UCP 2020 MINUTE OF MEETING OF INFRASTRUCTURE PANEL

USER CONSULTATION PLATFORM 2020

MINUTES OF MEETING OF THE INFRASTRUCTURE PANEL

Meeting Date	02.12.2020	**Time**	09:00-13:00
Meeting Called By	GSA	**Location**	Online event
Minutes Taken By	Christophe Taillandier (FDC)	**Next Meeting Date**	UCP 2022
Attendees	**Valeria Catalano (GSA), Panel moderator** **Christophe Taillandier (FDC), Panel coordinator** **User Community Representatives** Heiko Gerstung (Meinberg), **Panel Users' Chair** Cristina Ananasso (European Commission) Michal Babacek (GSA) Jean Pierre Barboux (GSA) Gilles Boime (OROLIA) Ivan De Francesca (Telefonica) Helmut Fabian (A1 Telekom Austria) Livio Marradi (Thales Alenia Space Italia) Marco Nisi (Sistematica) COMPLETE LIST OF ATTENDEES IS IN ATTACHMENT 6		
Distribution (in addition to attendees)	UCP Plenary, GSA, Public		

Agenda Items	**Presenter**
Welcome and introduction	Valeria Catalano (GSA)
Galileo differentiators: Authentication and Governmental Authorized Applications	Valeria Catalano (GSA) Jean Pierre Barboux (FDC)
New Development in T&S: - GEARS Receiver for Critical Infrastructure - GIANO Receiver for Critical Infrastructure - ROOT project: secure synchronisation requirements for telecom networks - UTC via GNSS as a time source for telecommunication systems	Gilles Boime, Orolia Livio Marradi, Thales AleniaSpace Italia Ivan De Francesca, Telefonica Helmut Fabian, A1 Telekom Austria
Update of User Requirements	Christophe Taillandier (FDC)
User Requirements for New Timing and Synchronisation functions: integrity, trusted time distribution, certified time steering and robust accurate time	Valeria Catalano (GSA)

Synergies with Copernicus - Copernicus data and products - AMPERE: electrical asset mapping in emerging countries worldwide using Galileo and Copernicus	Cristina Ananasso, European Commission Marco Nisi, Sistematica
Final Q&A	Valeria Catalano (GSA)

Summary

The Infrastructure panel of the third User Consultation Platform (UCP) took place on 02 December 2020 as an online event. The panel gathered around 90 participants with comprehensive coverage in terms of value chain.

The group thoroughly discussed the increased **need for robustness** against spoofing and jamming and GNSS threats which is particularly taken-into-account into three R&D projects supported by GSA (GEARS, GIANO and ROOTS) but also by the unique EGNSS features (OS NMA, CAS and PRS).

Protection against GNSS jamming and spoofing threats is now on the agenda of most - if not all - infrastructure operators. The importance of built-in GNSS authentication service such as **Galileo OS NMA** - but also **Galileo CAS and PRS** - was highlighted to improve robustness against GNSS spoofing and is welcome by the Infrastructure community. Several operators are looking forward to testing this unique capability in 2021. Obviously, other techniques will be implemented to face the new cyber threats, such as cross references with other timing sources and the use of terrestrial networks.

It was also highlighted during our session that the **quantification of these robustness requirements** is not an easy task as it depends on network architecture.

Moreover, **natural disturbances** can also affect GNSS, such as the solar activity that is expected to reach its maximum in 2025. GNSS **integrity** function could be of interest in this respect and the GSA introduced an interesting set of functions that would benefit Infrastructure operators. The question of the "**Time to Alarm**" was brought to the UCP for discussion for the first time.

In terms of applications, **5G synchronisation** appear to be the most promising and challenging one: Very high data rates, very low latency and massive type communications on the same mobile infrastructure leads to stringent time and phase accuracy requirements but also tight security and robustness requirements. Telecom operators also need to design their 5G networks taking-into-account their legacy network and this leads to consider both short/medium term strategies and longer-term strategies.

