IOWN GLOBAL FORUM ™

Remote Media Production for Broadcast Industry Use Case

Classification: APPROVED REFERENCE DOCUMENT

Confidentiality: [PUBLIC]

Version 1

July 2024

[RMP Use Case]

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

Legal

THIS DOCUMENT HAS BEEN DESIGNATED BY THE INNOVATIVE OPTICAL AND WIRELESS NETWORK GLOBAL FORUM, INC. (“IOWN GLOBAL FORUM”) AS AN APPROVED REFERENCE DOCUMENT AS SUCH TERM IS USED IN THE IOWN GLOBAL FORUM INTELLECTUAL PROPERTY RIGHTS POLICY (THIS “REFERENCE DOCUMENT”).

THIS REFERENCE DOCUMENT IS PROVIDED ”AS IS” WITH NO WARRANTIES WHATSOEVER, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY, NONINFRINGEMENT OF THIRD PARTY RIGHTS, TITLE, VALIDITY OF RIGHTS IN, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY WARRANTY OTHERWISE ARISING OUT OF ANY PROPOSAL, REFERENCE DOCUMENT, SAMPLE, OR LAW. WITHOUT LIMITATION, IOWN GLOBAL FORUM DISCLAIMS ALL LIABILITY, INCLUDING WITHOUT LIMITATION LIABILITY FOR INFRINGEMENT OF ANY PROPRIETARY RIGHTS AND PRODUCTS LIABILITY, RELATING TO USE OF THE INFORMATION IN THIS REFERENCE DOCUMENT AND TO ANY USE OF THIS REFERENCE DOCUMENT IN CONNECTION WITH THE DEVELOPMENT OF ANY PRODUCT OR SERVICE, AND IOWN GLOBAL FORUM DISCLAIMS ALL LIABILITY FOR COST OF PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, LOST PROFITS, LOSS OF USE, LOSS OF DATA OR ANY INCIDENTAL, CONSEQUENTIAL, DIRECT, INDIRECT, PUNITIVE, EXEMPLARY, OR SPECIAL DAMAGES, WHETHER UNDER CONTRACT, TORT, WARRANTY OR OTHERWISE, ARISING IN ANY WAY OUT OF USE OR RELIANCE UPON THIS REFERENCE DOCUMENT OR ANY INFORMATION HEREIN.

EXCEPT AS EXPRESSLY SET FORTH IN THE PARAGRAPH DIRECTLY BELOW, NO LICENSE IS GRANTED HEREIN, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS OF THE IOWN GLOBAL FORUM, ANY IOWN GLOBAL FORUM MEMBER OR ANY AFFILIATE OF ANY IOWN GLOBAL FORUM MEMBER. EXCEPT AS EXPRESSLY SET FORTH IN THE PARAGRAPH DIRECTLY BELOW, ALL RIGHTS IN THIS REFERENCE DOCUMENT ARE RESERVED.

A limited, non-exclusive, non-transferable, non-assignable, non-sublicensable license is hereby granted by IOWN Global Forum to you to copy, reproduce, and use this Reference Document for internal use only. You must retain this page and all proprietary rights notices in all copies you make of this Reference Document under this license grant.

THIS DOCUMENT IS AN APPROVED REFERENCE DOCUMENT AND IS SUBJECT TO THE REFERENCE DOCUMENT LICENSING COMMITMENTS OF THE MEMBERS OF THE IOWN GLOBAL FORUM PURSUANT TO THE IOWN GLOBAL FORUM INTELLECTUAL PROPERTY RIGHTS POLICY. A COPY OF THE IOWN GLOBAL FORUM INTELLECTUAL PROPERTY RIGHTS POLICY CAN BE OBTAINED BY COMPLETING THE FORM AT: www.iowngf.org/join-forum. USE OF THIS REFERENCE DOCUMENT IS SUBJECT TO THE LIMITED INTERNAL-USE ONLY LICENSE GRANTED ABOVE. IF YOU WOULD LIKE TO REQUEST A COPYRIGHT LICENSE THAT IS DIFFERENT FROM THE ONE GRANTED ABOVE (SUCH AS, BUT NOT LIMITED TO, A LICENSE TO TRANSLATE THIS REFERENCE DOCUMENT INTO ANOTHER LANGUAGE), PLEASE CONTACT US BY COMPLETING THE FORM AT: https://iowngf.org/contact-us/

Copyright © 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. Except for the limited internal-use only license set forth above, copying or other forms of reproduction and/or distribution of this Reference Document are strictly prohibited.

