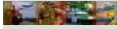




EDA LAVOSAR II – Industry Workshop

WP6 – Architecture Contribution to EDA Repository



Motivation – Architecture Framework

■ **Given:**

- Solutions for different concerns regarding development of LAVOSAR based vehicles
 - Terms and definitions
 - Many heterogeneous and complex mission subsystems views
 - Huge list of standards and technologies

■ **Need:**

- Common and interpretation free terminology
- Unified processes to deal with the architecture

■ **Solution: Architecture Framework**

- An architecture framework establishes a common practice for creating, interpreting, analyzing and using architecture descriptions within a particular domain of application or stakeholder community (ISO/IEC/IEEE 42010)
- LAVOSAR II uses the NAF (NATO Architecture Framework)

■ **Tool: Sparx Enterprise Architect**

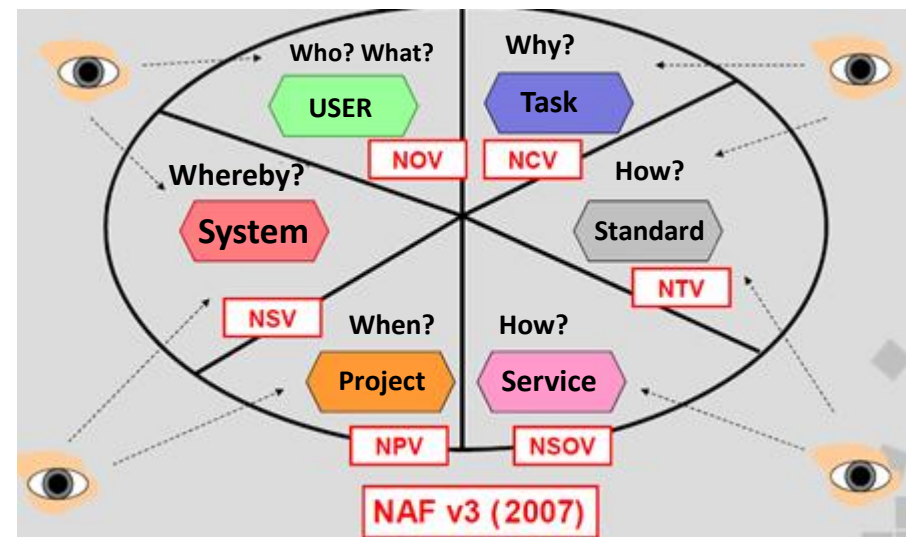
- Modelling tool based on UML
- Plug-In for NAF
- Free reader available

NAF – NATO Architecture Framework

- Formal description how to model from different points of view

- **NAF Views – focus is on one aspect of a system and to answer questions:**

- NAV – NATO All View
- NCV – NATO Capability View
- NOV – NATO Operational View
- NSV – NATO System View
- NSOV – NATO Service Oriented View
- NPV – NATO Program View
- NTV – NATO Technical View

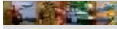


- **All views and their subviews are defined by the NAF Meta Model in UML and within the NAF Specification**



LAVOSAR II - Architecture Content

- **Based on LAVOSAR I results**
- **Formalized normative framework**
- **Formalized use cases**
- **Taxonomies for stakeholders and systems**
- **Reference Architecture**
- **Examples build upon the Reference Architecture**
- **Will be extended by additional LAVOSAR I system views and by LAVOSAR II findings**



LAVOSAR II - Architecture Content

■ Normative framework and Use cases

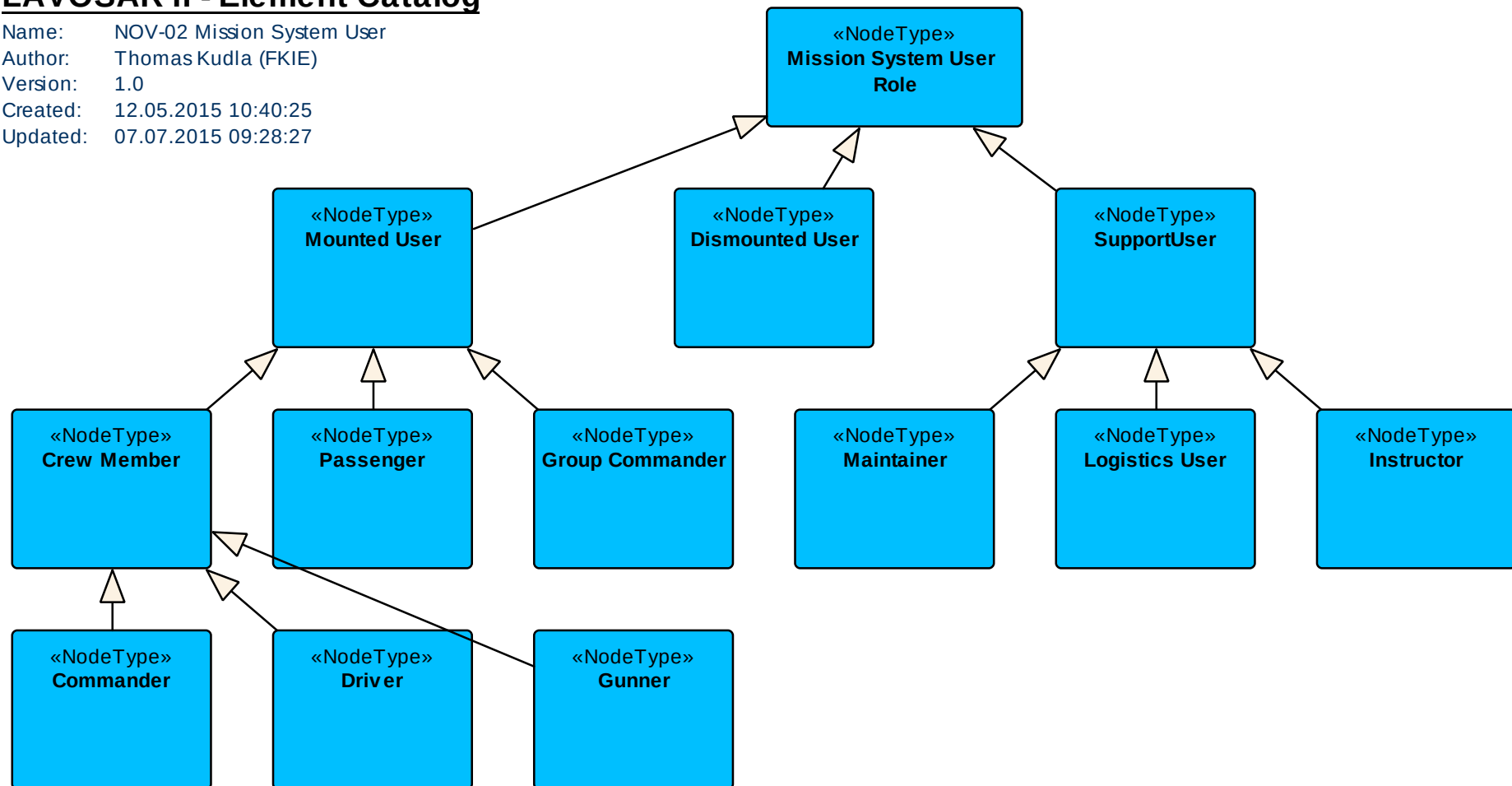
- Taxonomy for Mission System Users
- Use Cases
 - NAF views to show who is involved in an **activity**
 - NAF views to show which use case is carried out by a **user**
- Further Taxonomies for
 - Logical Data Model
 - Software
 - Mission System Subsystems
 - System Components
 - Effectors
 - Mounts
 - Sensors
 - User Devices
 - Etc.



