LF Edge Industry Solution Showcase

Jill Lovato

Upcoming meetings:

- Oct 7th at 8am PT (1500 UTC) - meeting cancelled
- Oct 14th at 8am PT (1500 UTC)
    - Join Zoom Meeting
    https://zoom.us/j/95227175653
- **The weekly 8 am PST meeting has been discontinued.** Thank you everyone for supporting the building of the LF Edge Industry Solution Showcase platform. We have identified 8 showcases for the ONE summit. After the summit, we will continue marketing related discussions at LF Edge OutReach committee meetings, and technical related discussions at LF Edge TAC meetings re. future industry showcases.

Past meetings:

- September 23rd

Meeting notes: https://docs.google.com/document/d/1WKILSmnbys-Oog23K8-mGKrc8YkgkmX9ZU8jWX5oLH0/edit

- September 30th

Meeting notes: LF Edge E2E Showcase Working Meeting Notes - Google Docs

- Oct 14th

Meeting notes: 10/14

- **Guidelines for solution showcase**
    - Need at least one LF Edge project to be participating - some have been submitted w/o consent/knowledge from the project
    - Each showcase needs to have an owner from on of the LF Edge projects listed (objective: ensure the LF Edge project names are not being used without actual project elements playing a role).
        - Who is qualified to sign off on this
    - Which ones get airtime at ONE Summit?
        - Outreach committee to determine with best effort to showcase as many as we can, prioritizing diversity of verticals and projects; priority for showcases with multiple LF Edge project involvement
- **Example questions to be used in presentation to the TAC**
    - What is the unmet need or problem being solved?
        - *State succinctly in one or two sentences.*
        - *Back up with statistics or anecdote, if available.*
    - Who is the target market for the solution?
        - *Map to existing vertical(s) in Project Taxonomy table, if possible. If vertical does not exist, please consider adding to table.*
        - *Is there an LF Edge End User Solution Group that could consult with you? If not, should one be formed and who might be interested in joining?*
    - Is there any known open-source competition?
        - *If so, what differentiates this approach other than the LF Edge project components?*
    - Which LF Edge projects are involved and to what extent?
        - *How many persons are actively working on it?*
        - *What LF Edge projects have official representatives assigned to this solution?*
        - *Are there regular meetings?*
        - *Is this solution time-boxed or will it otherwise expire by a certain date?*
        - *What outside third-parties are involved, to what extent, and would they consider joining LF Edge?*
    - How are the involved LF Edge Projects being used in the solution?
        - *Are they part of the core, vertically integrated, horizontally integrated, enabled by, or otherwise?*
        - *Consider providing a logical diagram or marketecture*
        - *Are there other LF Edge projects that you'd like to invite to get involved?*
    - What is the ultimate goal for the solution? How do you define success?
        - *Do you plan to deliver a reference design, product, framework for others to build on?*
        - *Might the solution be spun off into a separate open-source project?*
        - *Do you want to see commercial solutions built using the ideas or concepts in this solution?*
        - *What are your KPIs?*

Example of Kiosk for the ONE summit booth.
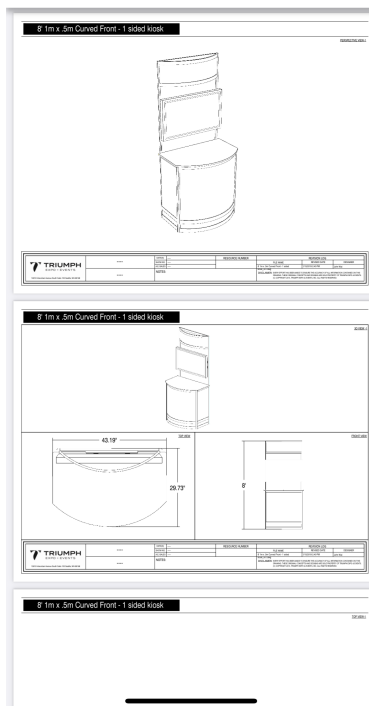
- Oct 21th

Meeting notes: 10/21

- Solution Showcase owner/leaders - please indicate **a single point of contact** (with email address) for each show case
- Showcase owners have the option to present the show case to the LF Edge TAC and get an "**LF Edge TAC approved**" badge for their showcase. This will give more creditability to their showcase. Joe will provide the process and requirements to present showcase to TAC
- **Other ways to show more creditability to your show case**
  - Give more details re. the showcase such as "winning a particular award" etc.
  - Give more links to the past talks that cover the showcase
- After the ONE Summit, this working group/forum will be moved to regular LF Edge OutReach committee meetings/forum for future showcase related discussions

