ENI ISG PoC Report Template

B.1 General

The following normative disclaimer shall be included on the front page of a PoC report:

> *Submission of this ENI ISG PoC Report as a contribution to the ENI ISG does not imply any endorsement by the ENI ISG of the contents of this report, or of any aspect of the PoC activity to which it refers.*

B.2 ENI ISG PoC Report

B.2.1 PoC Project Completion Status

Indicate the PoC Project Status. Can the PoC be considered completed? If this is a multi-stage PoC project, indicate the Reported Stage status and plans for future Project Stages/Milestones:

- Overall PoC Project Completion Status: _____**Completed**_____
- PoC Stage Completion Status (Optional - for Multi Stage projects only): _____

B.2.2 ENI PoC Project Participants

Specify PoC Team; indicate any changes from the ENI ISG PoC Proposal:

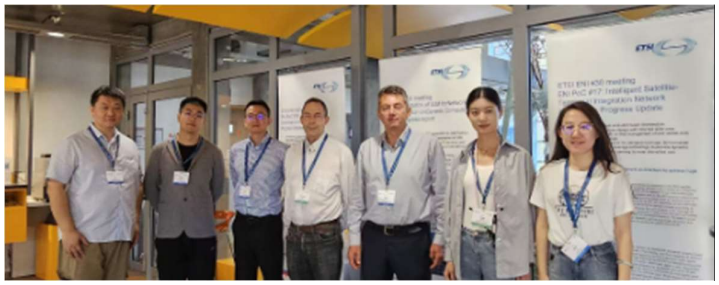
- PoC Project Name: _Intelligent Satellite-Terrestrial Integration Network Architecture___
- Network Operator/Service Provider:China Telecom Contact: _Yu Zeng (zengyu@chinatelecom.cn)
- Manufacturer A:_____Asiainfo_____ Contact: Shoufeng Wang(wangsf11@asiainfo.com)
- Manufacturer B:_____Huawei _____ Contact: _Aldo Artigiani (Aldo.Artigiani@huawei.com)
- Additional Members:____Tsinghua University __ Contact:_ Chunxiao Jiang (jchx@tsinghua.edu.cn)
- Additional Members:____CAICT_____ Contact: _Zhiruo Liu (liuzhiruo@caict.ac.cn)
- Additional Members:____CNIT _____ Contact:_ Fabrizio Granelli (fabrizio.granelli@unitn.it)
- Additional Members:____CNR ISTI _____ Contact: _Pietro Cassarà (pietro.cassara@isti.cnr.it)

B.2.3 Confirmation of PoC Event Occurrence

To be considered as complete, the PoC should have been physically demonstrated with evidences extracted from the demonstration, i.e. the following information should be provided:

- ETSI ENI #30 Plenary meeting, Sophia Antipolis, 3rd June, 2024

The PoC progress was presented by China Telecom and Huawei in the ESTI ENI #30 Plenary meeting, introducing the Intelligent Satellite-Terrestrial Integration Network Architecture for space communications.



ETSI

ETSI ENI #30 meeting
ENI PoC #17: Intelligent Satellite-Terrestrial Integration Network Architecture Progress Update

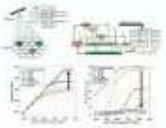
- ✓ PoC Project Goal #1: Hand-and-Arm based Architecture. Demonstrate the architecture design with inherent wide-area coverage capability and the unified management of user access with ubiquitous signaling coverage.
- ✓ PoC Project Goal #2: Intelligent On-demand Coverage. Demonstrate the intelligent on-demand coverage technology to provide dynamic resource allocation for traffic steering to meet diversified user demands.

The integrated satellite-terrestrial network architecture to achieve high effective network efficiency

The integrated satellite-terrestrial network architecture

The integration architecture is composed of the MEO satellite network and the terrestrial network, both of which are connected to the NG core network of the operator. To provide unified and continuous communication service, the MEO satellite network and the terrestrial network are integrated at the air interface level. In this way, unified terminal devices can seamlessly access either the satellite network or the terrestrial cellular network according to different service scenarios. For users located in the coverage of terrestrial networks, generally in urban areas, the users will access the terrestrial network for broadband services. For users in areas without terrestrial networks, such as rural areas, sea areas, and airspace, the users will access the satellite network for communication.

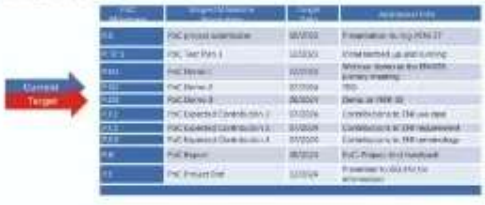
Intelligent On-demand Coverage



Performance of the intelligent on-demand coverage

A dynamic beam pattern and bandwidth allocation scheme based on DRL is proposed, which flexibly uses three degrees of freedom of time, space and frequency. And a cooperative multi-agent deep reinforcement learning framework is proposed to solve the explosion of action space, where each agent is only responsible for the illumination allocation or bandwidth allocation of one beam. The agents can learn to collaborate by sharing the same reward to achieve the common goal, which refers to maximize the throughput and minimize the delay fairness between cells. Simulations have proven that the proposed method has better performance of data throughput and the delay fairness than existing beam hopping approaches.

