CIGRE Study committe D2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG D2.70

NAME OF THE CONVENOR
Sun Fuyou (CHINA)

TITLE
Technologies and Practices of Enhanced IPv6 Packet Networks for the Smart Grid

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
3 / Digitalization
5 / Grids and Flexibility

POTENTIAL BENEFIT OF WG WORK
1 / commercial, business, social, economic benefits
3 / likely to contribute to new or revised industry standards
4 / state-of-the-art or innovative solutions or directions

STRATEGIC DIRECTION
1 / The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-ofthe-art technological advances
2 / Making the best use of the existing systems

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :

Currently, the electric power industry is undergoing energy, zero-carbon, and digital transformations, and a “green, secure, and economic” electric power industry is required worldwide.

With the construction and development of smart grids, especially in the era of artificial intelligence (AI), which is used to support intelligent and autonomous capability in both management and operation in power utility, traditional power utility architectures consisting of transmission and distribution will be impacted and will need to adapt to new services and a flexible packet transport layer for efficient data transmission.

To support the integration, cooperation, and scalability of Smart Grid scenarios, including transmission and distribution, communication will play an important role.

With the worldwide growth of operational packet-switched traffic, demand for Internet Protocol (IP) address space has increased significantly, with IP version 4 (IPv4) nearing exhaustion.

In addition, the power industry has been replacing legacy transport technologies, including Synchronous Digital Hierarchy (SDH), Synchronous Optical Network (SONET), and Plesiochronous Digital Hierarchy (PDH), with native packet-based communication networks. Even within IP-based and packet networking technologies, new approaches are needed to meet the demands of high bandwidth, wide distribution, efficient flexibility, low latency, lossless transmission, security, and intelligence, driven by a large number of new services across all Smart Grid scenarios.

Internet Protocol version 6 (IPv6)-based technologies have made significant progress in terms of deterministic latency, reliability, and security in recent years. Based on practices in public telecommunications and other industries, an enhanced IPv6 packet network has the potential to become an important option for Smart Grid,

including transport-layer extensions such as Segment Routing over IPv6 (SRv6), which is gaining traction.

However, widespread adoption of IPv6 in many countries' power systems is still lagging.

This work aims to provide an in-depth analysis of Smart Grid's new services, investigate them, and offer guidance on how these services can be enhanced through IPv6 transport communication technologies.

This work also aims to capture a snapshot of IPv6 adoption across various power industry applications and provide a view on IPv6's suitability and maturity in power system applications.

This work will cover background, standards references, comparative analysis, and best practices for power utilities across different use cases for enhanced IPv6 technologies.

We will also build on CIGRE work communication, conduct an analysis of the applicability and coordination of enhanced IPv6, optical and wireless, and explore the best technical route that can achieve the smooth transition to IPv6 for applications and may benefit from it

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

CIGRE's most recent focus on IP transport networks was around 2016, when the CIGRE D2 Green Book was published
.

It conducted relevant technical comparisons, analyses, and evaluations of power communication network technologies, including Internet Protocol over Multiprotocol Label Switching (IP/MPLS), Multiprotocol Label Switching Transport Profile (MPLS-TP), and Optical Transport Network (OTN).

Since then, Smart Grid services have greatly expanded. At the same time, innovations in enhanced IPv6 transport technologies have occurred at a tremendous pace, and this working group aims to research the current state of new services and enhanced IPv6 technologies and provide recommendations on IPv6 packet networks for power utilities.

SCOPE :

The scope of this WG is as follows:

- Carry out a survey within CIGRE member countries and related organisations, to capture a snapshot of the adoption of IPv6 in the various applications in the power industry, and provide a view on the suitability and maturity of IPv6 in power system applications.
- In-depth analysis of the development trend of the Smart Grid, including the goal of "green, secure, and economical" with the requirements of

energy transformation, zero-carbon transformation, and digital transformation, and the challenges in the AI era.
- Focussing on the core scenarios of transmission and distribution, this WG will analyse new service requirements, define corresponding security and O&M needs
.
- Introduction to enhanced IPv6 technologies, covering technical capabilities, standards developments and current use landscape in Operational Technology (OT) and power utilities in different countries, including the barriers to adoption of enhanced IPv6 as well as the opportunities and applications that benefit from enhanced IPv6.
- Provide the evolution of IPv6, its original intention and the problems it was designed to solve, and the current realities in adoption.
- Provide recent extensions such as SRv6 and IPv6’s roles as an enhanced transport layer and its suitability in applications in the power grid.
- Introduction of secure technologies in IPv6 networks and the evolution status of intelligent Operations and Maintenance (O&M) of IPv6 packet networks
- Scenario-driven target network architecture: emphasising the core scenarios of transmission and distribution, this WG will derive the enhanced IPv6 packet network as the target communication infrastructure for each scenario, forming a scenario-oriented target network evolution path.

- Collaboration between IP packet networks and other technologies, such as optical and wireless technologies, to achieve the optimal evolution path of smart grids.

DELIVERABLES AND EVENTS

Deliverables Types
Annual progress and activity report to Study Committee
CSE
Electra report
Event
Future connections

Meeting
Technical Brochure and Executive Summary in Electra
Tutorial

Time schedule

Q2	2026	WG member recruitment
Q2	2026	Develop work plan
Q4	2026	Draft TB for SC review
Q2	2027	Final review
Q3	2027	Publication
Q4	2027	Tutorial

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:
Rannveig Loken
July 06th, 2026