AT&T/FaceTime Case Study

Mobile Broadband Working Group

Open Internet Advisory Committee
Federal Communications Commission

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The Mobile Broadband group created a document explaining the facts behind AT&T's limited rollout of FaceTime on its mobile network, and included a number of different opinions on whether the limitations were appropriate.

The Mobile Broadband working group of the Open Internet Advisory Committee (OIAC) was formed to review the state of mobile broadband networks and assess how well Open Internet principles are working in practice. Although this report does not attempt to engage in any legal interpretations of the Open Internet Order, we do note that the Order [http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-201A1.pdf] treats these mobile broadband networks differently from traditional fixed networks. While both fixed and mobile broadband providers must disclose their management practices, mobile broadband providers have greater latitude for blocking devices and applications (as long as they do not compete with the provider's own voice or video telephony services) and discriminating in how they serve traffic, in accordance with reasonable network-management practices.

The working group is investigating the tension between the goals of a free and open Internet, and the very real challenges that arise in managing mobile broadband networks. Such an investigation can easily devolve into vague discussions of high-level concepts or principles that may not be realizable in practice. To ground the discussion, the group started by considering several concrete case studies to help identify important trade-offs, principles, and other issues warranting further study, rather than trying to reach consensus on specific policy recommendations. The group explored one timely case study concerning how AT&T restricted the use of Apple's FaceTime application over its cellular data network to customers subscribed to a particular pricing plan. Video communication is widely viewed as the logical next step beyond the delivery of voice, text, and images over cellular data networks. Yet, these applications consume significant bandwidth and often have strict performance requirements, making them especially challenging for carriers to support efficiently. In the rest of this report, we discuss the specifics of the case study, analyze the high-level issues it raises, and present several possible conclusions from the unique perspectives of application developers, carriers, and equipment vendors.

AT&T and FaceTime

FaceTime is a high-quality video-calling service created by Apple for use on the iPhone, iPad, and Mac. On the iPhone, rather than operating as a separate application, FaceTime is automatically integrated into the normal calling features of the user device. A user can upgrade a conventional phone call to include video simply by pressing a FaceTime button. Originally, Apple made FaceTime available only over wireless (WiFi) connections to the Internet, and the FaceTime calling features could not be used when devices were connected to a cellular network; however, that restriction was recently lifted, in part.

In June 2012, Apple announced that FaceTime would be available over cellular data networks, though Apple acknowledged that carrier restrictions may apply. In August 2012, AT&T announced that, in the wake of Apple's lifting of its restriction on FaceTime use, AT&T would limit the use of FaceTime over its cellular data network to customers of its MobileShare plans, in which multiple devices share a single limit for total data usage. Customers with "unlimited" data plans would not be able to use FaceTime on AT&T's cellular data network. The requirement for a specific plan would be enforced directly by the device, based on carrier settings [http://support.apple.com/kb/HT1970] (such as the current data plan or other eligibility information) learned from the carrier when the device authenticates with the cellular network.

Other providers, such as Sprint and Verizon, announced that FaceTime would operate over their cellular data networks for users of all billing plans [http://9to5mac.com/2012/07/18/sprint-says-it-will-not-charge-for-facetime-over-cellular-verizon-calls-talk-premature/, http://arstechnica.com/apple/2012/09/verizon-will-enable-iphones-facetime-on-all-data-plans-unlike-att/].

Some advocates and press denounced AT&T's decision, claiming that AT&T was violating the FCC's Open Internet Order [http://www.savetheinternet.com/press-release/99480/att-blocking-iphones-facetime-app-would-harm-consumers-and-break-net-neutrality, http://publicknowledge.org/att-facetime]. They argued that AT&T was blocking an application competing with its own voice or video telephony services, and that reasonable network management practices do not include favoring one pricing plan over another.

Responding to these claims, a blog post by AT&T [http://attpublicpolicy.com/fcc/enabling-facetime-over-our-mobile-broadband-network/] argued that AT&T's policy was fully transparent, and that AT&T does not have a competitive video calling application. AT&T also argued that the FCC's Open Internet Order does not regulate the handling of pre-loaded applications (i.e., applications integrated into the device's operating system, rather than installed manually by a user). AT&T also noted that all customers can continue running FaceTime over WiFi connections to the Internet.

