Enterprise architecture modeling as a catalyst for system development

Syntell

August 2017

Syntell | excellence in systems lifecycle management

Electric site example

- The development of large, complex, heavy construction equipment can be difficult, time consuming and expensive, even more so if the goal is to design a complete site solution.

- The example used is taken from an ongoing real project named Electric site. The aim is to electrify a transport stage in a quarry – from excavation to primary crushing and transport to secondary crushing.

- This example uses a standards-based enterprise architecture model to describe how this model can be used to significantly influence continued system engineering efforts as well as the software architecture for the application developments needed.

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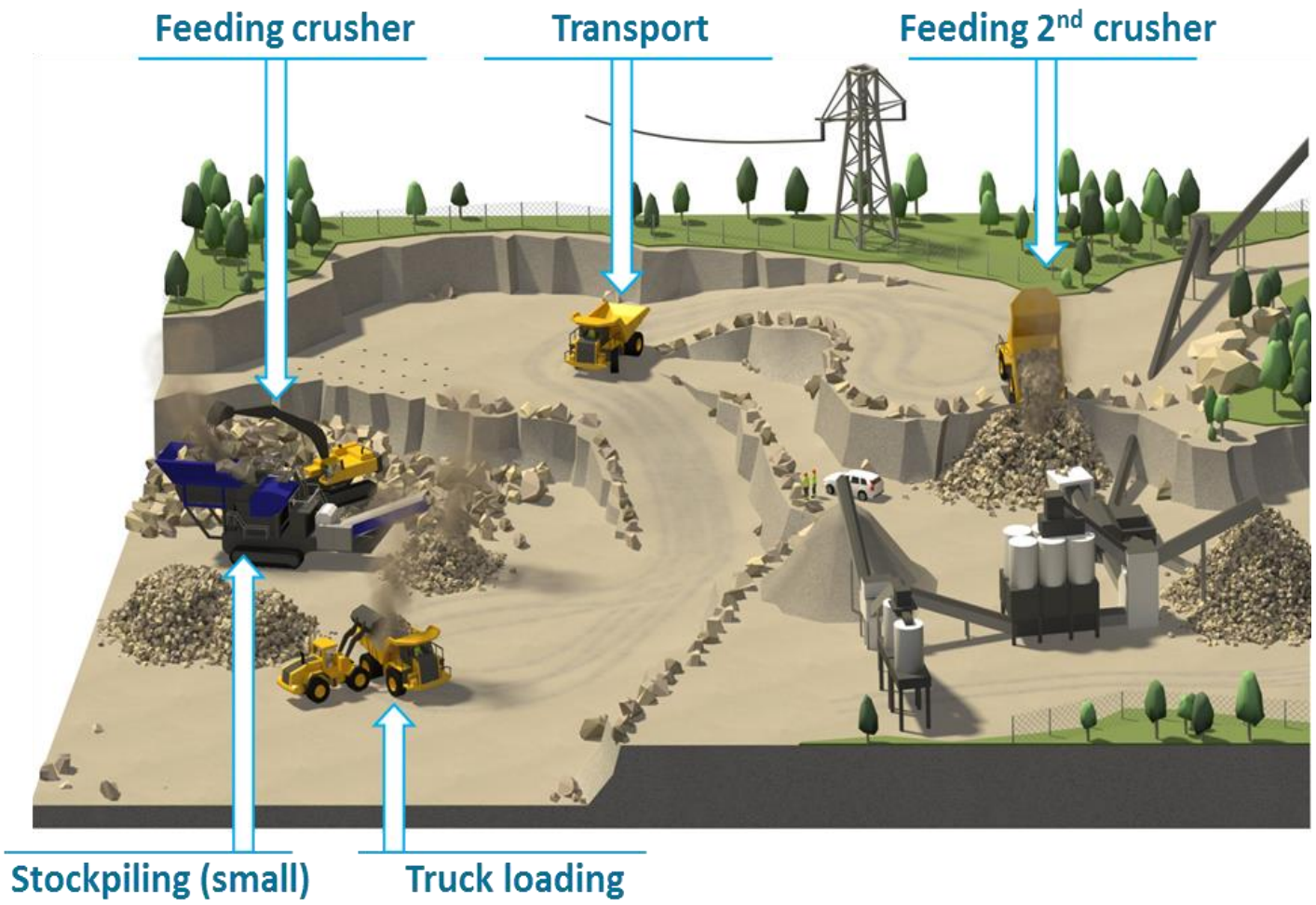
A quarry site



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Electric site considerations

- The overall interests here are the following:
- The handling of all of the machines need to be managed such that production of materiel can run efficiently.
- Disruptions due to errors of various kinds needs to be handled.
- Personnel security of the site needs to be maintained.
- Interactions between different functions in different machines need to be covered.

