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Includes editorial contributions from:

Adina Valean
EU Commissioner for Transport

Marian-Jean Marinescu
Speaker of the EPP Group in TRAN Committee, Chair of Sky and Space Intergroup

Cecilia Bonefeld-Dahl
Director-General, DIGITALEUROPE

domOS

“Enabler for digital energy services in existing buildings”

Insight

Digitalisation is progressing at a fast speed in nearly all application domains. In this respect, buildings – and especially energy in buildings – are behind the times. Consequently, facility managers and occupants have generally a limited understanding of their building as an energy system, and buildings are not acting as active nodes of the energy grid they are connected to.

Admittedly, increasing number of smart appliances and devices, ranging from smart coffee machines to online heat pumps, are available on the market. However, such silo solutions, whose individual relevance is not questioned, do not come up with the expectations of digital energy in buildings for several reasons:

- Energy appliances for heating and cooling, which are by far the highest energy consumers in buildings – have a long lifespan. Many of them are from the pre-digital area and feature no data interface.
- Deployment of services based on several smart appliances (e.g., energy management for photovoltaic inverter, electric vehicle charger, heat pump, and smart meter) is cumbersome, because of the heterogeneity of the digital interfaces.
- Higher-order energy systems (local energy communities, distribution grids, energy markets) cannot activate the energy flexibility of buildings due to lack of shared digital interfaces.
- The multiplicity of independent smart solutions degrades the user experience (multiple user interfaces and access control procedures).

domOS project aims at defining and prototyping an “operating system for buildings” acting as an intermediary between applications and field devices and appliances. The domOS operating system will offer two basic services: let applications access the building infrastructure independently of the type or brand of appliances and enable building occupants to manage their privacy centrally. The vision is to apply the same recipe that boosted the development of applications for smartphones for buildings.

Unlike the smartphone ecosystem, the smart building ecosystem is not dominated by a few big players. To trigger adoption by many stakeholders in a fragmented scene, domOS leverages both existing and emerging standards from recognised bodies. The aim is for domOS to be compliant with existing and new devices and appliances and allow their integration with low development effort.

About domOS

domOS is a collaborative research project supported by the European Commission under the Horizon 2020 Programme for Research and Innovation (Call LC-SC3-EE-4-2019-2020), with a duration of 36 months.

The project consortium is made up of 11 partners from four European countries. Each partner develops activities in smart energy services for buildings, either as a technology provider or as a service operator. This mix, together with the five demonstration sites, ensures that the developed solutions will be applicable in a large range of use cases.

“domOS is at the crossroads of smart buildings and of the Internet of Things (IoT). The consortium wants to bring new IoT developments for interoperability, privacy management, and provisioning to the smart building world. This will provide European buildings with a doable path for coordinated stepwise deployment of smart services” says Dominique Gabioud, the Project Coordinator from the University of Applied Sciences Western Switzerland.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 894240.

Objectives

1. **Design an open, secure, multi-service Internet of Things (IoT) ecosystem for smart buildings:** Any application for visualisation, energy optimization, or home automation can monitor and command any field parameter, if authorisation is granted, independently of the local communication network technology.

Features of the IoT ecosystem for buildings:

- Open & multi-service: Multiple applications from different vendors can access building sensor data and control building set points.

- Secure: Applications, users, and gateways dispose of integrated authentication and access control mechanisms. Facility managers (commercial buildings) or households (residential buildings) can control privacy: they decide which application has access to which data.

2. **Enable interoperability of data and services for smart buildings through a standard nomenclature:** Applications and local communication systems share a common nomenclature (ontology) for field data and building metadata. Existing nomenclatures will be evaluated and completed according to demonstrators' requirements.

3. **Increase energy performance through smart services:** Smart services make buildings more energy-efficient, flexible, and empower occupants and facility operators.

- Increased energy efficiency: Closed-loop control services, energy dashboards for occupants and facility managers.

- Increased flexibility: The intrinsic flexibility of consuming processes (e.g., heating) is controlled for techno-economic optimization: increased self-consumption at vertically nested systems (buildings, microgrids, local energy communities, distribution grids).

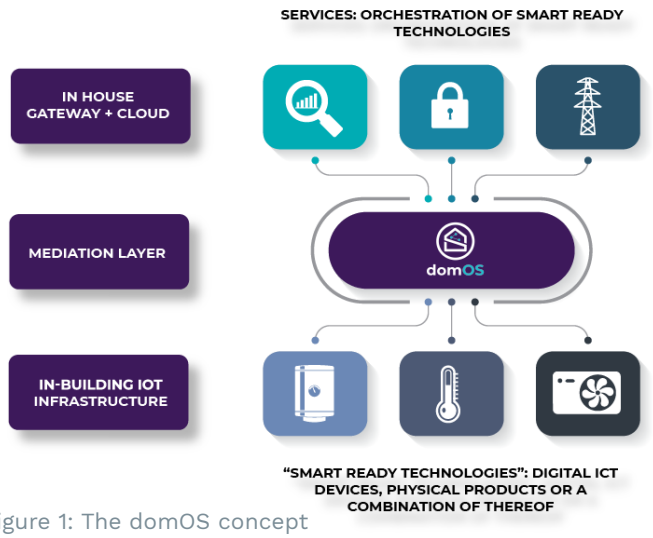

Figure 1: The domOS concept

4. **Demonstrate and evaluate smart services deployed on compliant frameworks:** Various smart services for existing buildings are deployed, using different frameworks compatible with the domOS IoT ecosystem specification. Their performance regarding technology, energy, user experience, and business is assessed.

Concept

Interoperability of a smart service and of building infrastructure is ensured if both share common technology building blocks and vocabulary.

The common technology building blocks are adapted from the Web of Things (WoT) project of W3C (World Wide Web Consortium). The WoT approach is interesting as it does not require upgrade of the building infrastructure but only to formally describe it, thus simplifying the integration of existing in-building digital systems.

The common vocabulary is provided by existing ontologies like SAREF4ENER that will be complemented when required. The following figure illustrates the mediation role played by domOS.

Demonstration sites

On five sites, domOS will prototype and demonstrate a wide range of smart energy services that:

- relate to electricity and district heating,
- have their intelligence either hosted on a building local gateway, in the cloud or mix,
- address different types of buildings (tertiary/residential buildings, single-family / multiple families),
- feature dynamics ranging from seconds to hours,
- integrate existing buildings in larger information systems, as those in use for energy grid operation and energy markets, and
- implement either closed-loop (e.g., need-based heat generation control) or open-loop (dashboards, performance reports) control strategies.

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Duration: 36 months
Website: https://www.domos-project.eu/
Project coordinator: Dominique Gabioud
Start date: September 2020
Contact email: info@domos-project.eu
Project partners: HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE, Switzerland
AALBORG UNIVERSITET, Denmark
CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA – RECHERCHE ET DEVELOPPEMENT, Switzerland
ELECTRICITE DE FRANCE, France
ALIUNID AG, Switzerland
NEOGRID TECHNOLOGIES APS, Denmark
SUNTHERM APS, Denmark
OIKEN SA, Switzerland
INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO, Slovenia
FENIX TNT SRO, Czechia
AALBORG ENERGI HOLDING AS, Denmark