LF EDGE
Akraino Spring Technical Summit

An IOWN Global Forum PoC report
Sensor Data Aggregation and Ingestion in the disaggregated edge computing by RDMA over IOWN All-Photonics Network

MAY 1ST, 2024

Hyde Sugiyama
Chief Technology Strategist, Red Hat

Blog
https://www.redhat.com/en/blog/ntts-accelerated-data-pipeline-red-hat-openshift-and-iown-all-photonics-network

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Who am I ?

Hyde Sugiyama,
Chief Technology Strategist, Red Hat

Hidetsugu (Hyde) SUGIYAMA has been with Red Hat for ten years. He is Global Chief Technology Strategist where he is now focused on Telecom, Media Entertainment and Edge segment. During his 35 years, he has worked in the telecommunications industry on distributed systems, multi-layer networking, programmable network, SDN/NFV, virtualization, and heterogeneous computing. He also serves as the co-lead of PoC consultation Task Force and an alternate director of IOWN Global Forum.

Current his majors are;
a) Data Centric Infrastructure(DCI) for AI-native disaggregated infra over All-Photonics Network
b) Open Programmable Infrastructure in IOWN DCI/Composable Disaggregated Infra
c) Mobile Network for Beyond 5G toward 6G
d) Reference Implementation Model for IOWN Cyber Physical System/AI integrated Communication use cases
e) Post Quantum Security

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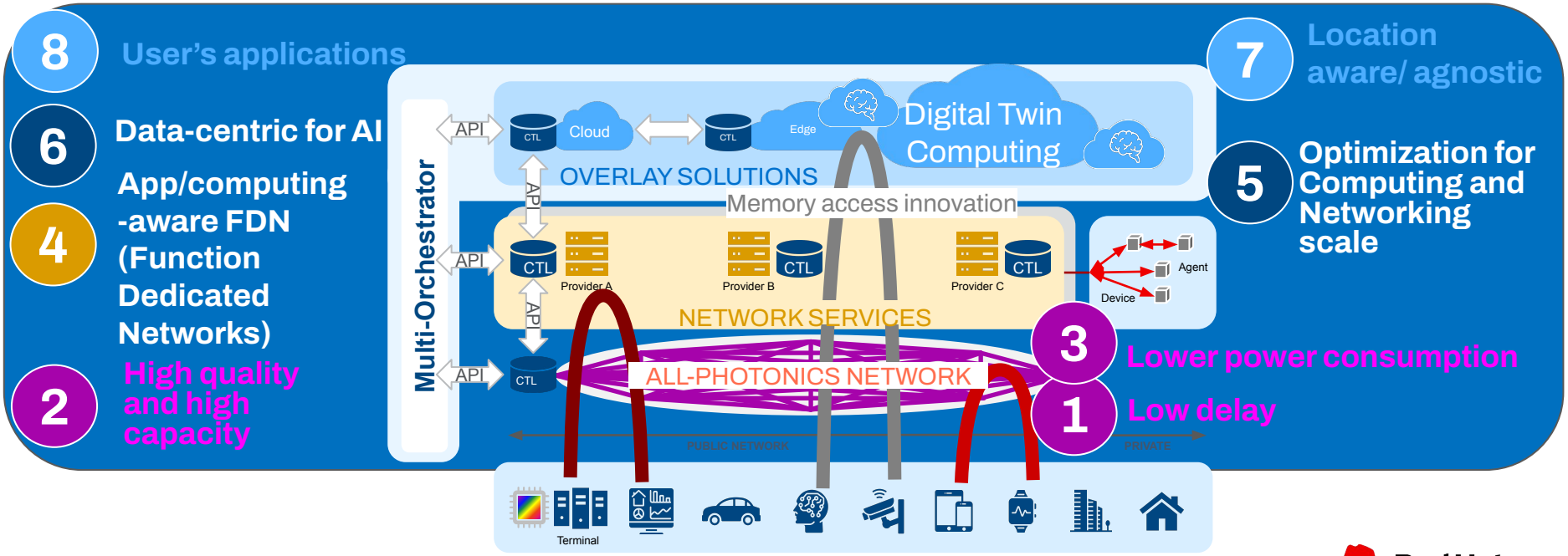
The Holistic Approach of IOWN (Innovative Optical and Wireless Network)

The following vision is to achieve by 2030.