LAVOSAR II - Architecture Content - Mission System User

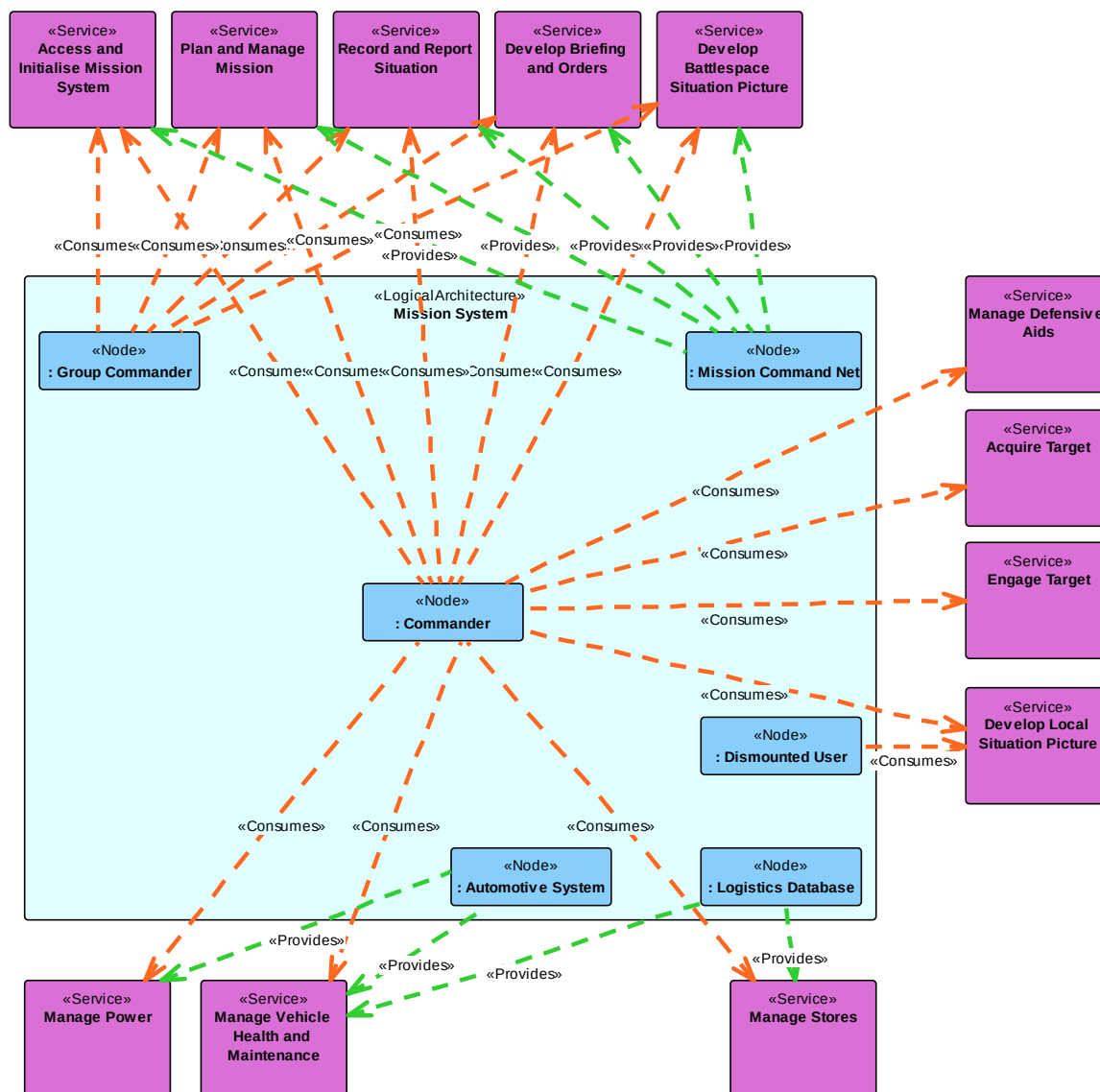
LAVOSAR II - Element Catalog

Name: NOV-02 Mission System User
Author: Thomas Kudla (FKIE)
Version: 1.0
Created: 12.05.2015 10:40:25
Updated: 07.07.2015 09:28:27



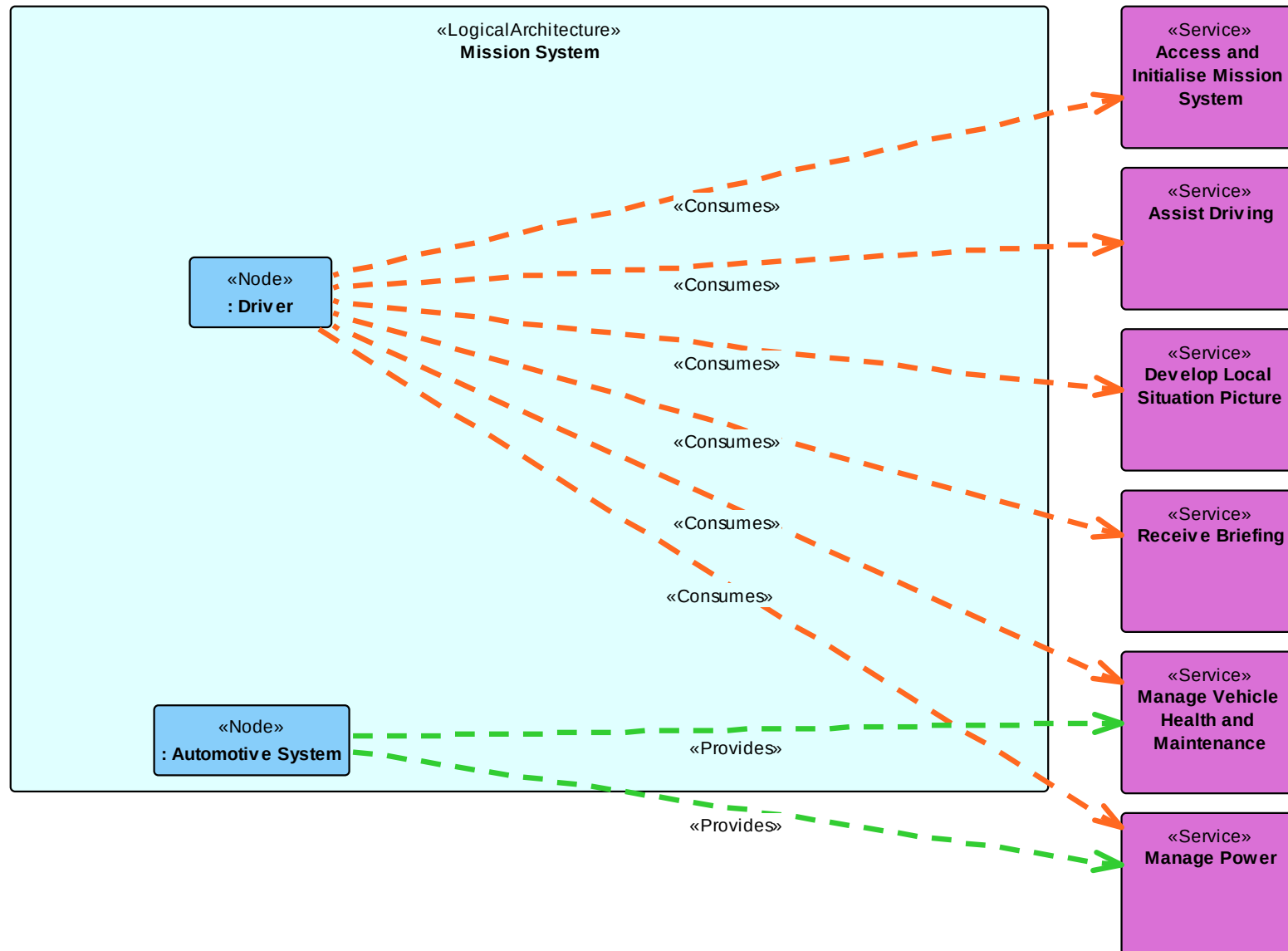


LAVOSAR II - Architecture Content - Use Cases



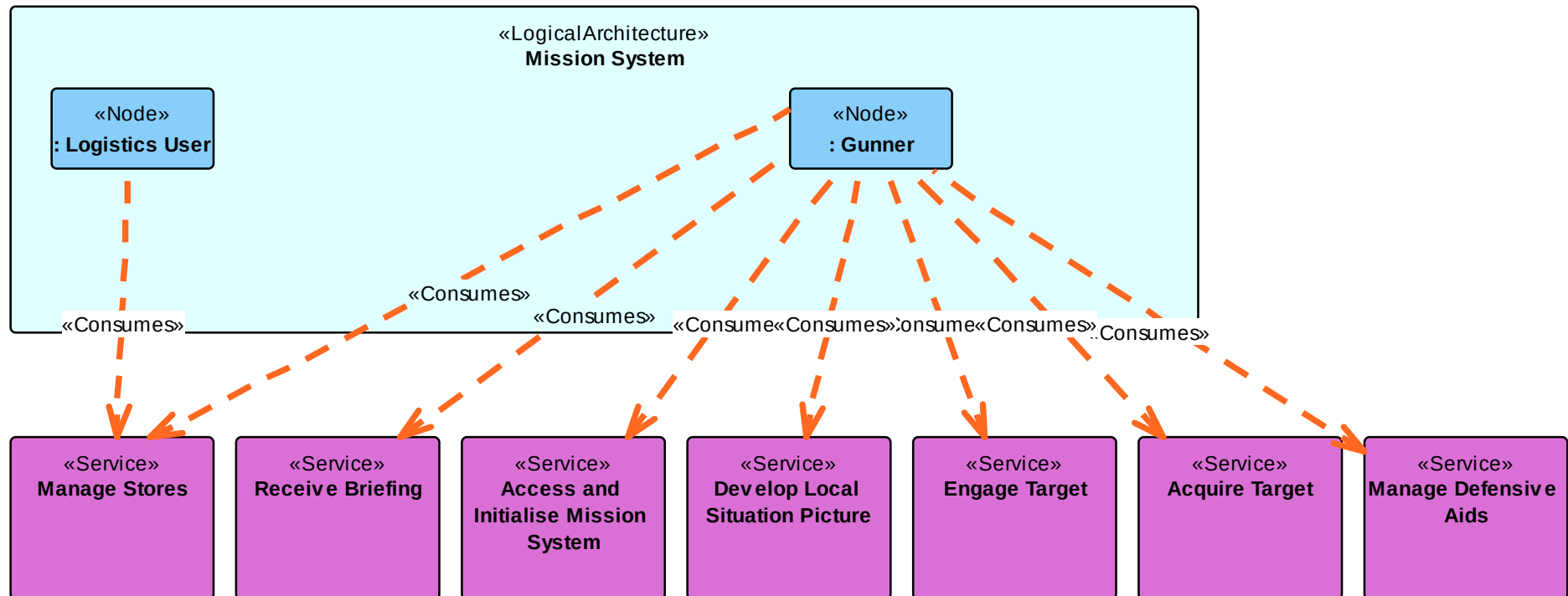
Leave service providers open to allow vendor specific solution?

