Fairhair: interoperable IoT services for major Building Automation and Lighting Control ecosystems

Dee Denteneer, Michael Verschoor, Teresa Zotti. Philips Lighting.

Abstract

Fairhair is a recently established open industry alliance which envisions a future where building automation and lighting control (BA&LC) systems utilize the IoT. It contributes to the realization of this future by providing 'Draft specifications' for web services solutions, a.o. for the BACnet, KNX and ZigBee ecosystems, including resource models and a unified solution for application services that are closely tied to the transport layer.

Fairhair targets a harmonization of application layers across relevant eco system standards. This harmonization does not aim at full semantic interoperability, but does seek for interoperability for common network services such as device and service discovery, security and network management. In our vision, this will enable a common low power RF networking infrastructure based on IEEE and IETF standards.

1. Standards in BA & LC

In the domain of Building Automation and Lighting Control, a few key established ecosystems and standards exist, each built upon ecosystem specific data models that represent the application domain. Prominent examples of such ecosystems are BACnet, KNX, and ZigBee. The data models they defined are an accepted representation of the domains they address, have a strong recognized position in the market place, and are backed by strong ecosystems of suppliers, installers, integrators and marketing organizations. Historically, these ecosystems also developed and differentiated at the level of networking technology. Generally however, the understanding of the application domain constitutes their core value.

Several of these standards are extending to the IoT and IP domain. This is driven by the convergence of IT networks and BA&LC networks, but also by the promise of emerging low power wireless and wired IP networking technologies for BA&LC applications, and the maturing of IETF protocols for resource constrained devices. Practically, this means the value and opportunity of differentiating at network layer between ecosystems will diminish.

2. Fairhair Vision

Fairhair is built on the belief that the established BA&LC ecosystems have a major asset in their mature data model; an asset which can be largely maintained when these ecosystems transition to the IP and IoT domain while the opportunity for differentiation at the networking layer will gradually disappear. To maintain the data model as an asset, most of the semantics attached to elements in the data models will need to be preserved.

By largely preserving the actual data model and its semantics, the impact on existing tooling, application design paradigms, training, and the 'brand promise' of the ecosystem is limited.

In the context of full semantic interoperability, this may not sound very visionary, and indeed, there is an element of pragmatism here: at current, we have little reason to believe that these ecosystems will abandon their core asset. Still, an important step towards increased interoperability will be made when these influential ecosystems adopt a common RESTful interaction model, established IETF data formats and a set of uniform application services such as service discovery.

3. **The Fairhair Framework and the technical challenges**

Fairhair will seek to define a framework, initially for adoption by BACnet, KNX, and ZigBee, which specifies the constrained web services solution for these application ecosystems.
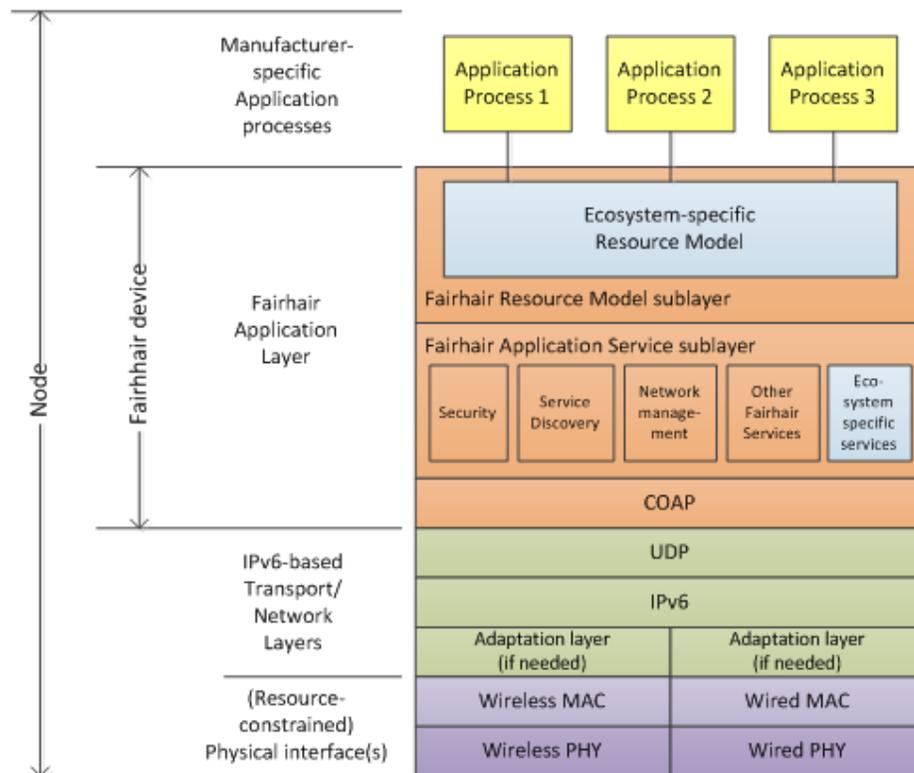

