Using UPDM for non-military applications



OMG Reston 15-03-23



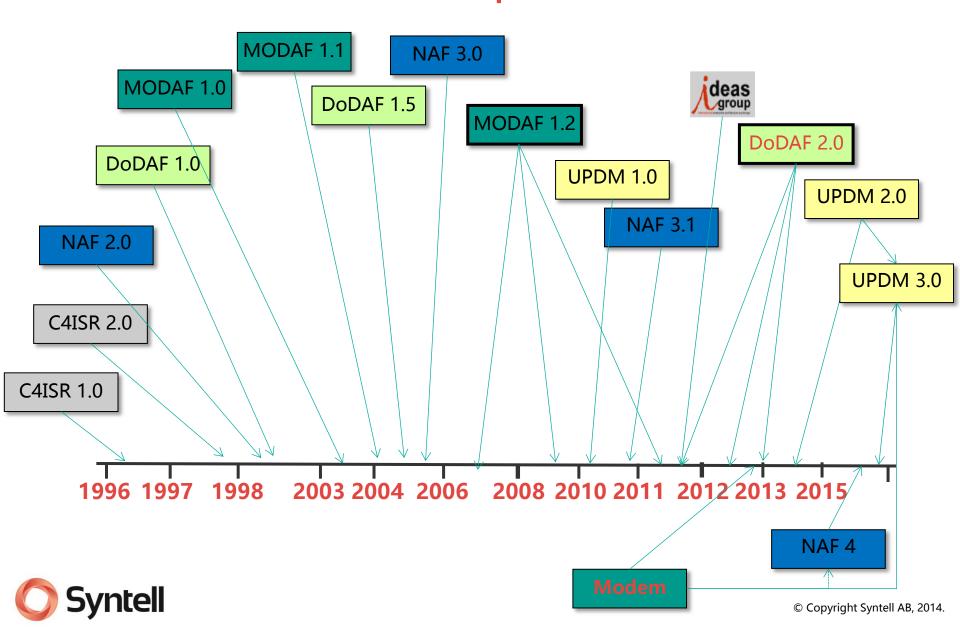


Presenter information

- Lars-Olof Kihlström is a principal consultant at Syntell AB, a Swedish engineering management consultancy firm.
- He has worked with model based development since the middle of the 1980:ies and enterprise architecture models since 2000.
- Member of the UPDM group since its inception.
- Member of the NAF revision syndicate tasked with the creation of the NATO Architecture Framework version 3.0 on behalf of the Swedish Armed Forces and was tasked with the upgrade from version 3.0 to 3.1.
- Member of the IDEAS group on behalf of the Swedish Armed Forces.
- Project Manager for the re-engineering effort that produced an IDEAS foundation based version of the UK Ministry Of Defence Architecture Framework MODAF (1.2.004) named MODEM.
 - MODEM is currently used together with the IDEAS based DoDAF metamodel as a part of the Domain Meta Model (DMM) for UPDM 3.0.
 - MODEM is being prepared by the UK as a proposal for NAF version 4.



Framework developments



EA frameworks provides

- Prior to MODAF 1.0, DoDAF as well as NAF (version 2.0) were really about filling out defined forms based on written instructions as to what to include in each form.
- MODAF 1.0 was a first attempt at providing a metamodel (called M3) where the elements in each form (views) were defined and where it was shown how they related to one another.
- Even at this point however, it was obvious that there were very few, if any, military connotations within the framework.



What does the meta-model provide?

- It could be said that the meta-model provides a grammar for speaking architecture in accordance with a framework.
- It defines the type of words that may be used and how they can be combined (related) to form architectural sentences, i.e. the syntax is well defined.
- Using a defined syntax can the be used to achieve syntactic interoperability.



What in addition to this is provided by an IDEAS based DMM?

Consider the following text:

'Twas brillig, and the slithy toves Did gyre and gimble in the wabe; All mimsy were the borogoves, And the mome raths outgrabe.

