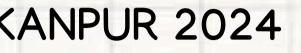
OPPORTUNITY OPEN SOURCE – IIT KANPUR 2024

The Quest for Supply Chain Resilience

Akarshan Kapoor



What's That?



The journey of a product from raw material to your hands. Ensures that the right product reaches the right customer at the right time and cost.

IoT Protocols

MQTT

Publish/Subscribe

- Typically uses TCP
- Relies on TLS over TCP for security \bullet
- Limited to basic messaging, lacks advanced management features

•

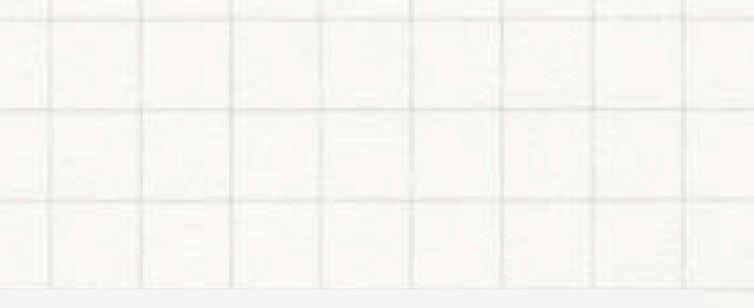
LwM2M

Client/Server Typically uses UDP/CoAP Built-in security features over CoAP/UDP, providing encryption and authentication • Offers full device management, including remote configuration, firmware updates, and monitoring

• An open-source project by Eclipse Foundation.

Leshan

- Implements the LwM2M protocol for IoT device management.
- Supports DTLS for secure communication.
- Flexible, secure, and suitable for scalable loT ecosystems.





LESHAN

OMA Lightweight M2M server and client in Java



Developers.

Zephyr®

- MIPS, RISC-V etc.
- Server setup and testing

• A RTOS Ecosystem, By Developers, For

• Small Footprint Kernel for resource constrained and embedded systems

 Supports a variety of different architectures like Intel x86, ARM v6/7,

LWM2M Provides Direct Support for

Getting Started

Zephyr®

- Monolithic v/s MicroKernels
- Scheduling, management
- Device-tree data structure
- RTIO and Z-bus.
- Understanding the west

threading,

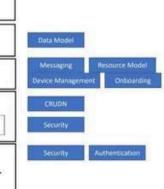
memory

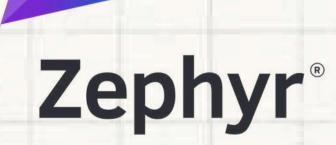




LwM2M Protocol stack

			Applic	ation				
IPSO WG	1 wM2M							
Up/LupidtrMUN								
DTLS		SMS	SMS		ТСР	TLS	LoRa	Clat
	CIoT	an-Device (no Sec)	on- Smartcard	UDP	TCP	TCP	WAN	CloT





Application



PUMP-TASTIC THE FLOW PROGRESS SHOW Hardware, firmware, and Designed for small to software medium-scale IoT advancements. Pump it deployments. Small but up! mighty! Leveraging RTOS Simplifies setup, components like zbus. configuration, and Because buses are cool! management. Go with the flow! **GEEK SPEAK ZEPHYR ZONE** Utilizes Zephyr OS and Developed with nRF9160 chipset. Test flownexus LwM2M and Django. like a pro! Nerds unite! \diamond Ensures robust device-Robust, flexible, and to-cloud user-friendly communication. Signal interface. Geeky! strength: Over 9000! CLOUD-FREE TRAIN TOILET ZONE TRIUMPH Uses LwM2M protocol Previous proprietary for communication. Talk version used by **Deutsche Bahn. Trains** the IoT talk! Operates fully within a love it! local environment. No Addresses issues like clouds allowed!

inoperable train toilets. Flush with success!

- for Solution small to medium IOT scale deployments
- Minimal and standalone **Open Source IoT platform**
- Simplify the complexities of IoT deployments, making them accessible and for manageable businesses of all sizes.
- On the go setup!!