In September 2012, several public interest groups announced their intent to file a formal complaint with the FCC [http://arstechnica.com/tech-policy/2012/09/att-faces-formal-fcc-complaint-for-blocking-cellular-facetime-use/], arguing that AT&T's restrictions of FaceTime usage violate the Open Internet Order. In October 2012, an AT&T customer in San Francisco filed a consumer complaint with the FCC concerning AT&T's blocking of FaceTime on his "unlimited" data plan [http://www.businessinsider.com/consumer-fcc-complaint-att-facetime-2012-10].

On November 8, 2012, AT&T announced [http://attpublicpolicy.com/consumers-2/a-few-thoughts-on-facetime/] plans to support FaceTime on all of its tiered data plans for users with an LTE device, over the next 8-10 weeks. AT&T customers with non-LTE devices or unlimited data plans would still not have access to FaceTime over the cellular network. AT&T also began rolling out new billing plans to enable deaf and hard-of-hearing customers to use FaceTime.

Main Issues
AT&T's restrictions on the FaceTime application raise several interesting issues:

Pre-loaded application: Unlike many applications, FaceTime comes pre-loaded on a very popular phone. The application is immediately available to all users of the phone without requiring purchase or download, and is accessed via the core calling functions of the device. Every time a customer makes a phone call, the option of using FaceTime is immediately available. This makes it much more likely that the application would enjoy large-scale adoption very quickly. In addition, simultaneous use of the application (say, by spectators at a sporting event) could overwhelm the available radio network capacity, with its finite spectrum. In contrast, applications that require a manual download typically see lower penetration, even for popular applications that can be downloaded free of charge. For example, while around 75 million iPhones were sold in 2010, Skype was downloaded to only 7 million iPhones, resulting in less than 10% penetration [http://www.statisticbrain.com/skype-statistics/]. The rapid availability of FaceTime is said to be a particular challenge for AT&T, which historically has a much larger penetration of Apple iPhones among its customers, compared to other carriers [http://news.cnet.com/8301-13579_3-57492508-37/iphone-owned-63-percent-of-smartphone-marketshare-at-at-t/]; today, more than half of AT&T's cellular data-network subscribers use an iPhone.

High bandwidth requirements: Cellular data networks have limited capacity, particularly in the "upstream" direction from user devices to the Internet; as such, carriers must carefully manage the shared "up-link" bandwidth to ensure reasonable performance for all users. While most content-delivery applications primarily impose load on the "down link," high-quality, video-telephony applications (like FaceTime) typically generate a large amount of traffic in both directions to deliver high-quality video to both participants in a video phone call. The quality of a multimedia application depends on the available bandwidth. Most popular applications adapt automatically in the presence of congestion, to decrease the quality of the audio or video stream to share bandwidth fairly with other applications. For example, data from Skype suggests that 128-300kbps is required for a standard video call [https://support.skype.com/en/faq/FA1417/how-much-bandwidth-does-skype-need], whereas various online reports suggest that FaceTime consumes around 100kbps - 1000kbps [http://www.tested.com/news/254277-why-is-att-doing-you-a-favor-by-blocking-facetime/, http://www.padgadget.com/2012/06/20/concerns-about-facetime-over-cellular-will-you-max-out-your-data- limits, http://appadvice.com/appnn/2012/10/its-pretty-stupid-ridiculous-how-much-data-netflix-uses-over-lte, http://www.nokiasiemensnetworks.com/system/files/document/smart__labs_-_facetime_over_cellular_in_iphone_ios6_final_0.pdf], consistent a limited set of measurements conducted at Bell Labs at the request of this working group. It therefore seems to be the case that FaceTime currently consumes on average 2-4 times more bandwidth than a similar Skype video call. It is important to note that there is no fundamental reason why FaceTime could not adapt to congestion the same way as other applications, and the way FaceTime behaves in the presence of congestion may easily change in the future.