The IOWN GLOBAL FORUM mark and IOWN GLOBAL FORUM & Design logo are trademarks of Innovative Optical and Wireless Network Global Forum, Inc. in the United States and other countries. Unauthorized use is strictly prohibited. IOWN is a registered and unregistered trademark of Nippon Telegraph and Telephone Corporation in the United States, Japan, and other countries. Other names and brands appearing in this document may be claimed as the property of others.

Contents

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

1. Introduction

1.1. Vision

Remote Media Production, empowered by Innovative Optical and Wireless Network Global Forum (IOWN GF) Technologies, will allow the media broadcast industry to create content in a cost-effective new architecture, while bringing exciting new capabilities to meet today's content development challenges. By deploying IOWN GF Technologies, the broadcast industry will be able to optimize existing content development operations and skilled personnel to maximize profitability while serving a larger addressable market.

1.2. Opportunities

The rapid advancement of media production technology makes it incredibly challenging to secure enough highly skilled and qualified media production operators to meet demand, especially in rural areas. This lack of skilled personnel, limited resources for acquiring advanced solutions, and high networking cost make distributing and developing quality content a daunting prospect. As a result, there is significant demand for new technologies and architectures that provide a more optimal profit structure to address these new market realities.

Among the highly advanced IOWN GF Technologies available to the broadcast industry, Open All-Photonic Networks (Open APNs) provide some of the most impactful results. Open APNs, which primarily rely on photonics (using laser light rather than electricity) as the basis for data transmission, can provide dynamic, flexible, resilient and highly performant connectivity to enable distributed applications, including high-quality video production.

By utilizing IOWN GF Technologies, an operator(s) who manipulates the media essence for live broadcasting will be able to remotely control the media production resources, such as production switcher and editor, as if the operator and the media production resource were together at the same site. The flexible workflow enabled by this model will help secure highly skilled and qualified media production professionals who may be geographically distributed.

IOWN GF technologies can offer the broadcast industry the required flexibility and performance gains in a cost-conscious manner through its on-demand purchase models, in contrast to the conventional installation of dedicated lines.

Moreover, they will operate with far less energy consumption than today's networks, contributing to further reduction of operation costs.

Furthermore, IOWN GF Technologies will enable the sharing and consolidation of top-end equipment, significantly reducing both CAPEX and OPEX while improving the agility and flexibility of the media production workflow.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

1.3. Scope

The objective of this activity is to prove the technology readiness and advantages of IOWN GF's Remote Media Production solutions to the key players of the broadcast industry.

The scope of this activity is to:

1. Describe the Remote Media Production Use Case and its key requirements
2. Define the Technology Evaluation Criteria, which include conditions, metrics, and evaluation method for benchmarking
3. Develop the Reference Implementation Model, which provides practical implementation of IOWN technologies as a reference model to realize the use case
4. Define the Proof-of-Concept (PoC) Reference, which provides guidelines for conducting PoCs for the use case to evaluate the Reference Implementation Model with the defined Benchmark Model
5. Develop and evaluate the PoC based on the PoC Reference

This document is the first step of this activity covering items 1 and 2 to engage early adopters in the broadcast industry.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

2. Use Case - Live Broadcasting by Remote Media Production

Three different use cases that address different values are described in this section; *Media Production from Remote Site, Network Resource Sharing* and *Media Production Resource Sharing*.

2.1. Use Case #1: Media Production from Remote Site

In this use case, as illustrated in Figure 2-1, the operator who manipulates the media essence for live broadcasting, will control the remote media production resources, as if the operator and the media production resource were together at the same site, in order to provide a flexible workflow.