Figure 1- Fairhair architecture stack

The Fairhair framework is expected to specify at least the following services and concepts:

- a generic model description of a domain model in terms of web resources and a mapping of elements in this data model (e.g., objects) to URIs
- mapping of the existing methods to interact with elements in the data model (e.g., to write a property value) to RESTful interaction methods as defined by CoAP.
- "IoT friendly" data encoding formats, such as JSON or CBOR, instead of ecosystem specific encoding formats
- a scalable mechanism for device and service discovery, independent on the ecosystem's specific semantics
- other orthogonal application services, related to the security model (e.g., supporting authorization, secure unicast and multicast communication) and network management.

In approaching these topics, Fairhair combines expertise on the IoT domain with in-depth knowledge of the application domains at hand as well as knowledge of the existing standards and best practices in the targeted ecosystems. Solutions are based as much as possible on the state of the art from the IETF.

The Fairhair framework is positioned as neutral towards the targeted ecosystems. This opens up the opportunity to avoid that these ecosystems, in their strategic ambition to capture a part of emerging IoT

and sensor networks market, will diverge in their technology choices for services that are orthogonal to the ecosystems' data models.
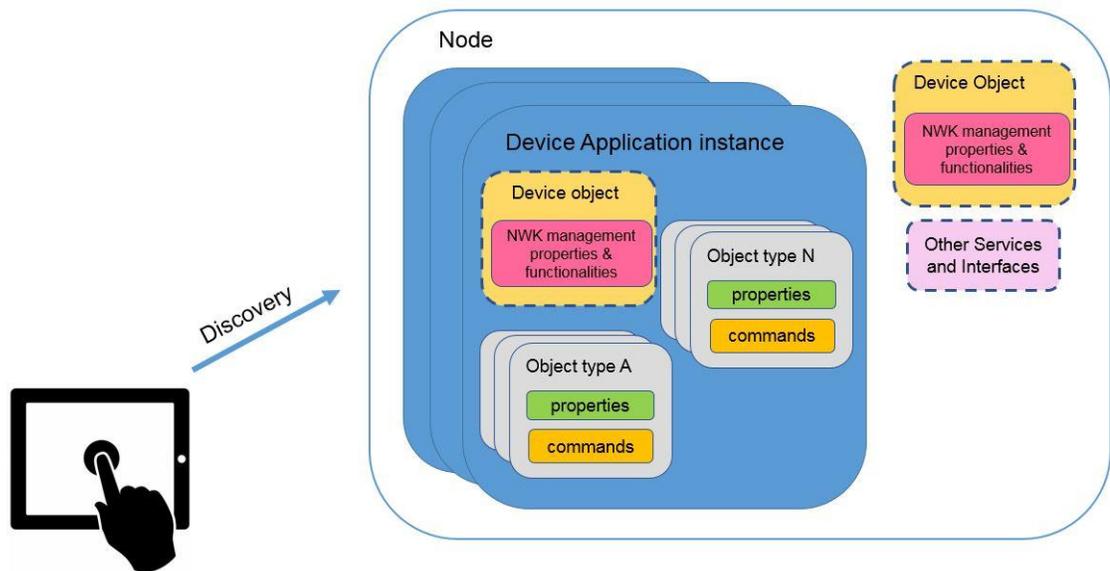

Figure 2- Towards a unified model for resource discovery

Device and service discovery is a clear example of a mechanism not bound to the ecosystems specific semantic that will benefit, in view of interoperability, from an application agnostic solution.

Independently whether modelled according to BACnet, KNX or ZigBee specific data model, every device, in order to be able to communicate within an IoT network, needs first to be discovered and identified along with its capabilities and application functionalities. Fairhair aims at providing a scalable discovery solution and the rules according to which such resources are registered, maintained and discovered. The Fairhair generic data model plays a complementary role by highlighting the information that the discovery mechanism requires for its purposes (e.g. a unique identifier for each device application instance, an object type and instance, etc.). Finally, each ecosystem can exploit the unified Fairhair solution and make it meaningful for their application by using their specific semantic (e.g. BACnet object type and instance or ZigBee Endpoint and Cluster identifiers).

Certification of the solution is intentionally not part of the Fairhair program. Testing and certification program will be defined and run according to the rules and specifications created by each ecosystem.

Conclusions

Fairhair aims at defining a framework for an IoT solution for the Building Automation and Lighting Control markets, consisting of a generic data model representing the application domain in terms of web resources, and a set of orthogonal application services. As a neutral standardization alliance, Fairhair will provide this framework for adoption and maintenance to a number of relevant existing ecosystems, including BACnet, KNX and ZigBee, to support their ambitions to extend to the IoT domain.

Additional info on Fairhair Alliance:

www.fairhair-alliance.org

secretary-general@fairhair-alliance.org