Rapport S-2018-01

CSA IoT för bygg: bilaga

FORMELL UML-MODELL

SMART BUILT ENVIRONMENT

CSA IoT för bygg

Dokumentet är automatgenererat från UML-modellen

Kontakta ulf@nozomi.se för mer info.

Med stöd från
VINNOVA Sveriges innovationsmyndighet
Energimyndigheten
FORMAS
Strategiska innovations- program

Innehållsförteckning

Introduktion

Detta är ett automatgenererat dokument. Det avspeglar innehållet i den UML-modell som är en del av resultatet i projektet ”Context Specific Architecture Internet of Things för bygg” (förkortat ”CSA IoT för bygg”) inom ramen för strategiska innovationsprogrammet Smart Built Environment. Själva modellen är skapad i Papyrus (https://www.eclipse.org/papyrus/download.html), RCP-distributionen version 3.4 . Modellfilerna kommer att tillhandahållas tillsammans med den tekniska rapporten och detta dokument.

Se vidare http://www.smartbuilt.se/projekt/standardisering/iot-standard-foer-bygg/ .

Obs att huvudsyftet med modelleringen i det här projektet är att visa relationerna mellan modellerna (i huvudsak CoClass och ISO/IEC 30141). För undvikande av dubbelarbete är en del modellelement listas med enbart namnet och inte den fullständiga beskrivningen; för vidare detaljer se

- ISO/IEC 30141:2018 IoT Reference Architecture https://www.sis.se/produkter/informationsteknik-kontorsutrustning/allmant/isoiec-301412018/
- CoClass’ websida https://coclass.byggtjanst.se .

1. CoClass

CoClass är en omfattande modell som beskriver ett antal aspekter på byggnadsverk och deras beståndsdelar.
Givet den begränsade tiden för förstudien "CSA IoT Bygg" så är innehållet i denna modell begränsat till det som är relevant för de valda användningsfallen.
För en detaljerad beskrivning av respektive element se https://coclass.byggtjanst.se .

1.1 Komponenter

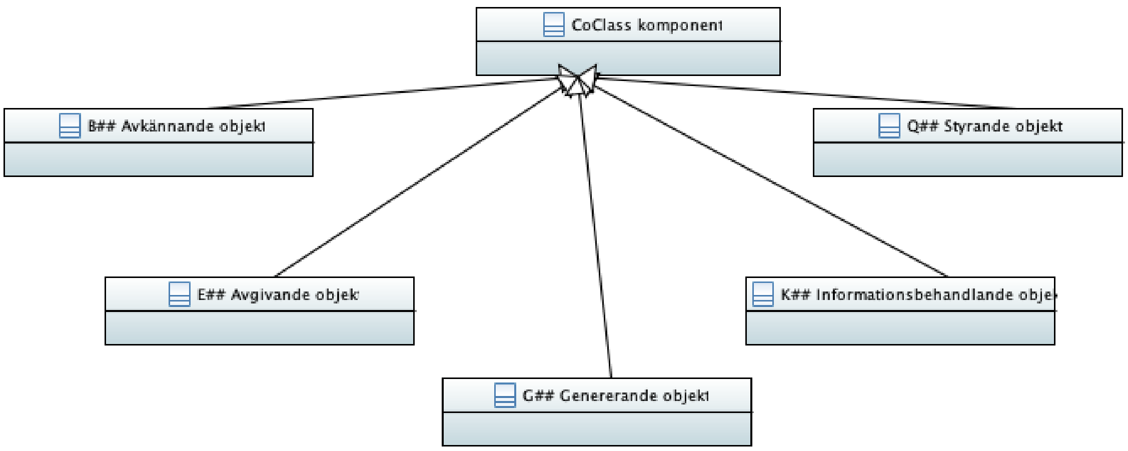

Figure 1: CoClass komponenter

- CoClass komponent

1.1.1 B## Avkännande objekt

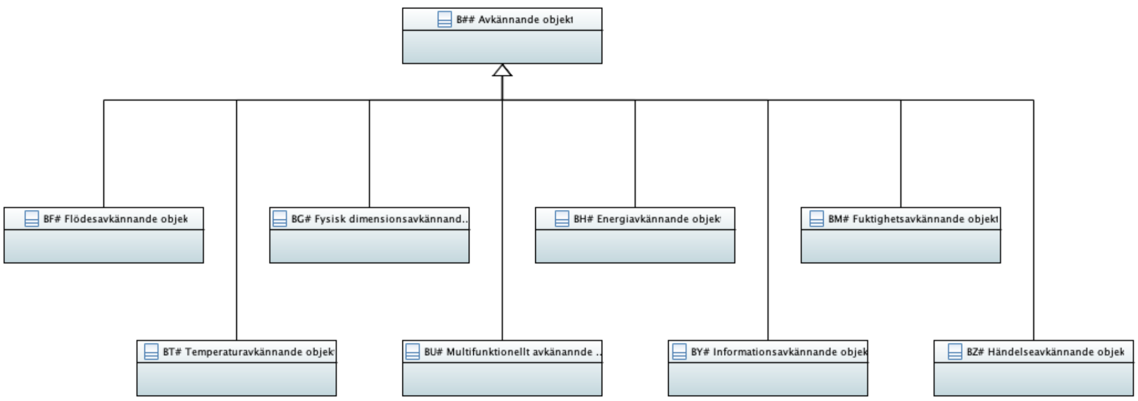

Figure 2: B## Avkännande objekt

- B## Avkännande objekt

1.1.1.1 BF# Flödesavkännande objekt

- BF# Flödesavkännande objek
- BFB Flödesssensor

1.1.1.2 BG# Fysisk dimensionsavkännande objekt

Exempel: magnetkontakt

- BG# Fysisk dimensionsavkännande objekt
- BGA Positionsdetektor

Exempel: dörröppningssensor

1.1.1.3 BH# Energiavkännande objekt

- BH# Energiavkännande objekt
- BHA Flödesenergimätare

Exempel: vindmätare

1.1.1.4 BM# Fuktighetsavkännande objekt

- BM# Fuktighetsavkännande objekt
- BMA Fuktighetsdetektor
- BMB Fuktighetssensor

1.1.1.5 BQ# Koncentrationsavkännande objekt

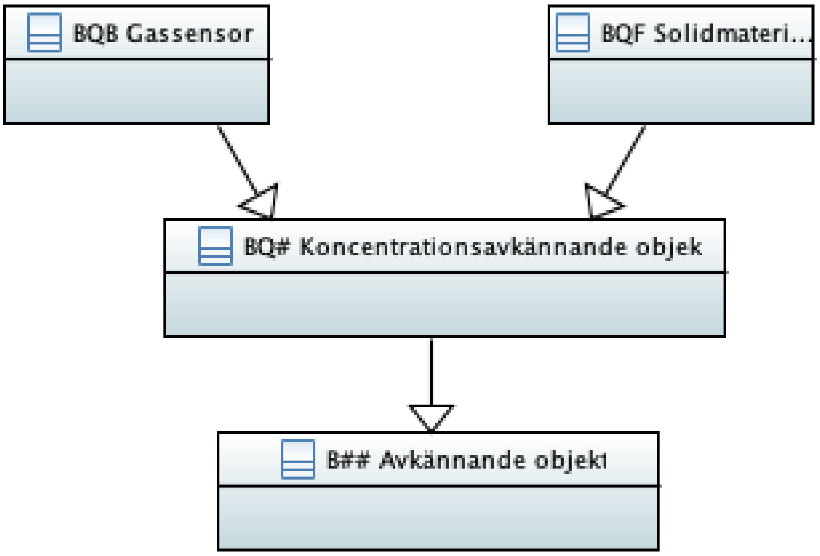

Figure 3: BQ# Koncentrationsavkännande objekt

- BQ# Koncentrationsavkännande objekt
- BQB Gassensor
- BQF Solidmateriasensor

T.ex. partikelsensor

1.1.1.6 BT# Temperaturavkännande objekt

- BT# Temperaturavkännande objekt
- BTA Temperaturdetektor
- BTB Temperatursensor

1.1.1.7 BU# Multifunktionellt avkännande objekt

- BU# Multifunktionellt avkänannde objekt
- BUB Flerfunktionssensor
  Exempel: närvarodetektor

