

# Transmission of IPv6 Packets over Short-Range Optical Wireless Communications (IPv6 over OWC)

**draft-ietf-6lo-owc-06**

by

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# Status of “IPv6 over OWC”

- draft-choi-6lo-owc-00 (IETF 117, San Francisco, July 2023)
  - The Introduction to the new I.D. IPv6 over OWC
- draft-choi-6lo-owc-01 (IETF 118, Prague, November 2023)
  - Revision addressing technical issues related to IPv6 over OWC
- draft-choi-6lo-owc-02 (IETF 119, Brisbane, March 2024)
  - Revision incorporating comments from IETF118
  - Addition of SCHC in IPv6 over OWC
- draft-ietf-6lo-owc-00 & 01 (IETF 120, Vancouver, July 2024)
  - I.D.-00 (an initial draft of draft-choi-6lo-owc-02 with typos fixed)
  - Addition of SCHC in IPv6 over OWC (new texts and figures in § 4.5.2 & § 6.)
- draft-ietf-6lo-owc-02 (IETF 121, Dublin, November 2024)
  - Revision for Fig.5, Fig.7 and Fig.8
  - IANA comment about the I.D.-01 & References
- draft-ietf-6lo-owc-03 (IETF 122, Bangkok, March 2025)
  - Comments and feedback from IEEE802.15 members and the 6lo meeting in IETF 121
  - IANA comment about the I.D.-02
- draft-ietf-6lo-owc-04 (IETF 123, Madrid, July 2025)
  - Feedback from the 6lo meeting in IETF 121
  - A New Section Added (Annex A): Hybrid compression strategy using 6LoWPAN HC + SCHC
- draft-ietf-6lo-owc-05 (IETF 124, Montreal, Nov. 2025)
  - IETF editorial conventions
  - Improved logical flow
- **draft-ietf-6lo-owc-06 (IETF 125, Shenzhen, Mar. 2026)**
  - **Security Considerations**

# Summary of Revised I.D.-06

draft-ietf-6lo-owc-05.txt	draft-ietf-6lo-owc-06.txt
6lo Internet-Draft Intended status: Standards Track Expires: 24 April 2026	6lo Internet-Draft Intended status: Standards Track Expires: 31 August 2026
Y. Choi, Ed. ETRI C-M. Kim KETI C. Gomez Universitat Politecnica de Catalunya 21 October 2025	Y. Choi, Ed. ETRI C-M. Kim KETI C. Gomez Universitat Politecnica de Catalunya 27 February 2026
Transmission of IPv6 Packets over Short-Range Optical Wireless Communications draft-ietf-6lo-owc-05	Transmission of IPv6 Packets over Short-Range Optical Wireless Communications draft-ietf-6lo-owc-06
Abstract	Abstract
[IEEE802.15.7], "Short-Range Optical Wireless Communications" defines wireless communication using visible light. It defines how data is transmitted, modulated, and organized in order to enable reliable and efficient communication in various environments. The standard is designed to work alongside other wireless communication systems and supports both Line-of-Sight (LOS) and Non-Line-of-Sight (NLOS) communications. However, ambient light interference from natural	[IEEE802.15.7], "Short-Range Optical Wireless Communications" defines wireless communication using visible light. It defines how data is transmitted, modulated, and organized in order to enable reliable and efficient communication in various environments. The standard is designed to work alongside other wireless communication systems and supports both Line-of-Sight (LOS) and Non-Line-of-Sight (NLOS) communications. However, ambient light interference from natural
skipping to change at page 1, line 46	skipping to change at page 1, line 46

- No feedback & comments in the previous 6lo meeting.

- Mainly updated for §7 (**Security Considerations**)
- No changes outside Section 7.

# Updates (1/2)

## - §7. Security considerations

draft-ietf-6lo-owc-05.txt

### 7. Security Considerations

Security mechanisms for IPv6 over OWC MUST address confidentiality, integrity, and replay protection. Future work may consider optical-layer encryption and physical-layer key establishment.

draft-ietf-6lo-owc-06.txt

### 7. Security Considerations

Optical Wireless Communication is a short-range technology based on visible or optical signals. Although communication is typically confined to an illumination area, signal leakage through reflection, refraction, or unintended optical exposure may allow unintended reception. Therefore, confidentiality protection may be relevant depending on the deployment environment.