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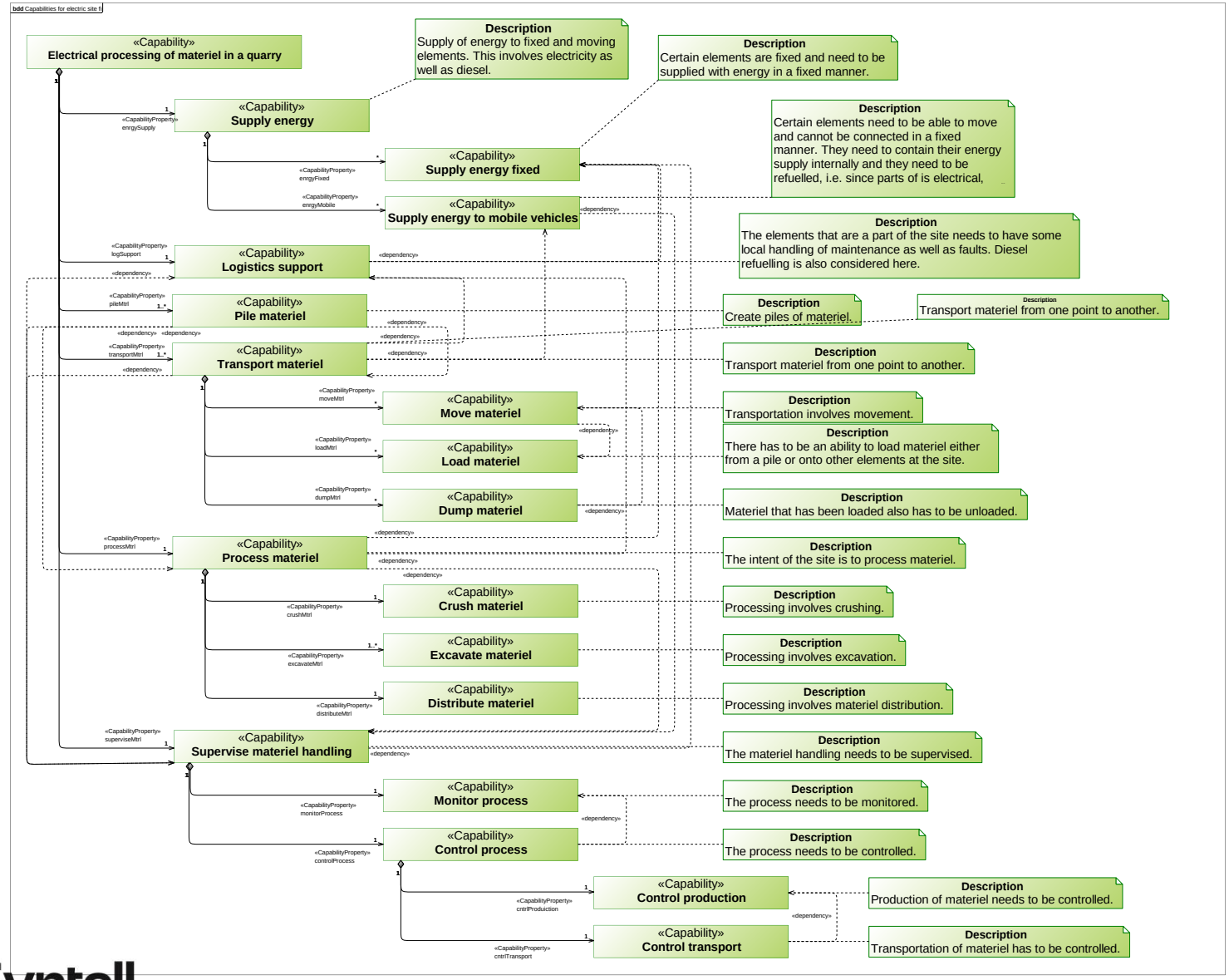
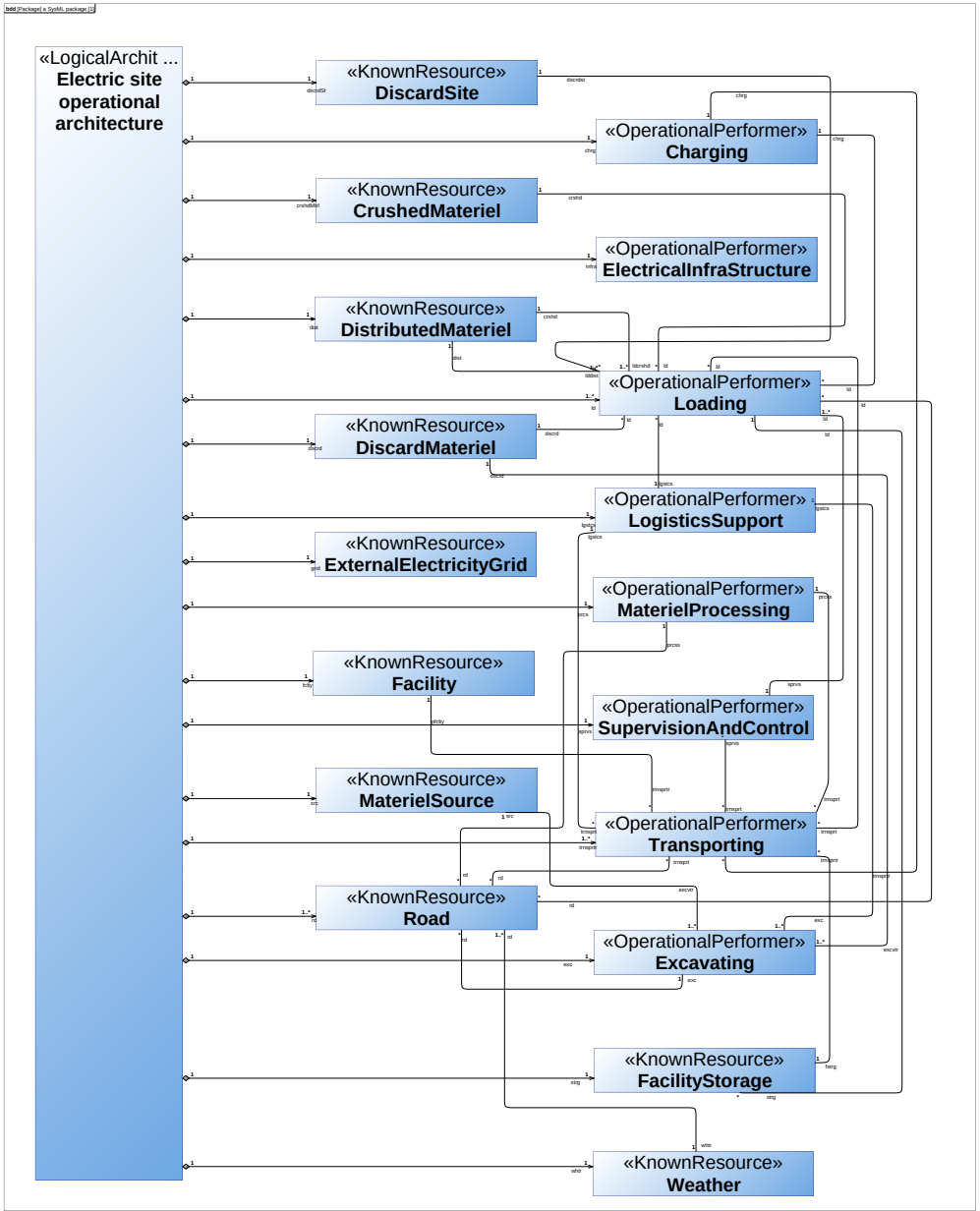
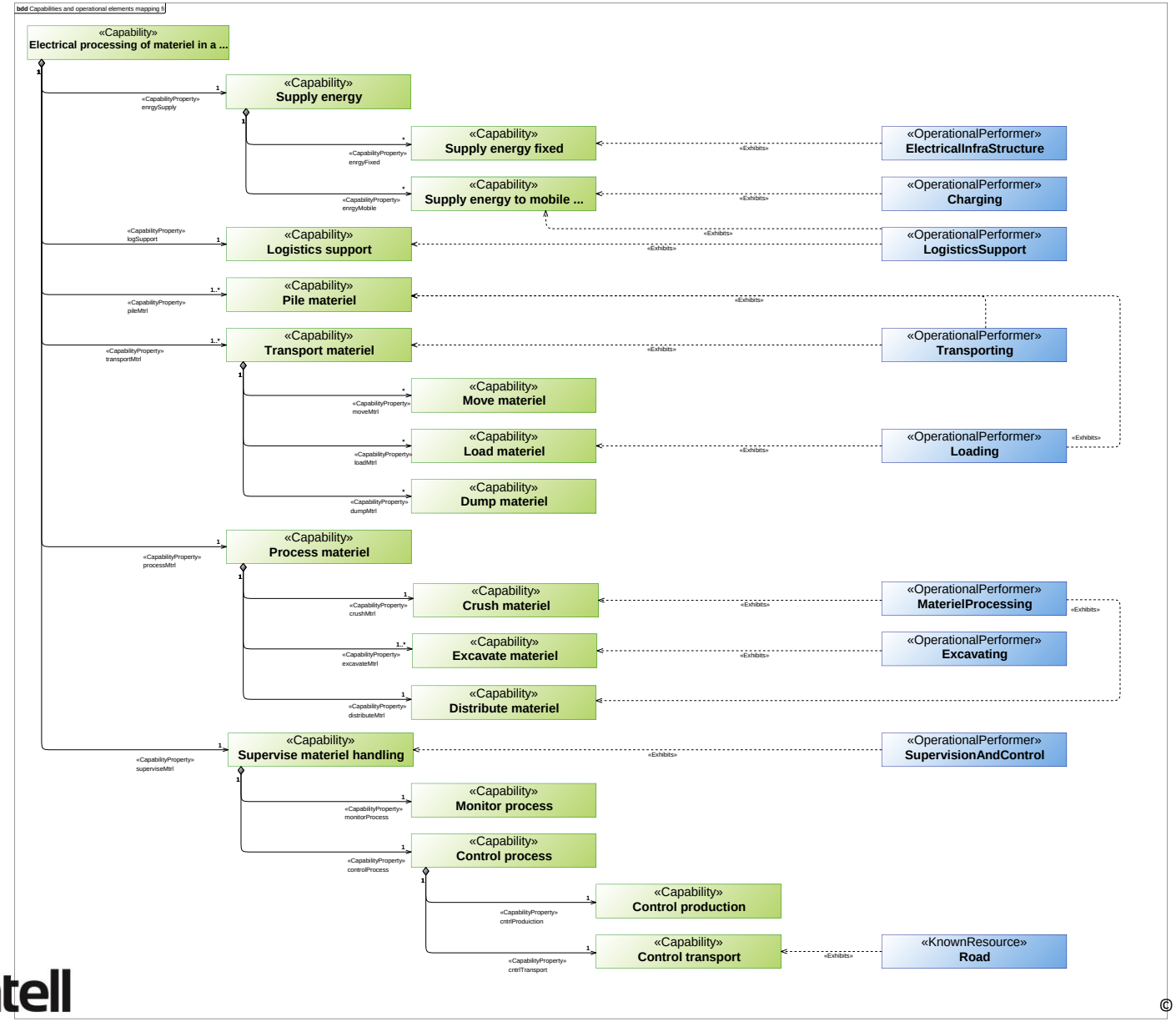
Capabilities considered as required