1.1.1.8 BY# Informationsavkännande objekt

- BY# Informationsavkännande objekt
- BYA Chipkortläsare

1.1.1.9 BZ# Händelseavkännande objekt

- BZ# Händelseavkännande objek
- BZC Persondetektor

1.1.2 E## Avgivande objekt

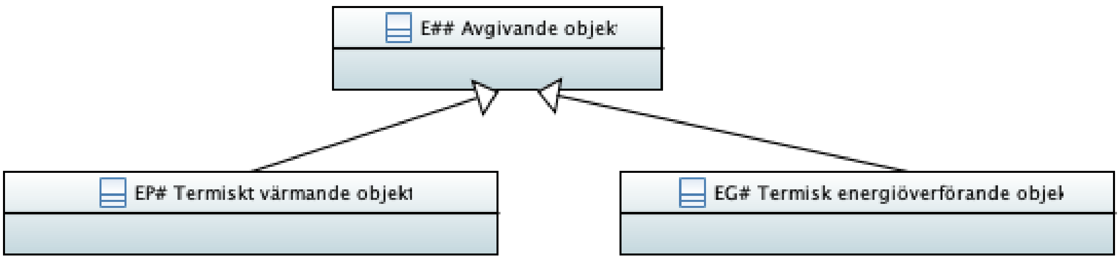

Figure 4: E## Avgivande objekt

- E## Avgivande objekt

1.1.2.1 EG# Termisk energiöverförande objekt

- EG# Termisk energiöverförande objekt
- EGA Värmepump/kylmaskin

1.1.2.2 EP# Termiskt värmande objekt

- EP# Termiskt värmande objekt
- EPC Värmeelement

1.1.3 G## Genererande objekt

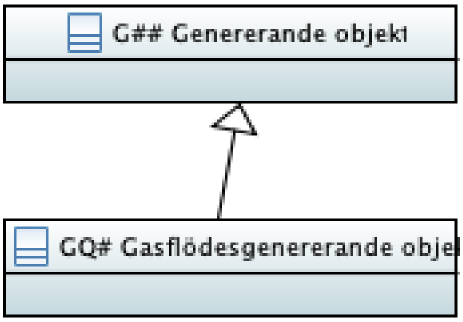

Figure 5: G## Genererande objekt

- G## Genererande objekt

1.1.3.1 GQ# Gasflödesgenrerande objekt

- GQ# Gasflödesgenererande objek
- GQB Fläkt

1.1.4 K## Informationsbehandlande objekt

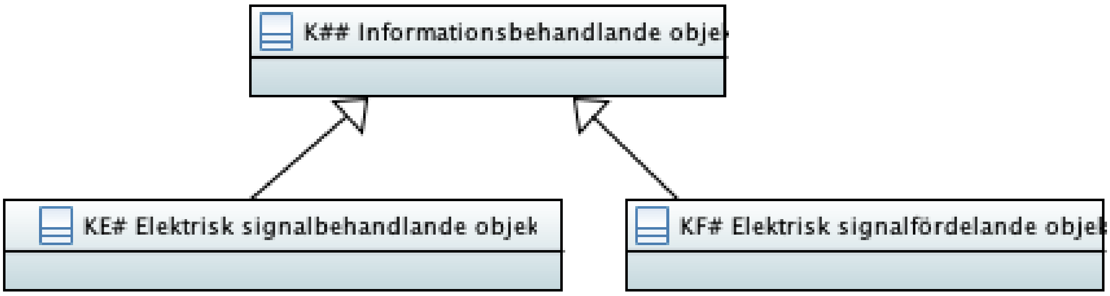

Figure 6: K## Informationsbehandlande objekt

- K## Informationsbehandlande objekt

1.1.4.1 KE# Elektrisk signalbehandlande objekt

- KE# Elektrisk signalbehandlande objekt
- KEA Dator
- KEB Styr- och regleringsenhet
- KEC Kommunikationsenhet
- KED Router

1.1.4.2 KF# Elektrisk signalfördelande objekt

- KF# Elektrisk signalfördelande objekt
- KFD Nätverksbrygga

- KFE Switch

1.1.5 Q## Styrande objekt

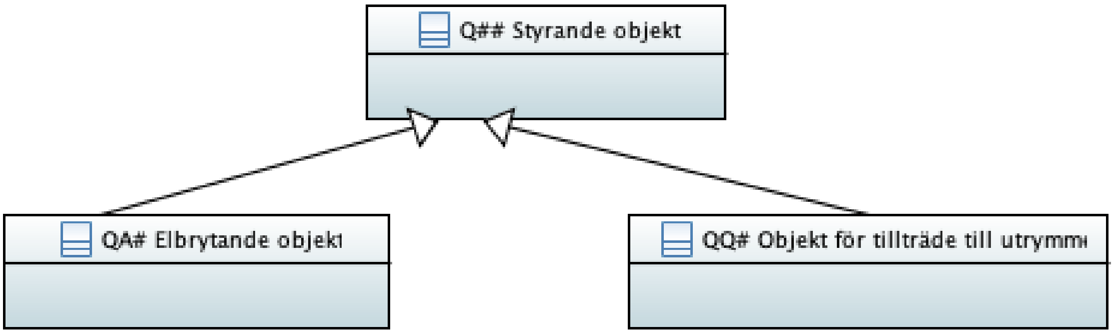

Figure 7: Q## Styrande objekt

- Q## Styrande objekt

1.1.5.1 QA# Elbrytande objekt

- QA# Elbrytande objekt
- QAA Strämkretsbrytare
- QAC Elektronisk strämbrytare

1.1.5.2 QQ# Objekt för tillträde till utrymme

- QQ# Objekt för tillträde till utrymme
- QQA Fönster
- QQC Dörr

1.2 Konstruktiva system

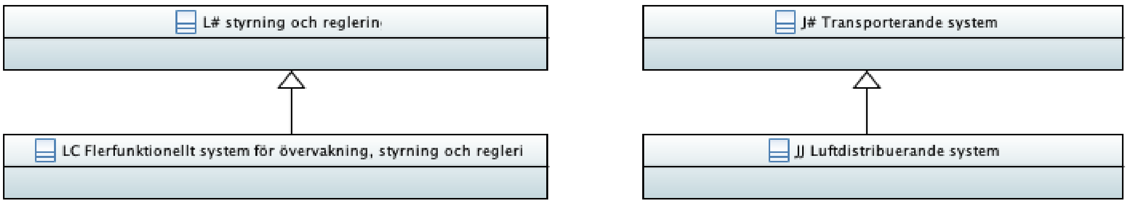

Figure 8: CoClass konstruktiva system

- J# Transporterande system
- JJ Luftdistribuerande system
- JL Signaldistributionssystem
- JL02 Datornätverk
- L# styrning och reglering
- LC Flerfunktionellt system för övervakning, styrning och reglering

2. ISO RA

This part of the model is by and large a complete copy of the parts of ISO/IEC 30141:2018 that are deemed relevant for the CSA IoT Bygg project.
Note that the descriptions given are on a very high level; for the complete text please see the IoT RA document.

2.1 Conceptual model

This part of the model lists the fundamental concepts supported by systems following the IoT reference architecture.
The concepts are realised in functional components (see the "Functional view" section), where such a component may be responsible for supporting several concepts. Likewise, a concept can be supported by several components.
Functional components are then aggreagated into subsystems (see the "Systems view" section).

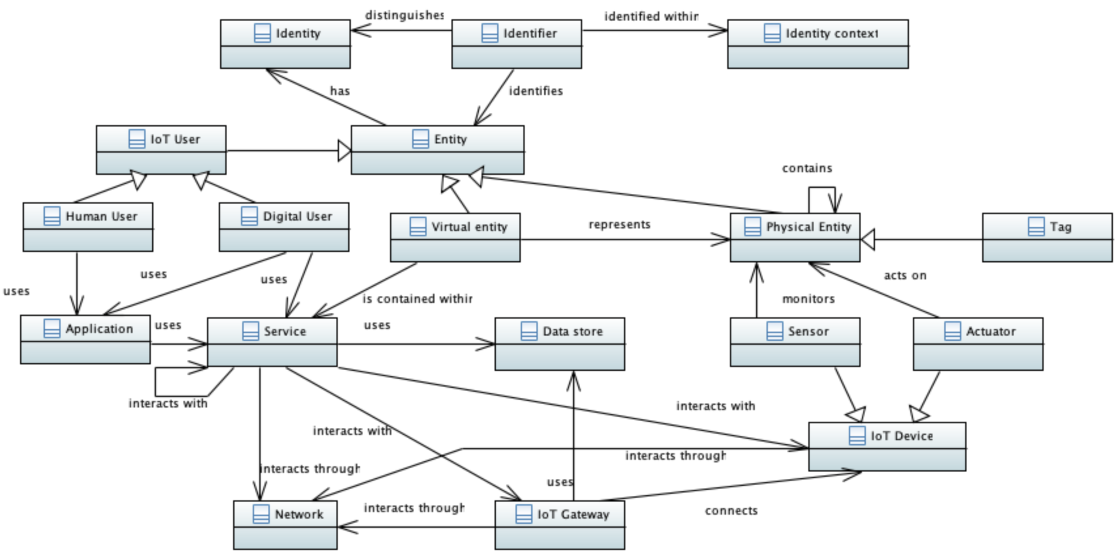

Figure 9: Full concept map

- Actuator
- Address mapper
- Application
- Architecture Domain
- Capillary
- Component
- Data store

- Device
- Digital Entity
- Digital User
- Endpoint
- Entity
- Fixed
- Human
- Human User
- Human physical entity
- Identifier
- Identity
- Identity context
- Identity repository
- Interface
- IoT Device
- IoT Gateway
- IoT User
- Local
- Network
- Network interface
- Physical Entity
- Sensor
- Service
- Service interface
- Tag
- Transport
- Virtual entity
- Wireless

2.2 Functional view

The functional is structured into domain-specific parts which make up the bulk of the domain-specific subsystems and cross-domain functions which appear in most subsystems.