RPC

IPv6 over OWC

February 2026

[IEEE802.15.7] specifies MAC-layer security mechanisms that provide data confidentiality, data authenticity, and replay protection. Depending on configuration and deployment, these services can mitigate some of the risks described above, such as unauthorized reception, frame modification, or replay attacks.

Devices located within the same illumination zone can potentially participate in communication if no additional safeguards are applied. Authentication and access control can be considered to reduce the risk of device impersonation or unauthorized access.

OWC links may be affected by optical interference or intentional jamming, which can impact link stability and availability. Such conditions may result in service disruption.

Security mechanisms may introduce additional processing or communication overhead. In energy-constrained deployments, the balance between energy efficiency and security protection can influence overall system robustness.

# Updates (2/2) – cont'd

## - What Was Updated

draft-ietf-6lo-owc-05.txt

- ① **Retained high-level risk considerations:**
  - Signal leakage / unintended reception
  - Authentication & access control
  - Interference / jamming
  - Energy-security trade-off
- ② **Added brief reference to IEEE 802.15.7 MAC security services:**
  - Data confidentiality
  - Data authenticity
  - Replay protection
- ③ **Clarified that:**
  - Some identified risks may be mitigated by these MAC-layer mechanisms

draft-ietf-6lo-owc-06.txt

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RFC

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Security mechanisms may introduce additional processing or communication overhead. In energy-constrained deployments, the balance between energy efficiency and security protection can influence overall system robustness.

# Ref: I.D., draft-choi-6lo-owc-security

- No More Updates

- **For § 7 (Security Considerations)**, a new contributor, Munhwan Choi (ETRI) was invited.
- In IETF 125, **some of his stable contents have been incorporated** in the updates of draft-ietf-6lo-owc-06.
- **I.D., draft-choi-6lo-owc-security-03** is not being updated any more.

draft-choi-6lo-owc-security-03	
6lo	M. Choi, Ed.
Internet-Draft	Y. Choi
Intended status: Informational	ETRI
Expires: 23 April 2026	20 October 2025
Security considerations for IPv6 Packets over Short-Range Optical Wireless Communications draft-choi-6lo-owc-security-03	
Table of Contents	
1. Introduction . . . . .	2
2. Security Considerations . . . . .	3
2.1. Eavesdropping and Data Interception . . . . .	3
2.2. Denial of Service (DoS) Attacks . . . . .	3
2.3. Authentication and Access Control . . . . .	3
2.4. Energy Efficiency and Security Trade-off . . . . .	4
2.5. Secure Routing in Multi-hop Networks . . . . .	4
2.6. RF/Optical Interference and Jamming . . . . .	4
3. IANA Considerations . . . . .	5
4. References . . . . .	5
Acknowledgements . . . . .	5
Authors' Addresses . . . . .	5

※ A New I.D., draft-choi-6lo-owc-security : Recently updated into I.D.-03  
(<https://datatracker.ietf.org/doc/draft-choi-6lo-owc-security/>)