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- Objectives of LF Edge Industry Solution Showcase:
- Requirements of LF Edge Industry Solution Showcase:
- In operation (ready to show):
  - LF Edge Cross Project Collaboration (Upstream project EdgeGallery + LF Edge Fledge + eKuiper + Akraino)
  - Robotics
  - Clean Energy
  - DevOps MEC Infra Orchestration
  - Delivering, Managing, and Scaling Retail Applications and Analytics Inside Stores and Warehouses with Minimal IT Staff Touchpoints

- Open Subsurface Data Universe (OSDU) Edge stack: An Oil & Gas Use Case

Opus One case study

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https://zoom.us/rec/share/1-5RDopItOgUQFRofLlMj9oFa5_Nhi2I9XZP1pUmuTrivjGhfxicxJxVfP5eJPy2.uOk5XML3jzkVn2AE?startTime=1654793820000

Objectives of LF Edge Industry Solution Showcase:

The LF Edge Industry Solution Showcase was initiated by LF Edge SPC, and is currently being lead by LF Edge TAC with the support and participation of LF Edge staff and community.

The objectives of the program are:

- To promote LF Edge projects and increase adoption
- To demonstrate how LF Edge project-based solutions solve real world problems
- To help identify solution gaps for the LF Edge developer community and seek support
- To help project developers build a stronger business case for their sponsor's investment in their project
- To help increase user adoption for LF Edge projects by providing repeatable patterns, increasing participant eminence, and driving project awareness
- To provide inspiration for more innovative projects under LF Edge

Requirements of LF Edge Industry Solution Showcase:

To ensure quality and consistency of each showcase, please provide the following required content in order to be qualified as "In operation (ready to show) "showcase.

For those showcases that are not ready (don't have sufficient content for the following requirements, please put your showcase under the "In pipeline" area, and we'd be happy to move your showcase whenever you're ready.

- **Title of the showcase** (only official LF Edge projects can be listed on the title)
- **Owner/Leaders** of the showcase (one of the owners/leaders listed has to be actively participating in the project). Please specify one single point of contact.
- **LF Edge projects involved** (minimum 1 LF Edge project need to be in the showcase)
- **Description**
    - The solution needs to "solve" an industry problem, which needs to be clearly stated in the "description" section of the showcase
    - Please provide solution architecture and any additional technical information that you want to provide in the "description" section of the showcase
    - The solution doesn't need to be "production ready", but the solution needs to be "demo-able"/"deployable", and currently exists in a lab. I.e. a POC that can be started by anyone in the community or a video demos the solution
    - Only official LF Edge projects can be listed in the title. Other projects, software/hardware products/technologies to round up the solution can be listed in the "Description" section
- **How to install/use**
- **Current Adopters**
    - Minimum one user endorsement. Pls provide the enterprise or organization name. Alternatively, a description of the user can be provided if the user doesn't want to publish their company name. Example - A telco in UK,
    - The user doesn't need to be a customer of the solution, but they need to show interest and participate in the solution building effort.
    - A service provider who is packaging the solution as part of their commercial solution/service offering can be qualified as an "user"
- **Video/presentation** (provide a video or a .ppt of the demo)
- **Related talks/links**
- **Call to action** (if you need more developers, resources, user endorsement, etc. please leave contact information)

Demo to be presented - Joe will provide to be "TAC approved".

In operation (ready to show):

LF Edge Cross Project Collaboration (Upstream project EdgeGallery + LF Edge Fledge + eKuiper + Akraino)

Owner:

khemendra kumar <khemendra.kumar13@gmail.com>Huiling Liu <liuhuiling4@huawei.com>Boren Zhang <zhangboren@huawei.com>

LF Edge project(s) involved:

~~EdgeGallery,~~ Fledge, eKuiper, Akraino

Description:

EALTEdge (Enterprise applications on lightweight 5G telco edge) BP from Akraino, which integrates various open source projects to build a MEC based edge computing platform. EALTEdge BP alongs with its upstream project EdgeGallery, providing an IOT stack which leverages Fledge(for IOT protocol and data collection) and eKuiper(Data Filter).

