and a frame rate of 30 frames per second, needs a bandwidth of approximately 4 megabits per second (Mbps) when compressed with a current generation video codec, such as H.264 or VP8. So, if ISPs *did* start to offer 'effectively' unlimited data, then it would probably be at quite low bandwidths, which would, nevertheless, be perfectly suited to a streaming-oriented approach to personal computing, but far less suitable for our current download-oriented approach. For example, a bandwidth of just 4 Mbps would make downloading something big, like a whole HD movie, quite time consuming, but that same bandwidth would be perfectly fine to watch the exact same movie in real-time on a streamed basis. In most

situations, a 4 Mbps link to the Internet would actually be quite useable. For instance, you would be able to send and receive email, exchange instant messages on social networking sites, listen to music, surf the web, and, of course, watch HD videos 24 hours per day, 7 days per week, 31 days per month. Now, you might ask, wouldn't a lot of digital services feel very slow if accessed at just 4 Mbps? Well, a few definitely might, and some might even be completely unuseable, but on the whole most would not, because most digital services (web sites) do not actually send their data out at particularly high bandwidths. So, just because you can currently receive data from the Internet at, say, 1 gigabit per second (Gbps), if a digital service only sends its data out at 2 Mbps then you will receive that service at no more than 2 Mbps, probably a lot less, which, when you think about it, makes having a 1 Gbps link to the Internet somewhat questionable, especially if you are paying any sort of premium for that type of link. Of course, today, with our predominantly download-oriented approach to personal computing, a link to the Internet with a bandwidth of 1 Gbps is exactly what you need *(for a whole bunch of stupid reasons that I will not even attempt to explain here)*, but in the future, when a streaming-oriented approach is more the norm, our bandwidth needs will significantly reduce, possibly by as much as two orders of magnitude, at which point low-bandwidth Internet access will be more than sufficient. *Please see my essay on Why Our Digital Future Needs Unlimited Data for more information on download-oriented and streaming-oriented approaches to personal computing.*

So, if ISPs did offer 'effectively' unlimited data at a bandwidth of 4 Mbps, just how much data could we download every month? Well, assuming that there were 31 days in the month, it would be roughly 1,339 gigabytes, which is considerably more than the 20 to 30 gigabytes currently available from a good wireless (mobile) Internet access service. However, I think that if 'effectively' unlimited data was actually made available on a commercial basis that a basic service would probably have a bandwidth that is a little bit higher than just 4 Mbps, perhaps around 10 Mbps, which would then allow you to download 3,348 gigabytes of data per month, and would easily be able to support the use of all streaming-oriented services and most download-oriented ones as well.

So, whilst zero-rating is seen as an evil by many people, I hope that it is just a short-term one that has been born out of necessity, which will eventually lead to a long-term good; the day when affordable flat-fee Internet access with 'effectively' unlimited data becomes a reality. I can but wish.

The STREAM TONE: *The Future of Personal Computing?*

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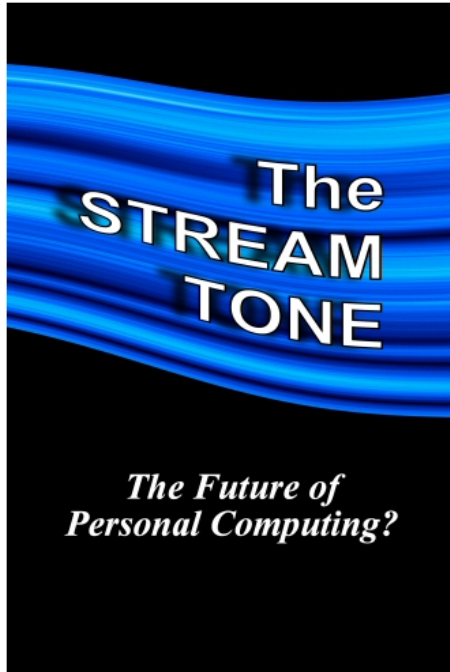
Imagine… a world where your next personal computing device is the last one that you would ever need to buy. Where you would never need to worry about operating systems, software patches, or viruses. Where you always had enough processing power, memory, storage, and top-of-the-line graphics. Where you could access all of the very best software applications, regardless of their platform. Where you had a constant connection to all your favourite digital services, and your battery lasted for days, perhaps even weeks, of full-on use. Sounds good, doesn't it? Well, this is the world of the Stream Tone. A world that does not exist in some far off future; this could be, figuratively speaking, our world a mere five minutes from now. All that is needed to make it a reality is the creative convergence of certain technologies that are already available and in use today.

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Personal computing is changing from an old world of local services, provided by local devices, to a new world of remote Web-based services, provided by cloud computing-based data centres. **The STREAM TONE:** *The Future of Personal Computing?* is a 408-page academically-oriented non-fiction book that explores, in considerable technical detail, what might be required to make a comprehensive move to this exciting new world, and the many benefits that move could bring. This book not only attempts to make a thorough evaluation of the technology ecosystem that will be required to create this future but also considers many of the implications of such a move. Along the way, it also discusses a wide range of currently-available technologies and how they could possibly be used to enable this future.

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