LAVOSAR II - Architecture Content - Use Cases





LAVOSAR II - Architecture Content - Use Cases



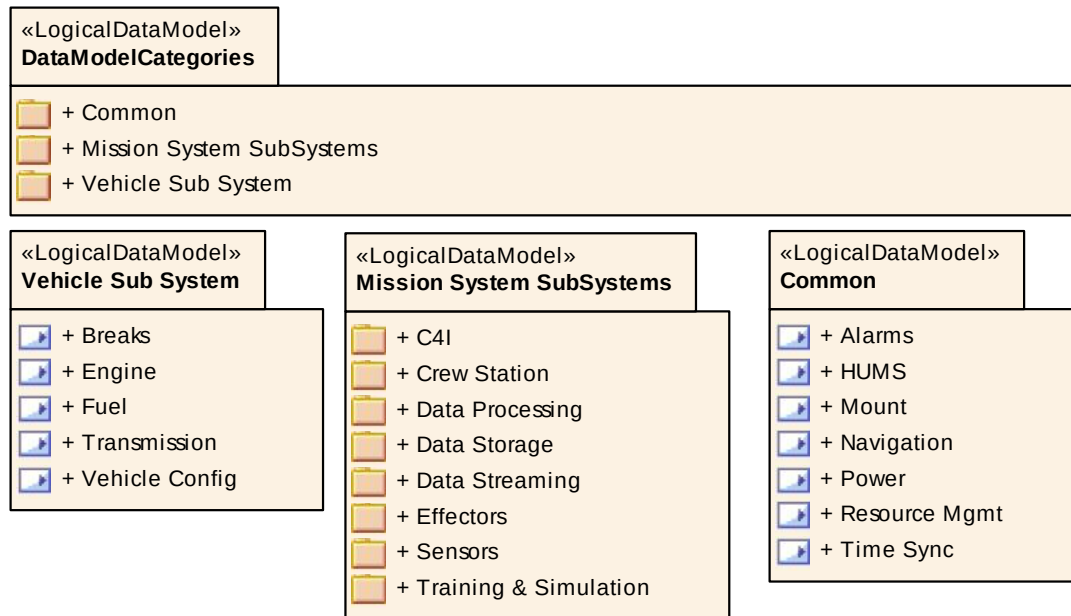


LAVOSAR II - Architecture Content - Logical Data Model



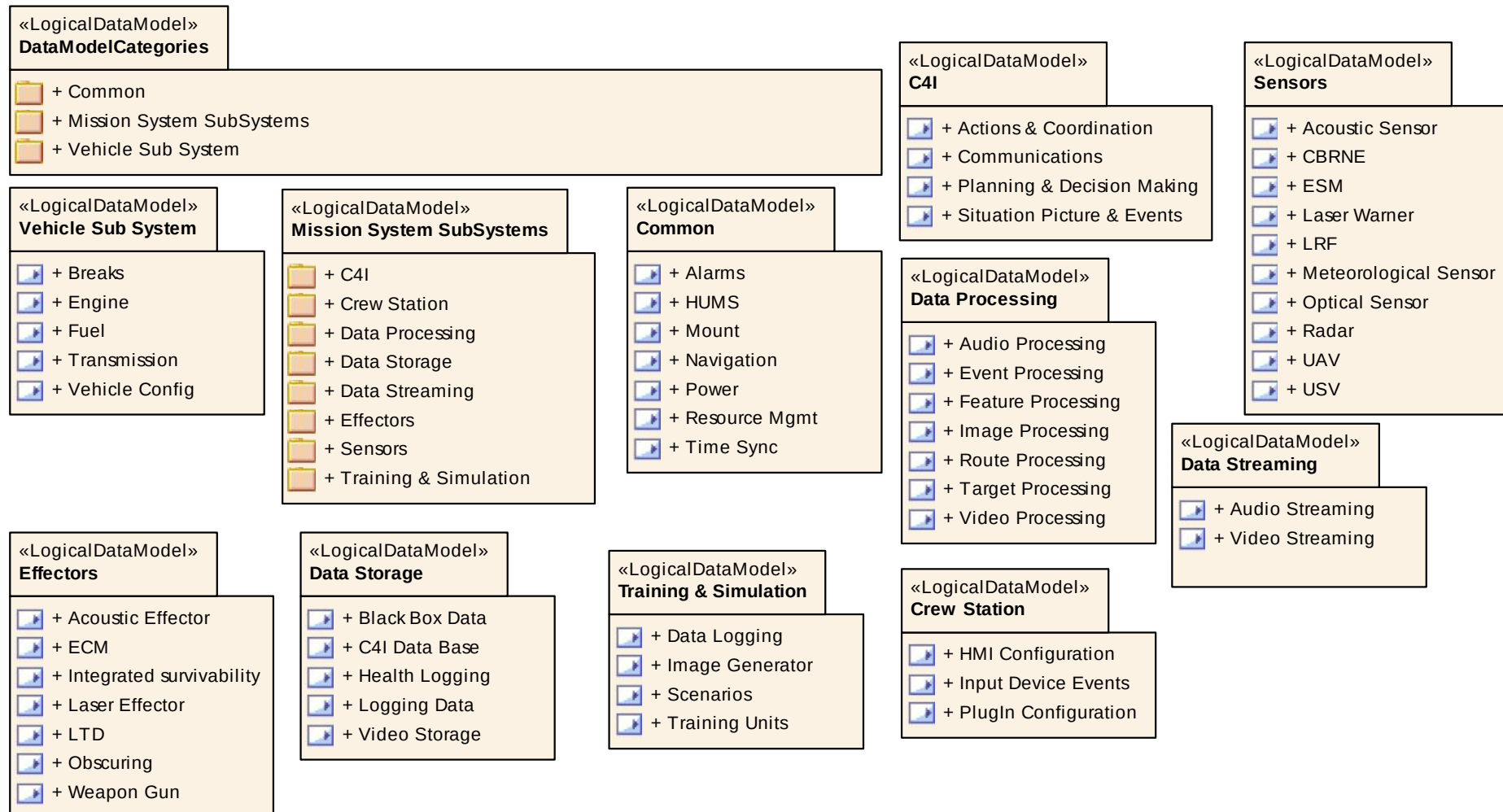


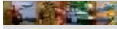
LAVOSAR II - Architecture Content - Logical Data Model