In this demo, we use a sample simulated IOT device. Data from Device is processed in pipeline in multiple stages like data collection from devices, data filtration and transformation then store in DB for offline scenarios.

Now IOT applications can access this data. It support http exporter to get data by application. Application like grafana can get data from DB as well.

In this Demo, we are using simulated MQTT device which produce readings every seconds and processed data is visualise in Grafana to monitor the device.

How to install/use:

Install Guide

Current Adoptors

telco companies in China

Video/presentation:

LFEdge-Cross-...Edge-Demo.mp4

Related talks/links:

Akraino Technical Meetings - Spring

LF Edge Community Workshop

Call to action:

Please see more details at "Open Experience Lab" of EALTEdge (LF Edge end-to-end show-case)

Robotics

Owners:

Fukano Haruhisa <fukano.haruhisa@fujitsu.com>, Inoue Reo<inoue.reo@fujitsu.com>, Jeff Brower <jbrower@signalogic.com>

LF Edge project(s) involved:

Akraino

Description:

Enterprise robotics use cases in manufacturing, production, agriculture, and retail are emerging rapidly due to macro economic pressures, including cost of labor, manpower shortages, and legal/liability issues. In these use cases, functionality is most important, followed by reduced SWaP (size, weight, and power consumption), employee safety, data privacy, and cloud independence. To achieve these objectives requires progress in key areas of underlying robotics technology:

- Fusion of sensor touch and tactile data, combined with AI in order to handle objects of various shapes and friction coefficients, and in variable circumstances
- Computer vision. In addition to detecting and recognizing people, enterprise robots also must identify dangerous situations, for example leaning or unstable objects (such as a leaning pallet in a warehouse), incorrect lighting, slippery floors, foreign objects on a conveyor belt, etc.
- Speech recognition. First and foremost, enterprise robots need to recognize "immediate and urgent" voice commands in order to prioritize human safety; for example if someone shouts "Stop Now" the robot must stop - regardless of who is the speaker, level of background noise, or other circumstance. Second, enterprise robots need to accept verbal instructions, rather than programming interfaces (e.g. keyboard, app) inconvenient for rugged, wet, and fast-paced environments
- Data privacy. Enterprise operations do not trust public clouds with video and audio that may contain sensitive and/or proprietary information. Training for deep learning purposes must be handled on-premise or otherwise trusted manner

Video/presentation:

Introduction_to_C...eprint_family.pdf

LF_Edge_Worksh..._OSS_Jun22.pdf

Call to action:

If you're interested in CPS Robot Blueprint family in Akraino, we welcome you to join to CPS Robot Blueprint family - Akraino - Akraino Confluence.

How to install/use:

1.Installation guide in Akraino

2.Docker Hub container demonstrating ASR on quad core Atom pico ITX board

Current Adopters (or vaguely describe the adopter such as a major telco provider):

Ritsumeikan University, Fujitsu and food comany in Japan are working on PoC.

Related talks/links:

SSES Platform - Ritsumeikan Univ. (sip-sses.net)

Schedule | Linux Foundation Events

RobotHPC™ Robotics Edge Platform

Clean Energy

Owners:

Mathew Yarger, Kathy Giori

LF Edge project(s) involved:

Project EVE, Project Alvarium

Description:

Alvarium: The growth in edge solutions has created a seismic shift in the ability to have a detailed understanding of data such as; where it comes from, who has access to it, how it's been processed, and how it can be trusted. By combining edge solutions with scalable and efficient distributed ledger technologies, this level of understanding also comes with a high level of transparency which can provide a new level of confidence in how things are monitored, measured, reported, verified and utilized by applications. Project Alvarium has taken these technologies and created novel data confidence fabrics that allow all stakeholders to have up to date data that can be measured, annotated and disseminated efficiently, while also quantifying the confidence in the data based on built in methodologies that are being standardized by the industries the capabilities are being piloted with. In this use case, Alvarium has utilized the IOTA Tangle to provide transparency in the monitoring, reporting and verification process of clean energy solutions with support of partners ClimateCHECK, Dell Technologies, and Environment and Climate Change Canada (Canadian Government). This use case enables real time confidence in good and clean data, while also signifying which data is more inclined to be faulty through a lower confidence score. This helps to combat garbage data in problems while addressing concerns of greenwashing, and ensuring that innovations in clean energy are accurately reporting the impact they're creating.