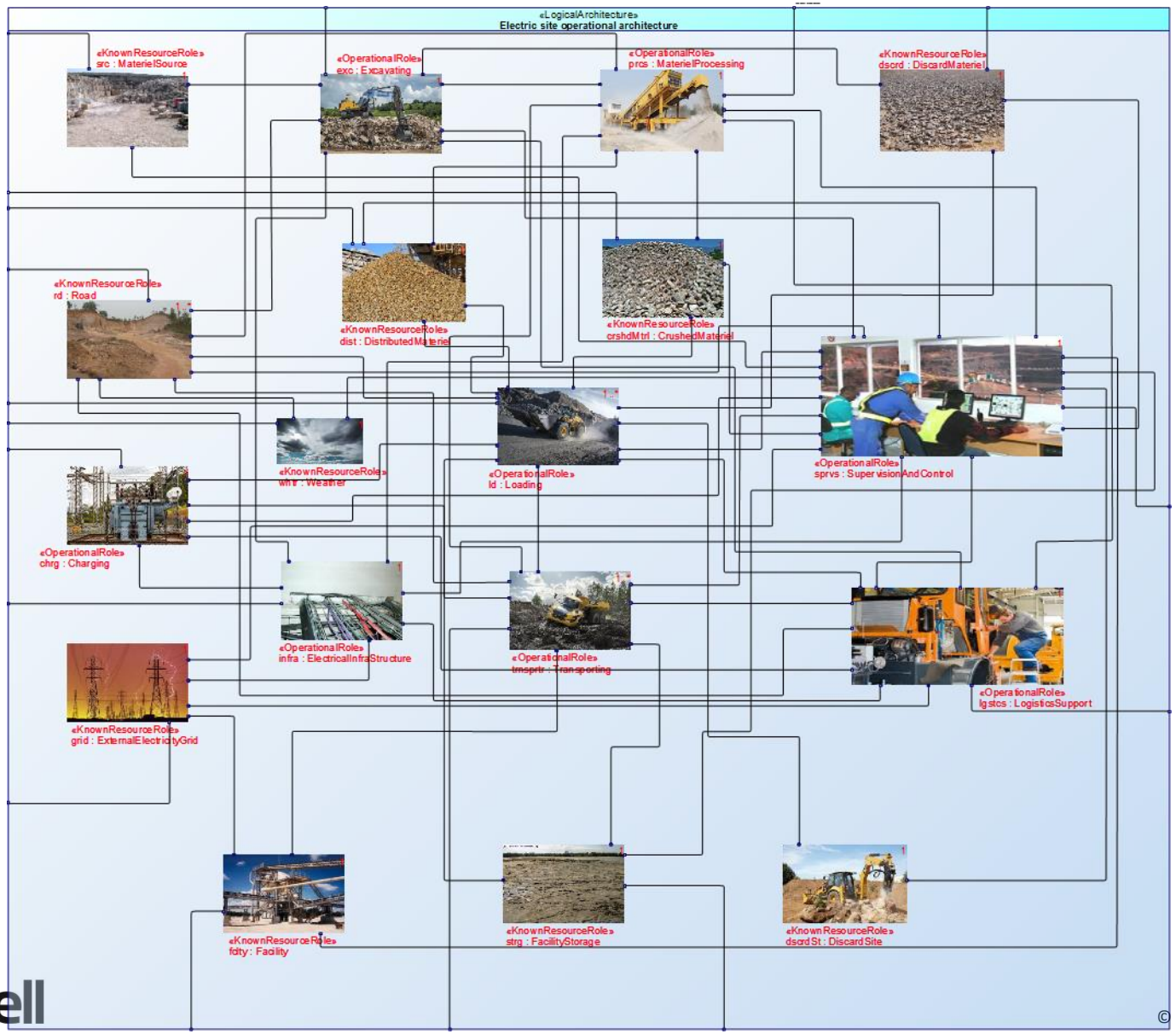
Operational performers and known resources for the logical model



Tying capabilities and performers



Resulting in a logical model



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Once again, the logical model?

- The elements described in the logical model are essentially pre-requisites, i.e. some are known resources and some are operational performers that have been decided upon from the start.

- They also have a defined purpose and this purpose can be logically explored.

- From a site perspective it therefore makes sense to look in detail as to what logically is required by these entities in the form of interactions with other elements, the information they need to deal with and the actions and behaviours they need to be able to perform.

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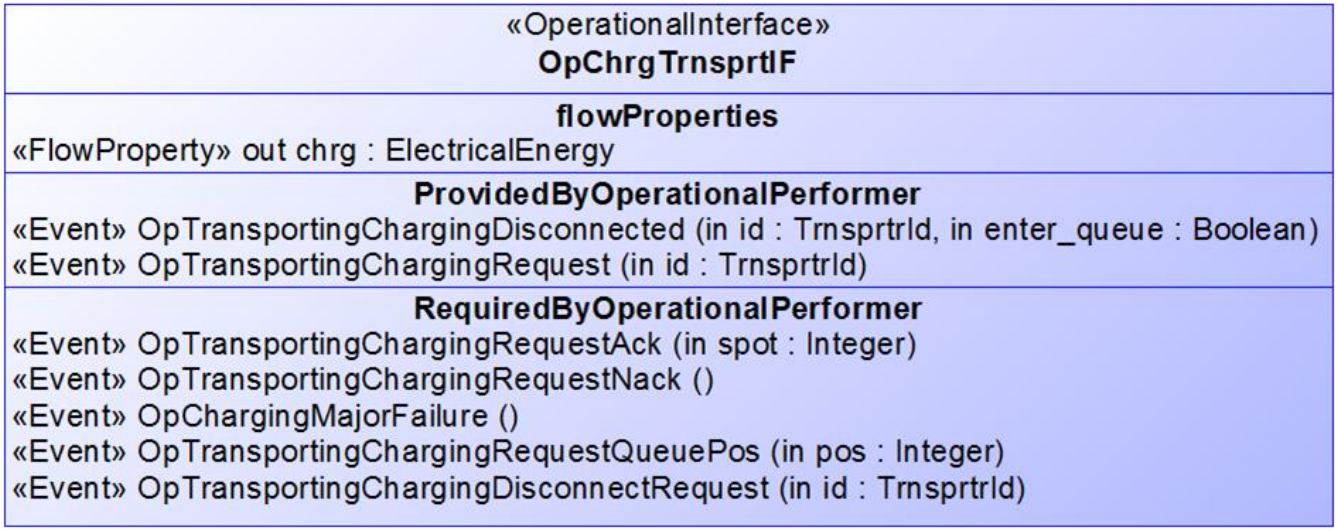
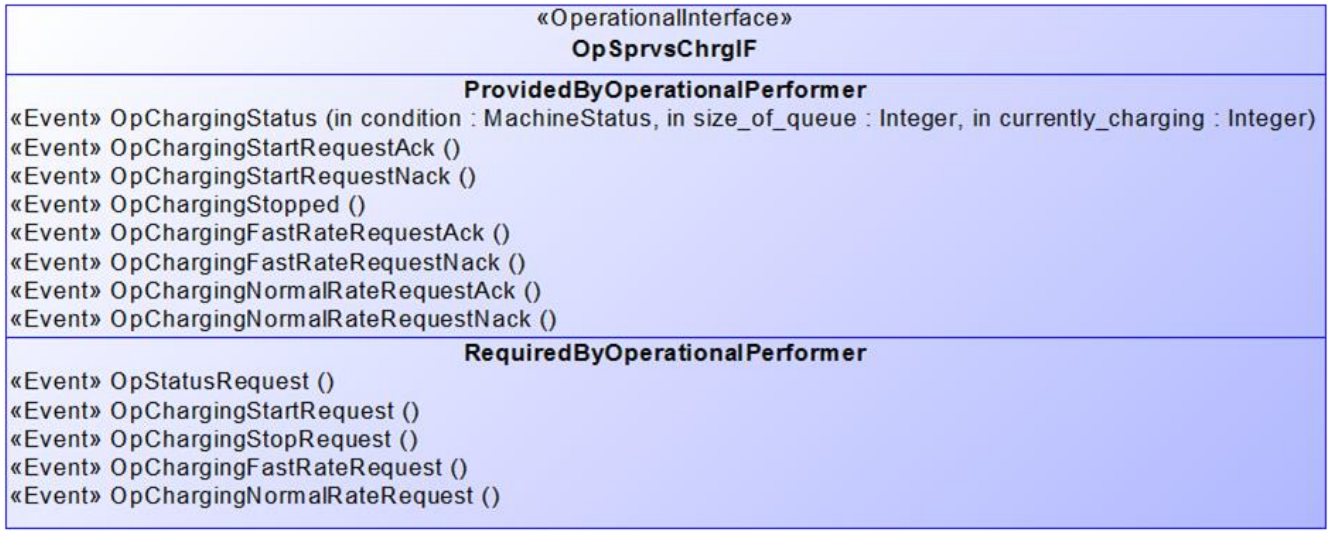
Interface definition example