Lower Power consumption by 100x Higher transmission capacity by 125x Lower end-to-end latency by 200x



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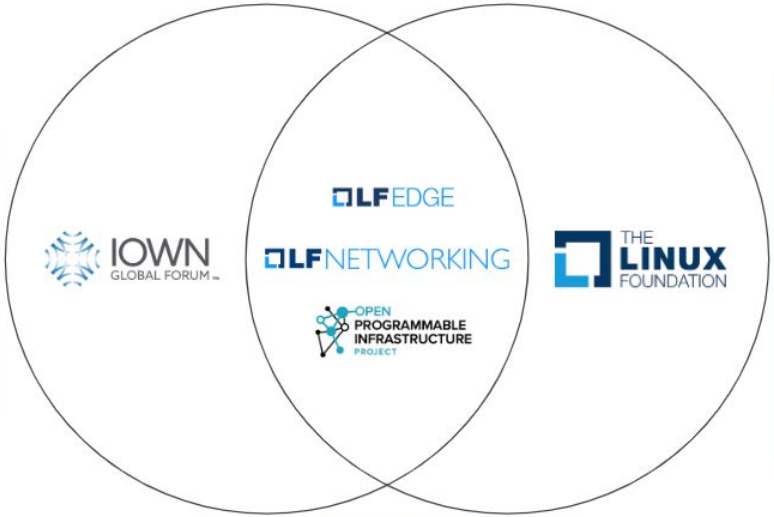
Current status

IOWN GLOBAL FORUM
FUTURES
25 April 2024 • Vancouver, Canada

The IOWN Global Forum + LF Ecosystem



THE LINUX FOUNDATION

IOWN and the Linux Foundation - Open Source Collaboration for Driving the Future of Communication Infrastructure

by Arpit Joshipura,

The Linux Foundation's goal is to create the greatest shared technology investment in history by enabling open collaboration across companies, developers and users.

We are the nonprofit organization of choice to build ecosystems that accelerate open source technology development and commercial adoption on a global scale.

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MOU between IOWN Global Forum and the Linux Foundation

IOWN GLOBAL FORUM

Press Release

Linux Foundation and IOWN Global Forum to Collaborate for Future Smart Connected World

Growing data demands driving liaison between hardware and software industries for Data-centric communication and computing

TOKYO—Interop Tokyo 2023 —June 14, 2023 – The Linux Foundation, the nonprofit organization focused on fostering innovation through open source, and the Innovative Optical and Wireless Network Global Forum (IOWN Global Forum), which seeks to create a smarter, more connected world, announced a new partnership to collaborate on integrating Linux Foundation software into the IOWN Global Forum platform. The common goal is to develop a collaborative infrastructure that enables higher performance, low latency, and energy efficiency to meet growing data delivery demands.

The two organizations have signed a Memorandum of Understanding (MoU) to solidify their working relationship by establishing joint activities. These will include cross-organization teams that will create presentations, seminars, and market education materials. Together, the organizations will accelerate the development of integrated photonic network architecture (from the IOWN Global Forum Vision 2030), with open source networking and IoT software (from Linux Foundation hosted projects within the ecosystem). The goal is to deliver comprehensive and accessible next-generation infrastructure for future use cases and business impacts.

"We are pleased to partner with IOWN Global Forum," said Arpit Joshipura, general manager, Networking, Edge & IoT, the Linux Foundation. "As 5G, 6G and newer smart technology from Optical to Apps become pervasive, a robust infrastructure is imperative in ensuring data demands are met. As a leader in communication and computing infrastructure, IOWN Global Forum and the Linux Foundation share a common vision to enable a smarter, more sustainable world through open, collaborative technology."