EVE: The unique value of EVE is that it brings the benefits of cloud computing (remote application deployment and orchestration), in a secure and open fashion, to the "physically remote and exposed" edge.

No Alvarium/IOTA application developers nor EVE device management personnel supporting this project were necessary on site at the remote biodigester plant in Molina, Chile (kind of a bummer actually 😉). A Dell server with EVE pre-installed was shipped to the site where it was connected to the Internet. Thereafter, the applications (Alvarium, IOTA) were managed by their respective project teams, and the Dell server bare metal was secured and remotely configured and controlled over the secure EVE API (using the commercial SaaS EVE Controller offered by ZEDEDA).

Video/presentation:

The below presentation describes a case study of a biodigester plant in Molina, Chile.

OSS-LATAM-2022-EVE-KG.pdf

The above was presented at LF OSS Latin America 2022 and was recorded as a video presentation.

More technical details about Alvarium and IOTA are documented in the slides below.

DigitalMRV for Climate.pdf

Call to action:

If you're interested in Project EVE and/or Alvarium, we welcome you to find us on the LF Edge Slack channels **#eve** and **#alvarium** (and related channels).

The developer program offered by ZEDEDA allows industry adopters to run proof-of-concept (PoC) distributed edge orchestration programs at no cost. The Alvarium/IOTA teams have developed their applications and tools to be ready to deploy on EVE, so that you can remotely manage them no matter where your EVE edge node is located.

How to install/use:

EVE deployment options on bare metal hardware include iPXE/PXE and a USB installer method. Deployment with nested virtualization isn't recommended for operational use, but has been used for development and testing.

iPXE: Each EVE release includes assets that contain valid iPXE configuration files. For example, see the 8.11.0 assets files and look for files with ipxe in the name, such as <xyz>.**ipxe**.<abc>.**cfg**.

USB: Each EVE release is posted to the public lfedge/eve Docker Hub repository so that a USB installer image for EVE can be quickly and easily created with a one-line docker command, such as:

```
docker run --rm lfedge/eve:8.11.0-kvm-amd64 installer_raw > installer.raw
```

For more usage options see:

```
docker run lfedge/eve help
```

More examples for how to run EVE and onboard it to an EVE Controller are documented in the project README on GitHub.

A quick start to running EVE on real hardware and managing it using the open source EVE controller is described in this README on GitHub.

The Alvarium project page describes the project and links to several language-specific Alvarium SDK repositories on GitHub.

Current adopters:

Industry adopters of the ZEDEDA SaaS solution (a commercial EVE orchestration controller) are running EVE on their edge hardware (hence there are already many thousands of deployed EVE devices under industry management). A number of case studies show that EVE adoption is popular in industries with difficult to reach edge locations and sometimes spotty or poor network connectivity. Examples include oil & gas and sustainable "clean energy" sectors (including wind turbines), manufacturing, various IoT verticals, and even where edge devices are connected only over 5G (telco use cases). EVE's open source (vendor neutral) code base and its top notch security-by-design architecture is another reason that high-value industries with large-scale edge computing needs have adopted it. EVE essentially brings the value of cloud computing application deployment and orchestration, in a secure and open fashion, to the "physically remote and exposed" edge.

The above Clean Energy use case is being run as part of a free developer program.

Related talks/links:

LF ONE Summit 2021: Lightweight EVE-OS Carries Heavyweight Security to Safely Enable Edge Software Orchestration

LF RISC-V Summit 2021: RISC-V on Edge: Porting EVE and Alpine Linux on RISC-V

DevOps MEC Infra Orchestration

Owner: Oleg Berzin oberzin@equinix.com

LF Edge project(s) involved:

Akraino

Description:

Public Cloud Edge Interface (PCEI) enables infrastructure orchestration and cloud native application deployment across public clouds (core and edge), edge clouds, interconnection providers and network operators. The notable innovations in PCEI are the integration of Terraform as a microservice to enable DevOps driven Infrastructure-as-Code provisioning of edge cloud resources (bare metal servers, operating systems, networking) public cloud IaaS/SaaS resources, private and public interconnection between edge cloud and public cloud, integration of Ansible as a microservice to enable automation of configuration of infrastructure resources (e.g., servers) and deployment of Kubernetes and its critical components (e.g., CNIs) on the edge cloud, and introduction of a workflow engine to manage the stages and parameter exchange for infrastructure orchestration and application deployment as part of a composable workflow. PCEI helps simplify the process of multi-domain infrastructure orchestration by enabling a uniform representation of diverse services, features, attributes, and APIs used in individual domains as resources and data in the code that can be written by developers and executed by the orchestrator, effectively making the infrastructure orchestration across multiple domains DevOps-driven.