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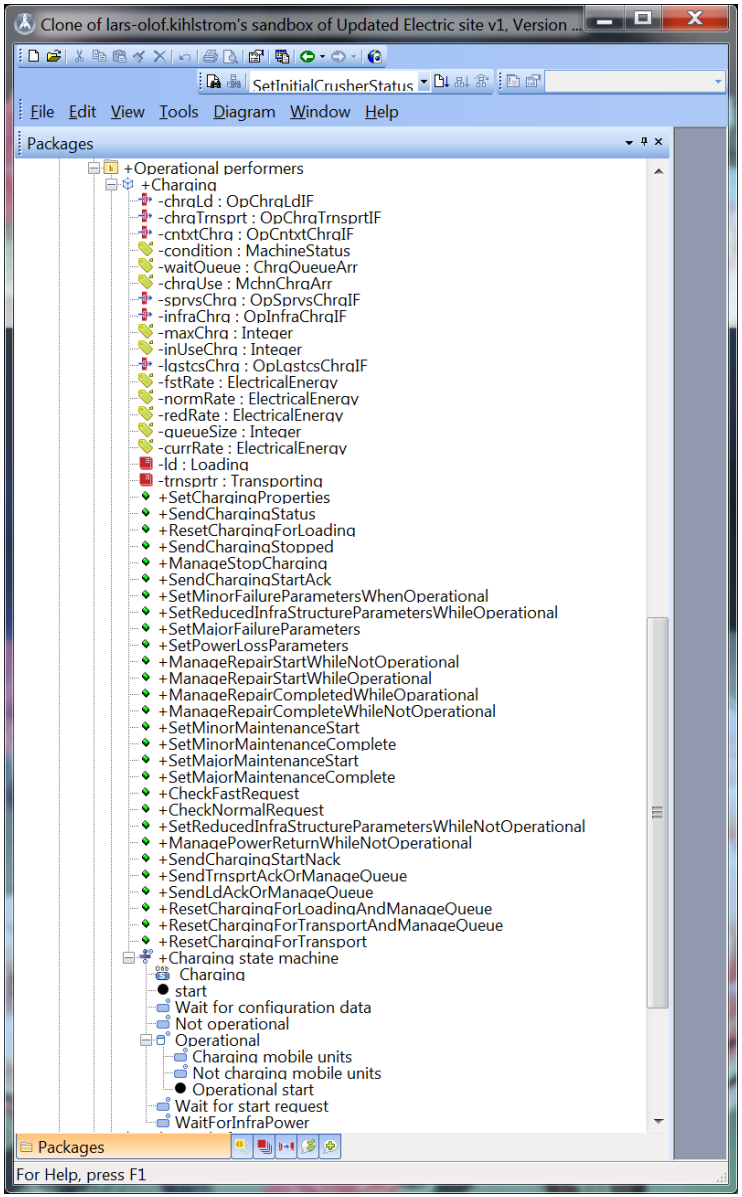
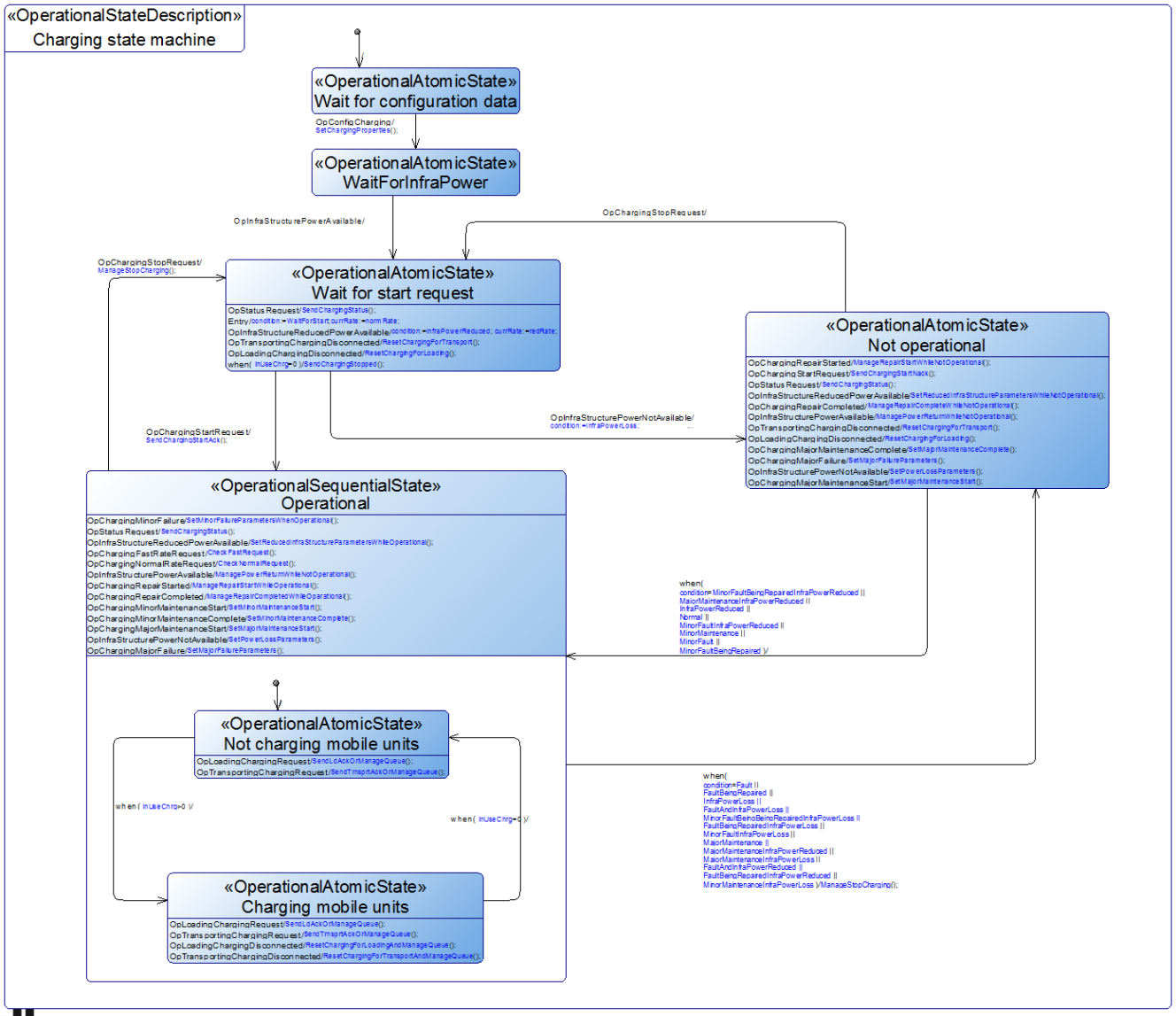
Information example



Charging logical state machine



The state machine

- The state machine defines the states for the element from a site perspective.
- It deals with the whole element from a site management perspective since this is the whole purpose of the model.
- It details the behaviour that the element is required to perform based on the interactions with other elements.
- Since there are areas that need to be explored that cannot occur on their own in the logical model, some of these interactions presume an external influence and are received from the border of the scenario, errors are an example of this.

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The realization model

- The intent of this model is to represent the real machine types rather than their logical representation.
- This means that consideration needs to be given to the parts that a machine is broken down into.
- This has been done here from a site management perspective. If a more complete description of the machine had been intended, this would presumably have been done somewhat differently.
- Let us therefore look at the realization model.