LAVOSAR II - Architecture Content - Logical Data Model

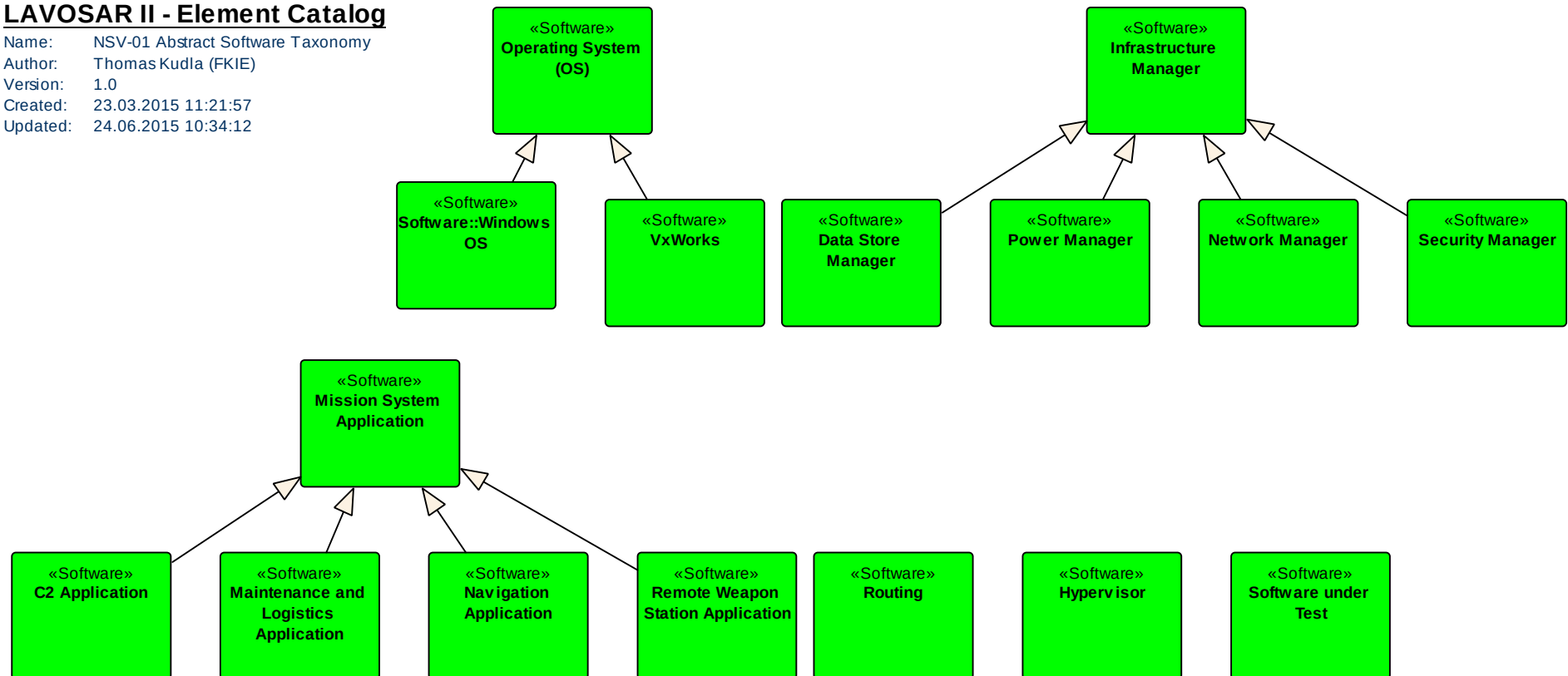




LAVOSAR II - Architecture Content - Software

LAVOSAR II - Element Catalog

Name: NSV-01 Abstract Software Taxonomy
Author: Thomas Kudla (FKIE)
Version: 1.0
Created: 23.03.2015 11:21:57
Updated: 24.06.2015 10:34:12