Single Resource Format (3303/0/5700)

```
{
    "ep": "qemu_x86",
    "obj_id": 3303,
    "val": {
        "kind": "singleResource",
        "id": 5700,
        "type": "FLOAT",
        "value": "24.899181214836236"
    }
}
```

Composite Resource Format (3/0/0..17)

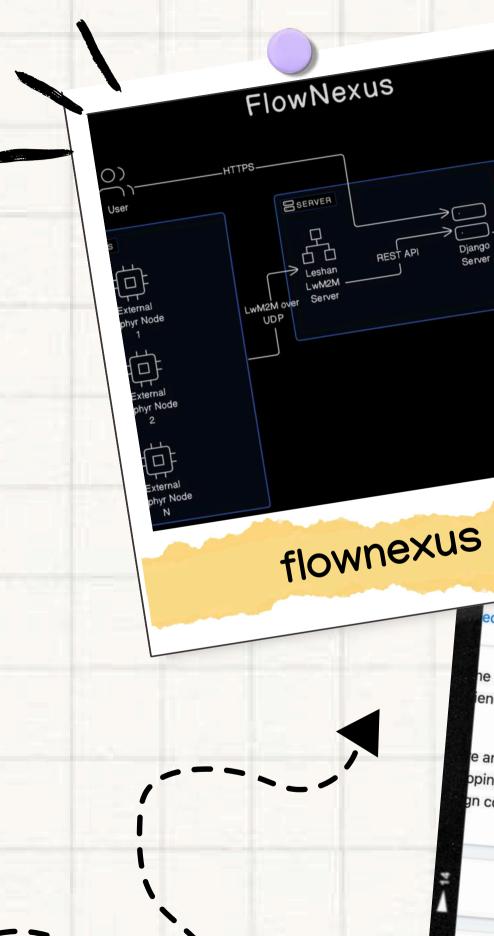
```
"ep" : "gemu_x86",
"val" : {
   "instances" : [ {
        "kind" : "instance",
        "resources" : [ {
           "kind" : "singleResource",
           "id" : 0,
            "type" : "STRING",
            "value" : "Zephyr"
        }, {
            "kind" : "multiResource",
            "values" : {
                "0" : "1".
                "1" : "5"
            },
            "kind" : "singleResource",
           "id" : 17,
            "type" : "STRING",
            "value" : "gemu_x86"
        }],
       "id" : 0
    }],
    "kind" : "obj",
    "id" : 3
```

API & Data flow

- RESTful API needs proper resource management
- Construct formats for single or composite instances
- Structure the flow from the endpoint to the backend.
- Configuring backend to endpoint configuration for bidirectional update.

- No external dependencies (e.g., AWS, MQTT brokers); must run locally.
- Focus on LwM2M protocol communication between Zephyr and server.
- Web application supports secure login and basic user management.
- Demonstrate adding data to a database and visualizing it in a web application.
- Supports OTA updates.

Advantages



d Run

er can also run locally, without the need of a docker container.

install openjdk-17-jdk maven nv/bin/activate ace/flownexus/server/leshan xus/server/leshan\$./leshan_build_run.sh

d now be up and running under the following URL: http://loca

in flownexus

uction ready LwM2M server and is used in many commercial exus. It is responsible for registering and managing endpoir mented in Leshan related Java code within flownexus. The

etween the LwM2M endpoints Django. There is no direc

ses

ne ongoing development of the Pump Monitor project, introduced at the Zep ence in software components. This approach reduces reliance on specific cl

e and firmware enhancements for the Pump Monitor, leveraging recent Zeph pping an Open Source IoT LwM2M and Django server with a user-friendly inte on contribute to ensuring operational stability and adaptability.

I hope you learned something new. Any questions ?

'flownexus' Documentation Looking forward to connect!!









Thank You!

A huge shoutout to Till, Aveek and the organising team at IIT Kanpur.