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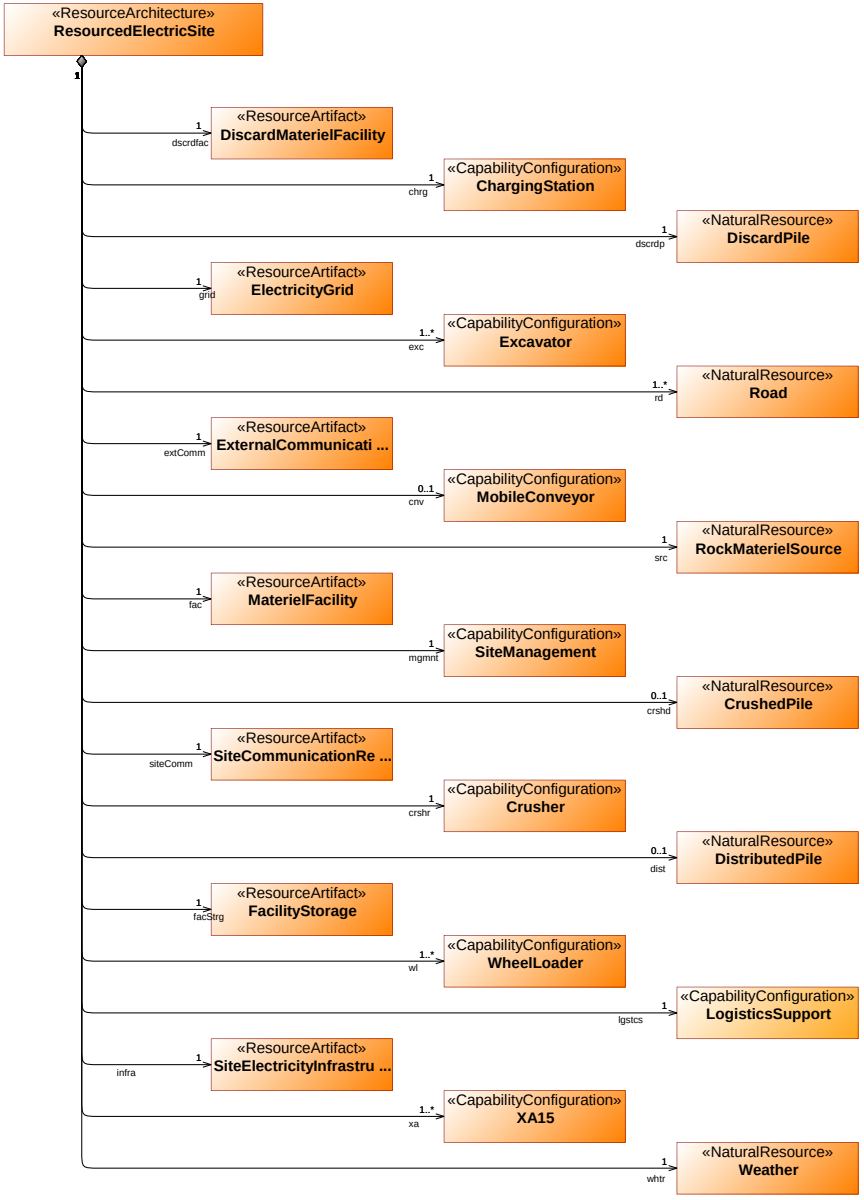
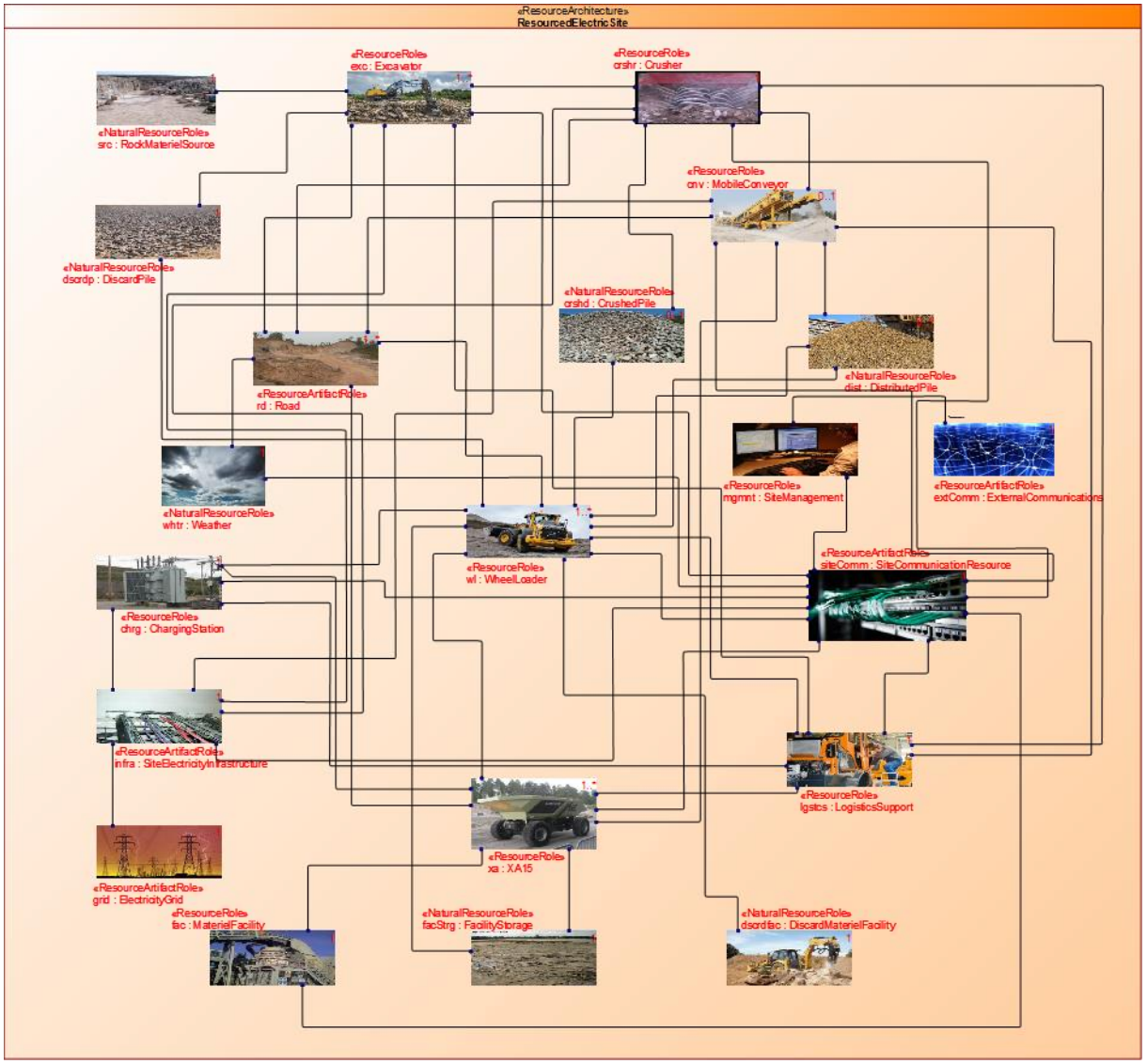
Realization model contents



Realization model



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This looks like the logical model?

- True, but there are differences.
  - Various elements have been defined as natural resources and have no internal structure or behaviour associated with them.
  - The external connections have gone.
  - The elements by and large do not communicate directly but rather through a defined communications resource that only the ones capable of communications make use of.
  - The interfaces between elements are quite different and not really considered since they are either representations of physical flows or totally implementation dependent.
  - Also, the elements of interest have a breakdown structure.

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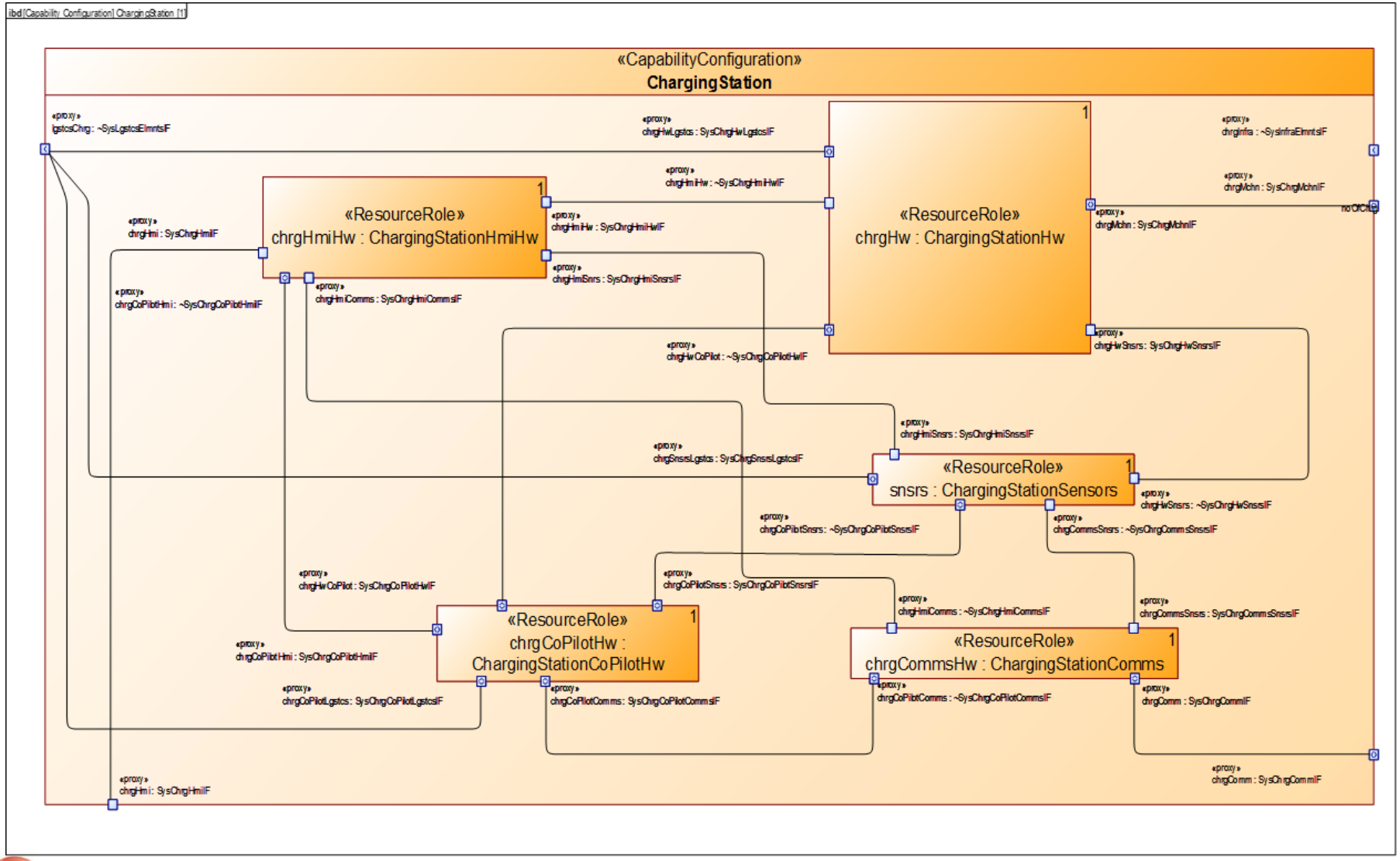
Charging station



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Breakdown structure

- From a site management perspective there was an interest in looking at the following aspects of the parts of the machine.
  - Machine itself
  - Communications
  - Sensors
  - Possible human machine interface

- As stated, had the intent been to define a model of the element from a complete design perspective, this separation would presumably not have been done.