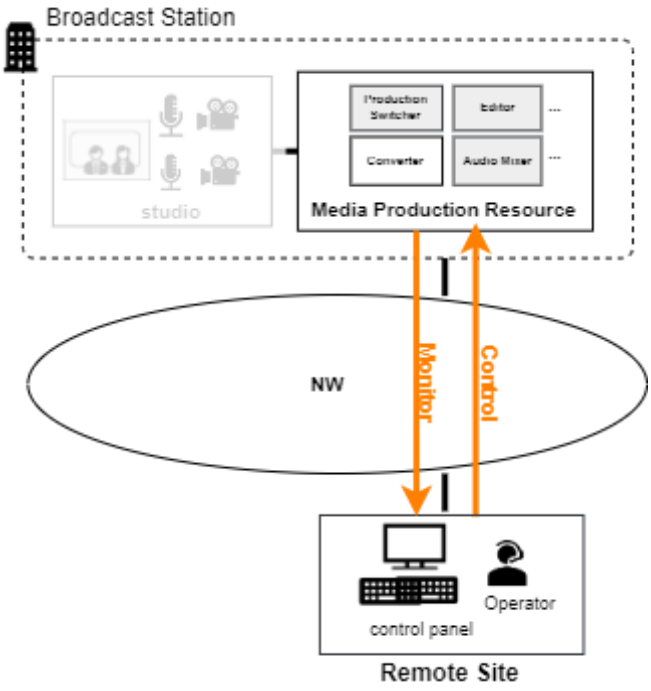


Figure 2-1: Media Production from Remote Site

By realizing this use case, the following additional values could be provided:

- Securing highly skilled and qualified media production professionals
- Provide flexibility in operator's way of working

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

2.2. Use Case #2: Network Resource Sharing

In this use case, as illustrated in Figure 2-2, the broadcast station will request network resource from the event venue to the broadcast station whenever an event occurs, in order to provide high-quality connectivity at an affordable cost. Unlike conventional media production at the event venue utilizing Outdoor Broadcasting (OB) van, raw media essence streams are directly sent from the event venue and are edited at the broadcast station.

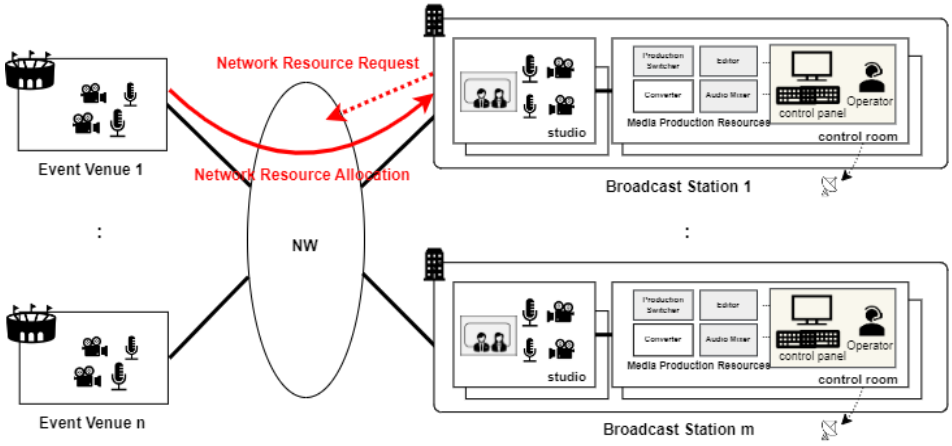


Figure 2-2: Network Resource Sharing

By realizing this use case, the following additional values could be provided:

- Cost reduction of WAN connectivity by the network resource sharing.
- Reduction of equipment and human resource needed for OB van

2.3. Use Case #3: Media Production Resource Sharing

In this use case, as illustrated in Figure 2-3, the broadcast stations will request media production resources at the Media Production Center whenever required for live broadcasting, in order to reduce the cost. When the resource is not needed the broadcast stations will release it, so it can be used by other broadcast stations.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