Standardisation was also discussed during the session as it is seen as a strong tool to increase market awareness and uptake. Two types of approach for standardisation could be followed: i) test performances with predefined thread and ii) Elaboration of a Common Criteria like methodology based on the explored RF GNSS band threats. The 2nd approach is more complex and expensive but provide a much higher level of confidence.

Telecom operators already have to follow standards but technical guidelines specifically covering GNSS issues would be useful.

A thorough **review of the GNSS user requirement** was also performed leading to the validation of updated quantified requirements and the identification of new user requirements.

New Timing and Synchronisation functions developed by previous R&D H2020 project were also presented as well as the possible synergies between EGNSS and Copernicus and their applications on electrical asset mapping.

As it happened during the previous UCPs, there was a very clear consensus that the **UCP was a very useful exercise**. Participants are eager to contribute to the next UCP edition.

Minutes of Meeting

Election of the users' chairperson
Heiko Gerstung (Meinberg) was elected as chairperson.

General discussion notes

Galileo differentiators: Authentication
Importance of built-in GNSS authentication was highlighted to improve robustness against GNSS spoofing. It was explained that cross references with other sources are also very useful to improve the overall Timing security. The basics and main benefits of the data authentication function to be provided by OS NMA were presented. Single frequency receiver receiving E1B in a continuous way is the minimal capability required to process OS NMA which works without network connection. OS NMA receivers only need to store a public key to be stored in a secure memory compatible with entry level receiver. Moreover, a loose time synchronisation (in the order of 10 s) is required.
OS NMA public testing will be started in 2021 and stakeholders are invited to provide their feedbacks on tests results when available.

The following questions were asked following the presentation:
When do you expect the documentation for OS-NMA receiver-level processing will be published? This will be essential to allow any form of public testing.
Documentation is expected to be ready in 2021.
How the OS NMA test will look like? Will the GSA be providing OS NMA receivers?
Several OS NMA prototypes devices have been developed through R&D H2020 and FE projects and the GSA is supporting industry at many levels to be ready for OS NMA. No pool of receiver will be specifically made available by GSA.
What are the differences between OS NMA, CAS and PRS? What could be the role of T-RAIM?
CAS is always used on top of OS NMA and requires reception of E6. CAS is working on spreading code encryption which provides a higher level of security in terms of robustness against spoofing. T-RAIM can be used to identify outliers but can be deceived as it is working on the assumption that the overall solution is genuine. T-RAIM is therefore interesting as a complementary solution to improve robustness but also (and firstly) to ensure integrity.

As a general comment one Telecom operator explained that it would like to see authentication implemented in the products from device vendors (e.g. in GNSS firewalls) as operators do not wish to invest in R&D in order to develop a proprietary GNSS authentication solution.

Governmental Authorized Applications
GSA introduced the principles of PRS and CAS. Many critical Timing application require reliable timing and guaranteed continuity which can be provided by PRS if authorised by their respective Competent PRS Authority. Possible interested areas include Telecommunication and Energy networks synchronisation but also timestamping for financial transactions.
Deutsche Telekom explained that they envisage to use Galileo PRS authentication for highest synchronization network level at core network to ensure robust protection against spoofing.
Meinberg mentioned that blue light (police, emergency services etc.) and defence sectors would also be potential PRS users as they require very secure services. Meinberg also mentioned the existence of certain projects to get PRS into critical infrastructures.

New Development in T&S:

GEARS Receiver for Critical Infrastructure

The GEARS FE project was presented, focusing on the outcomes of the stakeholders' survey which was performed to derive the GEARS user requirements. Main requirements regarding interfaces is the 1-PPS In&Out and 10 MHz In&Out. NTP network interface is the main standard for low end applications but PTP (with its different profiles) is also very widespread. Regarding GNSS, GPS is the most requested system while Galileo is gaining importance in particular in Europe. Anti-jamming capability is now seen as necessary with jamming events increasing over the last 5 years. Harmonisation of the existing standards in Telecom and power grids would require significant efforts.

