Emergency Warning Service in Galileo

State of play

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Global trend to develop Disaster Risk Reduction technologies:

- United Nations' Sendai Framework for Disaster Risk Reduction: "*Substantially increase the availability of and access to **multi-hazard early warning systems** and disaster risk information and assessments to people by 2030*"

- World Meteorological Organization – 2020 State of Climate Services report (13 October 2020), confirms the importance of ***early warning systems*** for disaster prevention and risk reduction

- **A new approach: use the GNSS satellite capacity for alert dissemination**

  - Purpose: **Alerting the population** in case of a looming disaster (fire, storm, floods, tsunamis, volcano, industrial accident…)

  - **National** Civil Protection entities **decide** to trigger the alert **and contact** Galileo to broadcast a message.

  - People receive the alert message on their **mobile phone/nav' device**.

SERVICE CONCEPT (1)

- Dissemination of an alert message, including associated guidance to react

- Global coverage

- No 'mobile' network required, no specific user equipment required

- On-demand

- **Complementary alert system to those already operated at national level**

  ➢ **'the more systems, the better'**

- Reach out population at large & small scale in a timely manner (~ minutes)

- Geo-fencing information is encoded in the message, so as to target only the relevant population.

  ➢ Targetted region can be of any size.

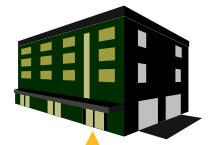- Message is displayed on screen when the user terminal is located within the encoded **ellipse**.

Example of target area for an alert message, defined by ellipse.

Ellipse radius is adjustable
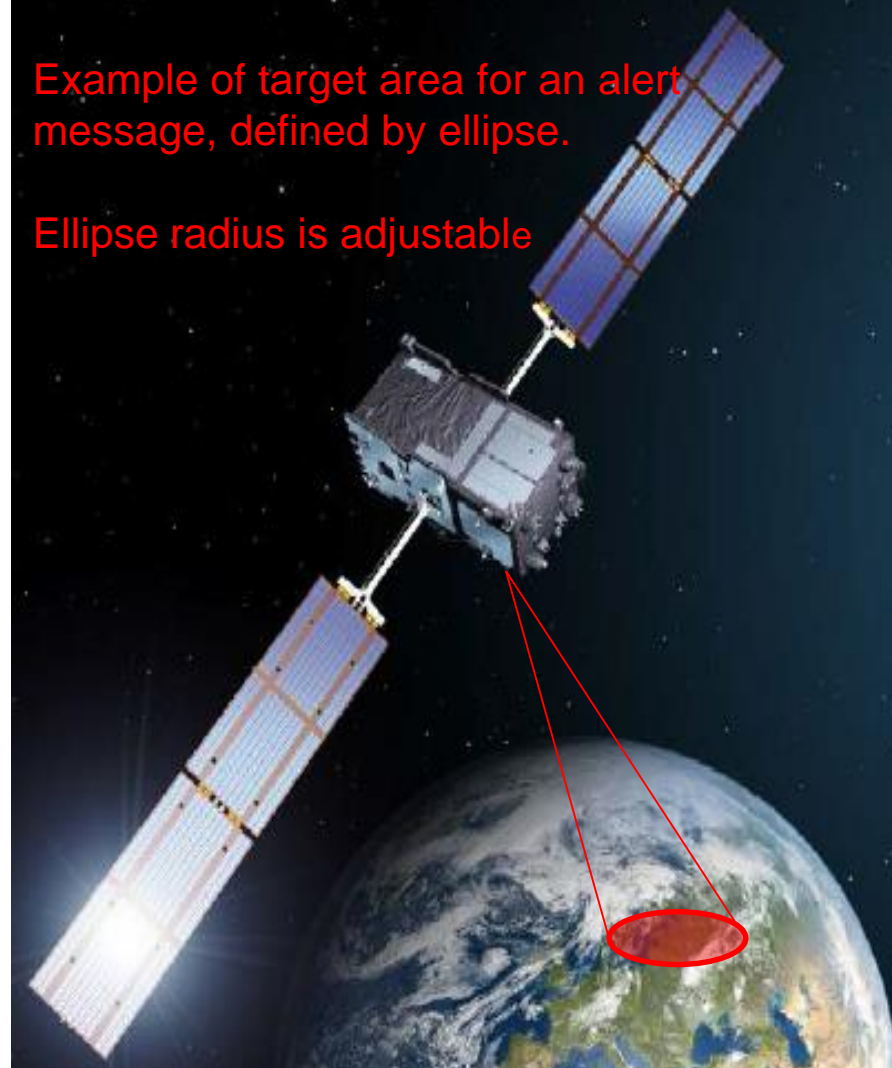
OPERATION CONCEPT

