ICG Systems Working Group
(WG-S) Systems, Signals, and Services

Co-chairs update of PPP Interoperability Task-Force

18 October, 2023
ICG17 meeting, Madrid, Spain

ICG-14 Recommendation 14S-2

- The ICG will establish a Task Force within the WG-S Interoperability Subgroup, with participation from WG's B and D. (done)
- Australia, Japan and the EU will provide the co-chairs of the Task Force. (done)
- The Task Force will draft a work plan focused on the objective of improving the interoperability of Precise Point Positioning (PPP) services. (done)
- Specifically, the Task Force will:
  - Coordinate with the ICAO Navigation Systems Panel and the SBAS providers Interoperability Working Group in the ongoing discussions and work of the Task Force
  - **Concentrate on establishing the foundational documents, baseline definitions and assumptions to develop common terminology on basic parameters for PPP service provision/broadcast**
  - **Encourage the publication and dissemination of PPP signal and system information**
  - **Continue discussions with Service Providers (governmental and commercial) to the issues raised at the 1st PPP Workshop and follow-on issues identified by the Task Force**

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PPP Task Force Members

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Identification of interoperability issues

- When multiple open PPP services are available, it increases the development and support effort of receiver and application providers.

- In 1st PPP WS, the interoperability issues were indicated (NRCan, ESA/EC, …)

- Common understanding of terminology and methodology is important.

Provider A   Provider B   Provider C
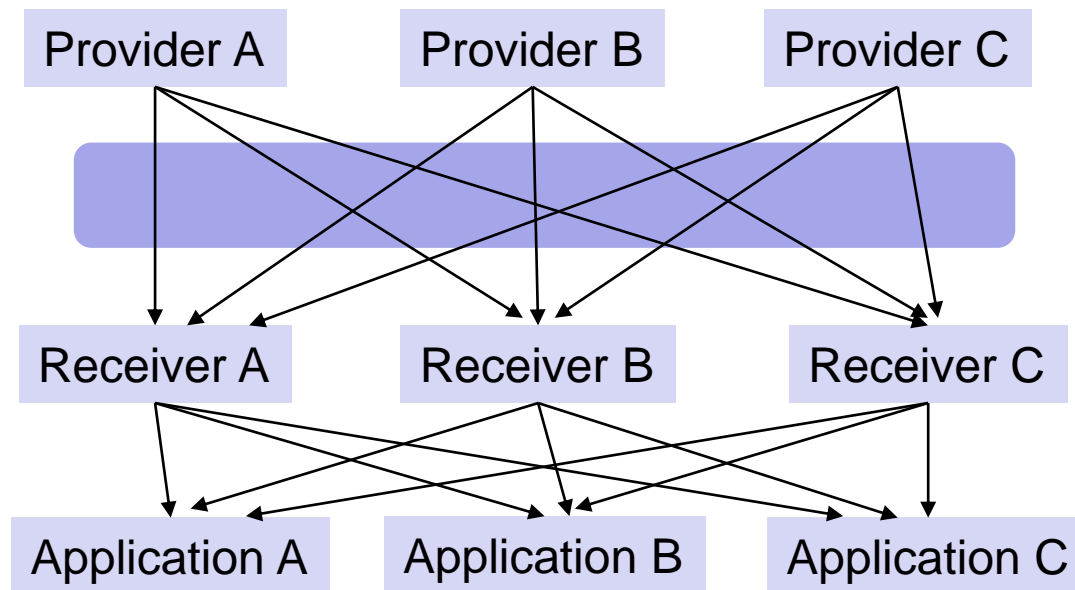
- Common format definition
- Signal plan
- Consistency in model and metadata (phase-windup, attitude, coordinates,…)
- Authentication and integrity

Receiver A   Receiver B   Receiver C

- Compatibility of performance parameters
- Integrity parameters

Application A   Application B   Application C

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Activities of 3PITF after ICG-16

■ Action and Plan discussed in 2nd PPP Workshop (22 March, 2023, JRC/Ispra)

  ✓ PPP Service Providers Report

  ✓ PPP Common Model with reference implementation

  ✓ 3rd Workshop

■ PPP Service Providers Report

  ✓ 3rd edition finalized 2nd August, 2023

  ➢ Changes in 3rd edition include:
  - Name changed: PPP/PPP-RTK Service Providers Report
  - Added: KPS POINT
  - Updated: Russian PPP based on presentation at 2nd PPP WS
  - Added: Terminology and definition
  - Added: Figures

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PPP Common Model

- ➢ PPP is described in the literature but implementations are sometimes ambiguous.
- ➢ Ideally, having an open-source reference implementation available, would be a good contribution of the Task Force.
- ➢ At least the **iono-free and the un-combined** approach need to be formulated.
- ➢ In addition to the model, **a dataset for interoperability testing** would be beneficial, allowing testing in different environments.
- ➢ In terms of pre-existing developments, EU comments that Galileo is planning to publish **a reference HAS PPP user algorithm** in the next months (end of 2023).
- ➢ It is also highlighted that there are already public libraries including PPP/PPP-RTK, such as RTKlib (including variants), cssrlib.

