How Telecom impacts Connectivity in Chinese market

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In December 2013, the MIIT of China (Ministry of Industry and Information Technology) released the 4G frequency license to the three government-owned telecom operators (China Mobile, China Unicom, and China Telecom), establishing that the Telecom industry of China has officially entered into the 4G generation, beginning from TD-LTE, although 3G has only been used for around 4 years in China. While the ground-based Telecom industry is rapidly developing, one large area in China appears to be forgotten - the area in the air. The cabin of the civil aircraft has become the last "isolated island" of the information age, which makes the passengers on board feel like being back in the early years of the 20th century. The Chinese civil aviation market is experiencing accelerated growth and as more travelers are flying, passengers require a similar communication experience like they enjoy on the ground, which will result in an accelerated and diversified growth phase for China's connectivity market.

Since business and personal life are already inseparable to the information over the Internet, individual users require information communications anytime, anywhere, with any device, and wish information to be efficiently and continuously transferred and received across the various cell or wireless networks wherever they move. This is called "*ubiquitous communications*". From the early age of 2G to the latest 4G, from the base station of cell mobile communications to the access point of wireless communications (like Wi-Fi), the people in the Telecom industry always push themselves toward this ultimate goal, *ubiquitous communications*. Therefore, from the point of view of the Telecom industry, the aircraft, which is much smaller than the ground, should not be an obstacle when *ubiquitous communications* is already anticipated in the near future. However, this "isolated island" has many more difficulties and complexities than the average person anticipates. Some of the difficulties exist all over the world, but some of them are so special to the Chinese market.

In China, the Telecom market is controlled by the government via three government-owned enterprises (China Mobile, China Unicom, and China Telecom). The government gives the frequency licenses respectively to the 3 telecom operators, in a way of an administrative order not by an open business process. By this method, the government can completely control the Telecom industry, and decide any critical or significant issue. For example, they could compel the three operators to establish TD-LTE for 4G, not FDD-LTE which is more popular in other countries, by defining that the 4G frequency license is only for TD-LTE, or they could order one operator to abandon an old Telecom service in order to withdraw the frequency license. Therefore, it is impossible for a western-based Telecom operator to get any license to run the service in China. Based on this background, when the connectivity industry is considered the discussion would be more complex due to the cross pollination of the Telecom and Aerospace industries.

Since any Chinese airline is considered 'domestic land', for cell mobile communications in the aircraft cabin the Telecom operator can only be one of the three government-owned enterprises. Therefore, any connectivity system that is already bound to a foreign operator must use a roaming policy. However, the situation here is not as easy as that of a cell phone taken by a user going abroad, who logs into a foreign Telecom operator using their service provider's roaming policy, because the connectivity system has included a part of the base station (i.e. BTS for 2G, NodeB for 3G, and eNodeB for 4G), which is normally designed for and controlled by a certain operator. As a result, for Chinese airlines, the connectivity system has to be specialized to one Chinese operator in its LRU design from the start of the program. For some connectivity system providers, it is not a problem since their system is not bound to any Telecom operator and just modifies the base station for the operator chosen by the airline or from the business partner relationship. However, for some connectivity providers, such a problem is cruel because they are already integrated and form a whole service chain, from the bottom (i.e. the LURs) to the top (i.e. the operator run by themselves) but they must modify the system in order to adapt to another operator and are forced to abandon a large part of the revenue, which is normally obtained from the cell mobile communication operation.

On the other hand, an interesting issue comes out when foreign airline aircraft get into China. Basically, the cabin of foreign airlines could be equipped with a foreign Telecom operator for two reasons. Firstly, although the foreign operator inside the cabin never has a frequency license granted by the government of China, the cell signal will not be detected by the cell equipment and networks on the ground when the aircraft is above around 6000 meters, and the base station inside the cabin will be shut down after the aircraft goes below 6000 meters. Therefore, from a technology point of view, it is safe that the frequency used by the foreign operator inside the cabin will not interfere with the same frequency used on the ground. Secondly, from the regulation point of view, does the regulation allow this operation since the sky is also considered to be the territory of China and therefore controlled by the government? The answer is neither NO nor YES. Based on the principle of the administration management, the government of China will surely require any frequency usage inside the cabin to obey the frequency license when the aircraft flies in the territory of China regardless of Chinese or foreign airlines, which means that the three Telecom operators owned by the Chinese government are the only option to be equipped inside the cabin since the government only gives aTelecom licenses to them. However, based on the regulation or law, no detailed clause exists, till now, to clarify this requirement because connectivity is a brand-new area and the clause about it has not been released. Now, the authority of China, i.e. CAAC (Civil Aviation Administration of China) uses an "arbitrary" but direct method - the cell mobile communication service inside cabin is forbidden in China regardless of Chinese or foreign airlines, which seems to be the only, although a little "slothful", method for the government before the connectivity operation is considered thoroughly. However, the news, that the FAA is in the process of considering and approving the cell mobile communication service inside the cabin, will give CAAC a positive drive to consider the regulation modification not just using a ban.

Compared to the complex issues arising from the cell mobile communication service, the wireless communication service makes the connectivity industry much more relaxed, because the Wi-Fi frequency is free to use. However, Wi-Fi could not provide the same voice and message service as the cell mobile communication, which must be guaranteed, immediate and real-time. The first reason is that Wi-Fi is not a Telecom system, but originated from "packet switch" which is a best-effort

system using the protocol of Ethernet and IP, and the cell mobile communication comes from the traditional telephone industry on the ground whose principle is to guarantee the service, previously using "circuit switch". Although "packet switch" has been evolved to fulfill the harsh requirements of the Telecom industry, the original aim of Wi-Fi neither was, nor is for Telecom, and thus it lacks strict internal designs as similar as the protocols and standards implemented everywhere inside the telecom system in order to guarantee the service. On the other hand, the Telecom industry has established a global addressing system (e.g. the telephone number) to guarantee that the voice and message could be transferred to the correct end user immediately, and AAA (Authentication, Authorization, Accounting) and Bill system have been established for users' login and charge. Wi-Fi could provide VoIP (Voice-over-IP) and message service, but they must be implemented by certain software applications (like Skype for VoIP, and Whatsapp for message). This means that the service could be successful only when the users at the two ends use the same application. For example, it is impossible that a user sends a message via Whatsapp to another user who knows nothing about Whatsapp. Therefore, the Telecom global addressing and AAA system, although very old-fashioned, but seems to be the only effective way to guarantee the service locating and transferring to the correct user.

Some interesting ideas could be considered based on *ubiquitous communications* when the connectivity industry finds a contradiction between Wi-Fi (the only available connectivity system that could be freely used in the cabin now) and the requirements of guaranteed and immediate voice and messaging. One method coming from *ubiquitous communications* is to implement the mobility management in the application layer in order to make the layers below (e.g. MAC layer or PHY layer) transparent for the user. In this way, the information could be transferred to the account generated in the application layer regardless what communication mode (e.g. 3G, 4G, or WiFi) is used. A well-known protocol named SIP (Session Initiation Protocol), which was invented based on such a principle, is already used by the Telecom industry in their 4G core networks. The operator uses SIP to transfer the information among different infrastructures, taking the telephone number to be the account used by SIP. This example could be enlightening to the connectivity industry. Since Wi-Fi is ready inside the cabin, is it possible that SIP is used to transfer the voice and message over Wi-Fi using the telephone number as the user account? A lot of hard work surely needs to be done on this idea, but the future is full of challenge and opportunities.

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Editor's Note: You can get a bit more information about the SIP reference here