Standardisation is seen as a strong tool to increase market awareness and uptake. Two types of approach for standardisation were presented: i) test performances with predefined thread and ii) elaboration of a Common Criteria like methodology based on the explored RF GNSS band threats. The second approach is more complex and expansive but provide a much higher level of confidence. OROLIA explained that telecom operators already have to follow standards but technical guidelines to help them would be useful.

Deutsche Telekom commented that the most stringent accuracy for Telecom operators is 40 ns (class A and class B sites) and asked if this stringent requirement was considered for the development of PRS T&S receivers. Orolia stressed that the development of PRS T&S receivers was not only focused on Telecom applications but that future developments will aim at developing such capability.

GIANO Receiver for Critical Infrastructure

The GIANO FE project was presented. Accuracy is the most important requirement for all segments followed by integrity and robustness. Future 5G requirements could drive accuracy requirement down to 10 ns and Finance could move from 100us to 1 us. Railway and aviation demand lower accuracy but have strong integrity and availability needs. Galileo could provide many benefits, in particular with OS-NMA but also thanks to multi constellation. The GIANO timing platform was then presented and the preliminary performance were introduced

The project has now entered a large test campaign with timing laboratory. Standardisation is also considered a very important issue to handle. Common standards such as the ones used in avionics would be important to have as well as certification of the equipment.

Some discussions happened after the presentation. In particular it was mentioned by 1 participant that it would be interesting that Galileo distributes a legal Time at European level. Mr Andreas Bauch from PTB was involved in the discussion since he developed a task within an EC project on the legal time. He explained that even within Europe a multitude of legal prescriptions are existing, ranging from clear statements, making reference to UTC and responsibilities regarding realization and dissemination to very vague statements and reference to mean solar time. Harmonization at European level would be required that represents a non-technical challenge. The Galileo nav message allows access to a prediction of UTC in real time. Whether reception of Galileo signals allows traceable measurements to be made is a matter of debate at the BIPM and the Consultative Committee Ionospheric scintillation corrections and mitigation techniques could be introduced in the GIANO timing platform in the future and would allow to obtain an even better time accuracy.

It was also clarified that traceability to UTC for finance is a very important requirement to take-into-account. This is even mandatory following the MIFID II regulation.

Finally, the auto-calibration capability of GIANO has also been discussed.

ROOT project: secure synchronisation requirements for telecom networks

5G networks are expected to support hyper connected society: very high data rates, very low latency and massive type communications on the same mobile infrastructure. Stringent time and phase accuracy are now requested but also robustness against spoofing, jamming and natural disturbances. Combination between GNSS and terrestrial (PTP) is therefore required.
The ROOT H2020 project, which has just started, aims to assess the benefits introduced by the Galileo OSNMA signal in the specific context of telecommunication network synchronization. The main challenge of the project is to estimate the increased resilience that the use of OSNMA can bring to GNSS-based timing sources. The proposed experimental approach intends to measure the increased level of robustness provided by the joint use of new OSNMA-ready GNSS receivers and of White Rabbit PTP for time synchronization in 5G networks to fulfil more and more demanding user needs.

UTC via GNSS as a time source for telecommunication systems

A1 Telekom Austria presented their short and long-term concept for Frequency-, Phase- and Time Synchronization in telecommunications networks. Most of network elements need phase and frequency synchronisation. Time and Phase sources are provided by GNSS receivers. Possible architectures were presented to meet 5G deployment needs. It was explained that multi constellations and multi band GNSS receivers are considered. It was also clarified that absolute and relative requirements are to be distinguished. Using the same Time source for the whole network is a solution not to rely on the GNSS time source but this also implies discussing with other operators. Future timing services from the National metrology institutes could be used as a second common time source. However, these services are not deployed yet.