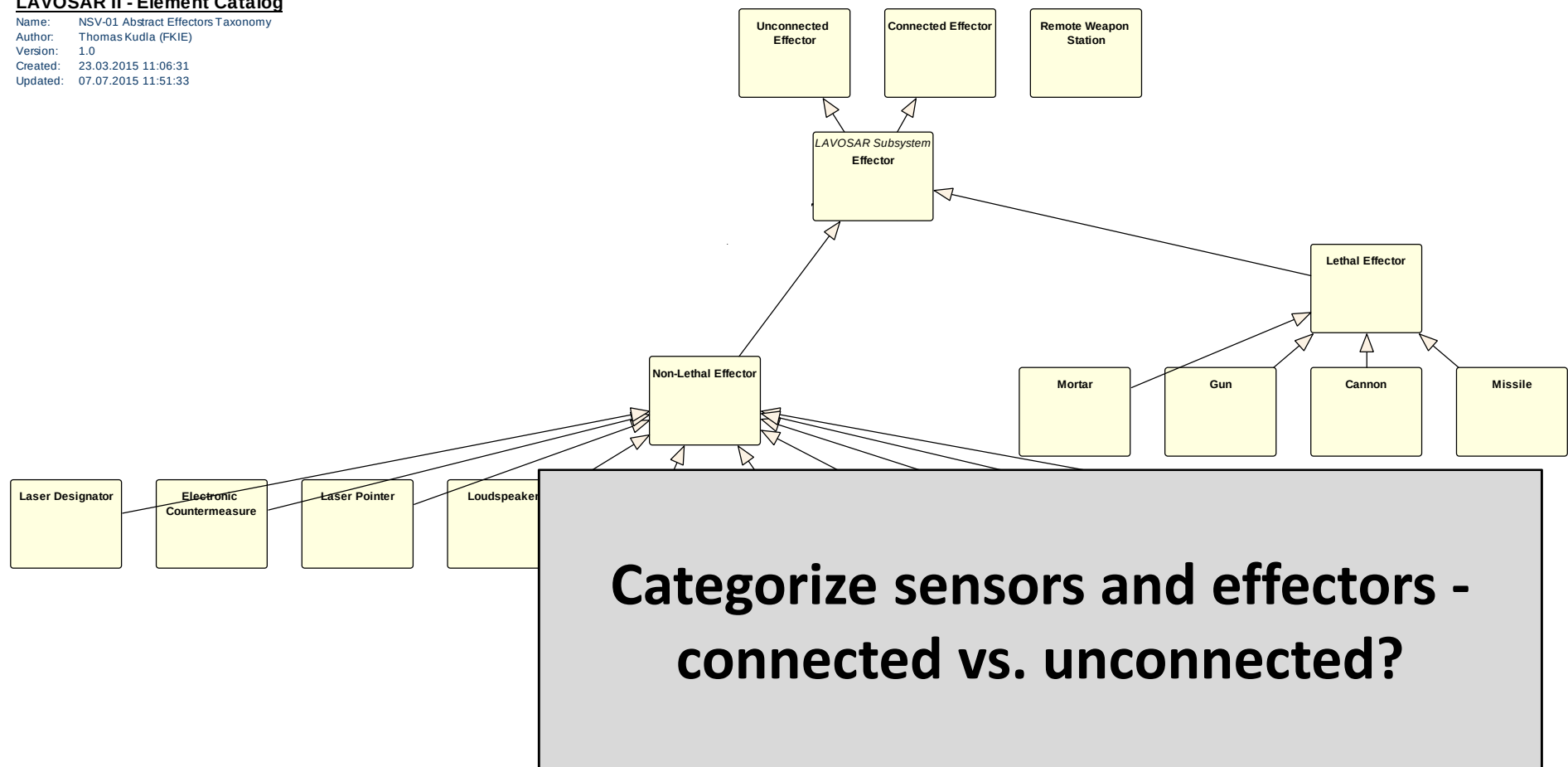




LAVOSAR II - Architecture Content - Effectors

LAVOSAR II - Element Catalog

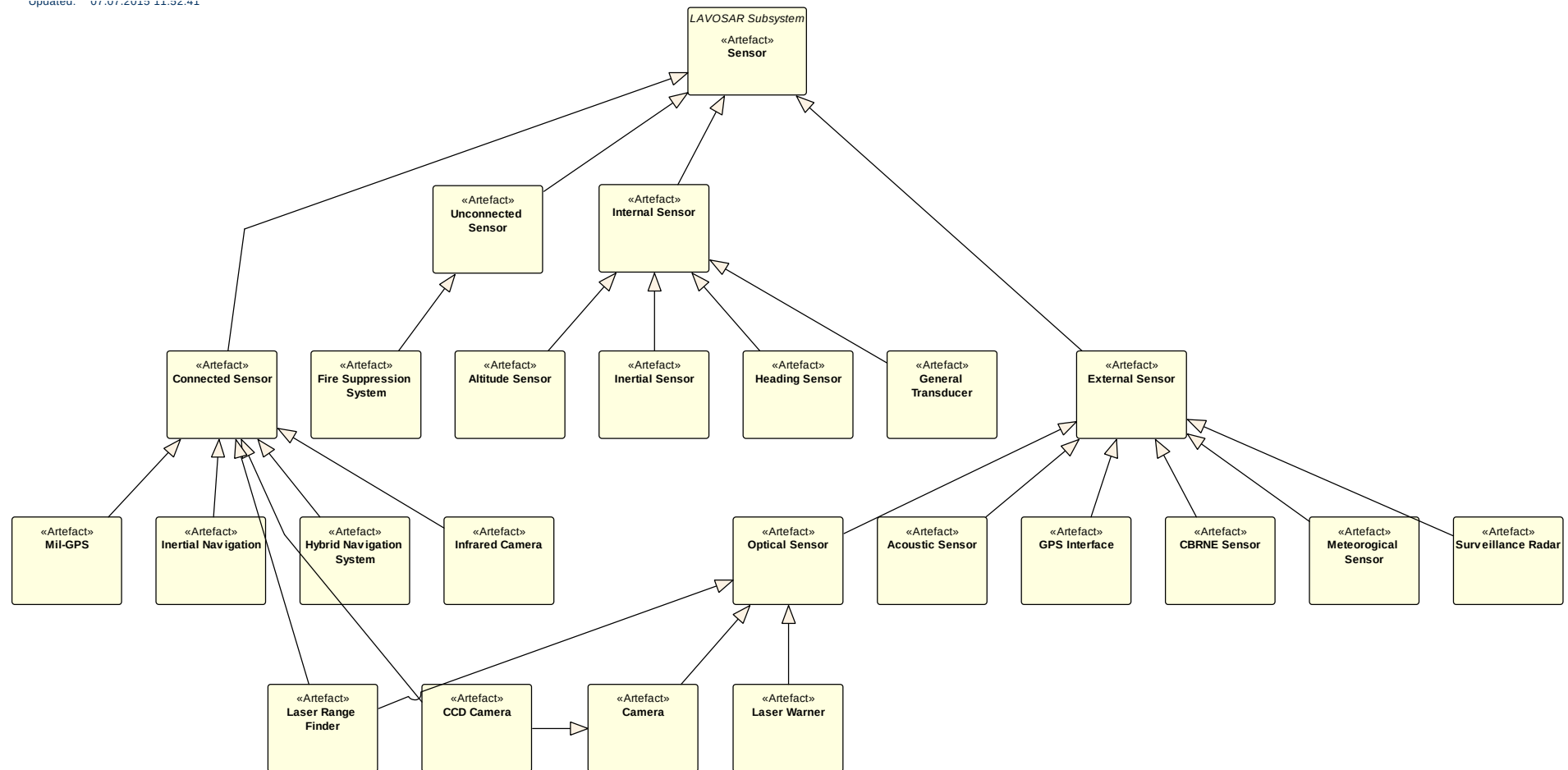
Name: NSV-01 Abstract Effectors Taxonomy
Author: Thomas Kudla (FKIE)
Version: 1.0
Created: 23.03.2015 11:06:31
Updated: 07.07.2015 11:51:33





LAVOSAR II - Architecture Content - Sensors

Updated: 07.07.2015 11:32:41





LAVOSAR II – Reference Architecture

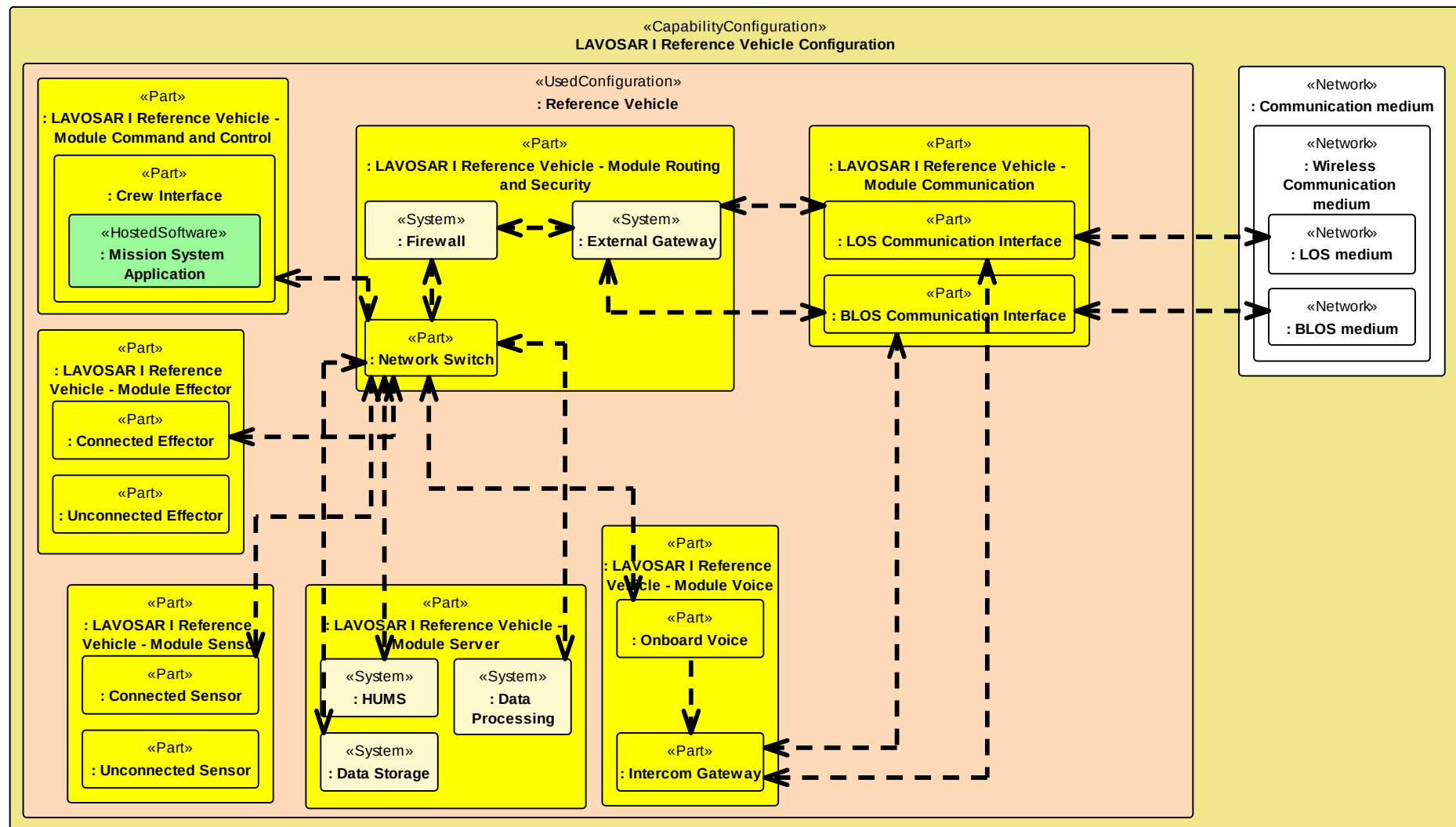
- **Reference Architecture provides guidance in system design**
 - Definition how vehicles should be set up
 - Identification of key modules in vehicles
 - Explains what kind of data is expected to be exchanged among components
 - Shows how components should be interconnected

- **Works as a blueprint**
 - Deriving actual vehicle setup from the architecture
 - Or just for one components/module