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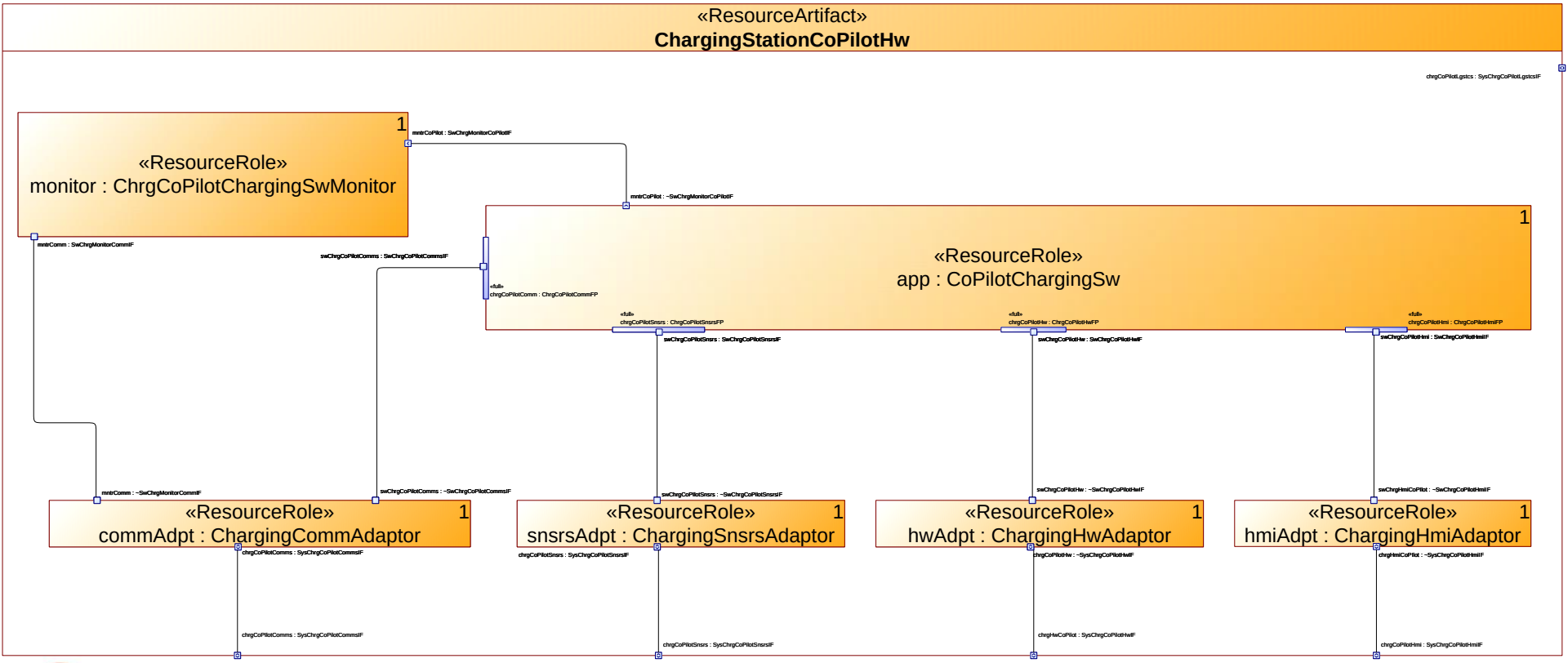
ChargingStationCoPilotHw

- The breakdown shows a monitor as well as adaptors for the interfaces to other parts of the machine and the actual application software.



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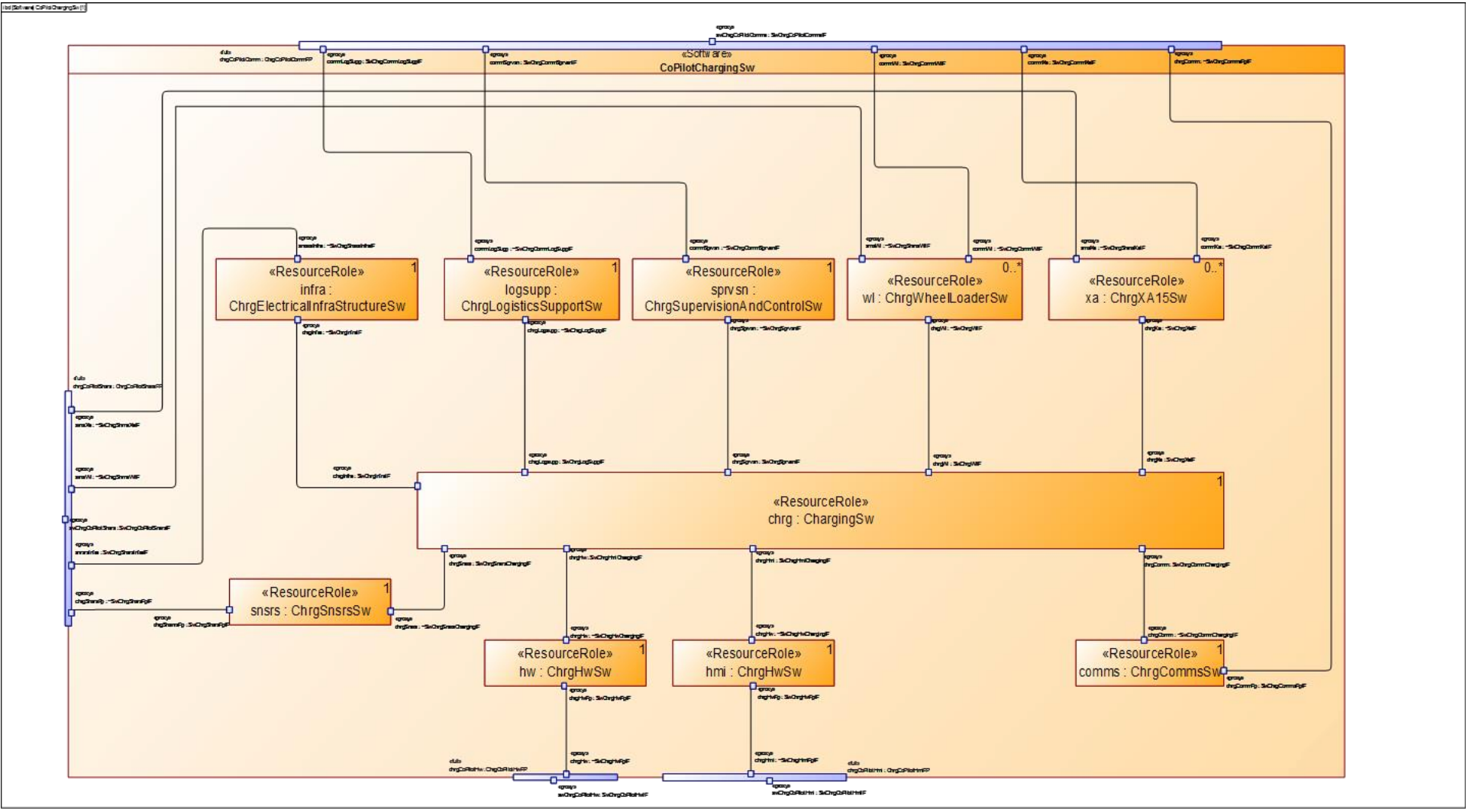
CoPilotChargingSw



Application software architecture

- A quick look at the logical model part dealing with charging will reveal that the elements of this architecture corresponds to the elements that the logical model is defined as connected to, in this case, to the charging station.

- In addition, special elements devoted to each of the internal parts of the charging station has also been defined.

- This has been done to ensure that the interactions with each can be dealt with separately.