Staged deployment of new applications: Rapid adoption of a new application might lead to large and unpredictable changes in the traffic load on a cellular data network. Carriers may want to

start with a limited trial deployment of a new application to better understand its effects before wide-scale deployment. This can provide measurement data and operational experience that carriers and application developers can use to make the most effective use of limited resources, or to identify appropriate policies for sharing resources with other applications. The AT&T/FaceTime case study raises an interesting question of whether or not restricting usage to customers of a particular pricing plan is a good way to limit (i) the number of users in an initial deployment (i.e., to users of a particular plan) or (ii) the total volume of traffic (i.e., by denying access to users with unlimited data plans), and what other alternatives might exist.

Application management on the device vs. the network: A carrier can block an application by discarding the packets it sends or receives; alternatively, a device such as a smart phone can prevent users from running a particular application, thereby keeping the traffic from ever reaching the network. In the AT&T/FaceTime case study, the usage of FaceTime on AT&T's network was limited directly on the device, rather than inside the network. An interesting policy question is whether it matters where an application-management decision is enforced, and which organization decides what policies to place on an application's use. In some cases, the creator of an application may want its users to enjoy unfettered access to the application, but in others the application developer may prefer to limit usage to ensure that supported users enjoy good performance; distinguishing between these two situations is surprisingly difficult. In this case, Apple and AT&T have not commented on which organization initiated the restrictions, and whether or not this was a collaborative decision.

These issues demonstrate the subtle trade-offs that arise in determining whether restricting FaceTime usage over AT&T's network constitutes blocking and/or reasonable network management.

Summary Opinions

Different members of the working group came to different opinions about the restriction of FaceTime usage on AT&T's network. Generally, the working-group members agreed that blocking applications runs the risk of discouraging innovation, but that carriers also need effective ways to manage the limited resources in cellular networks. This led to three main opinions about AT&T's decision to restrict customer access to the FaceTime application over its cellular network, presented from the perspectives of different parts of the mobile broadband ecosystem -- application developers, carriers, and network equipment vendors. These opinions convey the conclusions of advocates for these perspectives among the working-group members, but do not attempt to fully represent each community.

- From the perspective of application developers:

AT&T did not choose the optimal approach by blocking access to the FaceTime application for customers on certain data plans. By singling out one popular application, the door is opened for carriers to block lawful use of applications, require customers to upgrade to potentially costlier, limited plans, and justify their actions by claiming to be engaged in reasonable network-management practices. Unfortunately, blocking a specific application for a large number of users on certain pricing plans, instead of managing the congestion that application and others might cause, sets a precedent that could have very negative consequences for the vibrant market for mobile applications. Allowing application blocking means that no developer could be sure that

his or her mobile application will be able to reach customers. If a carrier can block an application entirely at its discretion, investors will have to consider a new risk in addition to the normal risks faced by any start up. Unlike technical risk, financial risk, or organizational risk, the risk of being blocked cannot be mitigated. The existence of that risk will limit the investment available to applications developers, limiting the number of applications created, slowing innovation, and limiting consumer choice.

AT&T may have chosen to block FaceTime because it was a simple way to manage the potential congestion that could have occurred if the application were widely used. The carrier may have chosen to block FaceTime because it was concerned that broad use of a high-bandwidth data application by users of unlimited pricing plans would impact its profitability. Managing congestion and profitability are legitimate objectives for AT&T, but furthering those objectives by blocking specific applications is not the way to do it. There are many ways AT&T could have managed the roll out of FaceTime over cellular without taking the kind of application-specific action that harms applications developers and ultimately consumers. For example, AT&T could have instituted rate-limiting of individual customers, applied in a neutral manner, to limit congestion. Rate limits could be imposed at peak times or in response to congestion. In the medium- or long-term, AT&T could more aggressively scale up network capacity or apply other bandwidth-management techniques (such as WiFi offload) in localized hot spots where FaceTime and other high-bandwidth applications create congestion problems. AT&T can also charge users for the amount of data they consume, independent of the application. We recognize that these approaches require AT&T to deploy the technology in the network to actually manage the network, or to make the investment to market a new pricing plan to consumers. We understand that blocking FaceTime may be simpler and cheaper than deploying new network-management technology, increasing capacity, or changing pricing, but blocking a specific application chills investment, harms application developers, and reduces consumer choice. That is too high a price to pay when other alternatives are readily available.