 A portion of Jabberwocky: A poem by Lewis Carroll published as part of: Through the looking-glass, and what Alice found there (1872)



What does this have to do with anything?

- While the grammar use is OK, i.e. adjectives, nouns and verbs can be somewhat identified and they seem to relate to one another as they should, the meaning is less than clear.
- The implication of this is that even if the grammar is known the language spoken based on it must still be understood and syntactic interoperability on its own cannot provide this.



What does this have to do with anything?

- The IDEAS foundation was created to achieve semantic interoperability, not just correct grammar but to achieve complete understanding of the language as well.
- The feasibility of this was demonstrated experimentally in 2008 in a US/UK experiment.
- MODEM and DM2 are based on the IDEAS foundation.
- Since UPDM 3 makes use of MODEM and DM2 semantic interoperability will be one step closer to reality.

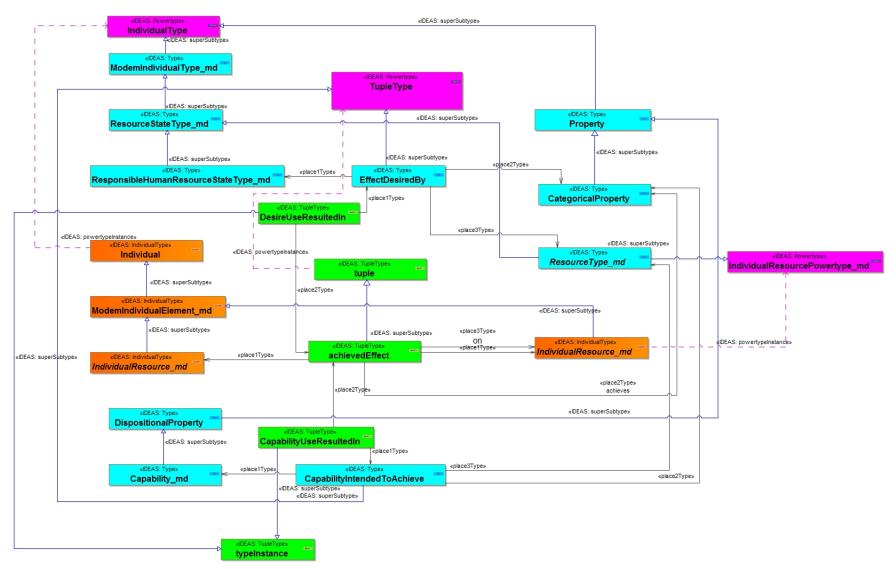


How is the ontology being used in UPDM3?

- UPDM 3 has to cope with a variety of added requirements such as DnDAF security views, human views (optionally) etc.
- All of these requirements have been "washed" through MODEM/DM2 before being implemented in UPDM3.

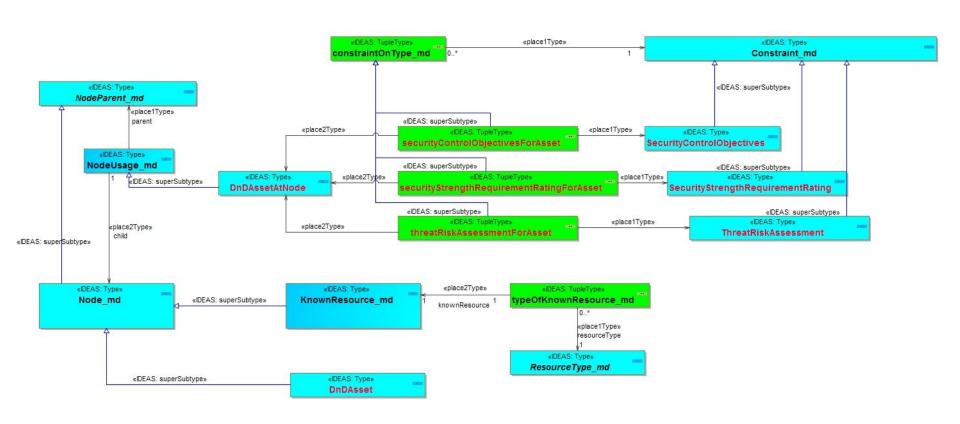


Effects definition as a MODEM wash





DnDAF SecV-1a MODEM wash





It is applicable outside of Defence!