LAVOSAR II – Reference Architecture

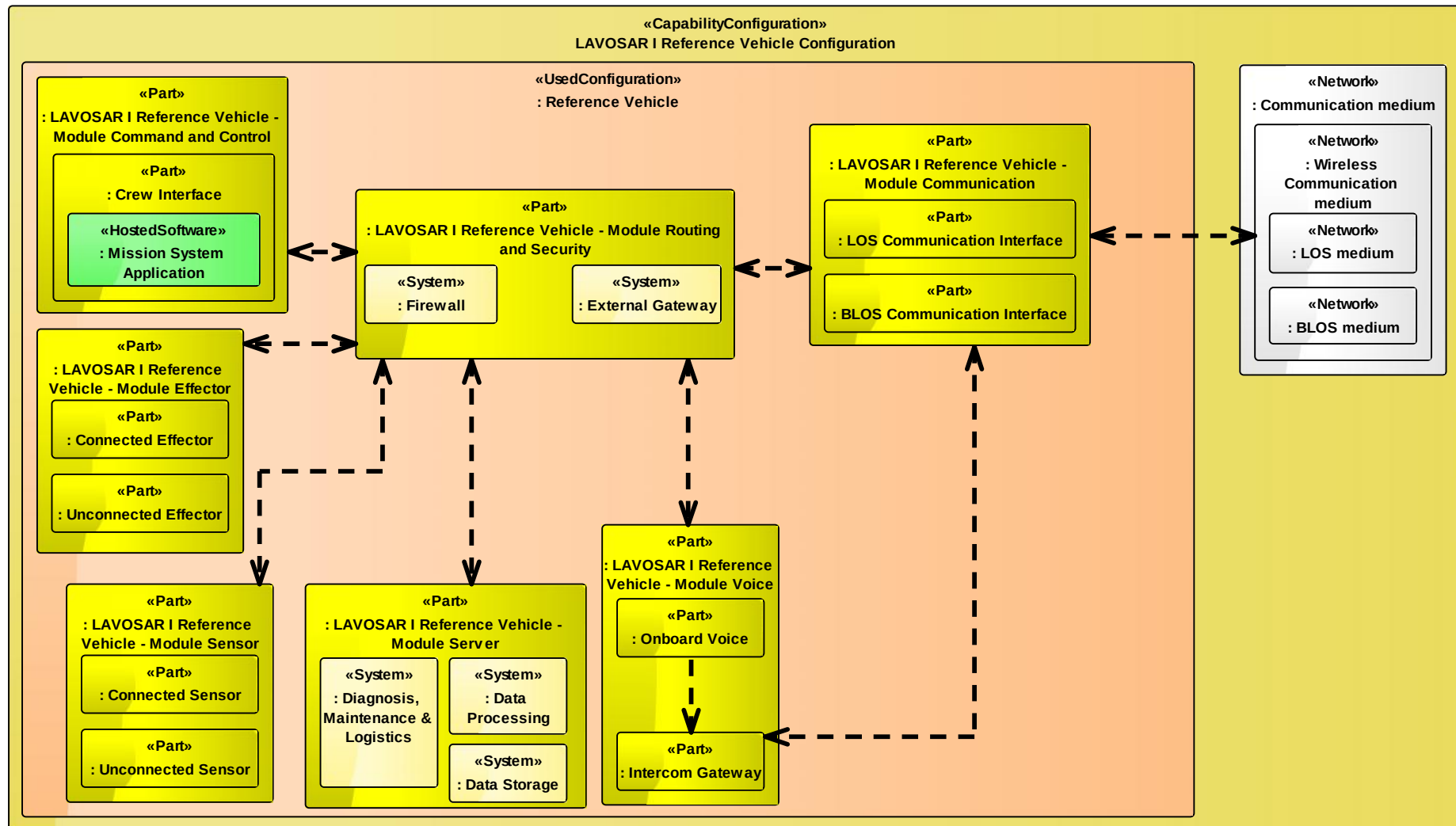
- Definition how vehicles can be set up





LAVOSAR II – Reference Architecture

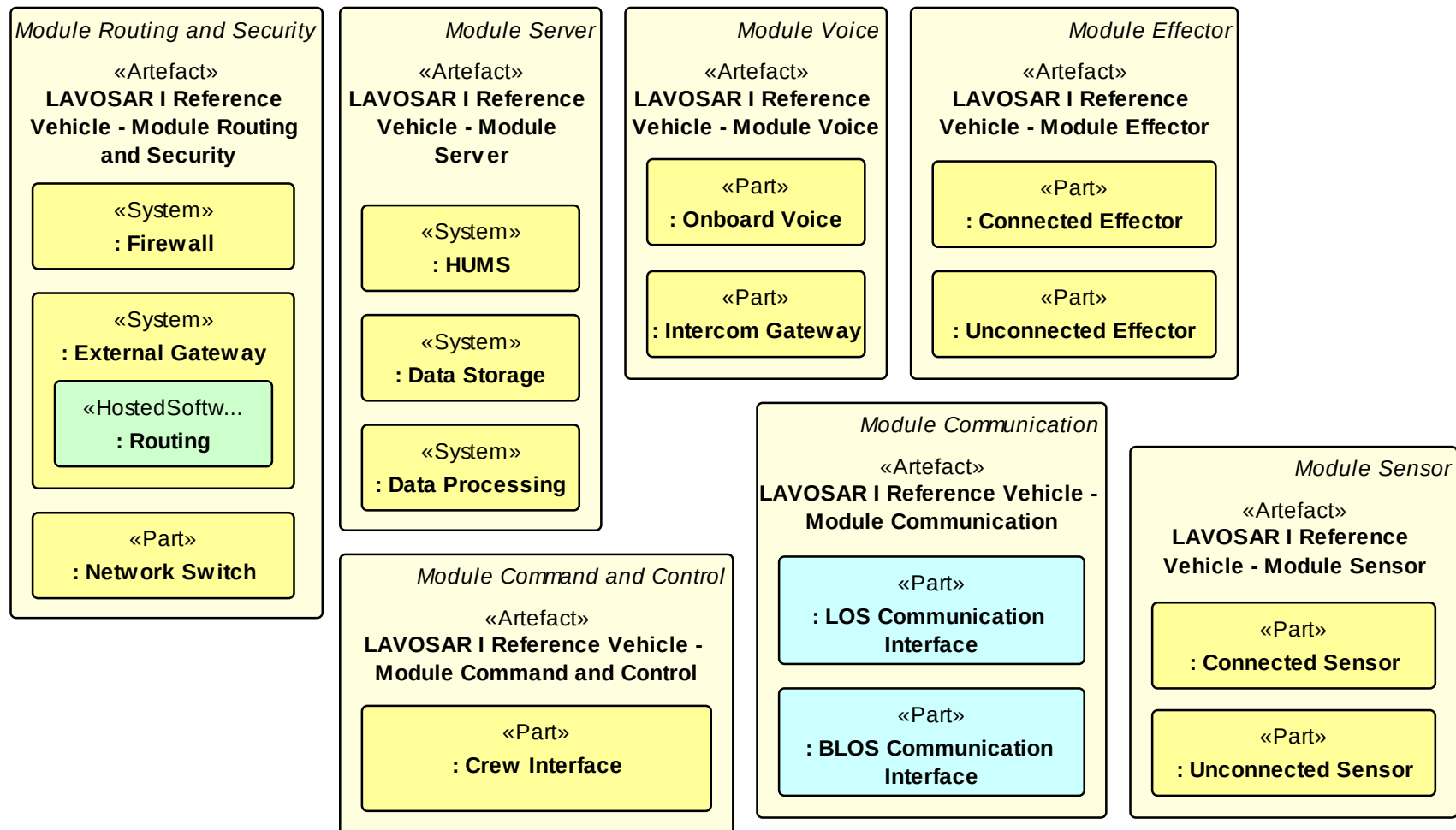
- Definition how vehicles can be set up





LAVOSAR II – Reference Architecture

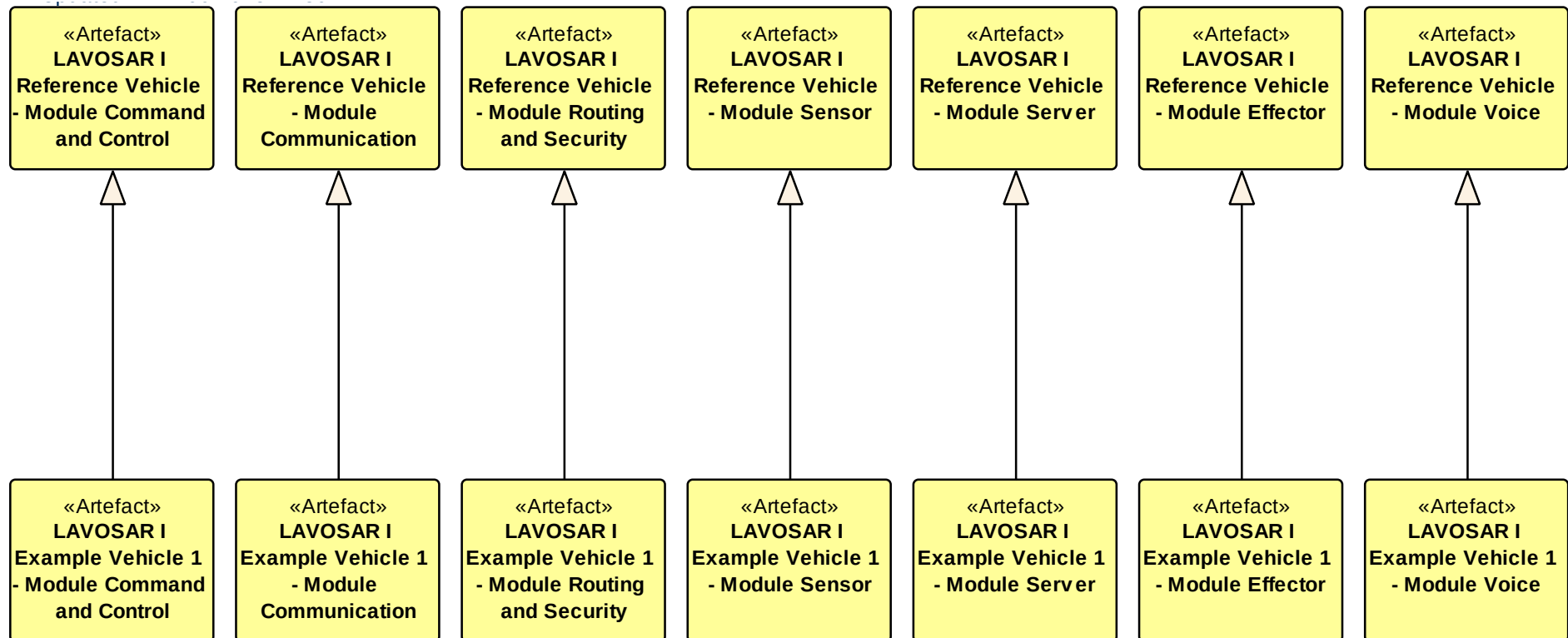
■ What are the key modules in vehicles





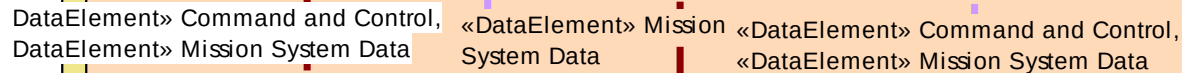
LAVOSAR II – Reference Architecture – Target Architecture