In short, network management should focus on the underlying conditions that cause degraded performance of the network and address those conditions with solutions that optimize performance in a neutral manner for all users and applications. Such approaches -- indeed, all aspects of traffic management and engineering -- may require advanced planning to ensure that they are available when network conditions require them, but that fact makes them no less appropriate from a technical perspective. Application-agnostic network-management approaches should be considered and exhausted before application-specific approaches are even considered on a temporary basis, and customers should be able to have their choice of applications without having to change their data plans. Giving customers choice includes the option for user-controlled quality of service, where users decide to favor traffic from one application over another, in allocating whatever share of network bandwidth they receive from the carrier.

- From the perspective of carriers:
Given the bandwidth-intensive nature of the FaceTime application and AT&T's significant base of iPhone subscribers, AT&T has good reasons to be concerned about the potential for FaceTime to cause a focused, or localized, overload condition in its network. AT&T's approach of enabling FaceTime on Wi-Fi and on cellular for shared data plan subscribers is a reasonable way of managing the risk of network congestion. As data about FaceTime usage becomes available and

as its network evolves, AT&T has indicated that it may further expand the availability of the application. In fact, AT&T has already expanded the availability of the application to users with LTE devices on tiered service plans and on new custom plans for the hearing impaired.

AT&T's approach reduces the probability of a focused overload of its network due to FaceTime usage. By requiring a usage-based plan to access FaceTime over the cellular network, AT&T's approach both encourages use of the FaceTime service in a manner that is less likely to adversely impact the experience of other users on the network, and manages the number of subscribers that are likely to use such a bandwidth-intensive application. Usage-based data plans provide an incentive for users to manage their consumption of network bandwidth, and ensure that heavier bandwidth users pay a proportionate amount for their usage when compared to lighter bandwidth users. Unlimited data plans provide no incentive to users to manage the data consumed by bandwidth-intensive applications. Unlike some of its competitors, AT&T continues to offer unlimited data plans to existing subscribers to those plans, even when those subscribers upgrade to a new subsidized device. Since some carriers mandate that subscribers switch to a shared data plan when upgrading to a new device, AT&T's approach gives customers more flexibility than some of its competitors in choosing pricing plans and services that meet their needs. AT&T's announced expansion of FaceTime availability to LTE devices on individual tiered plans recognizes the increased capacity of its LTE network which, unlike its UMTS network, is not currently carrying voice calls, thus balancing the overall service quality for all of its customers.

While critics of AT&T's approach have described possible alternative approaches to the situation, none of the alternatives would effectively address AT&T's concerns. AT&T is aggressively expanding its cellular network capacity, and its devices are configured to support offload of data traffic to Wi-Fi networks where possible. AT&T currently operates over 30,000 Wi-Fi hotspots freely available to its data plan subscribers. While some have proposed rate limiting subscribers during periods of congestion, this approach is problematic for two reasons. One reason is that dynamic rate limiting is a complex mechanism that is not currently supported by wireless standards and vendor equipment. While dynamic rate limiting might be an option in the future, it is not an option that is available to AT&T today. The second reason is that dynamic rate limiting has the potential to degrade performance for both FaceTime and other applications. As a result, rate limiting may lead to more user dissatisfaction than AT&T's approach. This does not rule out dynamic rate limiting as a potential solution. However, it illustrates the complexity of providing good quality mobile broadband services.

While some have argued that AT&T's approach may adversely affect innovation, this risk can be mitigated by application developers by working cooperatively with carriers to build applications that do not risk harm to the network. In the case of FaceTime, the company developing the application built a mechanism into its operating system that enables operators to require certain plans. Other non-US carriers have used the same mechanism. Apple's page at http://support.apple.com/kb/ht1937 shows the carrier-by-carrier breakdown of features supported by carriers world-wide. This specific example does not support the "chill to investment" argument, as the dominant player allowed its offering to be managed, which is rather different from a new entrant struggling to break in to a market.

In making these types of decisions, carriers are weighing multiple factors and taking competitive risks that may or may not succeed in the marketplace, but the marketplace can and should determine the success of these approaches. These decisions and the set of available techniques are not static and cannot be proscribed or regulated with any reasonable degree of applicability or validity over time.