GSA R&D activities

GSA explained that the audience can download the white paper on "EGNSS downstream funding priorities and funding tools" here. GSA asked then the audience to provide feedbacks on the three following questions:

- Emerging EGNSS applications that are using synergies with Copernicus?
- What financing tools to support market uptake?
- What large implementation projects are emerging in your market segment?

Responses and comments can be provided by email to Valeria Catalano following the session.

Update of User Requirements

FDC introduced the user requirements update process. The sli.do tool was used to engage with the UCP participants and to gather feedbacks.
Accuracy: the proposed updated for DCN Time, Phase and Frequency accuracy were agreed by more than 90% or the poll participants. It was commented that the 65nsec Phase accuracy is needed for fronthaul (relative only, between radio heads at the same BTS) and for some specific radio applications but this requirement can be relaxed for other applications. Regarding absolute synchronisation, it was commented that ePRTC accuracy is important but absolute +/- 1.5 usec accuracy from GNSS input is key for DCN. Moreover, one participant mentioned that the frequency accuracy could be even tighter with 1E-12 according to G.811.1.
Availability: No response was provided on the duration period to compute availability (1 year). One participant mentioned that 95% yearly availability (i.e. 18 days of unavailability per year) is not sufficient and that 99,9% would be better.
Integrity: All polls participants agreed that "the Timing & Sync system shall get access to integrity information with a certain level of confidence". However, no quantified requirement for the Alarm

limit and Integrity risk was provided as they depend on the application. The TTA was discussed in a follow-up session (see below).

Continuity: Continuity was considered as a relevant requirement parameter for Infrastructure by more than 85% of the poll participants. However, participants highlighted the need to better define the Continuity parameter, especially to distinguish it from availability. One participant commented that it could be more meaningful to refer to holdover times rather than continuity percentages that has a specific meaning in aviation.

TTFF: There was no consensus on the relevance of TTFF for Infrastructure. TTFF may be important for application start up time and should be related to availability.

Update rate: An update rate between 1 Hz and 10 Hz is required but this depends fully on oscillator accuracy and stability. Indeed, it was commented that the update rate is only defined by the oscillator/internal clock stability. If the oscillator can keep the time with an accuracy good enough for the application for a few seconds, an update rate of 1 Hz is typically good enough. And because it is needed that your clock to be able to provide holdover for an even longer period anyway, update rate should not be a major issue.

Service availability: worldwide availability is required for 35% of the poll participants but regional availability received plebiscite. Moreover, availability in urban canyon and indoor (with antennas outdoor) is desirable.

Traceability to UTC: 94% of the poll participants validated that traceability to UTC shall be demonstrated.

Authentication:

i) Half of the poll participants mentioned that authentication results are needed at the User Equipment level and the other half both remotely and at the UE level. Authentication therefore needs to be provided at UE level as a minimum.

ii) A large majority of respondents asks that Authentication is provided continuously

iii) The duration between successive authentications depend on the application and the oscillator but the order of magnitude is between 5 and 10 seconds

iv) No time accuracy loss shall be permitted

v) The impact of key management procedure shall be as transparent as possible (for 62%).

<u>User Requirements for New Timing and Synchronisation functions: integrity, trusted time distribution, certified time steering and robust accurate time</u>

GSA performed a short description of four new T&S functions leveraging the outcomes of R&D projects:

1. Timing Integrity
2. Time Distribution and Remote Audit
3. Certified Time Steering and Monitoring
4. Robust Accurate Time

For each function a set of questions was asked to validate the user requirements. The TTA was brought for discussion to the UCP for the first time and this would be a new requirement for the timing service.

Some attendances indicated preference for a lower TTA and GSA will further work to identify the TTA for specific applications.