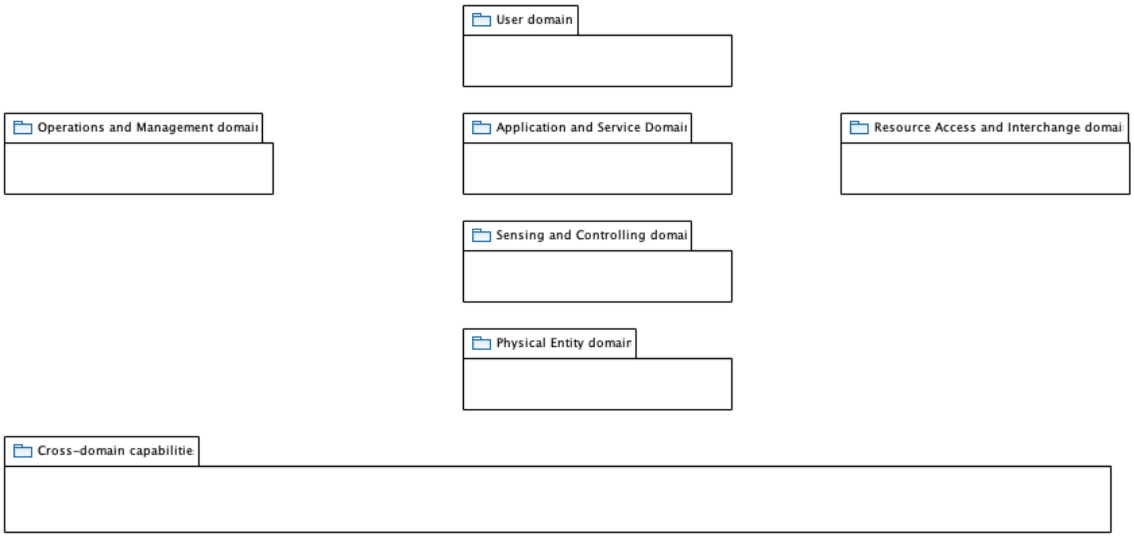

Figure 10: Functional view

2.2.1 Application and Service Domain

- APIs and portals
  This set of functions provides the main mechanisms for interaction with an IoT system: APIs mainly for digital users, portals for human users.
- Analytics services
  In typical IoT systems, the process of filtering, correlating and processing data (at rest and/or in flight) will be a major workload. Therefore, it is assumed that it will be very helpful for application developers if the platform provides ready made support in these areas.
- Application support
  This is a placeholder for the kind of infrastructure that will be expected from IoT frameworks. Much will be common to generic computing infrastructure, but with special emphasis on the characteristics required in IoT systems (see the Characeristics clause in 30141).
- Business services
  This set of functions is mainly about orchestrating resources and services to create new applications and/or higher order services.

2.2.2 Cross-domain capabilities

Figure 11: Cross-domain capabilities

- Dynamic composition

This function represents the capability supporting continuous integration and evolution of the IoT system.
Note that many such systems are likely to be mission critical and therefore expected to operate on a 24x7 basis even as functions are added, withdrawn and upgraded.

- Network connectivity

  Network connectivity is essential for the operation of any IoT system. However, as the technology is assumed to be fundamentally general purpose, it is not described further here.
  However, the development of some specific networking technologies (e.g., low-power variants) will most likely be driven by IoT requirements, even though the resulting solutions are likely to be used also in other scenarios.
- Trustworthiness

  This is a key block of functions: safety, privacy, security, resilience and reliability.
  They are vital to the success of any IoT system, but as for networking the supporting technologies are typically of a generic IT nature (even though usability requirements in the IoT scenario will pose some interesting challenges).

2.2.3 Operations and Management domain

- Business support system

  The BSS handles business aspects such as account managements,billing, product catalog etc. Exposure of these capabiities is through the RAID.
- Operational support system

  The OSS is responsible for the operational management of the IoT system. A subset of the control mechanisms may be made available to external partners through RAID:

2.2.4 Physical Entity domain

This domain contains no functions that belong to the IoT system as such, but is a placeholder for the real-world items that are sensed and/or controlled by the IoT system.
The only exception is the concept of tags: they range from completely passive device (carriers for bar codes) to devices with at least some computing capabilities (e.g., NFC enabled devices).
However, they always require a sensor (reader) that is then the interface to the IoT system proper.

- Physical tag

2.2.5 Resource Access and Interchange domain

- Access data flow

This function handles authentication and authorization of data and control access requests, as well as the necessary formatting and processing required to enable intersystem communication.
Note that the physical execution of such functions may be allocated closer to the responsible devices in cases where latency is critical.

- Discovery
  The discovery function presents mechanisms for finding and identifying IoT system resources for external use.
  Internal use is also of course possible, as it may simplify resource access and partitioning of the system for security purposes.

2.2.6 Sensing and Controlling domain

- Actuation
  This function is responsible for delivering control signals to the physical actuators (the devices that actually affect the controlled world).
- Control services
  This is a set of functions that manages sensors, actuators and northbound interfaces locally. This is typically motivated by requirements on performance, safety etc.
  Thus, the functions here help provide support not only for concepts but also for characteristics.
- Identification
  Devices must be able to identify themselves in order to ensure that sensor readings are correctly related to the state of the environment, and that actuation is performed where appropriate.
  Note that the identities should be minimal in the sense that the mapping to location etc should be handled by the uper layers of the system.
- Sensing
  The sensing functions basically read sensor data, but may also provide low-level adaptation functions such as setting sample frequencies and trigger thresholds for reporting.

2.2.7 User domain

- User interface

2.3 Intersystem relationships

In most real cases an IoT system would be expected to be connected with other IoT systems (and other higher order systems).
The interface is defined by the set of data provided and the accepted control signals (and its corresponding responses).
Al such cooperation is under the control of the subsystems in "Resource Access and Interchange Domain", but note that the actual transport of data and control can take place directly between lower-level entities.

Access control is still mediated through via RAID subsystems.

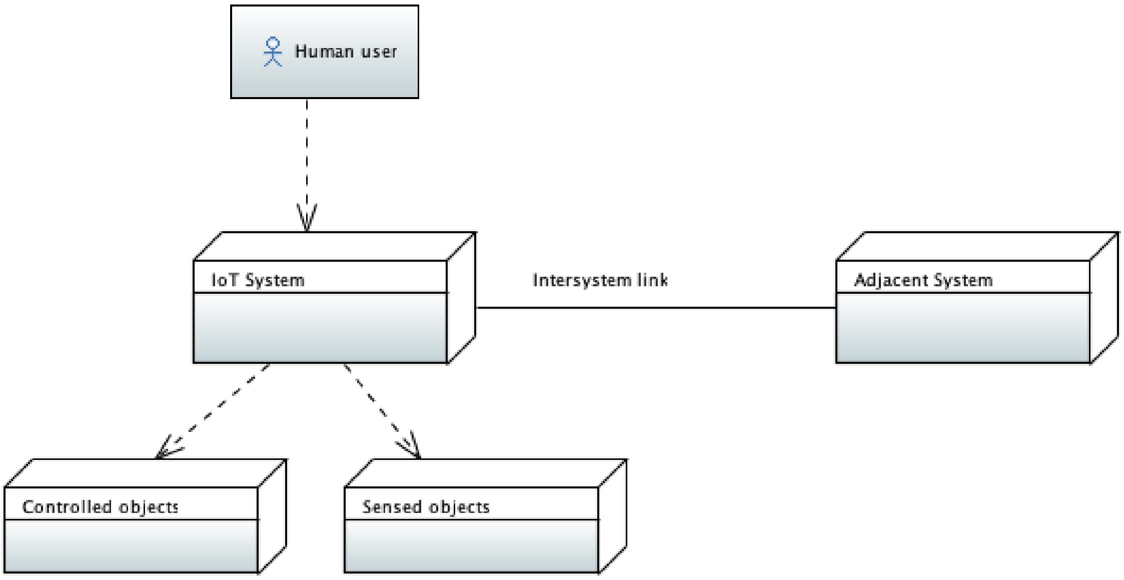

Figure 12: Intersystem relationships

- Adjacent System
  The adjacent system(s) may be cooperating IoT systems, digital users, business orchestration systems, higher order control systems or any combination.
- IoT System
  This node is basically representing the full scope of a system built in accordance with the IoT RA.