"The IOWN Global Forum is honored to collaborate with the Linux Foundation, as two of the leading organizations in the technology industry are driving innovation in a collaborative and open manner for advanced IT infrastructures." said Dr. Katsuhiko Kawazoe, President and Chairperson of the IOWN Global Forum. Kawazoe continued, "only through global collaborations like with the Linux Foundation, can we realize the next-generation communication and computing infrastructure needed to meet the demands of the coming decade and beyond."

The agreement calls members and experts from both the IOWN Global Forum and Linux Foundation to collaborate towards the realization of their shared goals. One of Forum's aims is to provide the IOWN Reference Implementation Model to realize each use case of AI integrated Communication and Cyber Physical Systems. The Linux Foundation projects involved in the collaboration include LF Networking, LF Edge, and Open Programmable Infrastructure (OPI) Project.

https://iowngf.org/press-releases/linux-foundation-and-iown-global-forum-to-collaborate-for-future-smart-connected-world/

1) **IOWN GF RIM Task Force collaboration opportunity**
   - Exploring LF Edge Akrino new blueprint by Disaggregated Edge Computing with RDMA over IOWN All-Photonics (ex IOWN CPS use case RIM SDAI PoC)
2) **IOWN GF DCI Task Force collaboration opportunity**
   - CNCF Kubernetes Dynamic Resource Allocation in IOWN Data-Centric Infrastructure/Composable Disaggregated Infrastructure

https://sched.co/1ZPDw

IOWN BOF@ KubeCon | CloudNativeCon Europe 2024

3) **IOWN GF INS/DCI Task Force collaboration opportunity**
   - Open Programmable Infrastructure with DPU/IPU for IOWN function dedicated network (ex Distributed UPF, RDMA, etc)
4) **IOWN GF OAA Task Force collaboration opportunity**
   - LF Networking OpenDaylight SDN Transport PCE for IOWN All-Photonics Network Controller Network

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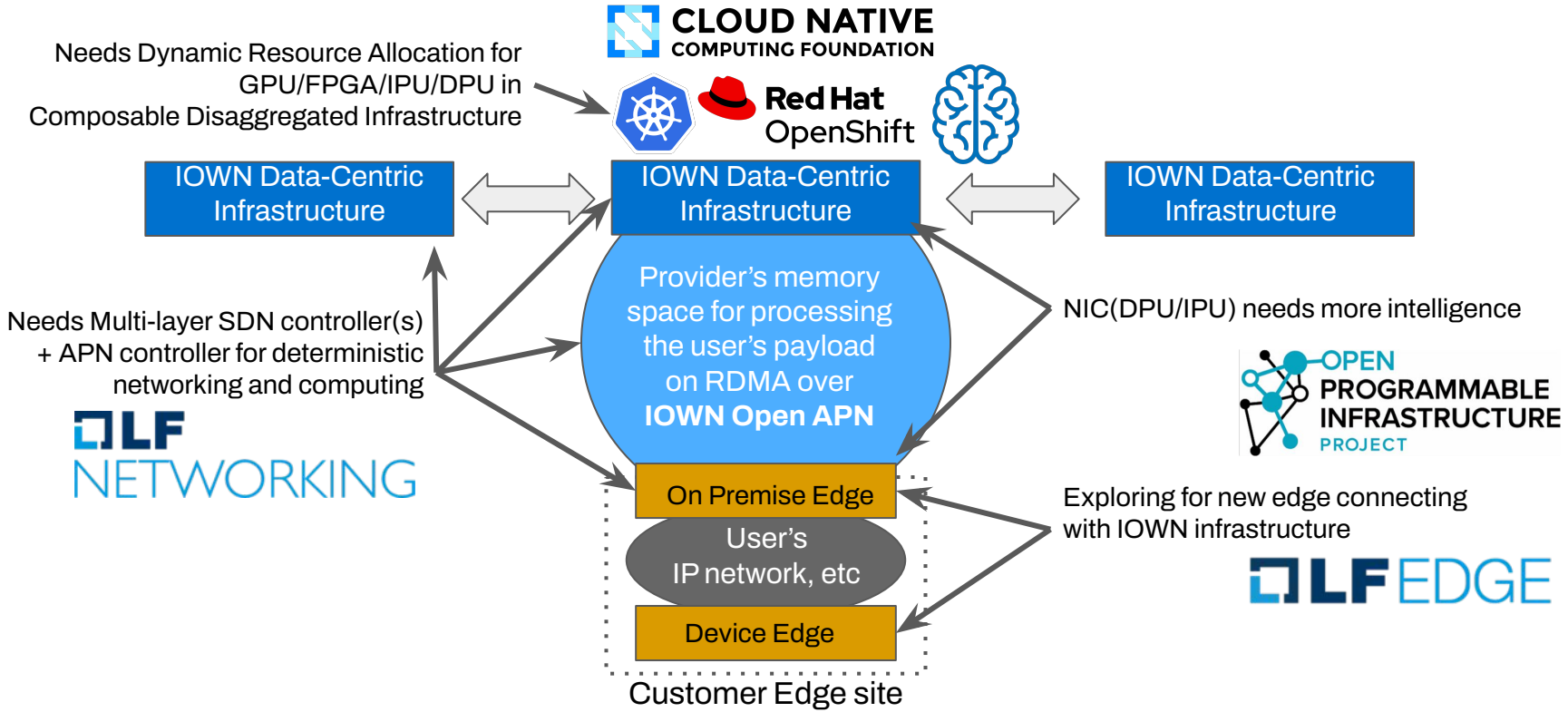
IOWN use case RIM PoC (WIP) and LF Projects