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Open source toolkit for PPP

	RTKLIB	CLASlib	MADOCALIB[1]	PPPlib	PRIDE PPPAR
Method	RTK, PPP	- OSR conv. - PPP-RTK[1]	PPP	PPP	PPP
Measurement	RINEX, RTCM3, …	RINEX	RINEX		RINEX
Correction	RINEX, RTCM3, …	CSSR	CSSR	(SP3/ Bias-SINEX)	(SP3/ Bias-SINEX)
Language	c	c	c	c/c++	f90

*1 distribution is restricted.

	HASlib	CSSRlib [1]
Method	OSR conv.	RTK,PPP, PPP-RTK
Measurement	-	RINEX
Correction	HAS	CSSR and derivatives
Language	Python	Python

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[1] Hirokawa, R. , Hauschild, A., Everett, T.,
"Python Toolkit for Open PPP/PPP-RTK Services", ION GNSS+ 2023

Toward 4th edition of report

- ➢ Common Model (User Algorithm)
- ➢ Open-Source Tools
- ➢ Figures (Service Area, …)

System	Service	Status
QZSS CLAS	PPP-RTK	Operational
QZSS MADOCA-PPP	PPP	Trial Service
Galileo HAS	PPP	Initial Service
BDS PPP	PPP	Operational
PPP Via SouthPAN	PPP	Early Service
GLONASS PPP	PPP	Modernization
KPS POINT	PPP-RTK	Development

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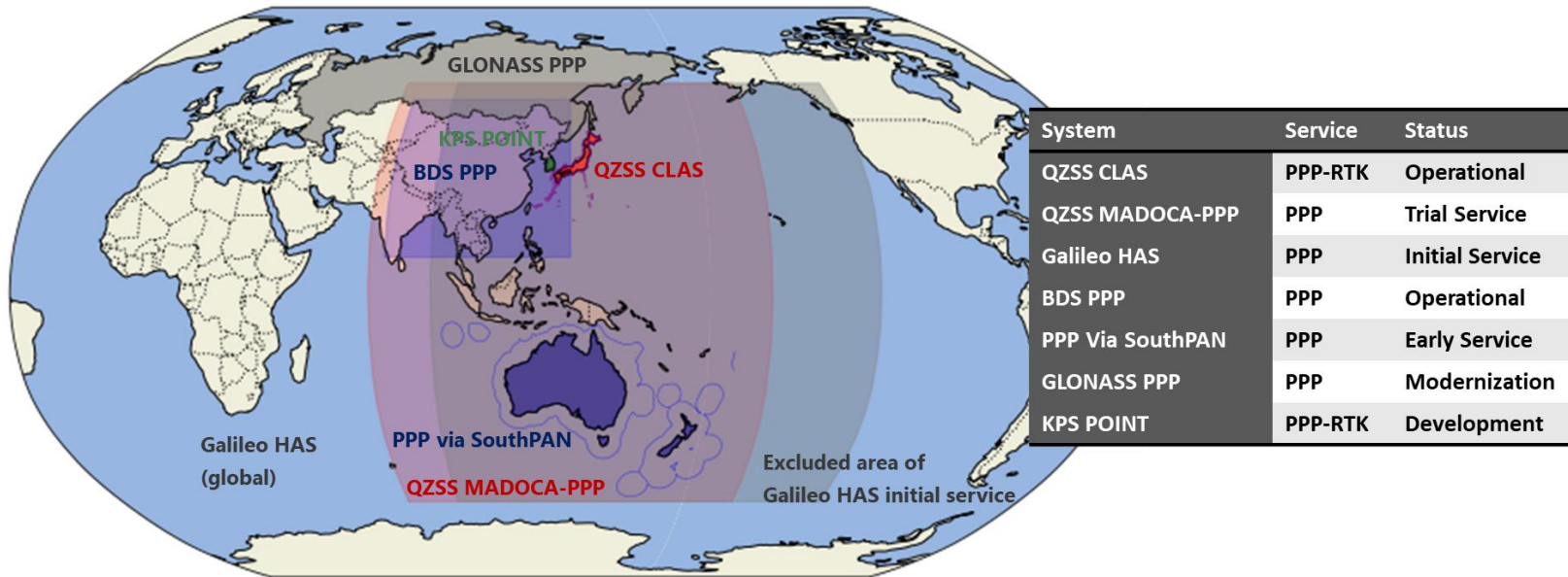
Actions, Next Steps

- 4th Edition of Providers Report

    - Plan to be published: Q1 2024

- 3rd Workshop

    - The 3rd Workshop may be aligned with another major event to get more popularity.
    - Representatives of industry groups will be invited for the 3rd Workshop. The candidates are RTCM, and some commercial PPP/PPP-RTK service providers.

14th MGA Annual Conference (30th Jan-2nd Feb 2024, Chiang Rai, Thailand) (https://www.mga-conference.com/)

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