2.4 System view

NB: the structure of the System View in this model is slightly different than in 30141.
The adjustments are made to accommodate the formal modeling approach as the System View part of 30141 is described in free text and hand-drawn diagrams.
The aggregation of functions from the functional view into subsystems is fairly straightforward, and is not currently captured in the model.

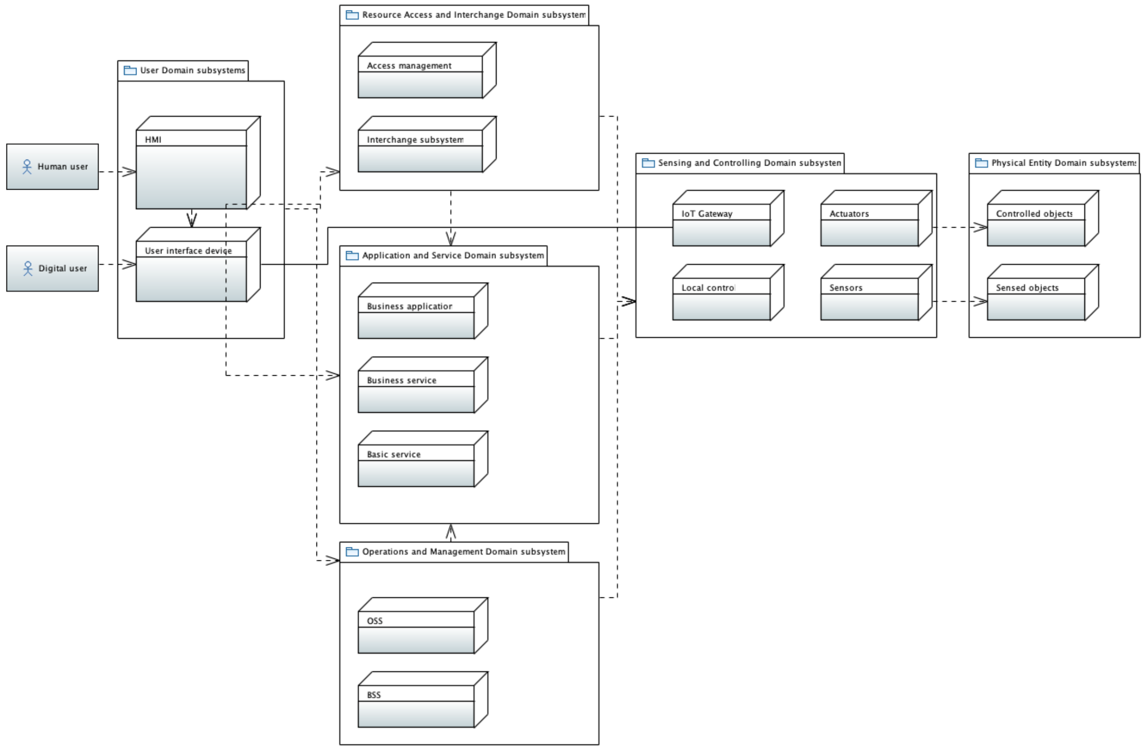

Figure 13: Subsystems

2.4.1 Application and Service Domain subsystems

- Basic service
- Business application
- Business service

2.4.2 Operations and Management Domain subsystems

- BSS
- OSS

2.4.3 Physical Entity Domain subsystems

"Controlled objects" and "Sensed objects" are in many cases likely to be the same physical entities.

- Controlled objects
- Sensed objects

2.4.4 Resource Access and Interchange Domain subsystems

- Access management
- Interchange subsystem

2.4.5 Sensing and Controlling Domain subsystems

- Actuators
- IoT Gateway
- Local control
- Sensors

2.4.6 User Domain subsystems

- HMI
- User interface device

3. CSA IoT Bygg

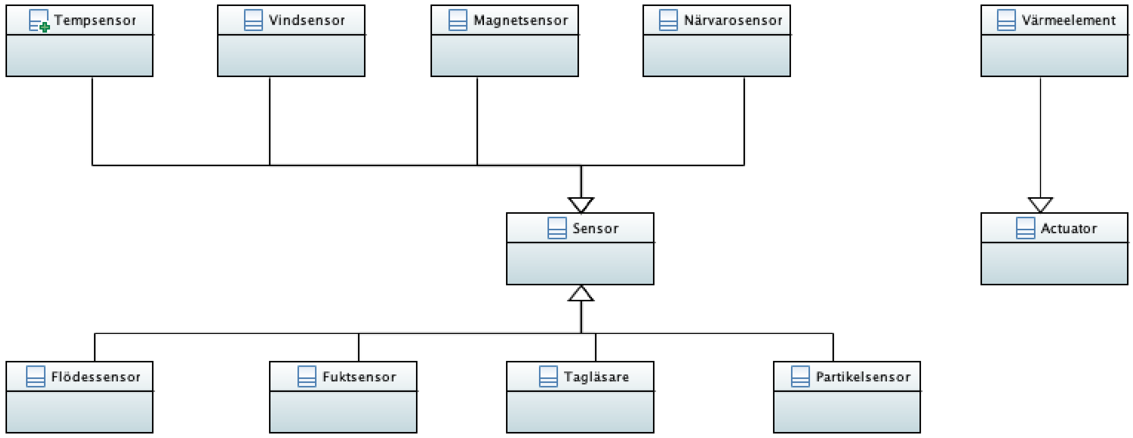

Figure 14: CSA Bygg specialiserade koncept

3.1 Specialiserade givartyper

- Flödessensor
- Fuktsensor
- Magnetsensor
- Närvarosensor
- Partikelsensor
- Tagläsare
- Tempsensor
- Vindsensor

3.2 Specialiserade ställdonstyper

- Värmeelement

4. Inomhusmiljö

Den här sektionen innehåller de element som behövs för att modeller det (enkla) exempel som projektrapporten innehåller.