**Please read the draft  
and  
welcome any feedback !!**

**Thank you.**

# Ref.#1: Short-Range Optical Wireless Communications (OWC) ?

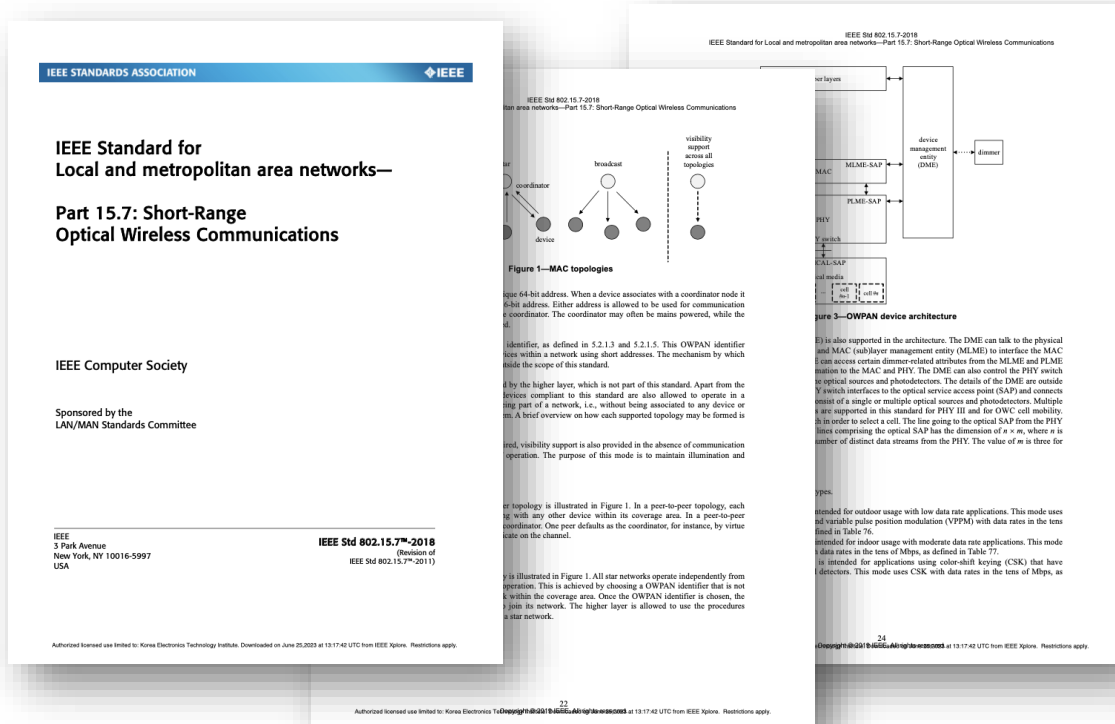
- OWC uses **intensity modulation of optical sources**, such as **Light Emitting Diodes (LEDs)**.
- OWC combines lighting and **bidirectional data communications**.
- OWC can be applied to various domains including area **lighting, signboards, streetlights, vehicles, traffic signals, displays, LED panels, and digital signage, smart phones ...**
- OWC devices can be powered by **limited energy sources (e.g., battery or energy harvesting)** for energy-efficient services.



# Ref.#2: OWC v.s. IEEE 802.15.7

- OWC is defined by **IEEE 802.15.7 standard** providing six key characteristics, including

**Visible Light Communication (VLC), Short-Range Bidirectional Communication, Line-of-Sight (LOS) & Non-Line-of-Sight (NLOS) Support, High and Low Data Rates, Energy Efficiency, and Secure Communication.**



# Ref.#3: Test-bed for "IPv6 over OWC"



# Ref.#4: Test Results of "IPv6 over OWC"

- Ping responses

```
PING 2001:db8:aaaa::1cfd:08ff:fe73:8567(2001:db8:aaaa:0:1cfd:8ff:fe73:8567) 100 data bytes
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=1 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=2 ttl=63 time=1.68 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=3 ttl=63 time=1.68 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=4 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=5 ttl=63 time=1.67 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=6 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=7 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=8 ttl=63 time=1.67 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=9 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=10 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=11 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=12 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=13 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=14 ttl=63 time=1.63 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=15 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=16 ttl=63 time=1.62 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=17 ttl=63 time=1.67 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=18 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=19 ttl=63 time=1.62 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=20 ttl=63 time=1.62 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=21 ttl=63 time=1.68 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=22 ttl=63 time=1.62 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=23 ttl=63 time=1.64 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=24 ttl=63 time=1.65 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=25 ttl=63 time=1.67 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=26 ttl=63 time=1.62 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=27 ttl=63 time=1.66 ms
108 bytes from 2001:db8:aaaa:0:1cfd:8ff:fe73:8567: icmp_seq=28 ttl=63 time=1.64 ms
```

- Wireshark captured

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	::e0:4cff:fe5a:dd06	::1cfd:8ff:fe73:8567	UDP	134	51991 → 1234 Len=100
2	0.000000505	::e0:4cff:fe5a:dd06	::1cfd:8ff:fe73:8567	UDP	134	51991 → 1234 Len=100
3	0.000000599	::e0:4cff:fe5a:dd06	::1cfd:8ff:fe73:8567	UDP	134	51991 → 1234 Len=100