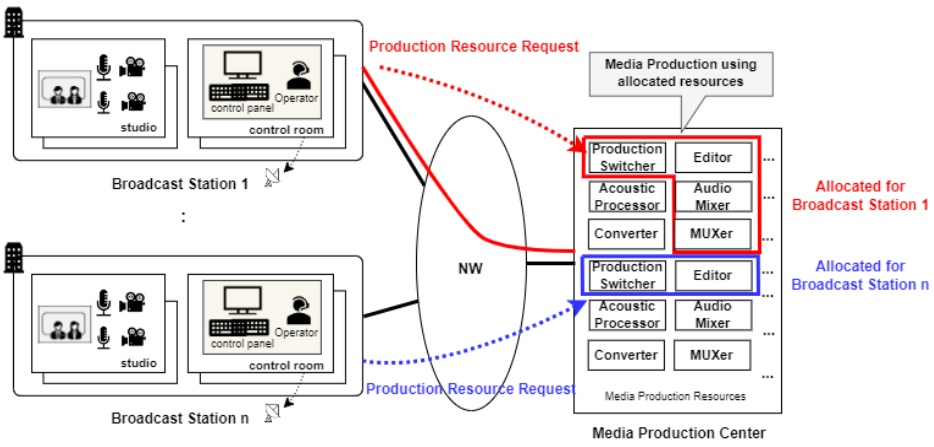


Figure 2-3: Media Production Resource Sharing

By realizing this use case, the following additional values could be provided:

- Driving cost efficiency for using the state-of-the-art media processing resources with low-cost investment, and maintenance cost reduction
- Enabling flexibility and extensibility in media production
- Enabling scalability

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

3. Key Requirements

Table 3-1, 3-2, 3-3 describes the key requirements for the envisioned use cases.

Table 3-1 Key Requirements for UC#1

Item	Value	Note
Remote Operation Delay	16.6 msec	The Remote Operation Delay is the time difference in the Operation Delay when operated from a remote site compared to on-premise. The Operation Delay is the time from when a video stream for monitoring is output from the media production resources to the time when the media production resources receive the control data generated by the operator. The allowable maximum value of Remote Operation Delay is 1 video frame time interval at 60fps. Today's media production resources process frame by frame, and if this requirement is satisfied, the delay time is negligible compared to the on-premise case.
Network Availability	99.9999 %	The Downtime is 0.036 sec in a one-hour TV program and this value is about 2 frames.

Table 3-2 Key Requirements for UC#2

Item	Value	Note
Network Bandwidth per Broadcast Station	20 Gbps	Media essences captured at the venue are transmitted to Broadcast Stations. Video streams may be compressed using low-latency codec such as JPEG XS. (for example, 1080@60p w/ JPEG XS compression < 50 cameras, 2160@60p w/ JPEG XS x <12 cameras)

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

Remote Production Delay	16.6 msec	The Remote Production Delay is the difference of Live Media Production Time when the broadcast station and the event venue are connected via WAN compared to a single location (on-premise). The Live Media Production Time is the time from when a live media essence stream is generated from a source to the time when the edited live media stream is outputted from the media production resources after switching and editing. The allowable maximum value of Remote Production Delay is 1 video frame time interval at 60fps. Today's media production resources process frame by frame, and if this requirement is satisfied, the delay time is negligible compared to the on-premise case.

Table 3-3 Key Requirements for UC#3

Item	Value	Note
Network Bandwidth per Broadcast Station	20 Gbps	Multiple media essences are transmitted from Broadcast Stations to Media Production Center. Video streams may be compressed using low-latency codecs such as JPEG XS. (for example, 1080@60p w/ JPEG XS compression < 50 cameras, 2160@60p w/ JPEG XS x <12 cameras)
Maximum Network Latency including Jitter	16.6 msec	This is one-way network latency between Broadcast Station to/from Media Production Center. This value is as the same level as the on-premise case. The value is equal to 1 frame delay in the case of 60 fps.
Network Availability	99.9999 %	The Downtime is 0.036 sec in a one-hour TV program and this value is about 2 frames.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

4. Technology Evaluation Criteria

To evaluate the effectiveness and merits of adopting the IOWN GF Technologies to realize the use cases, we define the Reference Case, Benchmark Conditions, Metrics and Evaluation Method here under.