4.1 Apparater

4.1.1 Givare

4.1.1.1 Fuktmätare

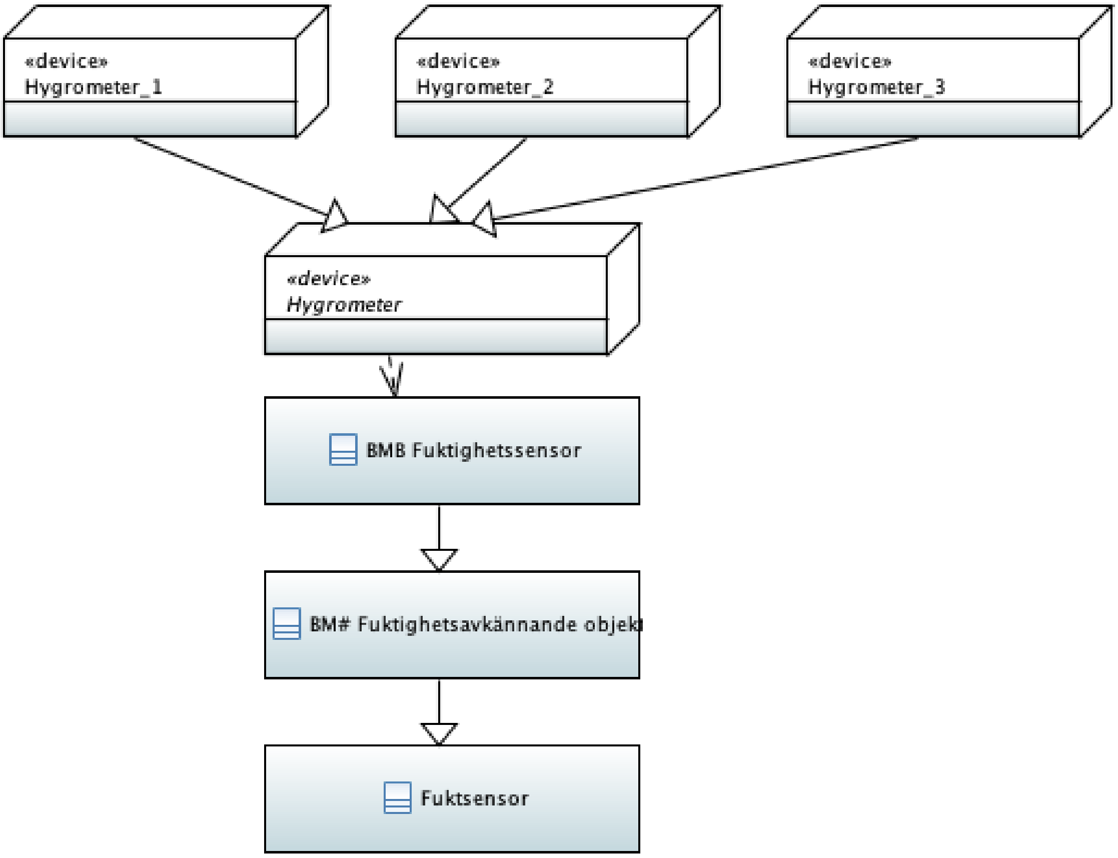

Figure 15: Fuktgivare beroenden

- Hygrometer
- Hygrometer_1
- Hygrometer_2
- Hygrometer_3

4.1.1.2 Närvarosensorer

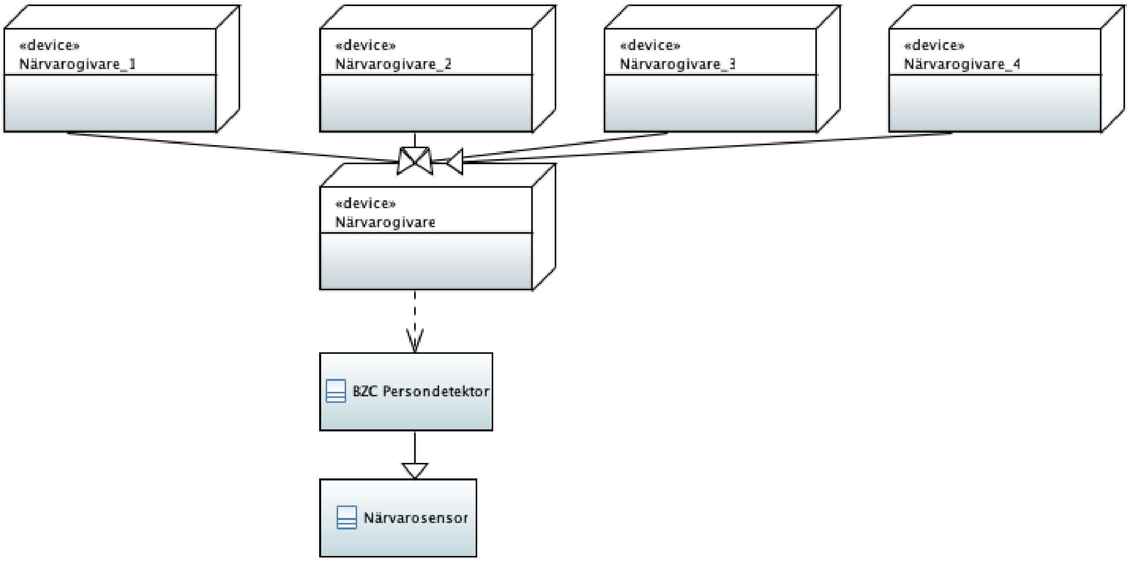

Figure 16: Närvarogivare beroenden

- Närvarogivare
- Närvarogivare_1
- Närvarogivare_2
- Närvarogivare_3
- Närvarogivare_4