> Frame 1: 134 bytes on wire (1072 bits), 134 bytes captured (1072 bits) on interface enx988389fde577, id 0  
> Ethernet II, Src: RealtekS\_5a:dd:06 (00:e0:4c:5a:dd:06), Dst: SamsungE\_fd:e5:77 (98:83:89:fd:e5:77)  
6LoWPAN, Src: ::e0:4cff:fe5a:dd06, Dest: ::1cfd:8ff:fe73:8567

- IPHC Header
  - 011. .... = Pattern: IP header compression (0x03)
  - ...0 1... .... = Traffic class and flow label: ECN and flow label inline (0x1)
  - .... .1. .... = Next header: Compressed
  - .... ..10 .... = Hop limit: 64 (0x2)
  - .... .... 0... = Context identifier extension: False
  - .... .... .1. .... = Source address compression: Stateful
  - .... .... ..11 .... = Source address mode: Compressed (0x0003)
  - .... .... .... 0... = Multicast address compression: False
  - .... .... .... .1. = Destination address compression: Stateful
  - .... .... .... ..01 = Destination address mode: 64-bits inline (0x0001)
- 00.. .... = ECN: 0
- ..00 .... = Padding: 0x00
- ... 1100 1011 0001 1001 0000 = Flow label: 0x0cb190
- [Source: ::e0:4cff:fe5a:dd06]
- Destination: ::1cfd:8ff:fe73:8567
- UDP header compression
  - 1111 0... = Pattern: UDP compression header (0x1e)
  - .... .0.. = Checksum: Inline
  - .... ..00 = Ports: Inline (0)
- Source port: 51991
- Destination port: 1234
- UDP checksum: 0xc4fa

> Internet Protocol Version 6, Src: ::e0:4cff:fe5a:dd06, Dst: ::1cfd:8ff:fe73:8567  
> User Datagram Protocol, Src Port: 51991, Dst Port: 1234  
> Data (100 bytes)

# Ref.#5: IEEE WCL about “IPv6 over OWC”

The screenshot shows the IEEE Xplore article page for the paper "6LoWPAN Over Optical Wireless Communications for IPv6 Transport in Internet of Things Networks". The page includes the IEEE logo, search bar, and navigation options. The article title is prominently displayed, along with the publisher (IEEE) and options to cite or download the PDF. The authors listed are Cheol-Min Kim, Sang-Kyu Lim, Jin-Doo Jeong, Younghwan Choi, and Seok-Joo Koh. The abstract discusses the use of 6LoWPAN over OWC networks for IoT services. The page also features a "More Like This" section with related articles and a "Get Published in the IEEE Open Journal of Circuits and Systems" banner.

**6LoWPAN Over Optical Wireless Communications for IPv6 Transport in Internet of Things Networks**  
Publisher: IEEE

Cheol-Min Kim ; Sang-Kyu Lim ; Jin-Doo Jeong ; Younghwan Choi ; Seok-Joo Koh

**Abstract:**  
As an emerging technology for the Internet of Things (IoT) wireless connectivity, there have been a lot of research and standardization activities on Visible Light Communications (VLC) and Optical Wireless Communications (OWC) using Light Emitting Diode (LED) lights. In the meantime, the Internet Protocol version 6 (IPv6) over Low Power Wireless Personal Area Network (6LoWPAN) has been discussed to provide the IPv6-based IoT services in wireless networks. However, the study on IoT systems using 6LoWPAN over OWC networks has not been made so far. This letter proposes a new architectural model to effectively use 6LoWPAN between IoT gateway and IoT device in the OWC-based IoT networks. The proposed model is easy to implement and provides the performance enhancement in OWC-based IoT networks, compared to the general IPv6 model. From testbed experimentations, it is shown that the proposed model provides the delay gain up to 5% and the throughput gain up to 19.52%, compared to the conventional IPv6 transport model.

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[Cheol-min Kim](#), Sang-Kyu Lim, Jin-Doo Jeong, [Younghwan Choi](#), Seok-Joo Koh, "6LoWPAN Over Optical Wireless Communications for IPv6 Transport in Internet of Things Networks" **IEEE Wireless Communications Letters**, Vol. 11, Issue 6, June 2022.