National Emergency Centre
DECISION

Galileo Emergency Service Interface

CAP / XML

EWS Message Bit level

Civil protection

Galileo Ground Segment

GALILEO EGNOS
NAVIGATION

ALERT

Population

The service is realised by three components:

Civil Protection Authorities   **Galileo infrastructure**   **end users**

- **EWS Message format common to Galileo and QZSS now finalized, after thorough review by EC and Japan in 2022**
  - ✓ Message coded on 122 bits for transmission in the signal
  - ✓ Message format discussed with Japan space authorities since 2 years, **now adopted**.
    - ➢ EU-JP **Joint statement** soon to be published
    - ➢ **Common EWS format definition document** in preparation
    - ➢ Common format will ease **service interoperability and integration** in smartphones and GNSS terminals

Common EWS Message format
- ❑ Message Type: Alert/Update/Test/Cancel
- ❑ Country ID: ID of the country from which the alert is issued.
- ❑ Provider ID: National agency raising the alert
- ❑ Event Category: Tsunami, Forest Fire, pandemic, volcano, storm, etc
- ❑ Severity: moderate/severe/extreme
- ❑ Event Onset: Day/Hour/Minute
- ❑ Duration: in hours, from < 0.25 h to 48 h
- ❑ *Target Area: 2D ellipse, with semi-axis ranging from 200 m to 2500 km*
- ❑ *Instructions: Generic instructions taken from library*
- ❑ Additional information for message customization

FIELD DEMONSTRATIONS in EUROPE

- **Several field demonstrations will be run in 2023**
  - 4 locations selected for the demonstration campaign: France, Germany, Cyprus, Belgium/Netherlands/Luxembourg.

- **Demonstrations will be used to test the service characteristics, the performance, and to show case to civil protection community**
  - 4 thematic hazards will be tested: industrial incident (2x), tsunami/wild fires, floods
  - Several use cases will be tested:
    - various sizes of alert area (small scale, regional scale)
    - Cross border events (filter out not relevant message at Rx level)
    - Hazard with high dynamic of evolution (high cadence of messages)
    - Several KPIs will be measured (latency, probability of reception, compliance of message received)
    - Broadcast of several different alerts at the same time (peak in broadcast requests)

- **Window for the demonstrations: Q1-Q3 2023**

- **Service concept confirmed at Galileo programme level.**
  - ➢ Engineering of the service on-going since 2021.
  - ➢ Target date for initial service: 2024 / Field demonstrations in 2023

- **Multilateral coordination:**
  - ➢ **Civil protection authorities from EU Member States,** for confirming service design.
  - ➢ **Other interested nations** invited to learn more about the potential offered by the common format of the alert message.
    - ✓ Interoperability is key to ensure broadest reception by as many people as possible, worldwide !
  - ➢ Further promotion and use of such international service (e.g. through **UN-ICG**).
  - ➢ Dialogue with **mobile manufacturers and operating systems developers** to introduce the 'decode & display' functionalities in the firmware.
    - ✓ Qualcomm, Broadcom, Mediatek, Apple, Google, STM, u-blox, Sony…

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SYSTEM CONCEPT AND DESIGN (PHASE 1)

In order to accelerate the deployment of this service, a phased implementation approach has been adopted by the Programme, where **Phase 1** leverages on minimum modifications to the system:

- **Updates** done at the edge of the system, **at service facility level;**

- **No modification** to system interfaces or core infrastructure;

- **Reutilisation of existing signals.**

Thanks to a number of synergies with EWS, the Return Link capability of the Galileo system (part of SAR/Galileo) has been selected as the solution to support Phase 1 of EWS.