- This was always the case since neither NAF, MODAF or UPDM contained any real military items.
- The SESAR (Single European Sky ATM Research) project uses NAF (NATO Architecture Framework) as an architecture framework.
- The overall goals of SESAR for 2020 are the following:
 - Triple the airspace capacity.
 - Maintain or increase traffic security irrespective of the increase in traffic.
 - Reduce the environmental impact by 10% per flight.
 - Reduce the costs of air traffic control by 50%.



Equipment manufacturer <u>business</u> challenges

- More and more manufacturing businesses are looking at offering services based on the use of their products rather than selling just the products to an end-customer.
- Such services can be of different nature:
 - Provide information services to be used by the customer when dealing with the kind of operations where the equipment they manufacture are being used.
 - Provide information to be used for company internal purposes and deal with customer support after sales, efficient maintenance or upgrade handling.
 - Actually performing the work the end customer would have used the equipment for.
- Services and their use within an operational context can be easily described within UPDM since it allows services to be specified, placed in a usage context and describing different kinds of implementation possibilities.



Manufacturer <u>development</u> challenge

- Many manufacturers feel that they have reached the end of a document driven development process and are starting to consider the use of a model-based system engineering approach.
 - Using SysML to enable this paradigm shift is a logical decision.
- For a competitive edge it is also becoming increasingly important to fully understand the use and operational context of the equipment.
- UPDM (especially UPDM 3 that is entirely based on SysML) provides the tools needed to explore scenarios and to draw conclusions related to usage.

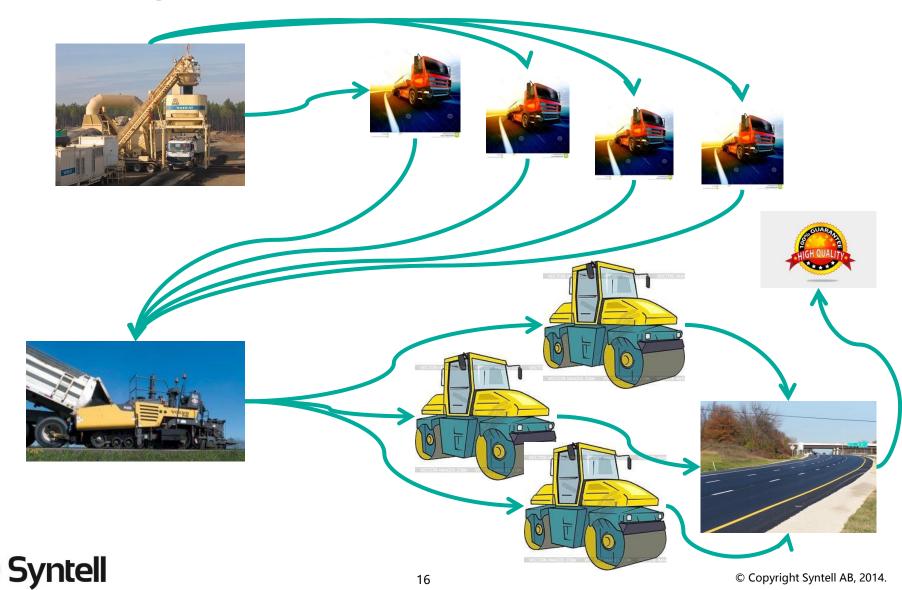


Meeting the Challenges

- By making use of a scenario that is modelled using SysML it becomes possible to seamlessly transition from a model describing an enterprise scenario to an MBSE project to actually develop systems meeting the functionality defined in the scenario.
- The use of a model-based systems engineering approach also makes it possible to analyse the interactions between different functions that previously were mostly described by textual requirements in isolation (silos) and either manage the adverse functional interactions in advance or leverage them to provide additional functionality.