- Derive modules from the reference architecture by designing new modules with specific components



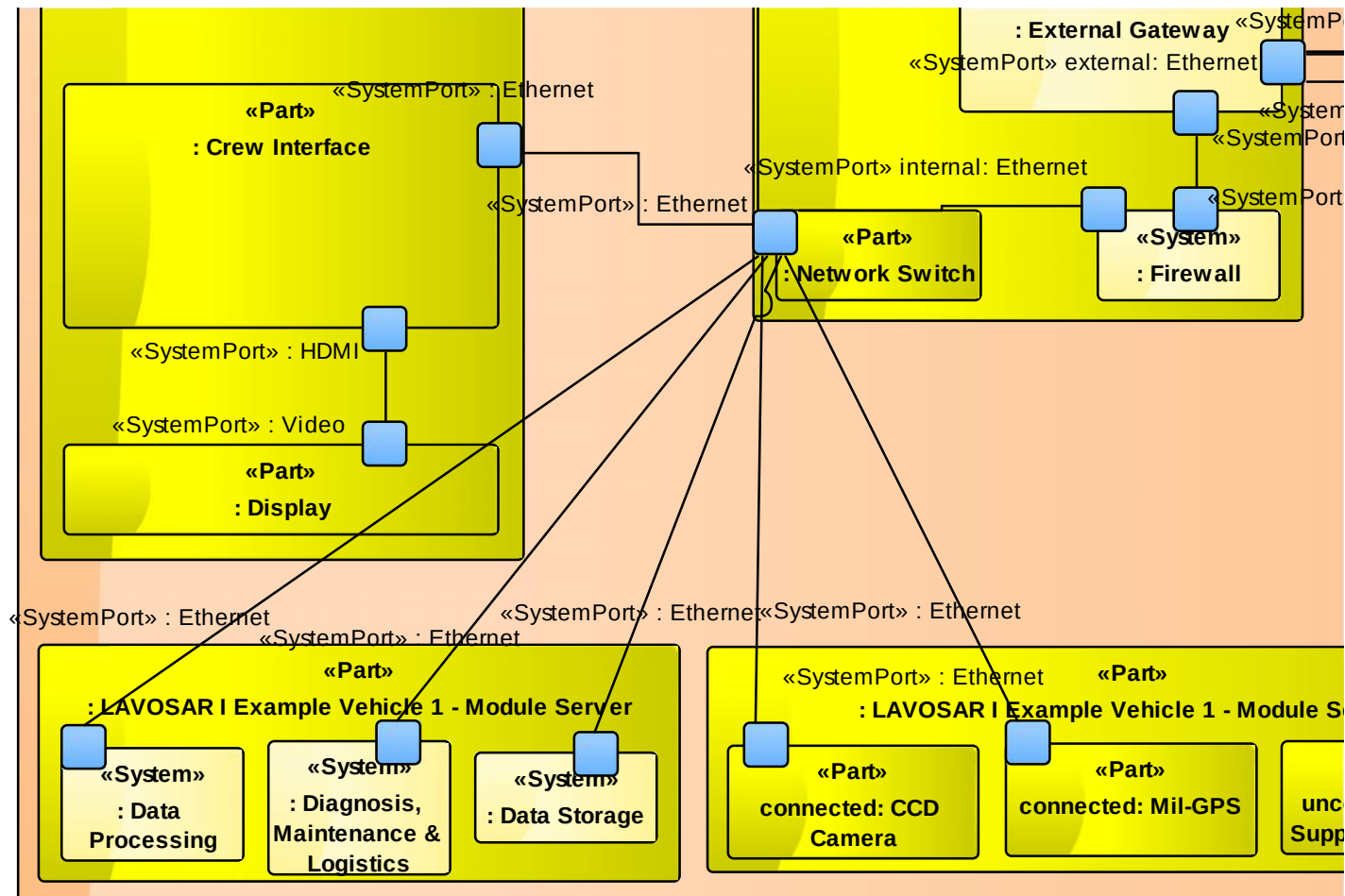


- **What kind of data is expected to be exchanged among components**



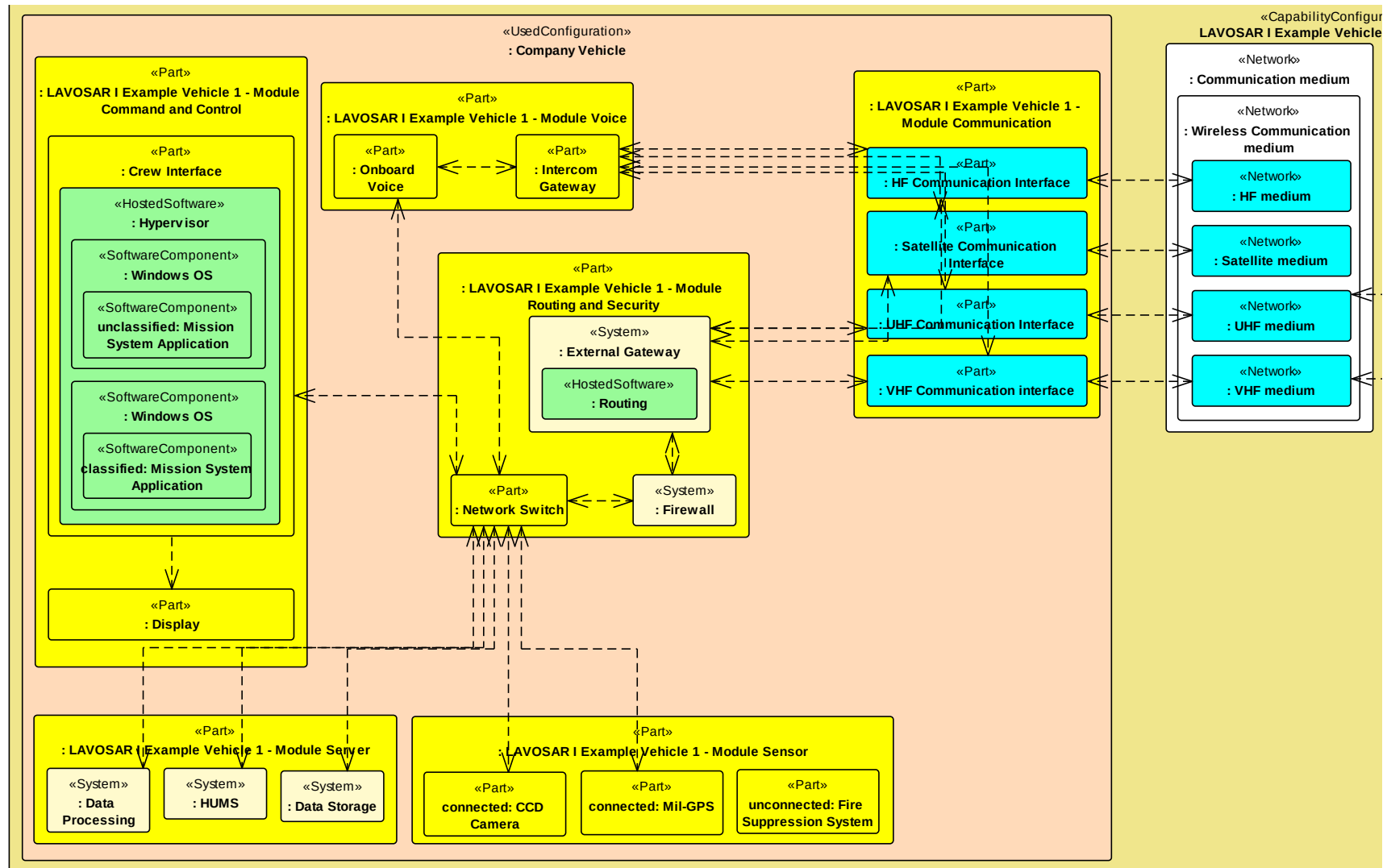
LAVOSAR II – Reference Architecture

- How vehicle components could be physically interconnected



LAVOSAR II – Reference Architecture – Target Architecture

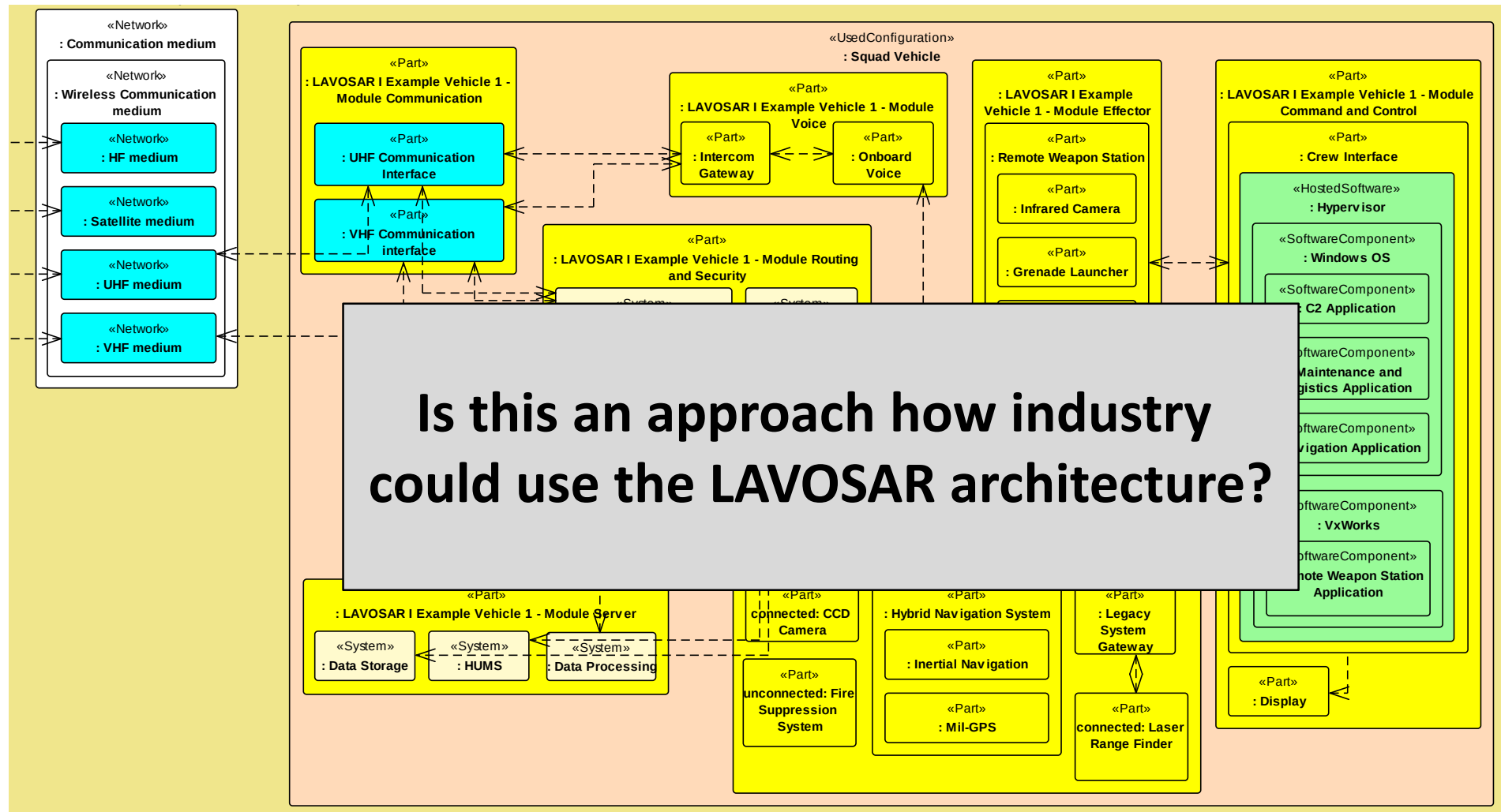
- Derived example „company vehicle“ from the reference architecture

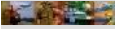




LAVOSAR II – Reference Architecture – Target Architecture

- Derived example „squad vehicle“ from the same reference architecture





LAVOSAR II – Architecture Benefits

- **LAVOSAR II Architecture aggregates information from the report to facilitate understanding of the project results**