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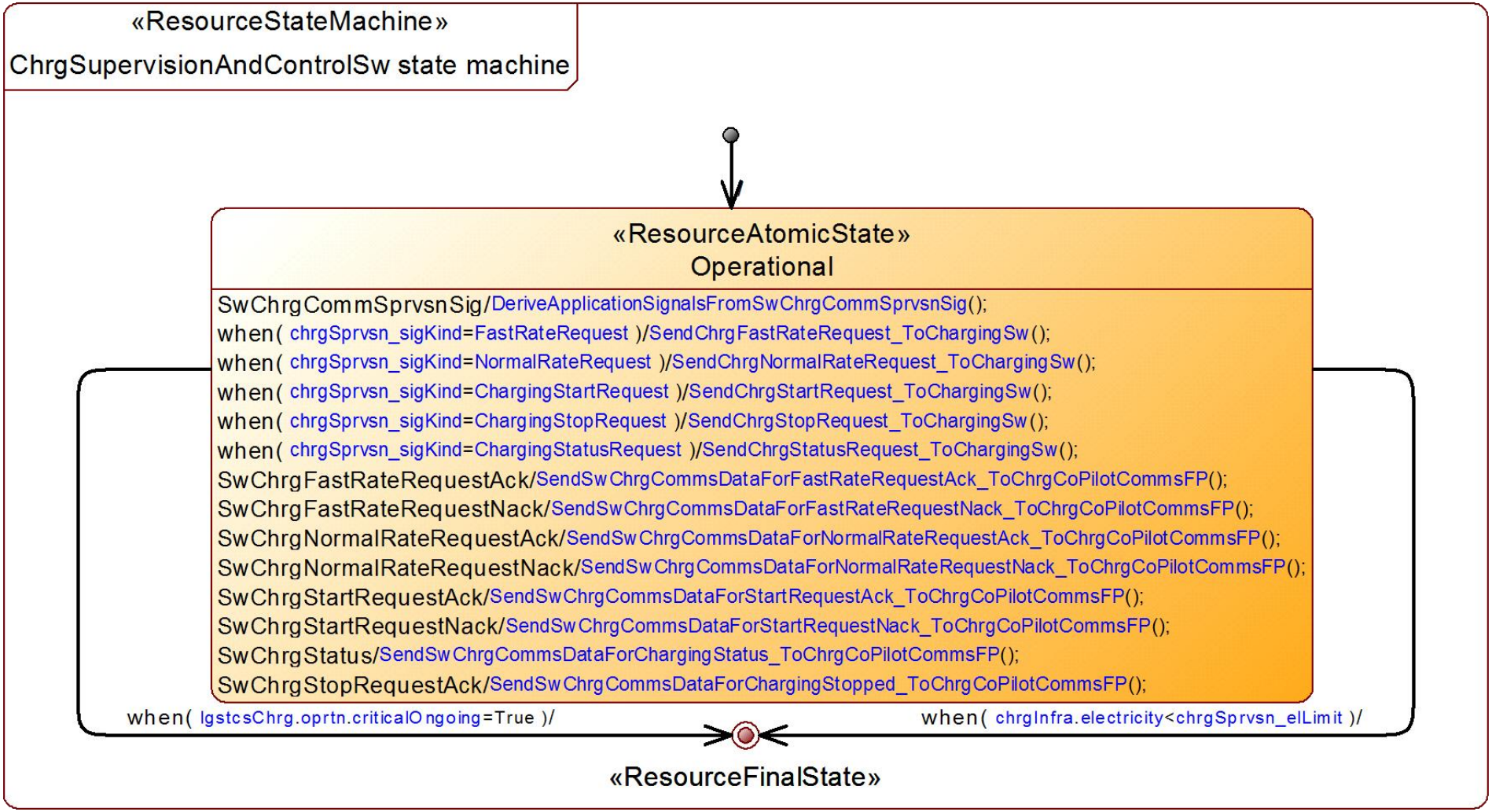
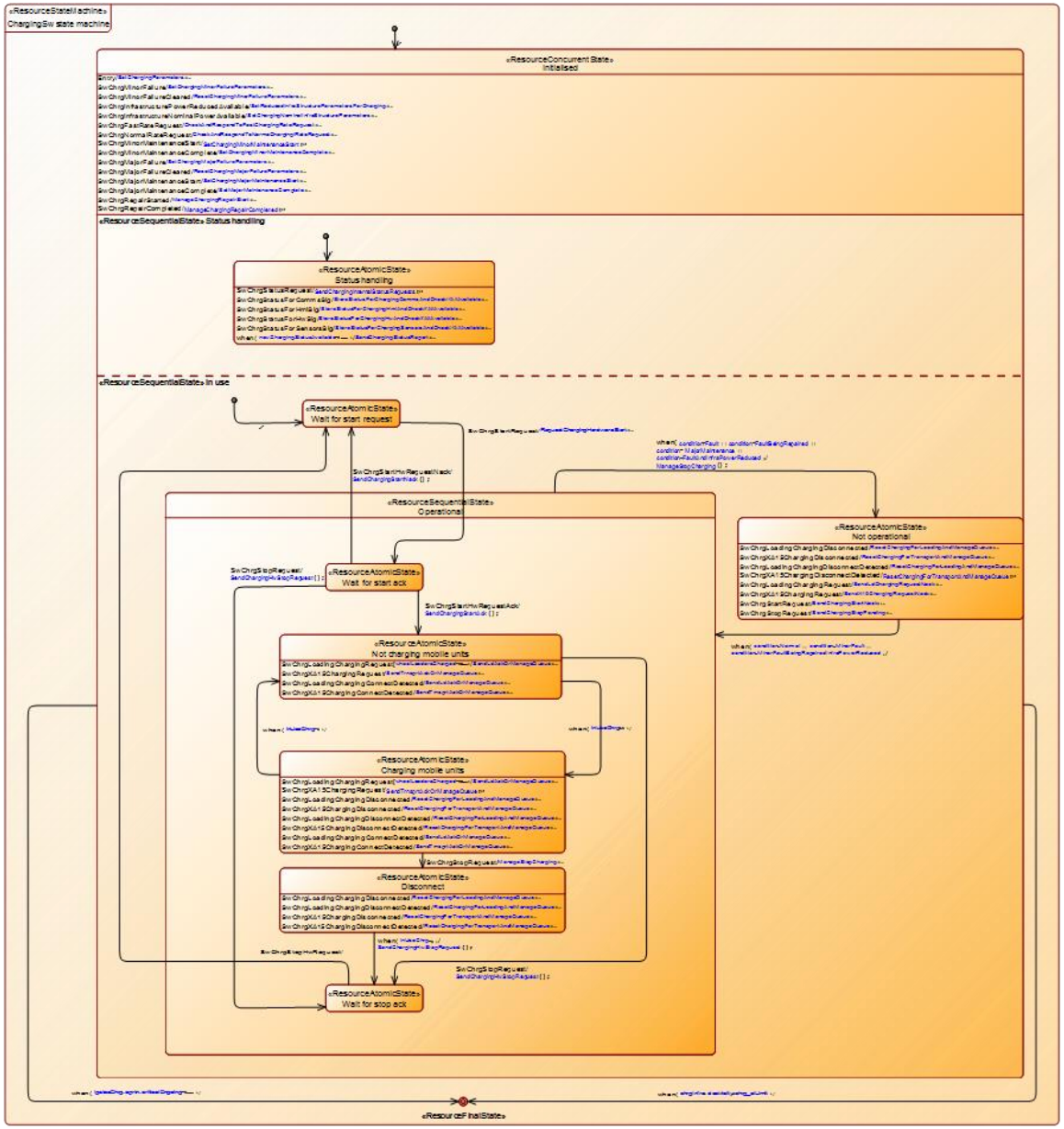
ChrgSupervisionAndControlSw



ChargingSw



The ChargingSw state machine

- The behaviour of the actual application of the ChargingSw is defined in the state machine.
- This definition reuses a great deal of the handling that was already defined as part of the logical model and is therefore relatively quick to produce.
- The site management realization representation shows this to an even greater degree and the last slides of this presentation deals with the site management part.

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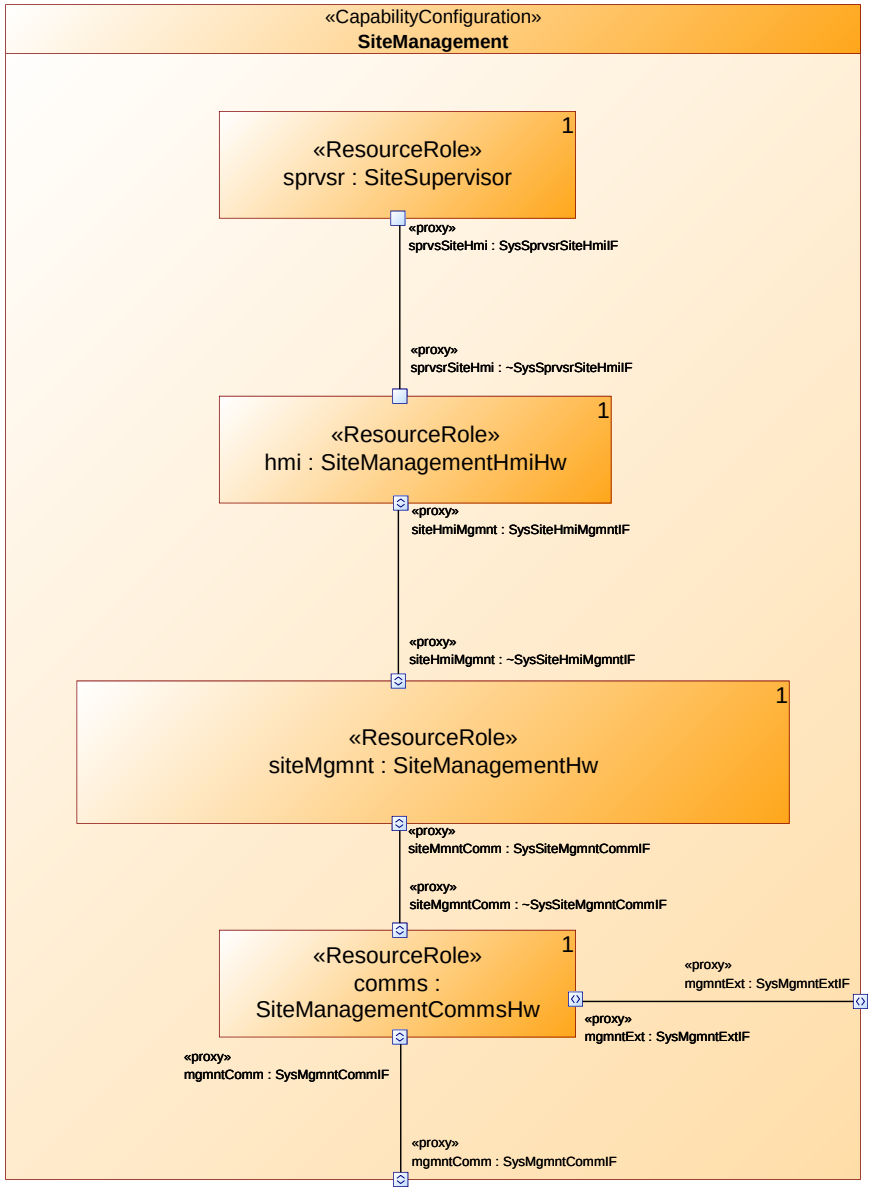
Site management

- The site management part is only concerned with interfaces towards the human machine interface and communications.
- There are no local sensors or a ”machine” that needs to be considered.