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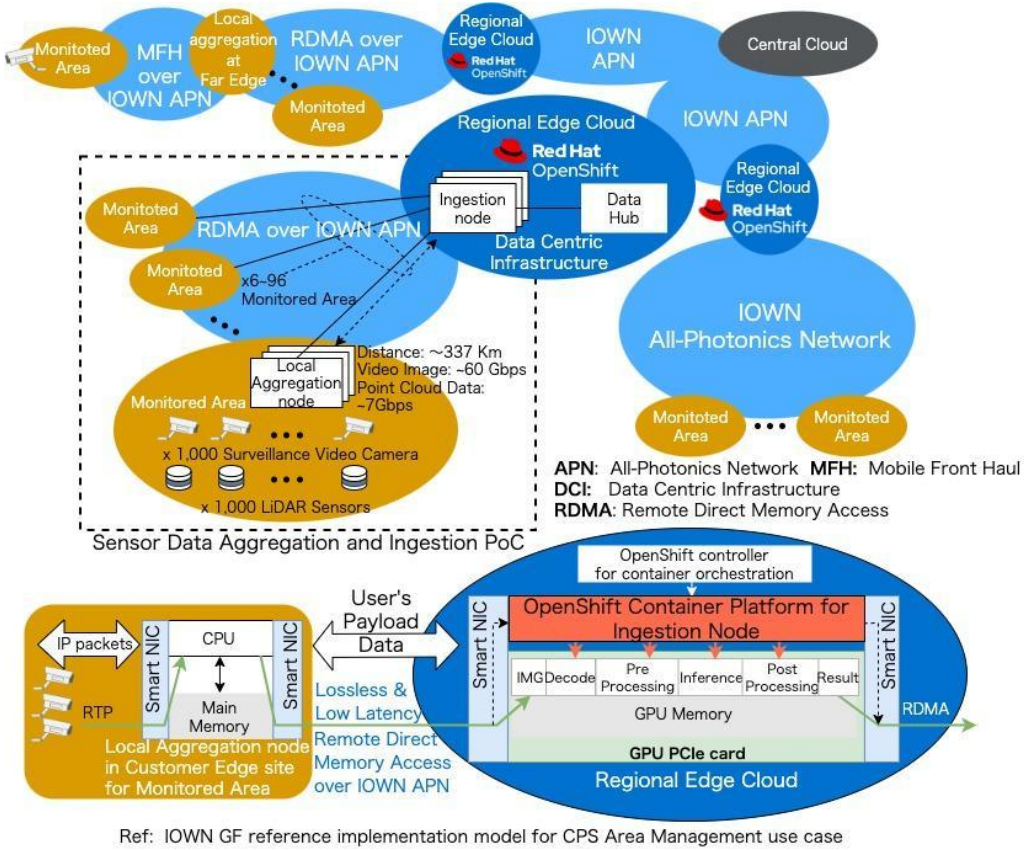
Joint Press Release
NTT and Red Hat Fuel AI Analysis at the Edge with IOWN



