Maritime Communication Evolution

< IMT-2030(6G): Building Block for Connected Ocean >

14th May 2024
KOO, Hyounhee
SyncTechno Inc.
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Introduction of the Speaker
Activities in progress – KOO, Hyounhee

Mobile Communication & Global Standardization

- 2002: Mobile Communication & Global Standardization
- 2005: Public Safety & Collaboration with Relevant Stakeholders

Public Safety & Collaboration with Relevant Stakeholders

- 2023 ~ Present: Chair of AWG TG PPDR for public safety over IMT in APAC region
- 2020 ~ 2022: Editor of AWG work related to public warning
- 2016 ~ 2020: Rapporteur of 3GPP ePWS for the enhancement of public warning

Maritime Safety & Digitalization over IMT-2020(5G)/IMT-2030(6G)

- 2023 ~ Present: Leader of IALA DTEC Task Group on Marine AtoN over IMT-2030
- 2019 ~ Present: 3GPP representative (liaison) for the collaboration with IALA for maritime sector over IMT
- 2023.01~09: Main contributor of ITU-R report M.2527 introducing maritime usage over IMT-2020&beyond
- 2016~2018: Rapporteur of 3GPP MARCOM work introducing the maritime usage into 3GPP standardization
IMO Strategic Plan
for 2024 to 2029
MISSION STATEMENT

The mission of the International Maritime Organization (IMO), as a United Nations specialized agency, is to promote safe, secure, environmentally sound, efficient and sustainable shipping through cooperation. This will be accomplished by adopting the highest practicable standards of maritime safety and security, efficiency of navigation and prevention and control of pollution from ships, as well as through consideration of the related legal matters and effective implementation of IMO instruments, with a view to their universal and uniform application.

VISION STATEMENT

The vision of IMO for the period 2024 to 2029 is as follows:

1. IMO will uphold its leadership role as the global regulator of shipping, promote greater recognition of the sector’s importance to world trade, and enable the advancement of shipping. In this regard, IMO will address the challenges and opportunities presented by ongoing developments in technology, the protection and preservation of the marine environment, tackling climate change, improving the well-being and competence of seafarers, and strengthening the resilience of the maritime industry and global supply chains.

2. To achieve this, IMO will focus on the review, development, implementation of and compliance with IMO instruments in its pursuit to proactively identify, analyse and address emerging issues. IMO will support Member States in achieving the goals of the 2030 Agenda for Sustainable Development, including through capacity development, taking into account the Organization's Capacity-Building Decade 2021-2030 Strategy.

Strategic Direction

SD 1: Ensure implementation of IMO instruments supported by capacity development
SD 2: Integrate new, emerging and advancing technologies in the regulatory framework
SD 3: Respond to climate change and reduce greenhouse gas emissions from international shipping
SD 4: Continue to engage in ocean governance
SD 5: Enhance global facilitation, supply chain resilience and security of international trade
SD 6: Address the human element
SD 7: Ensure the regulatory effectiveness of international shipping
SD 8: Ensure organizational effectiveness
regulatory framework affecting which phase of maritime communication technology?

New & Emerging & Advanced Technologies

Current approach

Regulatory Framework

Phase in which error found | Cost relative to requirements phase
--- | ---
Requirements (Standardization) | 1
Design | 3-6
Coding | 10
Development testing | 15-40
Acceptance testing | 30-70
Operation | 40-1000

Source: Exploring requirements: quality before design, Donald C. Gause, Gerald M. Weinberg, Dorset House/Wiley, 1992


IMO regulatory framework affecting which phase of maritime communication technology?
Various Industries’ Trends
towards IMT-2030 (6G) Standardization
### IMT families (1/2)

<table>
<thead>
<tr>
<th>Year</th>
<th>IMT-2000</th>
<th>IMT-Advanced</th>
<th>IMT-2020</th>
<th>IMT-2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
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<td>2030</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Commercial market</th>
<th>3G</th>
<th>4G</th>
<th>5G</th>
<th>6G</th>
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<tbody>
<tr>
<td>UMTS</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3GPP</td>
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</tbody>
</table>

Be Creative with Us.
IMT families (2/2)

1990s

1998

2000s

2010s

2020s

2030s

10 years

10 years

10 years

10 years

Evolution of GSM/GPRS/EDGE from 1998 to 2020* in 3GPP

UMTS/WCDMA/HSPA/HSPA+ from 1998 to 2020* in 3GPP

GSM/GPRS/EDGE in ETSI

GSM: Global System for Mobile communication
GPRS: General Packet Radio Service
EDGE: Enhanced Data for GSM Evolution

UMTS: Universal Mobile Communication System
WCDMA: Wideband Code Division Multiple Access
HSPA: High Speed Downlink Packet Access

LTE / LTE Advanced / LTE Advanced Pro

5G

5G/5G-Advanced

6G

SMARTPHONE/TABLET
AUTONOMOUS VEHICLES
SMART FACTORY
SMART CITIES
SMART HOME

Diverse forms of 5G devices tightly coupled with societies anywhere anytime

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Case studies

(within the framework of 3GPP standardization)
Regulatory Policies Prior to Standardization

Inter-Authority communication

Authority-to-Public communication

Emergency Call (eCall) communication

Source of photos: www.firstnet.com

Source of figure: transsec.eu
Inter-authority communication in Public Safety Networks

Transition of public safety networks from proprietary solutions to 3GPP standards-based solutions

Proprietary solutions

Public Safety Networks

Commercial Mobile Networks based on 3GPP standards

GSM (2G) → UMTS (3G) → LTE

(LTE) (Since Release 8)

5G

(LTE) (Since Release 13)

6G

Source of figure: SyncTechno Inc.
Satellite stakeholders participating in 3GPP since 5G started to integrate satellite component into the framework of 3GPP standardization for 5G and 6G.