https://www.lfedge.org/2021/12/14/where-the-edges-meet-apps-land-and-infra-forms-akraino-release-5-public-cloud-edge-interface/

Video/presentation:

Multimedia File MEC-TECH-SERIES_epN - DevOps MEC Infra Orchestration v0.4.mp4

Call to action:

Please join our weekly meetings at https://wiki.akraino.org/display/AK/PCEI+Blueprint+Meetings

How to install/use:

See https://wiki.akraino.org/display/AK/PCEI+Release+6+Documentation; the documentation includes an installation guide

Current Adopters (or vaguely describe the adopter such as a major telco provider):

A couple of major Asian telcos are evaluating the blueprint.

Related talks/links:

For the most recent demo and slides, see https://wiki.akraino.org/display/AK/ETSI-LF+Edge+Akraino+Hackathon+2022

Delivering, Managing, and Scaling Retail Applications and Analytics Inside Stores and Warehouses with Minimal IT Staff Touchpoints

Owner: Mahesh Dodani, IBM <dodani@us.ibm.com>

LF Edge project(s) involved:

EdgeX Foundry, Open Horizon, SDO (FDO), (incubating under EdgeX) ORRA

Description:

In this showcase we walk through the architecture, demonstration and the business outcomes delivered by leveraging open source projects to build commercial solutions that can be applied across multiple industries to address how to rapidly scale actionable insights at the point of interaction -- i.e. delivering AI at the Edge. By combining open source technologies from Intel based on Edge X Services and from IBM based on Open Horizon the solution focuses on delivering AI at the Edge showcasing how to speed the deployment and operations delivering fast time to value. The project shows how customers can use the solution to decrease operational costs through secure, autonomous and declarative management across geographically distributed locations at scale. The set of capabilities highlighted will be to remotely manage data, applications and AI models independently and flexibly to deliver the actionable insights at the point of interaction. Finally we will showcase how open technologies can support vendor agnostic DevSecNetOps tooling and infrastructures, including how we can run at the Edge on both Intel and purpose built Scale Computing servers.

Video/presentation:

Link to demo at ORRA meeting, demo begins at 4:00 mark

Call to action:

How to install/use:

- GitHub repo with demo source code - EdgeX Foundry Kamakura w/ Onvif Device Service + Edge Video Analytics + Camera Management Example App

Current Adopters (or vaguely describe the adopter such as a major telco provider):

Related talks/links:

- **Intel InnovatiON: Scalable Deployment of Edge Solutions with Intel NUC (Session NEC001) -**

  Brian McCarson, VP & Sr PE, GM of Intel NUC Group , Intel

  Ashwin Vijayakumar, Strategic Business Development Manager, Intel

  Sanjeev Gupta, Edge Computing Lead, Networking & Edge Computing CTO Group, IBM

Craig Theriac, VP of Product Management, Scale Computing

- **Edge Computing Expo North America** - **Rob High keynote talk**
- ONE Summit: Rapidly Scaling Actionable Insights at the Point of Interaction - Mahesh Dodani, IBM & Sean Williams, Intel Corporation

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Open Subsurface Data Universe (OSDU) Edge stack: An Oil & Gas Use Case

Owner: Daniel Lazaro <daniel.lazaro@aveva.com> Daniel Lazaro

LF Edge project(s) involved:

Fledge (Daniel Lazaro), EVE (Kathy Giori)

Description:

The OSDU Forum under The Open Group is developing an open source standards-based, technology-agnostic data platform that stimulates innovation, industrialized data management and reduces time to market. The OSDU Forum seeks to reduce data silos to enable transformational workflows, accelerate the deployment of emerging digital solutions for better decision making and create an open, standards-based ecosystem that drives innovation for the energy industry. The OSDU Edge group targeting intelligent edge analytics for oil & gas operators uses the LF Edge stack for drilling data analysis and edge to cloud integration. This showcase features a cross-consortia collaboration success story.