4.1.1.3 Partikelmätare

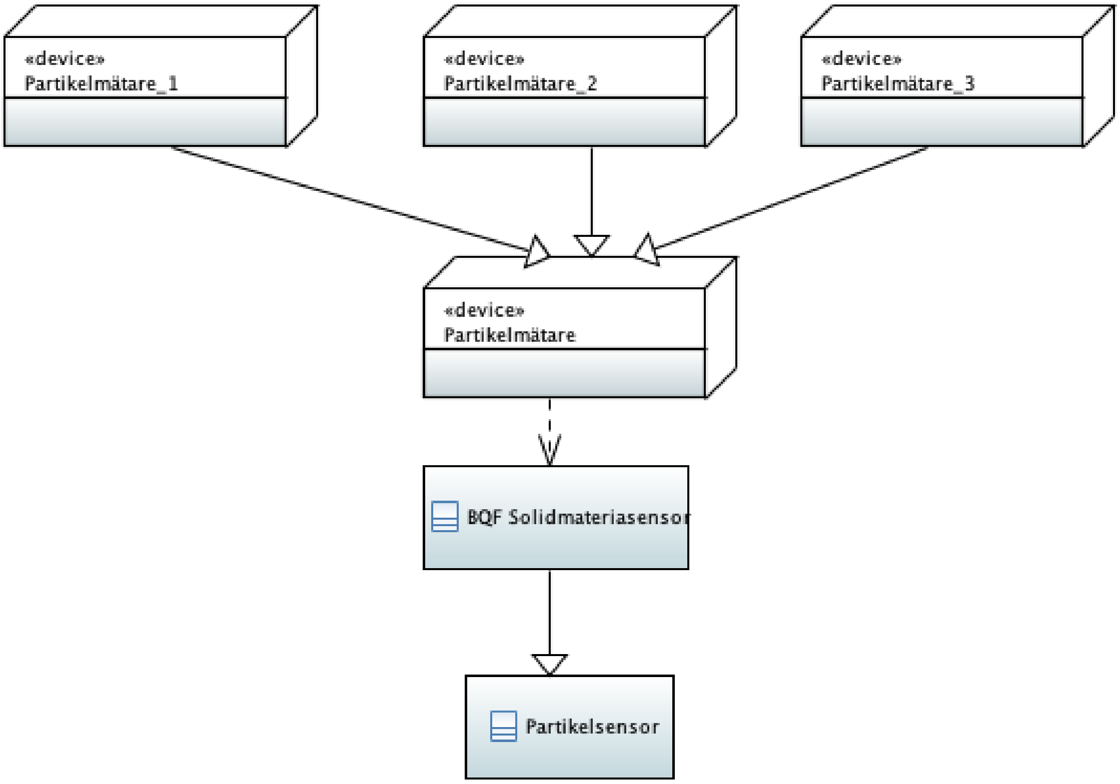

Figure 17: Partikelmätare beroenden

- Partikelmätare
- Partikelmätare_1
- Partikelmätare_2
- Partikelmätare_3

4.1.1.4 Sammansatta givare

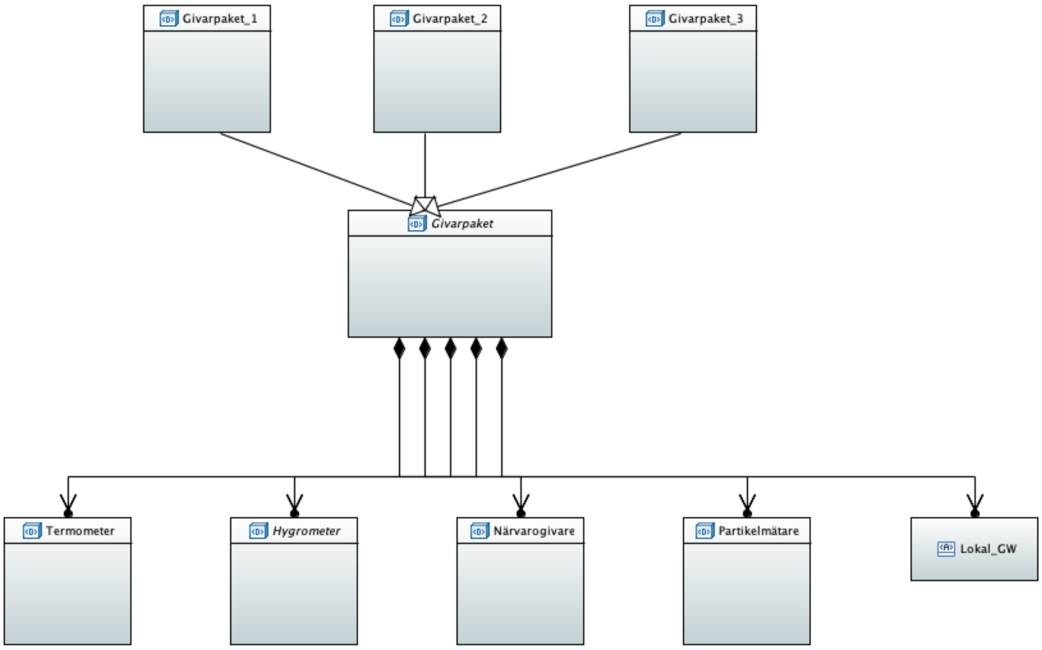

Figure 18: Givarpaket sammansättning

- Givarpaket
- Givarpaket_1
- Givarpaket_2
- Givarpaket_3

4.1.1.5 Temperatur

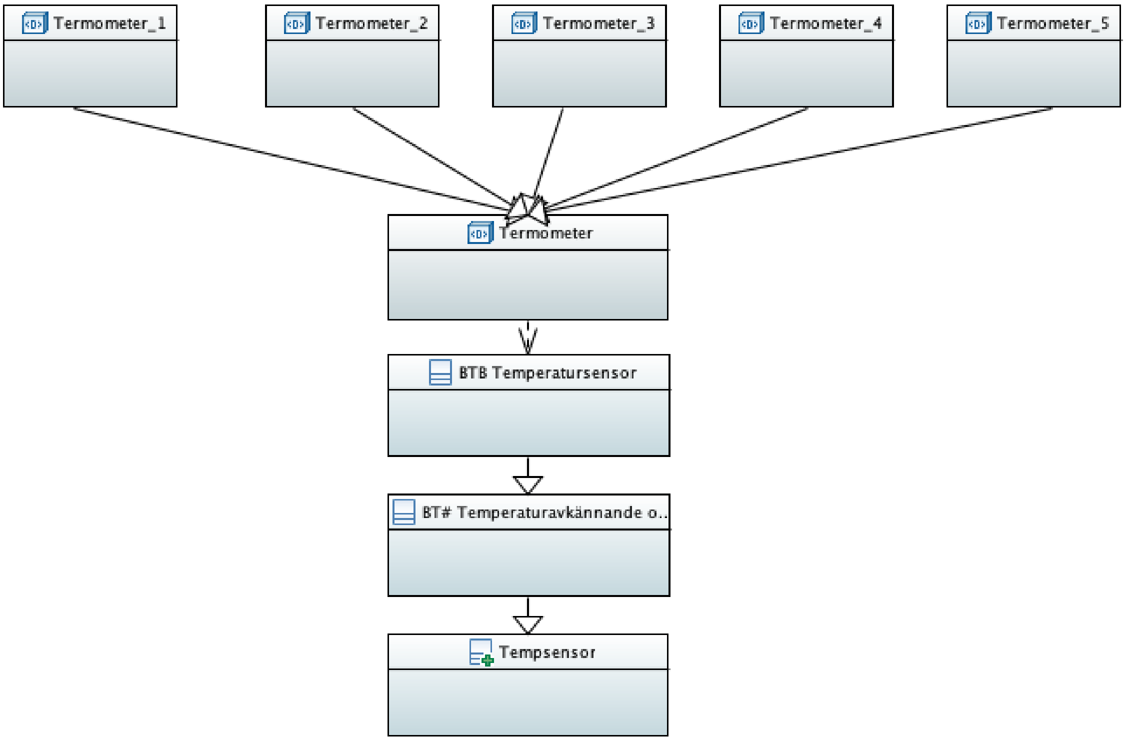

Figure 19: Termometer arvsstruktur

- Termometer
  Generisk termometer
- Termometer_1
  Mäter temperaturen i hallen
- Termometer_2
  Mäter temperatur i receptionen
- Termometer_3
  Mäter temperatur i kontoret
- Termometer_4
  Mäter temperatur i apparatrummet
- Termometer_5
  Mäter utomhustemperaturen

4.1.1.6 Öppningar

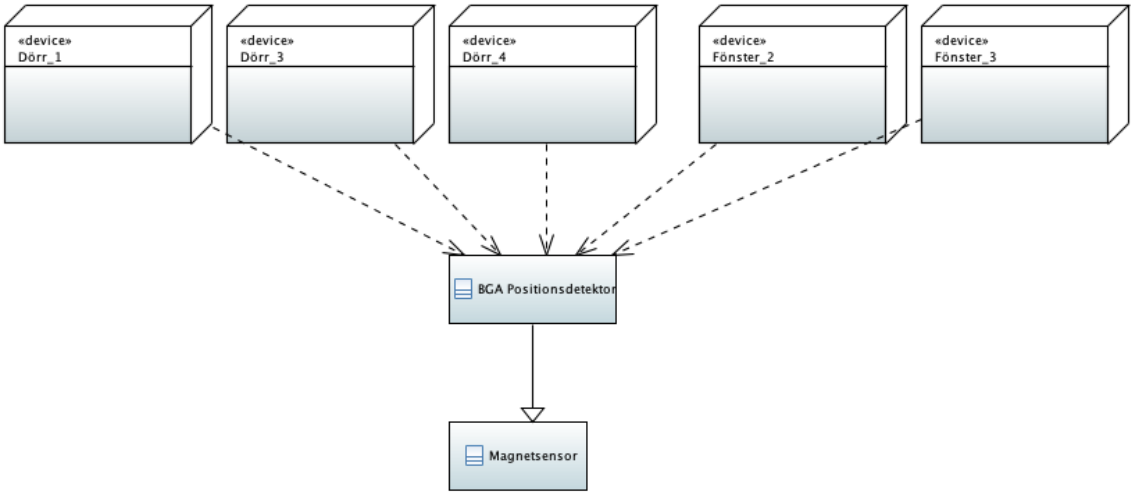

Figure 20: Dörr/fönster beroenden

- Dörr_1
- Dörr_3
- Dörr_4
- Fönster_2
- Fönster_3

4.1.2 Lokal SW

- Lokal_GW

4.1.3 Ställdon

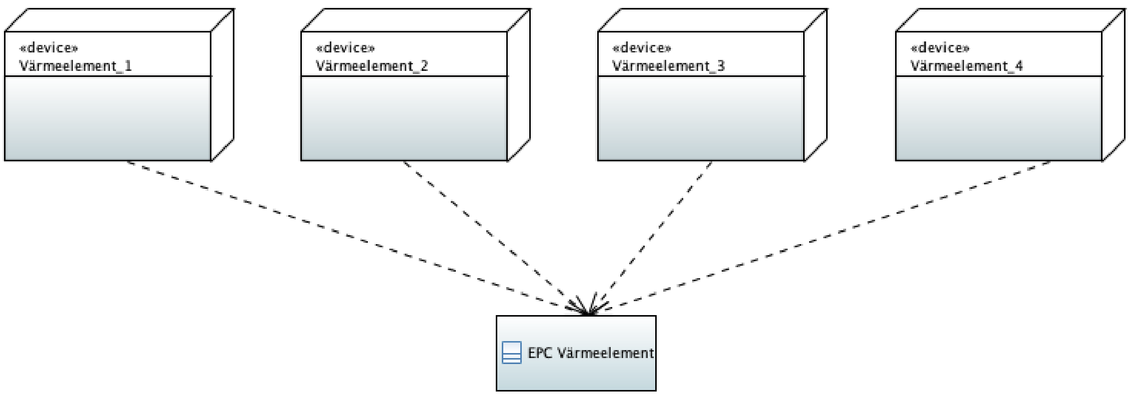

Figure 21: Styrbara värmeelement

4.1.3.1 Styrbara värmeelement

- Värmeelement_1

- Värmeelement_2
- Värmeelement_3
- Värmeelement_4

4.2 Ingående konstruktiva system

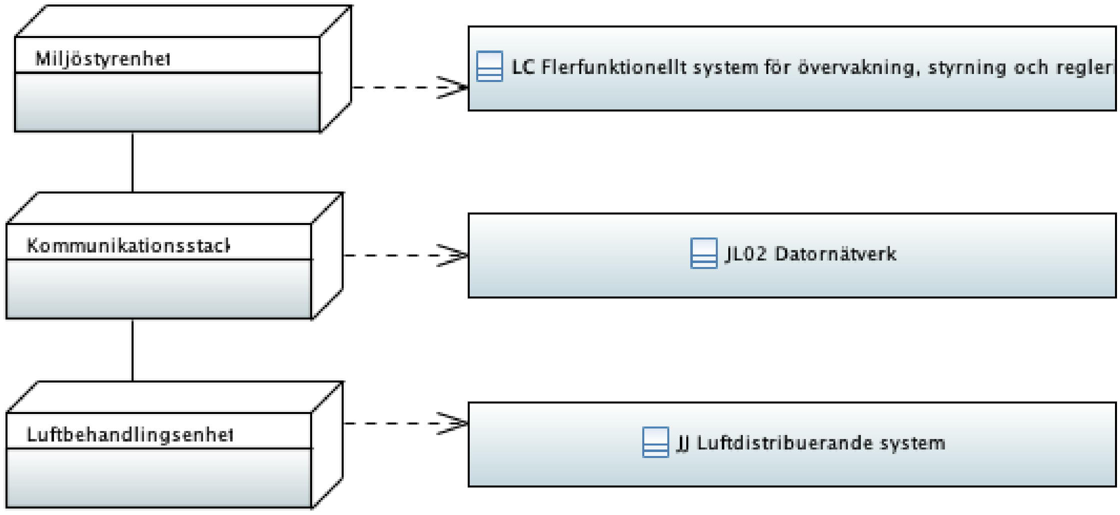

Figure 22: Ingående konstruktiva system

4.2.1 Kommunikationsstack

- Kommunikationsstack
  Kommunikationsstacken i exemplet är i allt väsentligt uppbyggd av standard IT-komponenter, och modelleras därför inte ingående här.