- From the perspective of network equipment vendors:
Applications supporting real-time, two-way video calling such as Skype have become increasingly popular (more than 100 million logins/month and 30 million simultaneously active calls [http://www.statisticbrain.com/skype-statistics/]) and this popularity has increased with the availability of mobile clients for these applications. Given the significant additional bandwidth requirements of video sessions over voice calling, encoding the video frames at lower bit rates and the ability to adapt to changing network conditions such as the available bandwidth is key to the successful deployment or use of such applications. This is particularly true for mobile networks which represent a highly constrained and shared resource in both the uplink and downlink directions. For these reasons Skype utilizes adaptive session control techniques to constantly adjust the bit rate of the video stream transmitted between the two endpoints.

Apple's Facetime application is targeted to the same video calling market segment, but as noted above does not seem to adapt as readily/aggressively to changing network conditions. To illustrate the additional potential consumption compared to Skype usage, consider the following: if, as stated above, 10% of iPhone users were Skype users. When one compares this to the 100% of iPhone users who have access to the Facetime client and the at least 2x additional bandwidth consumption by the iPhone Facetime client compared to the Skype client, it is reasonable to conclude that the total network bandwidth usage (across all users and sessions) of Facetime could be as much as 20x higher than that of Skype, for operators who have a significant proportion of iPhones in their network.

In this context, it is reasonable to conclude that AT&T, with the largest number of iPhone users and largest fraction of their subscribers as iPhone users would have particular concerns about the load that the Facetime application would put on their network, with the potential to significantly degrade the available bandwidth for all other applications. Moreover, the concern would be most prevalent with respect to the most scarce resource -- the cellular network (which typically has ~20Mhz of spectrum compared to the more than 100Mhz of WiFi spectrum [http://en.wikipedia.org/wiki/List_of_WLAN_channels]) -- which is also the resource for which users have the highest service expectation. Given this, there would be a clear imperative to manage the usage of FaceTime application on AT&T's cellular network, with the option for unmanaged usage of FaceTime over their network. This is precisely the behavior that AT&T exhibited by limiting the usage of FaceTime to only a subset of their pricing plans, whilst making FaceTime available to all users over the WiFi interface. As such, it is reasonable to conclude that AT&T was trying to employ reasonable network management to the use of FaceTime over their network, albeit it in a relatively crude form.

It is interesting to contemplate whether there are alternative means by which the usage of FaceTime could have been managed in a way that would have made it available to all cellular users but in a scalable way. Clearly, if FaceTime was similar to Skype in terms of its bandwidth

utilization per session, or having the same device penetration (available on 10% of iPhones), no specific network management would have been required relative to that applied for Skype. Therefore an alternative approach would have been for AT&T to work with Apple to improve the bandwidth adaptation capabilities of the FaceTime application. Another alternative approach could have been to rate limit the usage of FaceTime in the network both on an individual session basis (per user), and an aggregate basis (total bandwidth allowed for all FaceTime users) using rate limiting techniques employed by some operators when usage caps have been reached, or for service plans that explicitly exclude usage of certain applications. Last, a non-application-specific rate-limiting approach could have been employed whereby the peak bandwidth usage by each user was limited when the network was congested. These approaches would have been reasonable and preferable in terms of the universal applicability and equanimity of the solution. It is important to note, however, that these alternative approaches may actually have resulted in a less satisfactory experience for all FaceTime users, or across all applications being used (for the non-application-specific approach), in contrast to the approach that AT&T took which likely resulted in a more satisfactory FaceTime experience, but for a subset of users. In other words, non-application specific approaches can appear 'fair' as they apply a 'one size fits all' philosophy whereby all users receive the same treatment for all applications. But, in some cases, and at some points in time, users may have a preference for a certain application (e.g. a FaceTime session for an important call) and would prefer it to be prioritized over other internet-based services when the network is congested.

Conclusion

The three summary opinions capture different perspectives, with some overlapping points and differences in emphasis. Most members of the working group agreed with aspects of all three opinions, with some aligning more strongly with one view over the others. The case study also highlights the need for future cellular networking equipment and management systems to offer greater flexibility in managing the fine-grain sharing of limited network resources. This would make it easier for carriers to limit the impact new applications have on the performance experienced by other users using application-neutral techniques.

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