Ref: IOWN GF reference implementation model for CPS Area Management use case

60% Latency reduction for AI analysis

Red Hat blog

PR at NTT

PR at Red Hat

(A) Dashboard of Kepler

(B) Power Consumption of a Container

KEPLER

An Energy Efficiency project in IOWN GF(WIP)

40% - 60% Power consumption reduction

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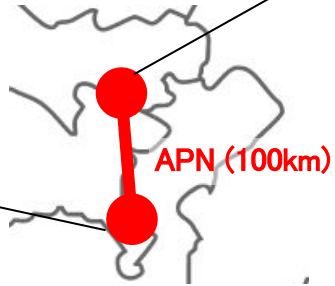
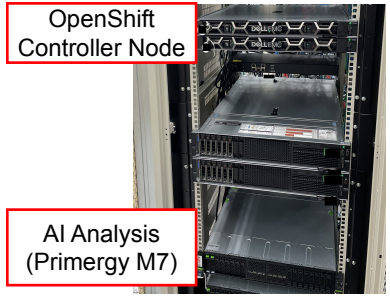
Overview of IOWN SDAI PoC

- Demonstration system

Monitored Area（Yokosuka City, Japan）
Transferring aggregated video camera streams with RDMA over APN



Regional Edge Cloud (Musashino City, Japan)
- Providing GPU resources
- Efficiently analyzing video camera streams with fully accelerated data pipeline for AI



- Demonstration results (with single GPU)
  - Latency required to aggregate sensor data for AI analysis was reduced by 60%
  - Power consumption of AI analysis for each camera was reduced by 40%
  - You can find the details in the recognized PoC report in IOWN GF.
    - https://iowngf.org/recognized-pocs/
    - “Sensor Data Aggregation and Ingestion”

NOTE: To confirm the effectiveness of our accelerated data pipeline, APN is consistently used through all the evaluation, including evaluation of conventional technologies.

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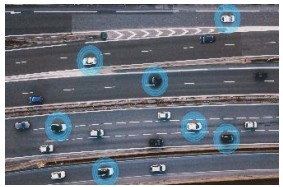
Overview of CPS Use Cases in IOWN Global Forum