Regarding the Time Distribution and Remote Audit, it was commented that “The End User time offset error to the source time shall be better or equal to 30 micro seconds (1sigma) over LAN” is

not sufficient for energy/power applications (where 1 us sync accuracy required for some applications).
Regarding the remote audit service availability, if the time steering function is intended to be used for serious or even critical use, an availability of 95% on a yearly basis would not be sufficient. The final number depends on how long the remote user terminal can deal without steering.
Some participants highlighted the need to know if a satellite is healthy or not. This information could be provided via an internet service or transmitted in the augmentation signal.
Another participant commented that the Certified Time Steering and Monitoring and the Robust Accurate Time seems have functionalities that are overlapping and could be merged in a unique function.

GSA invited UCP participants to provide any additional comments by email.

Synergies with Copernicus
Copernicus data and products
The European Commission presented the Copernicus contribution to Infrastructures (Telecom, Energy, Finance). Three Copernicus services can provide useful services or products in the infrastructure segment: Land monitoring (e.g. to support 5G network planning, business intelligence for geo-marketing, use of renewable energy, power infrastructure maintenance), Climate change (e.g. finance modelling), marine service (e.g. tidal energy assessment).

AMPERE: electrical asset mapping in emerging countries worldwide using Galileo and Copernicus
The AMPERE project was presented by Systematica. The project aims to ease access to electricity by enabling electrical asset mapping in emerging countries using Galileo and Copernicus. In particular, the benefit of Copernicus for urban planning and monitoring and of Galileo HAS for simplified mapping operation will be considered.

Modifications to requirements already compiled in the Report on User Needs and Requirements (RUR):

Requirement ID	Proposed change
GSA-MKD-USRREQ-TSC-0020	The Timing & Sync system shall provide a Timing accuracy of 30 ns to UTC for DCN applications.
GSA-MKD-USRREQ-TSC-0160	The Timing & Sync system shall get access to integrity information with a certain level of confidence

New requirements to be added to the RUR:

- GSA-MKD-USRREQ-TSC-0021: The Timing & Sync system shall provide a Phase Sync accuracy of less than 65 ns for DCN applications
- GSA-MKD-USRREQ-TSC-0021: The Timing & Sync system shall provide a Freq Sync accuracy of 1.10^{-11} for DCN applications
- GSA-MKD-USRREQ-TSC-0170: The Timing & Sync system shall provide an update rate of 1Hz to 10 Hz
- GSA-MKD-USRREQ-TSC-0180: The Timing & Sync system shall be preferably provided worldwide and regionally as a minimum
- GSA-MKD-USRREQ-TSC-0190: The Timing & Sync system shall be able to demonstrate traceability to UTC

- GSA-MKD-USRREQ-TSC-0200: The Timing & Sync system shall be able to provide an authentication capability at User Equipment level
- GSA-MKD-USRREQ-TSC-0210: The Timing & Sync system shall be able to provide an authentication capability on a continuous basis
- GSA-MKD-USRREQ-TSC-0220: The Timing & Sync system shall be able to provide an authentication capability with a duration between successive authentications of 5 to 10 seconds
- GSA-MKD-USRREQ-TSC-0230: The Timing & Sync system shall be able to provide an authentication capability with no degradation of the time accuracy
- GSA-MKD-USRREQ-TSC-0240: The Timing & Sync system shall be able to provide an authentication capability with a key management procedure as transparent as possible.

Moreover GSA-MKD-USRREQ-TSC-0090 is removed (replaced by GSA-MKD-USRREQ-TSC-0180).

Conclusions
The third edition of the Infrastructure UCP session is successfully closed by the GSA. Key results of this working session will be highlighted during the plenary UCP session on December 7th, 2020 by Heiko Gerstung.

Other Notes & Information
With the contribution of:                

Annexes & Attachments
Att1_UCP_Infrastructure Att2_UCP_GEARS Att3_UCP_GIANO Att4_UCP_Synchronisation Needs Att5_UCP_UTC via GNSS as a time source for telecommunication systems Att6_UCP_List of Attendees

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