4.1. Reference Case

Reference cases define the conditions of the use case for benchmarking.

The following reference cases for the three use cases described in Section 2 will be used for benchmarking.

4.1.1. Reference Case #1: Media Production from Remote Site

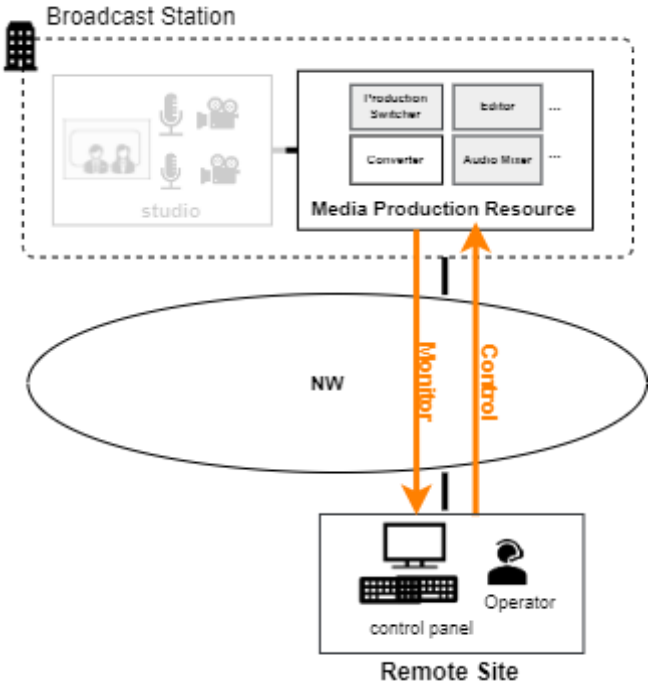


Figure 4.1-1: Reference Case: Media Production from Remote Site

Table 4.1-1: Benchmark Conditions: Media Production from Remote Site

item	value	note
Maximum service area size	Radius of 1,000 km	Approximate radius of Japan

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

4.1.2. Reference Case #2: Network Resource Sharing

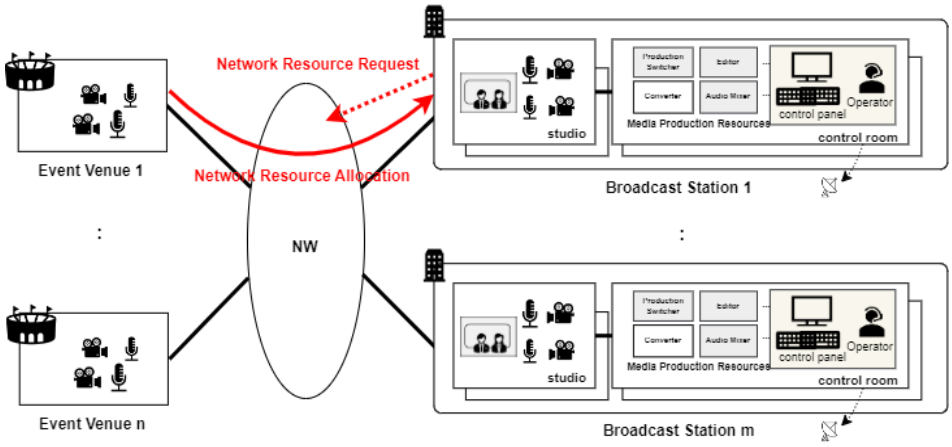
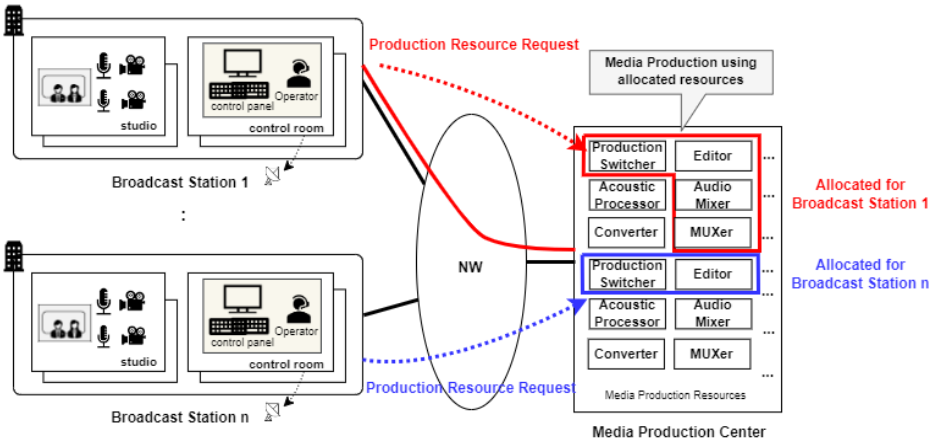