4.2.2 Luftbehandlingsenhet

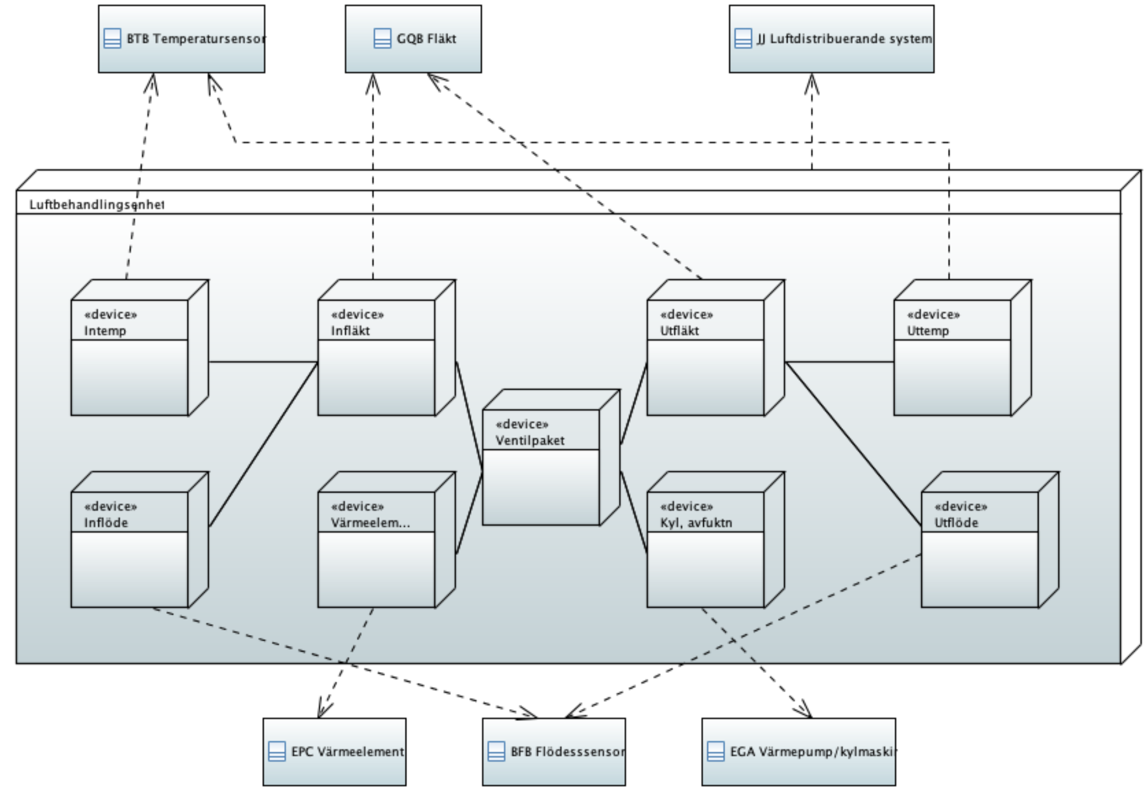

Figure 23: Luftbehandlingsenhet

- Luftbehandlingsenhet
- Infläkt
- Inflöde
- Intemp
- Kyl, avfuktn
- Utfläkt
- Utflöde
- Uttemp
- Ventilpaket
- Värmeelement_LBA