Video/presentation:

OSDU_Edge_Video_V2.mp4

Call to action:

Please join our Fledge TSC meeting: https://lists.lfedge.org/g/fledge-tsc/calendar

How to install/use:

Quick Start Guide

Current Adopters (or vaguely describe the adopter such as a major telco provider):

Major Oil & Gas Operators, OSDU, OSDU Edge Lab

Related talks/links:

OSDU, OSDU Edge Lab

Application of FLEDGE at Neuman Aluminium: An Industrial Use Case

Owner: Tom Arthur, Dianomic <tom@dianomic.com>

LF Edge project(s) involved:

Fledge (tom arthur)

Description:

The Neuman Aluminium Group is your global partner for high-quality aluminium solutions with 10 locations, over 3000 employees, over 200 years of experience. Multiple production facilities in Europe are controlled by a centralized MES (Manufacturing Execution System). The MES submits a production order to a facility. The machine processes the order and notifies the MES of the current production status. The MES sends data to a subsequent machine. Once the connection to the MES is lost, production will Continue as long as no new Input is required. The centralized nature of the system creates a critical dependency on the network connection!

The roadmap for connected production systems at Neuman includes open-source software stack to deliver device, core, application and supporting services for production equipment. Self-healing, scalable, up-gradable, flexible, platform independent and offline capable edge devices. Knowledge or /and ML driven smart edge devices to semi- autonomously control machine, forward data and adjust production equipment.

Fledge_Community_Presentation_22_09_2021.pptx.pdf

Video/presentation:

Meeting Recording - Minute 14:00

Call to action:

Please join our Fledge TSC meeting: https://lists.lfedge.org/g/fledge-tsc/calendar

How to install/use:

Quick Start Guide

Current Adopters (or vaguely describe the adopter such as a major telco provider):

Neuman Aluminium Group

Related talks/links:

Meeting Recording - Minute 14:00

Fledge_Community_Presentation_22_09_2021.pptx.pdf

UC Davis and Opus One Using Fledge to Produce World Class Wine in Safer Conditions

Owner: Tom Arthur, Dianomic <tom@dianomic.com>

LF Edge project(s) involved:

Fledge (tom arthur)

Description:

During fermentation of juice to wine, the conversion of sugar to alcohol produces CO_2 – about 64 liters of pure CO_2 per 1 liter of juice. If not properly managed, the buildup of CO_2 from fermentation actives can create a hazardous work environment. The OSHA permissible exposure limit of CO_2 is 5000 ppm for 8 hours. Typically, CO_2 in wineries is measured by a single or a few hard-wired sensors, however, the inherent variability of CO_2 across a floor plan can be better monitored by a distributed network of sensors. Additionally, the use of batteries enables sensors to be easily installed anywhere in the winery. Temperature and humidity should also be measured, as these parameters give insight into the growth of unwanted microbials in the facility, the operation of the building HVAC and the evaporation of wine from barrels.

Originally developed by Dianomic Systems, Fledge joined LF Edge, an umbrella organization that aims to establish an open, interoperable framework for edge computing independent of hardware, silicon, cloud, or operating system. Fledge is an open-source Industrial IoT framework to collect sensor /machine data, transform, buffer and analyze the data on the edge, run edge ML models and reliably integrate the data with operational systems, OEE, MES, ERP, historians and the cloud. In a matter of weeks, UC Davis successfully built their custom sensor to cloud software IIoT solution using Fledge. A Custom printed circuit board (PCB) was designed and manufactured with the optimal components, form factor and price. A microcontroller with an integrated transceiver (CC1352r; TI) was used to create a Zigbee® mesh network. A low-power architecture was implemented to completely disconnect the microcontroller and sensors from the battery between measurements. A PCB antenna was designed to lower bill of material costs. A non-dispersive IR sensor measured CO_2 while temperature and humidity were measured with a combined sensor from TI (HDC1080; TI).

Opus One case study

Video/presentation:

Opus One case study

Call to action:

Please join our Fledge TSC meeting: https://lists.lfedge.org/g/fledge-tsc/calendar

How to install/use:

Quick Start Guide

Current Adopters (or vaguely describe the adopter such as a major telco provider):

UC Davis Robert Mondavi Wine center, Opus One

Related talks/links:

Opus One case study

See all showcases that are in pipeline here: LF Edge Industry Solution Showcase - In Pipeline