

## GEOFFREY BOUQUOT

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Then one of the main drivers, which links to our next panelist, is the exploitation of data, which is one of the big areas in commercial space. We know about GPS, which you will hear about, and then exploitation of data. Over to you, Geoffrey.

### **Geoffrey Bouquot**

Thank you very much for inviting me. I would like to start with a very simple and legitimate question, what is the link between automated cars and connectivity and space? Right now, if you take a regular expression which is that it is a smartphone on wheels and I think Tesla has been the first to exemplify and show the way for development of new cars as software-defined vehicles, as you already mentioned. In fact, it is a piece of hardware that is connected and, increasingly, this kind of connectivity is linked to space. This is exactly why we are having this kind of session today and why we see cars as a smartphone, connected as an IoT, as they have already been designed, as being a provider of data as well as a user of data in real-time. I already mentioned Tesla and the link between connected cars on one side with Starlink, which is actually the low-Earth-orbit (LEO), as was already mentioned, constellation of satellites launched by Elon Musk. It is probably the first one where we have such a concrete connection between a car manufacturer and a builder of a satellite constellation.

There are other examples from other countries, such as Geely, the Chinese manufacturer, which is also very interested in building its own constellation of LEO satellites. In fact, there are many other examples coming, with an announcement from BMW just yesterday that it was interested in going a bit further in that direction, possibly with partnerships, not necessarily its own constellation. I think this is really the trend and at the same time, with the parallel with the smartphone industry, Apple has also mentioned that for its next iPhones it would use this link between their smartphones and the connection to such satellite services. Why is that? I would say because of new chips, which I would say are affordable because in the car industry you need cheap chips to be affordable in terms of volume, which is making interesting business models really viable. The first ones available are not really safety-critical but more like connection of the last resort, so if you are moving in places, such as rural areas, where you do not have the connectivity provided by traditional infrastructures, this can be used in case of a crash, emergency or battery problem on an electric vehicle. This could be the connection of last

resort, which is enabled with latency that is okay, which we already mentioned, which is roughly 40 milliseconds.

This is the sort of technology that will be available in the near future. If we look a bit beyond that to around 2030, it becomes really interesting, not just providing seamless connectivity but also enabling what we call over-the-air developments, so that those cars will be upgradable wherever and whenever you want. This is exactly what satellite technology of tomorrow will be able to provide. It is also a link to automated cars, which we are designing right now and will hit the roads in the next few years. They are actually becoming automated, and this is enabled by this type of connectivity devices from these LEO satellite constellations, where you can have very precise tracking down to a few dozen centimeters. That used to be a defense paradigm and it is now increasingly entering civilian applications. By having automated vehicles that can register, you can also use it to enrich what are seen as broader services, which is what we call crowdsourced systems where the car can enrich maps, actually give information to many other service providers. Cars are becoming parts of more global systems. I could also give you some examples from tractors for agriculture where Valeo, for instance, is providing these sorts of connectivity systems, as well as in mining applications. As far as I am concerned, we stop at defense.

There are some technical challenges that I will not bother you with, but I am very enthusiastic about the design of those antennas, which have to be really technologically advanced to connect with the satellites at the same time as the traditional infrastructures. However, if I were to summarize a few technical hurdles that I see very concretely right now. The first, is the standards because you cannot develop this area if you do not have a global governance that makes sure that this technology developed by Tesla is also available when it is developed by another car manufacturer. Here, we can see that in the 3GPP systems and governance by 2030 we hope that 6G will offer the first applications of the next release of the norms and standards, making it possible for such applications between cellular and satellite applications. The second area is cost efficiency which, as I said, if you want to scale and make sure those chips are available for the automotive industry, you have to think in terms of volume. This is also why I drew the parallel with the smartphone industry because we actually use the same, which I think is positive in the sense that we will get the volume effect from the chipsets for the smartphone industry, in order to embed them in the car industry. Last but not least, as has already been mentioned, there is the cyber issue. Those devices that are designed from a commercial and civil perspective are or could be very interesting threats. When you take control of an automated fleet it becomes a very interesting weapon. That is why the blurred frontiers between the civilian and the military activities is very important when it comes to IoT devices and I think that is where we are all heading with the ownership of constellations by some private companies raising the problems you already mentioned. Therefore, independence of technology is still the new frontier, even in space.

### **Patrick Nicolet**

Thank you, Geoffrey. I think it is very interesting and we heard before from Professor Suzuki and Daniel, there is space and then further space, so we go to the Moon, Mars, etc. In fact, space is a new type of frontier because then it sends us back to Earth. Something you explained — and which will probably be Thierry's topic for another one — is the enablement of



autonomous systems. That will raise another set of questions for Daniel as we will operate with multiple identities in autonomous systems and we'll no longer be able to interact physically as human beings as you do today with your phone and an application, which is a basic, even rustic, model. Your avatar will be part of an autonomous system and space is enabling this.