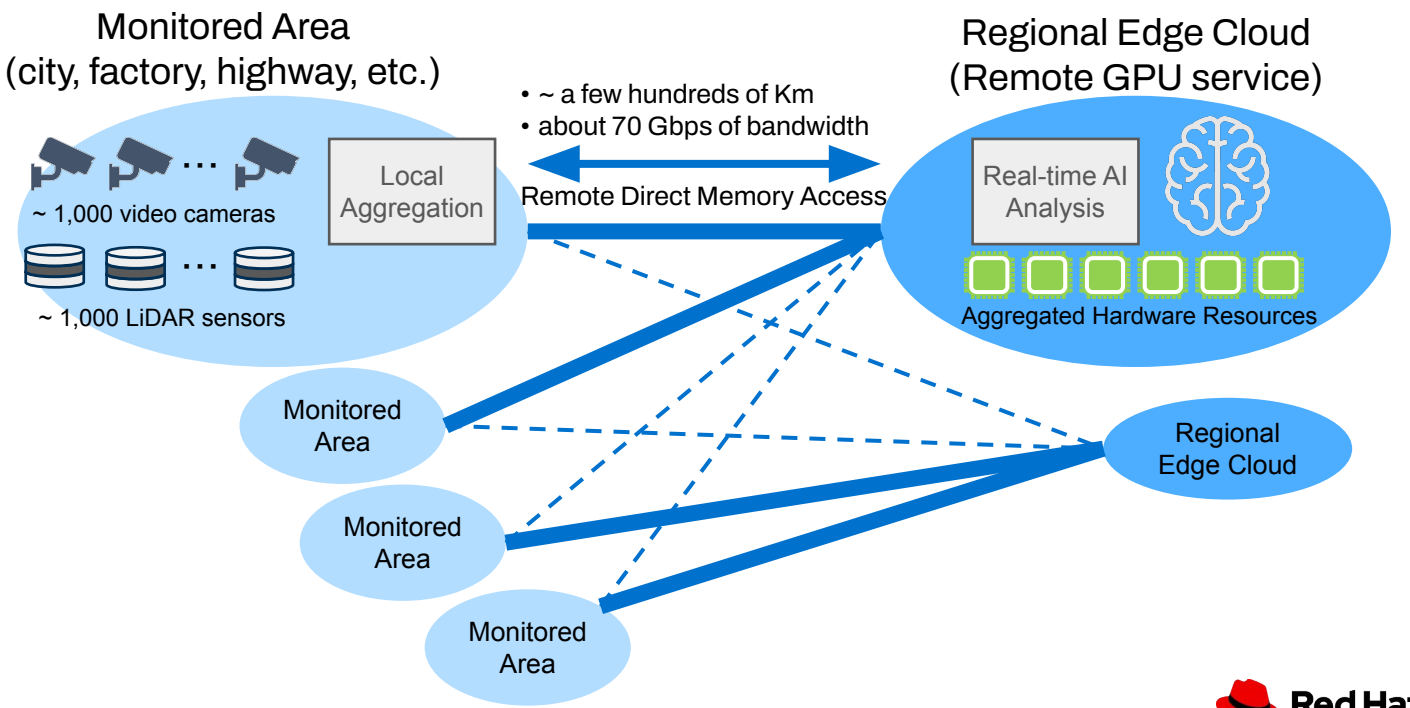
Continuously analyze a large number of sensor data streams (e.g., video images and LiDAR data) at remote computing sites (or Regional Edge Cloud) to enable prompt actions and automation.