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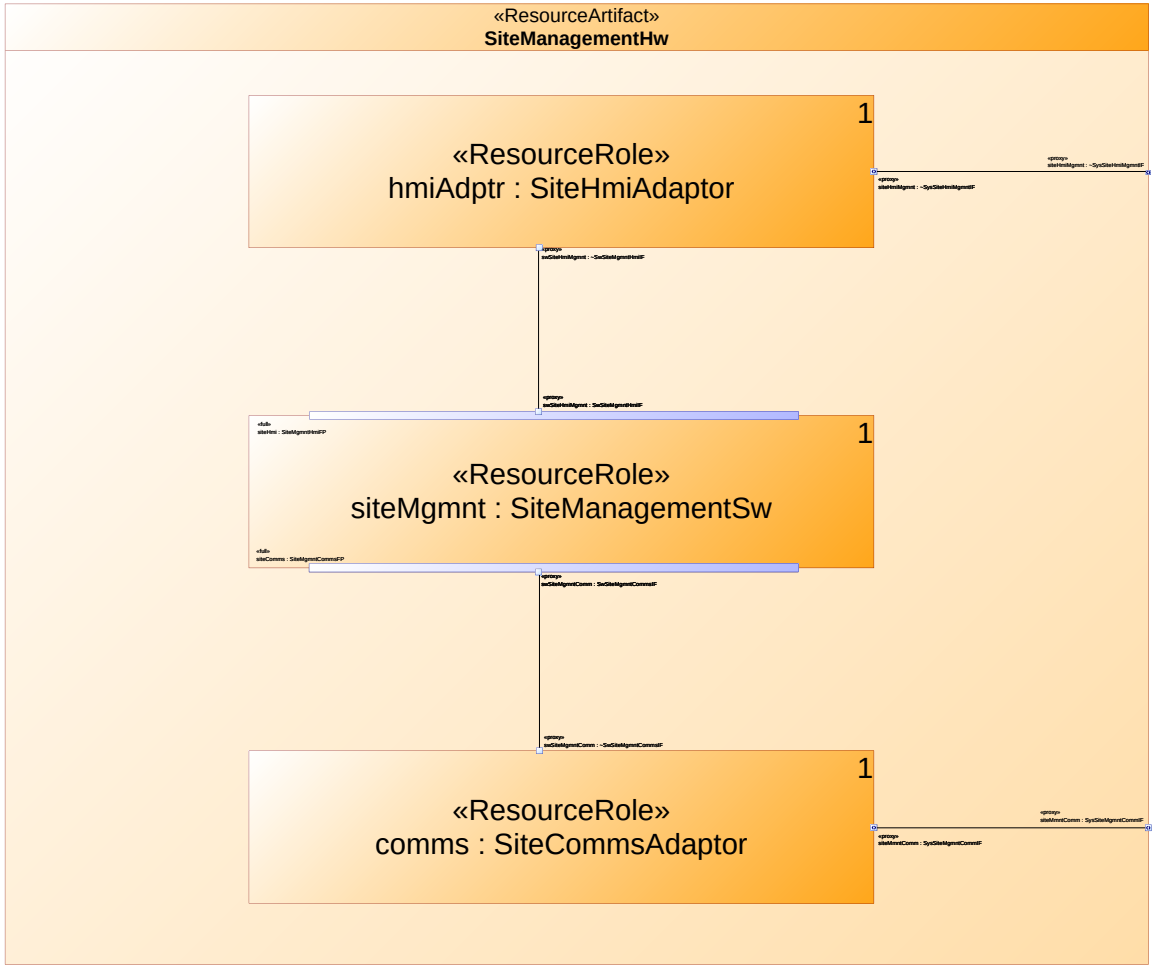
Site Management hardware model

- Adaptors are made use of here as well.
- The only item left to consider is the architecture of the Site Management software itself.



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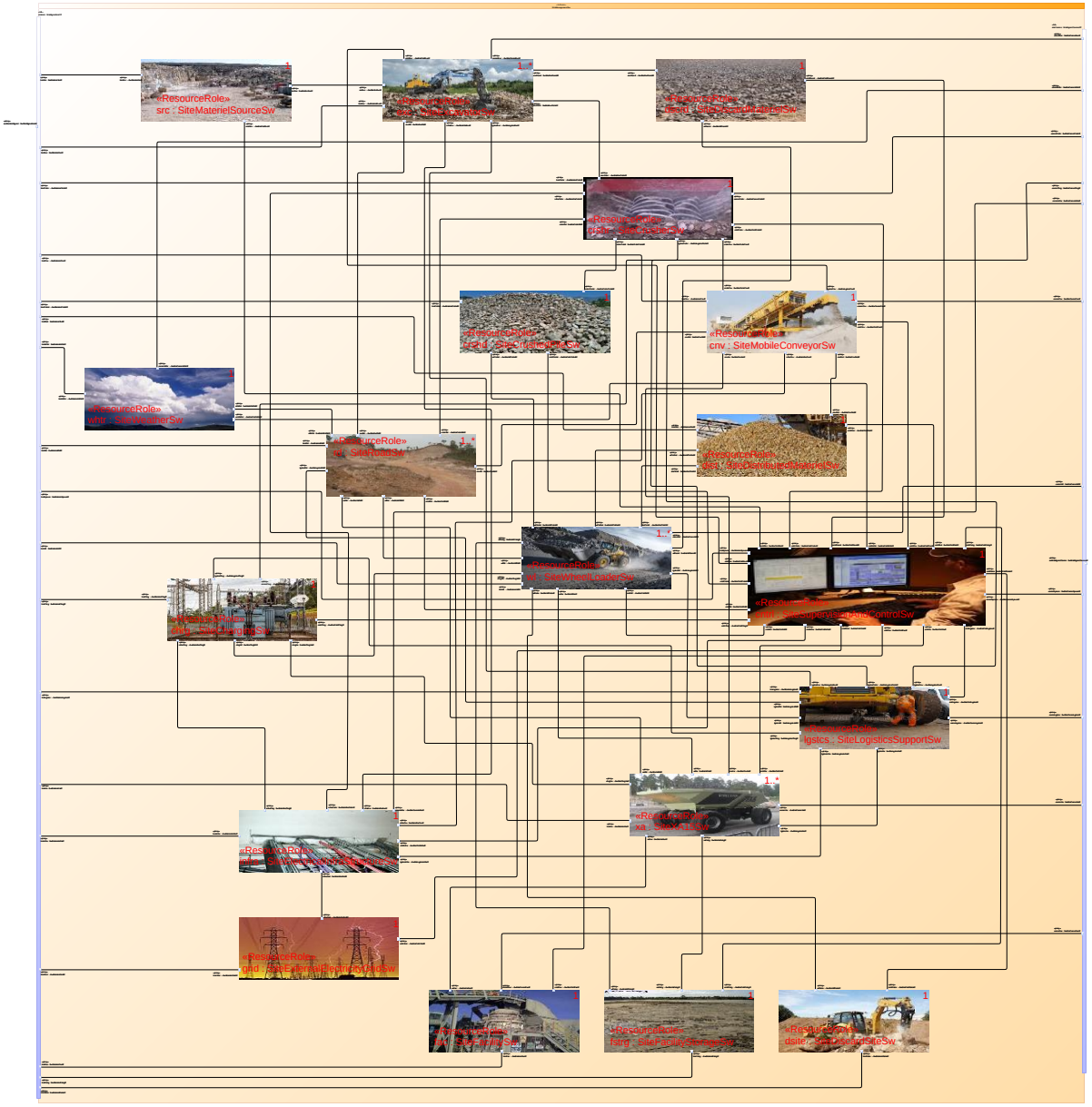
SiteManagementSw model



Conclusions

- There is an uncanny resemblance between the software architecture structure and the logical model.
- This goes far beyond the superficial resemblance and is essentially true throughout all software architectures for the applications dealing with the total site.
- Therefore, UAF and enterprise architecture can be used as a shortcut in systems development and seamlessly transfer from system of system considerations to relatively detailed design.
- This however necessitates a specific approach to how to model that hopefully this presention has been able to present in such a manner that it will be food for thought.

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Questions

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