4.2.3 Miljöstyrenhet

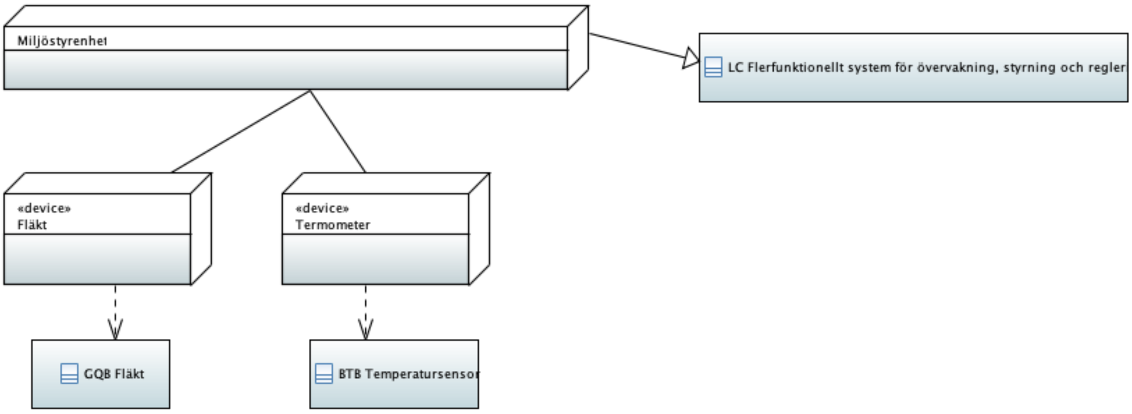

Figure 24: Miljösystem förbindelser

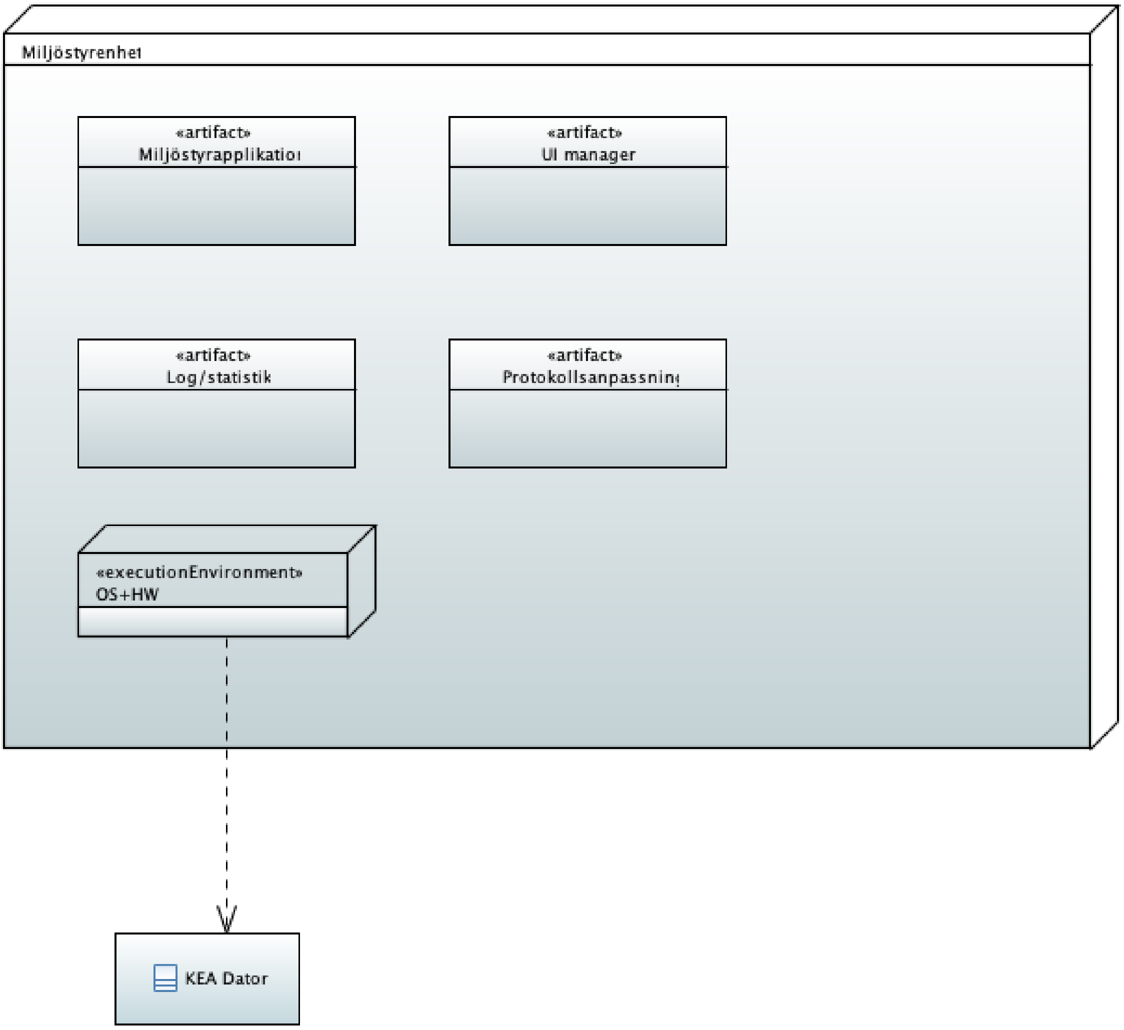

Figure 25: Miljöstyrenhet detaljer

- Fläkt
- Miljöstyrenhet
- OS+HW

4.3 Utrymmen

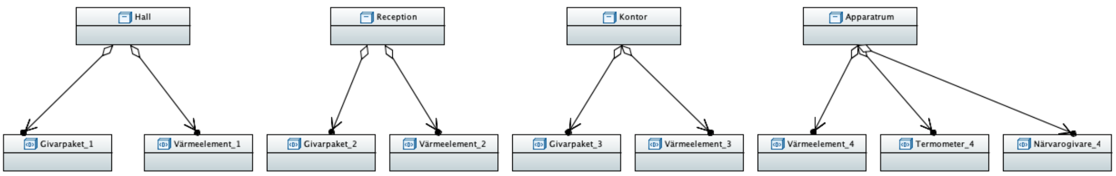

Figure 26: Utrymmen med devices

- Apparatrum

- Hall
- Kontor
- Reception

5. Relation RA-CSA-CoClass

5.1 Relationsexempel 1: RA-CSA-CoClass

Det nedanstående diagrammet visar hur ett begrepp ("concept" i IoT-referensarkitekturen relaterar till en specialisering (CSA) och hur de vidare relaterar till motsvarande element i CoClass-modellen.
I exemplet visas alltså att "tempsensor" är ett specialiserat RA Concept. På samma sätt kan B## Avkännande objekt i CoClass ses som en specialisering av Sensor i referensarkitekturen, och.
På lägre nivå i strukturen kan BTB Temperatursensor ses som en specialisering av CSA Concept Tempsensor.

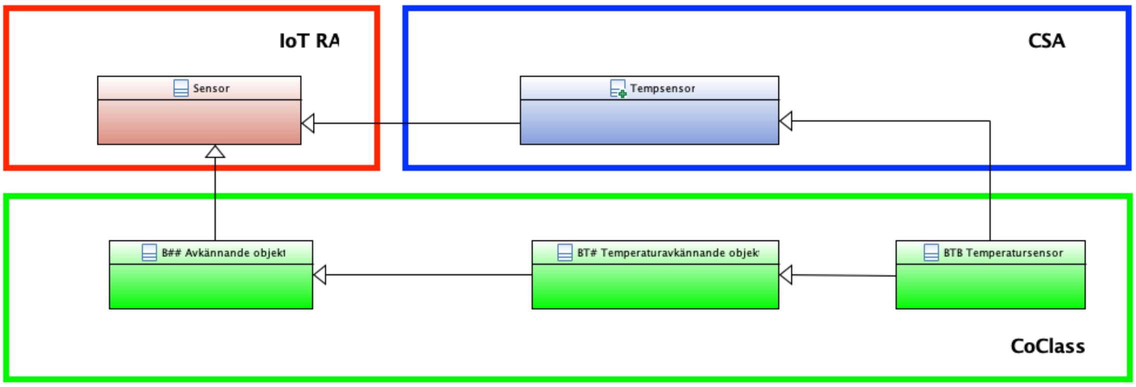

Figure 27: Relationsexempel RA-CSA-CoClass

5.2 Relationsexempel 2: med devices

I ett lite mer komplext exempel kan man visa hur devices, CoClass-komponenter, RA concepts och CSA concepts kan länkas ihop i ett beroende- och arvsnät.

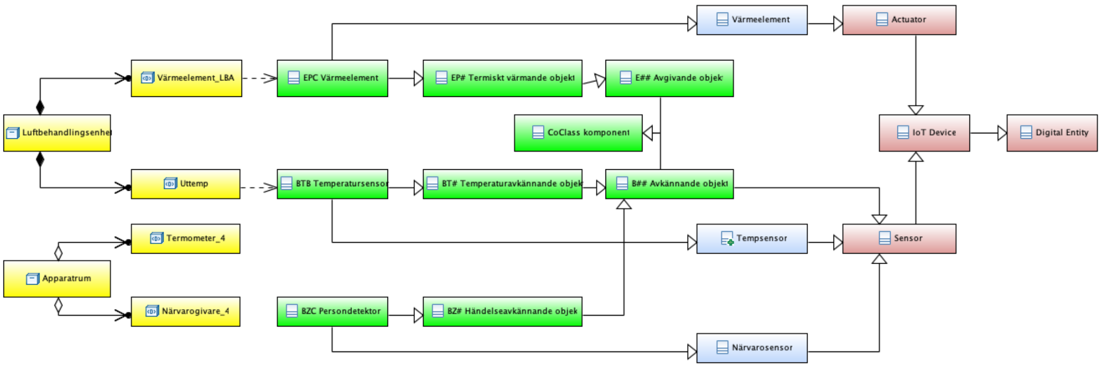

Figure 28: Relationsexempel med devices

5.3 Relationsexempel 3: smart termostat

Detta exempel visar hur en smart termometer (NEST valt som exempel) kan modelleras med användning av CSA Bygg. Därigenom kopplas en produkt till ISO RA och CoClass.
Diagrammet visar också hur instanser representeras i UML: två instanser av NEST-devicet markerade med instansbeteckningarna Badrummet och Vardagsrummet.

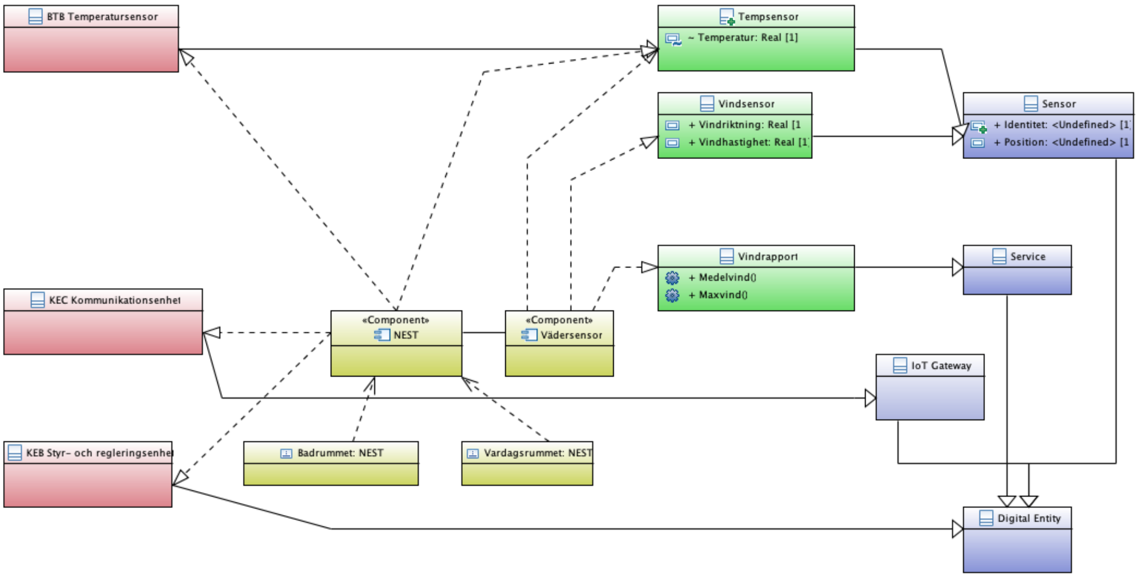

Figure 29: Exempel: smart termostat

- NEST
- Vindrapport
- Vädersensor

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