The “uberization" of the GNSS Positioning Infrastructure

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SUMMARY

In the past the major GNSS precise positioning developments have been made by surveyors and geodetic engineers, leading to concepts such as GNSS Real-Time Kinematic (RTK) (and network-RTK) services. These users possessed expensive phase-tracking GNSS receivers with installed software that was able to apply correction data (transmitted by either commercial or government RTK service providers) to sophisticated measurement processing algorithms to generate centimetre-level accuracy positioning solutions. The use of GNSS in high precision mode is today a de facto standard for precision agriculture, construction engineering, automated ports operations, and even UAV photogrammetry. The authors speculate on a future where the driving forces for precise real-time GNSS positioning are changed, and which could lead to some far-reaching changes in hardware, software and service provision. The price of GNSS chipset, and associated OEM boards, has decreased dramatically, and now cost up to several hundreds $USD in small quantities. Furthermore such hardware has progressively increased their tracking and measurement processing capability, so that nowadays they are capable of tracking multi-constellation (GPS, Galileo, GLONASS, BeiDou, and others) and multi-frequency (at least dual-frequency, and often triple-frequency as well). To operate in high precision mode, these receivers must receive and process measurements and corrections from either a single reference station (single-base RTK), or from a GNSS network RTK server (network-RTK). Data and transmission standards such as RTCM and NTRIP have facilitated such real-time services, typically via mobile terrestrial internet links (4G and soon 5G). On the other hand, techniques such as Precise Point Positioning (PPP) and PPP with ambiguity resolution (PPP-AR) have the advantage of requiring a significantly reduced number of reference stations to provide global coverage. Enabling developments include transmission of augmentation data via a satellite downlink, and proprietary data formats, though a new RTCM-SSR standard will assist in “democratizing” real-time PPP. But what is the impact on GNSS Positioning Infrastructure? Less Positioning Infrastructure potentially

allows for many new service providers. But what about the impact on users? The authors speculate that every GNSS receiver will not be classified, as they are today, as a “rover” or as “ base” station receiver. A GNSS user receiver can be connected to the Cloud and could participate in a collaborative positioning scheme. Much as a car owner can chose to “sell” spare capacity by transporting strangers from one location to another using services such as those provided by “Uber", or a house or apartment owner could chose to rent rooms or apartments via “AirBNB”, a GNSS receiver owner could contribute their data to a precise positioning service. Who might be these new GNSS receiver owners? They may come from a new class of user, perhaps from market segments such as IoT, Industry 4.0, autonomous vehicles, etc. Cloud services could then monetize these high accuracy receivers for the benefit of many other users. This paper explores this concept.