NOTE: ESOA is the 3GPP MRP member.


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Towards **Ubiquitous connectivity based on multiple RATs** over

In-flight connectivity (AS IS)

Example of system architecture

Aviation Connectivity (TO BE)

Aviation communication categories

- Air Traffic Management (ATM) / Air Traffic Service (ATS)
- Aeronautical/Airline/Aircraft Operational Communication (AOC)
- Aeronautical/Airline/Aircraft Information Services (AIS)
- Aeronautical Passenger Information and Entertainment Services (PIES)
- Aeronautical Public/Passenger Communication (APC)

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Source: https://www.seamlessalliance.com/publications/
Stakeholders from various industries have actively participated in influencing the standardization process of Railways, Automotives, and Smart factories.

- Railways: UIC
- Automotives: BMW, GM, BOSCH, HYUNDAI, TOYOTA, 5GAA, (3GPP MRP)
- Smart factories: SIEMENS, ERICSSON, Deutsche Telekom, verizon, 5G IA, (3GPP MRP)
Global Activities on IMT-2030 (6G) for Maritime Domain in ITU-R, IALA and 3GPP
Recommendation ITU-R M.2160 「IMT-2030 Framework」

IMT-2030 (6G)

6 Usage scenarios

Extension from IMT-2020 (5G)
- eMBB ⇒ Immersive Communication
- mMTC ⇒ Massive Communication
- URLLC ⇒ HRLLC (HRLLC – Hyper Reliable & Low-Latency Communication)

New
- Ubiquitous Connectivity
- AI and Communication
- Integrated Sensing and Communication

4 Overarching aspects
- Sustainability
- Connecting the unconnected
- Ubiquitous intelligence
- Security/resilience

Source: ITU
Report ITU-R M.2527-0
(09/2023)
M Series: Mobile, radiodetermination, amateur and related satellite services

Applications of the terrestrial component of International Mobile Telecommunications for specific societal, industrial and other usages

5.10 IMT application in maritime sector

Annex 8 – Case study of IMT applications in maritime sector

A8.1 Example of Autonomous Surface Ship over IMT system
## Task 6.2.1 for Marine AtoN over IMT-2030 (1/2)

**Task 6.2.1 for Marine AtoN over IMT-2030**

approved at IALA DTEC#01 meeting held in September 2023.

<table>
<thead>
<tr>
<th>IALA COMMITTEE WORK PROGRAMME 2023-2027</th>
<th>Reference to Standards</th>
<th>Title</th>
<th>Description</th>
<th>Expected outcome</th>
<th>Committee</th>
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<tbody>
<tr>
<td>S1060 Digital communication technologies</td>
<td>Contribute to the development of IMT-2030 by formulating user requirements for Marine AtoN.</td>
<td>Contribute towards the development of 3GPP mobile communication standards, with a specific focus on the maritime industry vertical.</td>
<td>Revised Guideline, Reportage, input to 3GPP</td>
<td>DTEC</td>
<td></td>
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**Task 6.2.1 for Marine AtoN over IMT-2030 (2/2)**

**< Work Scope >**

Development of *use cases and service requirements including regulatory aspects* for Marine Aids to Navigation (Marine AtoN)* over IMT-2030 (beyond 5G) *to formulate inputs as served for incorporating demands of Marine AtoN related stakeholders* into 3GPP *standardization* for IMT-2030 (beyond 5G).

**< Categories (tentatively ) considerable for use cases >**

- Maritime Buoyage System (MBS)
- Positioning, Navigation and Timing (PNT)
- Vessel Traffic Services (VTS)
- Digital Maritime Services such as Single Window Reporting etc.

**< Global collaboration with external bodies >**

- IALA contribution/liaison notes to be sent out to IMO, ITU-R and 3GPP TSGs to inform them of IALA task 6.2.1 for Marine AtoN over IMT-2030 after the approval of IALA Council in June 2024
Maritime Communication over IMT-2020 and beyond

**Aug. 2016 ~ Dec. 2018:** Rel-16 MARCOM*

*MARCOM: Maritime Communication Services over 3GPP Systems

**Sept. 2019:** liaison with

- 3GPP Liaison Person
- A contact between 3GPP and a dedicated external (standards) body, sometimes even only to a specific working group of an external body.
- External bodies that 3GPP Liaison Persons were appointed for at 3GPP TSG SA#185 in September 2019

**Maritime domain** was included in the **Scope** of 3GPP standardization with the completion of Rel-16 MARCOM work.

**Sept. 2021:** Rel-18, maritime requirements prioritization

based on the collaboration with IALA

**Jun. 2023:** Rel-19, maritime requirements prioritization

based on the collaboration with IALA

Source: SP-210601, 3GPP SA Rel-18 Workshop. 9~10 September 2021

Source: SWS-230017, 3GPP SA Rel-19 Workshop. Taipei, June 13-14, 2023

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Moving Forward
Utilizing **camera, sensors** but **false operation likely to occur** due to low accuracy depending on day/night or weather

**Dedicated lane** of the expressway for ambulance, fire engines, and police cars etc. **in case of emergency** as well as bus

*The car's sensor identified the **moon** as a **traffic light.***
**IMT-2030(6G): Building Block for Connected Ocean**

**IMT-2030(6G) Standardization**

**New Approach**

to integrate IMO regulatory aspects into the framework of the IMT-2030 (6G) for maritime communication & connectivity

**Regulatory Framework**

**New initiative**
to *timely* influence IMT-2030(6G) standardization for maritime safety
Thank You