Area Management

Industry Management

Mobility Management





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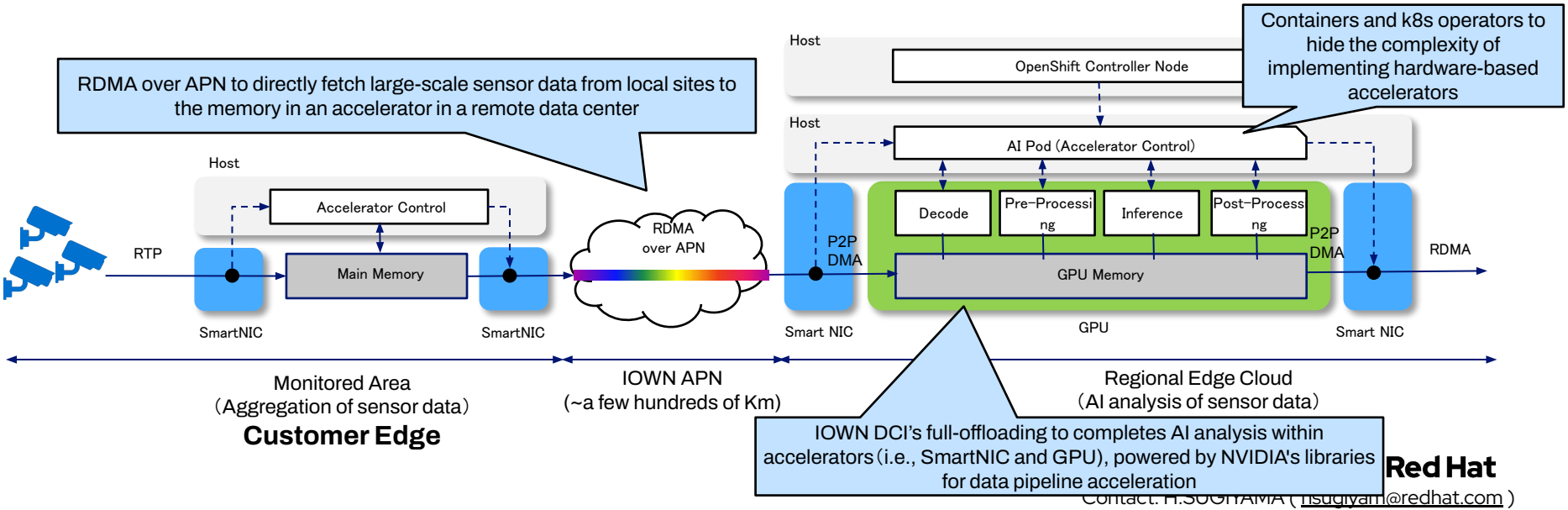
Accelerated AI Workloads

- **Accelerated data pipeline for AI inference:**
  - RDMA over APN for reducing the protocol-handling overheads in the conventional network
  - Full-offloading of AI workloads to GPU for improving the power efficiency
- **Large-scale AI data analysis in real time:**
  - Red Hat OpenShift, supporting Kubernetes operators, for enabling improved flexibility and easier deployment across disaggregated sites, including remote data centers



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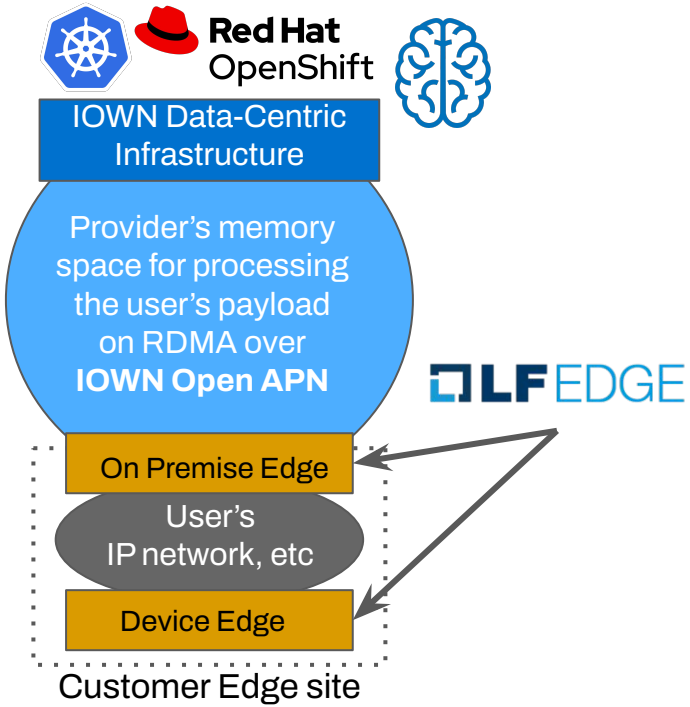
Summary

- RDMA base Remote GPU service by Innovative Optical and Wireless Network is new approach for AI infrastructure biz.
  - Successfully demonstrated 60% AI latency reduction, 40% power save.
- RDMA based multi-vendor Customer Edge solution helps to accelerate the remote GPU service use case supporting Energy Efficiency project in IOWN Global Forum.
  - New common customer edge will be needed!



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