Let us look at a scenario example: Paving a road



The above is a complicated problem

. . .

- The plant has a specific production as well as storage capacity.
- The trucks have a specific maximum load.
- The plant and the site are usually not co-located implying that trucks need to transport asphalt to the site.
- The paver needs to be operating continuously and should not run out of asphalt (at least not until the end of the shift).

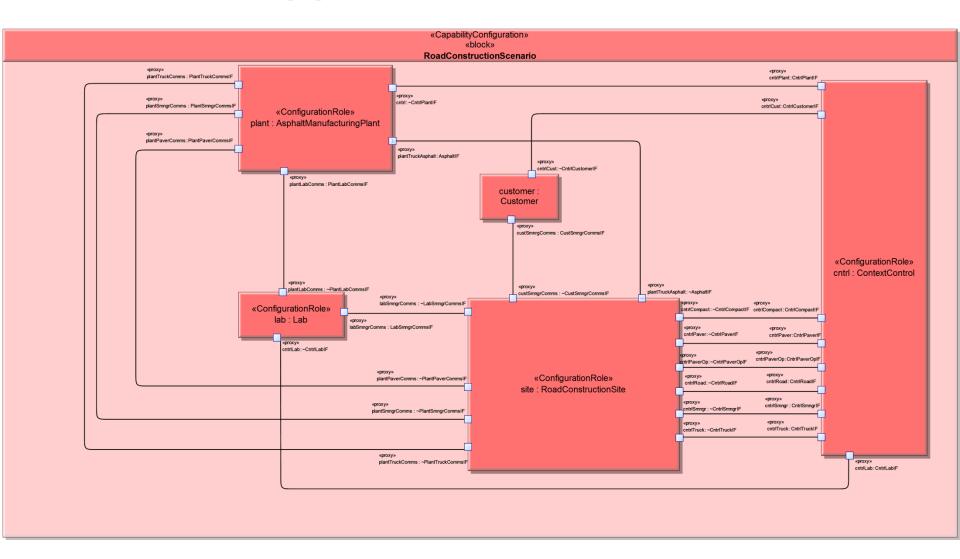


... the above is a complicated problem

- Several different layers of asphalt with different depth needs to be dealt with.
- The compactors have a limited time period to finish compacting the paved asphalt.
- The compactor is usually not as wide as the paver and needs to apply a given compacting pattern within the allowed time period.
- The quality of the road depends on managing the above in real-time.

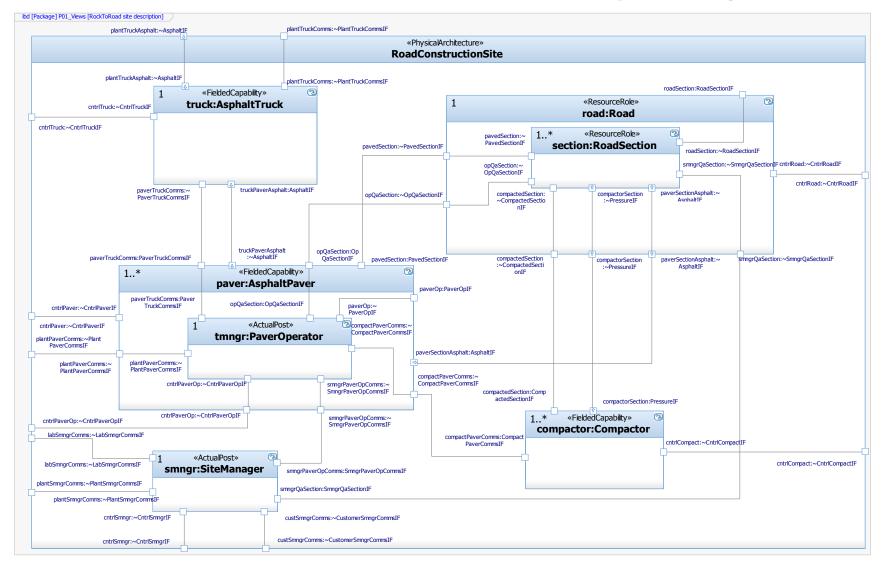


Upper level scenario





Lower level scenario: Rhapsody





What can be accomplished by this?

