EDDIE – Enabling Distributed Intelligence in Oniro

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Stefan Schmidt <stefan.schmidt@huawei.com>
Principal Solution Architect, Huawei OSTC
Agenda

• Introduction
• Goals & Use Cases
• Implementation: Linux & Zephyr
• Roadmap
• Summary
Introduction
EDDIE – Enabling Distributed Intelligence

- Project within the Oniro working group
- Cooperation with Politecnico di Milano
- Middleware composed of different layers
- Apache 2.0 license
- C++ code base, constrained devices in mind
- Implementation: Oniro Linux & Zephyr flavours
- Work in progress
Goals & Use Cases
“Objective to design a middleware capable of giving to the applications and services an unified global view on cross-device resources. The various devices are not seen any more as individual entities with specific resources, but as a unified pool of virtual resources.”

• Cross-device and also cross operating systems: starting with Linux and Zephyr
• For now resources as in peripherals and not general purpose resources like memory and CPU
Intelligent orchestration of the available resources will allow an efficient use, as well as, some very unique use cases e.g. peripherals like camera, storage and audio from any device in the network could operate like a local peripheral. They would be *instantly compatible with your local applications.*

- Even with many resources available its overwhelming to make good use of them
- At this stage the project goes from a simple rule-set based engine to complex orchestration
Example Use Case: Video call

- Video call while on the commute back home
- Call starts on your mobile
- Enter your car: the unified pool of resources also has the car dashboard camera and audio system available and switches over
- Walk from car to house: switching back to mobile as the car resources vanish
- Enter kitchen: video moves to the kitchen TV or tablet, camera to the security camera and audio to the multiroom audio in your house

Plethora of available, distributed, resources that can be used based on your personal preferences and patterns.
Implementation
EDDIE is a middleware sitting on top of Oniro
Offering services and API to applications
Local agents part of every device
Virtual devices / super devices formed out of local agents
- Communication layer
- Virtualization layer
- Application management layer
- Intelligent coordination layer
- Forming the local agent
Communication Layer

• Compared MQTT, Zenoh and CoAP for our use cases
• Device and resource discovery
• Constrained devices in mind (frame size, latency, memory, etc)

• Settled on CoAP as it is fitting our purpose well
• Libbcoap on Linux and a native CoAP implementation on Zephyr
• IPv4 & IPv6
• Running over low-power wireless connectivity
• Resource Directory implementation on Linux
Virtualization Layer

- Resource Directory implementation turns out to work well for an initial resource abstraction
- Device announces itself via multicast to the network
- If no other directory is found a Linux based local agent would elevate itself
- Registers available resources at the found directory
- API for upper layers to query by device type, attributes, URI’s, etc
- Give uniform view on resources and access
- Results are the base for decision making process
Intelligent Coordination Layer

• Current focus of the work
• Research on options for ontologies/schemas to express attributes
• Webthings, OCF, ROS, etc
• Use ontologies to select the best execution environment

• Different coordination approaches
  – Centralized coordinator (current first approach)
  – Any local agent could run as coordinator (with stand-by for failover)
  – Complete peer-to-peer coordination, no central coordinator
Usage in Oniro Blueprints

- A blueprint to demonstrate how EDDIE can be used
- Used between Linux and Zephyr
- Used over OpenThread with IPv6 (low-power and loosy network)
- M2M between touch controller and doorlock blueprints
- Based on availability of resources the touch controller can adjust UX dynamically
Roadmap
Future Roadmap

2023

- Focus on ontologies/schemas
- Focus on intelligence orchestration
- Explore different coordination approaches
Thank you!

Join us @ Oniro booth
oniroproject.org