Source: modified SAR -SDD

Phase 1 will already fulfil many of the core needs of EWS (e.g. number of events, capacity, service monitoring, etc), thanks to the characteristics of the Return Link dissemination chain, e.g.:

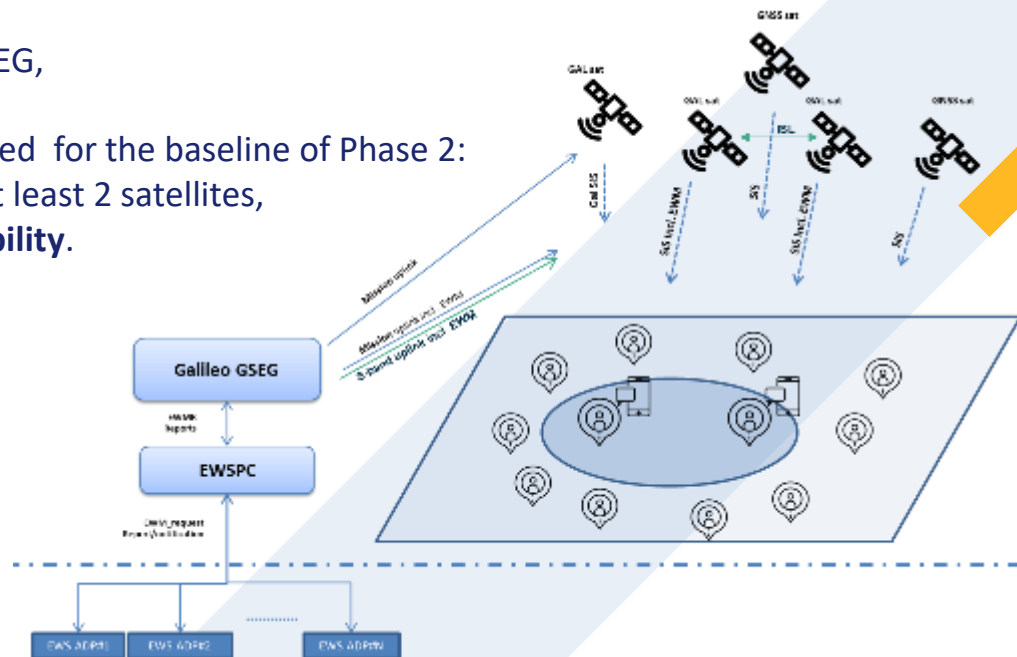|	Phase 1 mission (through SAR RLM)
EWS events	6000 per year
EWS messages	120000 per year
EWS latency	<1min (priority, cannot be guaranteed in very high loads) <10mins (normal)
EWS frequency band	E1b
EWS false alarm	*1 out of 20y (cannot be guaranteed)*
Service Feared Events	*Availability/integrity/misuse/image (cannot be guaranteed end-to-end)*
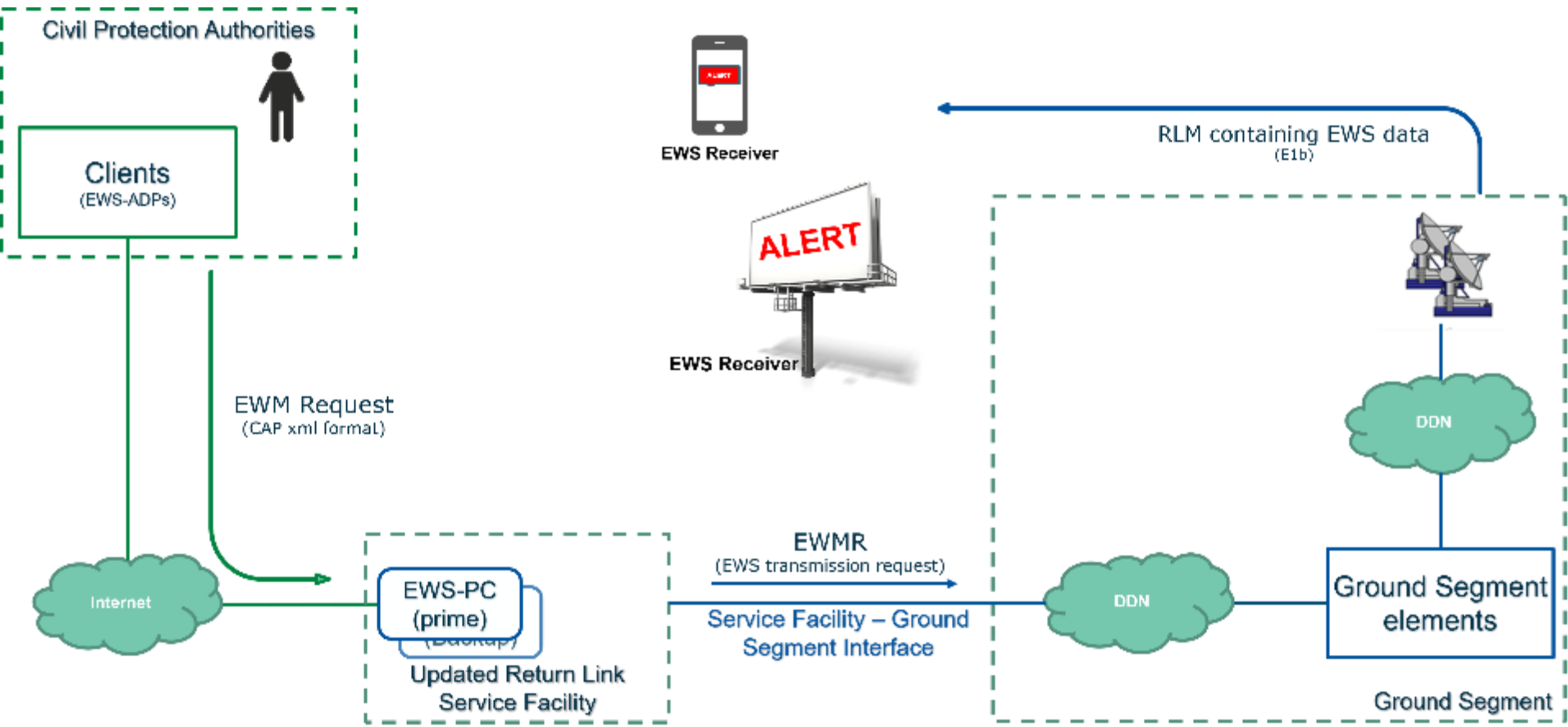
EVOLUTION TO GALILEO 2nd GENERATION (G2G)

The primary objective of the Galileo EWS remains the same across Phases 1 and 2.

Phase 1 aims at enabling EWS capability in a short time frame, without modifying the core infrastructure. It allows initial operation, lessons learnt, better understanding of service features and triggers market adoption actions.

The design of **Phase 2** introduces evolutions with respect to the implementation of Phase 1:
- The future GSEG design will offer more capabilities for the EWS-related functions:
  - **Satellite selection algorithm and repetition handling at the GSEG**,
  - Dissemination in **both in E1-b and E5-b**,
  - **Improved end-to-end latency**,
  - Authentication via OS-NMA on ground or onboard, as per system config.,
  - Implementation of the required **severities**
    - ✓ Additional GSEG repetitions in case of need,
    - ✓ Long CRC at generation and link auth. till SSEG,
    - ✓ S-band/ISL and/or C/band uplink;
- A **specific SiS message allocation** has been designed for the baseline of Phase 2:
  - Dissemination as a **single 122 bits word**, over at least 2 satellites,
  - **Flexible use of** I/NAV pages via **overwrite capability**.

THANK YOU

http://ec.europa.eu/galileo