Figure 4.1-2: Reference Case: Network Resource Sharing

Table 4.1-2: Benchmark Conditions: Network Resource Sharing

item	value	note
Maximum distance between Event Venue and Broadcast Station	< 200 km	Maximum distance between an event venue and the airing broadcast station in the region (e.g. Kanto Region in Japan)
Number of Broadcast Stations	6	Approximate number of affiliated stations per prefecture in Japan
Number of Event Venues	10	Average event venue with 10,000 capacity per prefecture in Japan
Duration of Event	5 hours	Average duration of a baseball game plus preparation

4.1.3. Reference Case #3: Media Production Resource Sharing



© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

Figure 4.1-3: Reference Case: Media Production Resource Sharing

Table 4.1-3: Benchmark Conditions: Media Production Resource Sharing

item	value	note
Maximum service area size	Radius of 1,000 km	Approximate radius of Japan
Number of Broadcast Stations	128	Approximate number in Japan
Average service time	8 hours per day	2 hours live or recording x 4 times per day. This is the time period for one Broadcast Station to use Media Processing Resources at Media Production Center.
Maximum concurrent connection rate	50%	Number of concurrent connections divided by the total number of connections

4.2. Metrics

The following metrics will be measured when evaluating the developed system:

- System/Operation cost (for UC#2 and UC#3)
- Latency (for UC#1, #2 and #3)
- Jitter (for UC#1, #2, and #3)

4.3. Evaluation Methodology

The Metrics specified in the section 4.2 is evaluated as the following way:

- System/Operation cost
  The following items will be considered to analyze the economic feasibility of the envisioned use case.
  - Items required for media production
    - Total Amount of Media Production Resources (Equipment)
      - the amount of Media Production Resources that are required to satisfy the peak time
    - Number of Operators (Human Resource)
      - the number of Operators that manipulate control panels to edit the media essence streams using Media Production Resources
  - Items required for network connectivity
    - Number of Network Connections
      - the number of logical network links that are used between Broadcast Station and Media Production Center for media production
    - Network Occupancy Ratio

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

    - the ratio between total network availability vs. actual usage time (e.g. 6 hours usage per day equals 25% Network Occupancy Ratio) of the above logical network link

Cost of conventional on-premise media production and the proposed remote media production will be compared taking the above items into account. Remote media production utilizing existing network may also be evaluated.

- Latency and Jitter

The method on how to evaluate other metrics will be described in the PoC Reference.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

5. Conclusion

In this document the IOWN GF presented its vision to revolutionize the broadcasting workflow by developing and utilizing Remote Media Production empowered by IOWN GF Technologies.

As explained in the section 1.3, this document covers the first step of the IOWN GF's activity to engage early adopters in the broadcast industry. Further documentation, which will cover greater technical detail in this document, will be issued to evaluate the feasibility of this vision through development of Reference Implementation Model and PoC demonstrations.

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

Acknowledgments

This Reference Document was jointly prepared by Technical and Use Case Working Groups of the IOWN GF under the direction of Masahisa Kawashima (Technical WG Chair) and Katsutoshi Ito (Use Case WG Chair).

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org

History

Revision	Release Date	Summary of Changes
1	July 2024	Initial Version

© 2024 Innovative Optical Wireless Network Global Forum, Inc. All rights reserved. • www.iowngf.org