- The knowledge of how to use the equipment for a given purpose can be documented as an interactive simulation.
- Various possibilities to enhance functionality in order to better meet customer needs may be tested out within the scenario.
- Services dealing with information handling may be defined and tested within the boundaries of the scenario.



What can be accomplished by this?

- Since the simulation is based on the use of SysML, it is possible to trace or even transfer some of the functionality straight into an equipment MBSE development.
- As the equipment MBSE development progresses the scenario may be adapted to the development performed and used to aid the development effort.
- All in all, traceability between end-user operations and product development cab be established that will facilitate the goal of systems engineering to provide the stakeholders with the best possible solution to their needs. As an equipment manufacturer, you will be able to find new innovative offerings and validate that your equipment actually provide value to your customers.



If this is to be possible, however....

- A functional model of the equipment needs to exist as part of the MBSE development and a strict model structure has to be adhered to.
- It is imperative that traces from the scenario are made to these equipment functional model elements and then traced further into the actual realization model.

Because:

- Attempting to move straight into the realization model runs the risk of causing the individual trees to hide the structure of the forest.
- A functional model is also the only way to quickly ascertain at an early stage how different functions interact with one another.



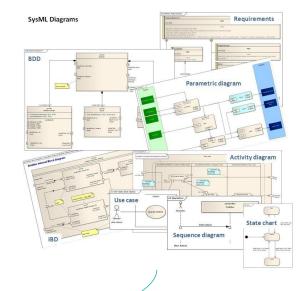
The parts that make up the whole!!!

UPDM based scenarios



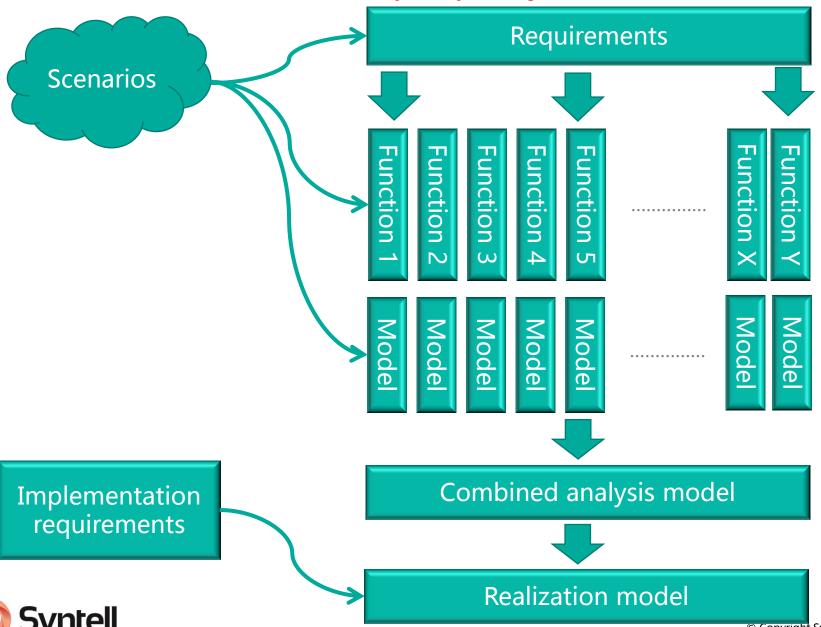
MBSE model

- Model overview
- Requirements for each function
- Use cases for each function
- Model for each function
- Combined functional model
- Realization model with allocated functional properties
- Common data





and deals with this properly.....



Questions?







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