Milestones



PoC member

cnit CAICT

ENI(24)030_042	Other	PoC 17 Intelligent Satellite-Terrestrial Integration Network Architecture update

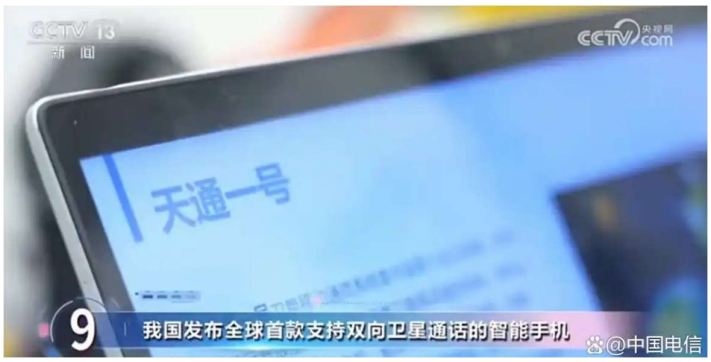
- ISG ENI #31 Plenary meeting, Beijing, 9th, September, 2024

The PoC#17 team demonstrated some further results on simulation results on transport layer protocol and intelligent on-demand coverage using deep reinforcement learning (DRL)

ENI(24)031_042r1	Other	**PoC 17 Intelligent Satellite-Terrestrial Integration Network update**

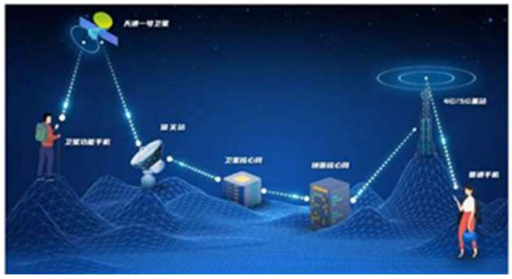
- Launch of Direct Mobile Satellite service, 8th September, 2023

  China Telecom officially launched its mobile direct satellite service on September 8 2023 together with Huawei mobile device (Mate 60 series), provide communication service directly connecting consumer smartphones to satellites. This marks a gradual expansion of the satellite mobile communication industry Users can enjoy integrated communication services without changing their devices, SIM cards, or phone numbers, significantly lowering the threshold and cost for the public to use satellite communication services.



Li Jun, Deputy General Manager of China Telecom, attended China Telecom's Digital Technology Ecology Conference held in Guangzhou Dec 2024, promote collaborative innovation in artificial intelligence, 5G and satellite communications

On Jan 2025, China Telecom plans to work with partners to develop direct-connected satellites applications to be integrated with 5G, AI, Internet of Things



B.2.4 PoC Goals Status Report

Specify PoC Goals from ENI ISG PoC Proposal (clause A.1.2). Identify any changes from the original ENI ISG PoC Proposal with an explanation as to why the changes were made. Indicate the extent that each goal was met. Provide sufficient information for those not familiar with the PoC goals to understand what has been achieved and/or learned.

- PoC Project Goal #1: Hand-and-Arm based Architecture. Demonstrate the architecture design with inherent wide-area coverage capability and the unified management of user access with ubiquitous signalling coverage (Demonstrated/Met?) Met
- PoC Project Goal #2: Intelligent On-demand Coverage. Demonstrate the intelligent on-demand coverage technology to provide dynamic resource allocation for traffic steering to meet diversified user demands (Demonstrated/Met?) Met

B.2.5 PoC Feedback Received from Third Parties (Optional)

Where applicable, provide in a free text, feedback received from potential customers, Ecosystem partners, event audience and/or public.

B.3 ENI PoC Technical Report (Optional)

B.3.1 General

PoC Teams are encouraged to provide technical details on the results of their PoC using the PoC Scenario Report template below.

B.3.2 PoC Contribution to ENI ISG

Use table B.1 to list any contributions to the ENI ISG resulting from this PoC Project.

Table B.1

Contribution	WG	WI/Document Ref	Comments
ENI(25)034_040_CR_RGS_ENI-001v411_Use_Cases__V4_0_5__PoC_17_related_5_3_13_.docx	ENI	ETSI GS ENI 001	Add “5.3.13 Use Case #2-13 - Intelligent Satellite-Terrestrial Network Optimization” into ENI 001 for reference.
ENI(25)034_042_update_to_RGS_ENI-002v411_Requirements__4_0_3__5_5_of_PoC_17.docx	ENI	ETSI GS ENI 002	Add “5.5 Network Optimization No.9 – No.13” in ENI 002.

B.3.3 Gaps identified in ENI standardization

None.

B.3.4 PoC Suggested Action Items

None.

B.3.5 Additional messages to ENI

ENI may explore more use cases for satellite-terrestrial integration network related applications.

B.3.6 Additional messages to Network Operators and Service Providers

Future exploration can help to expand coverage via MEO satellite-terrestrial 5G/B5G integration for urban, remote, and emergency scenarios; intelligent traffic orchestration using AI/ML (e.g., DRL) for dynamic resource allocation; cost-efficient open-source architecture for rapid deployment; AI-optimized operations via protocols like SMAC and LDPC coding; and collaboration in ENI standardization to lead industry ecosystem and enhance competitiveness.