 - Elements in the architecture are unique and not ambiguous
 - No misunderstanding if two same named elements are really the same or different
 - All elements in the architecture are traceable - where they are used or how specific elements can be exchanged? (taxonomies)
 - Conceptual changes can be done more reliable
 - There is only one model and inconsistent changes can be tracked more easily

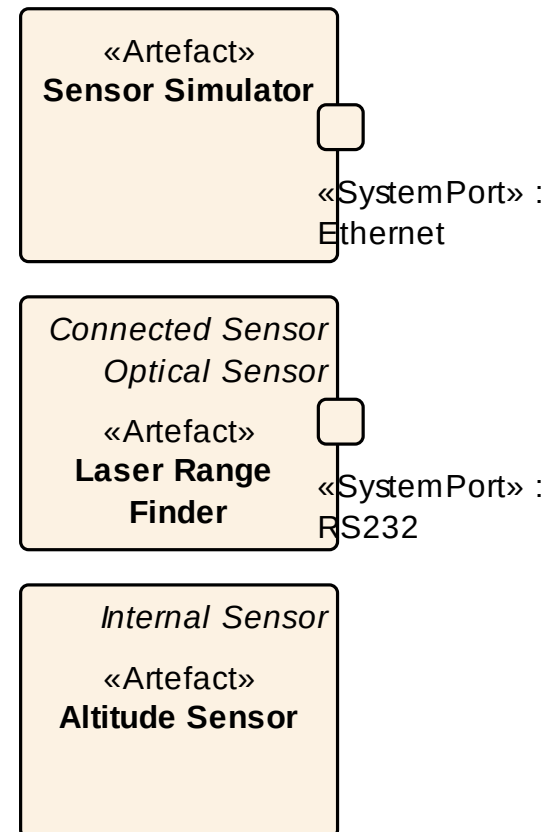


LAVOSAR II – Constraints and Opportunities

- **Links between defined Standards/Protocols and their usage in components**

- If all ports would have all necessary information interoperability and connectivity between components could be verified

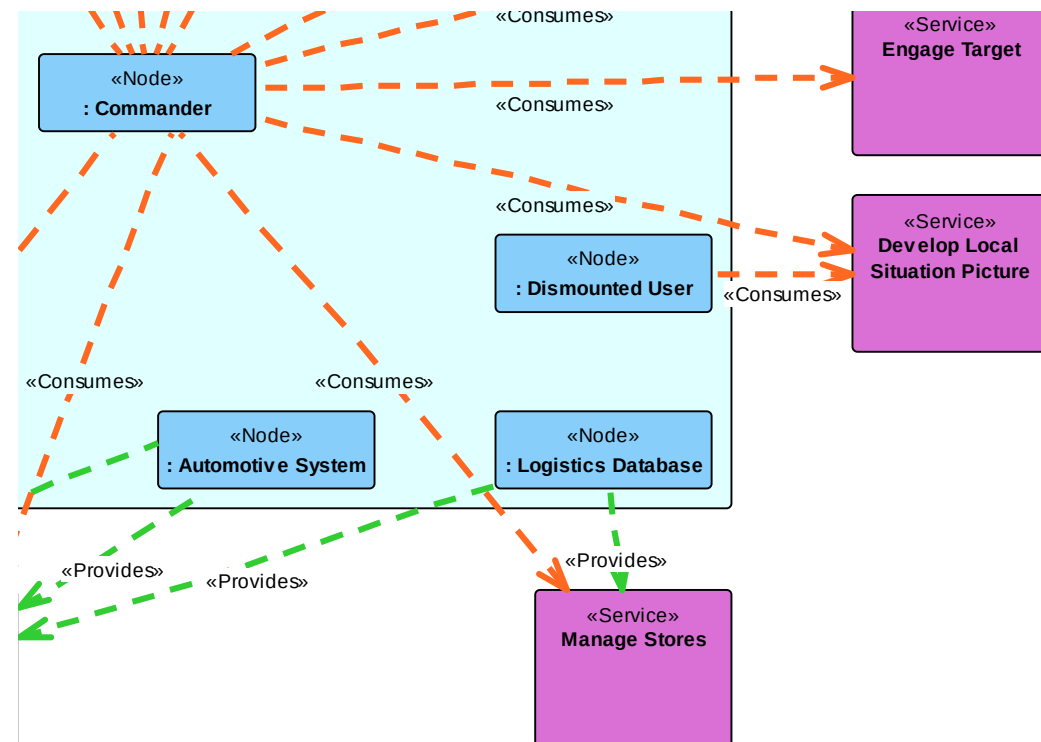
- LAVOSAR is not going to prescribe a specific standard/protocol, but will cut it down to viable collection





LAVOSAR II – Constraints and Opportunities

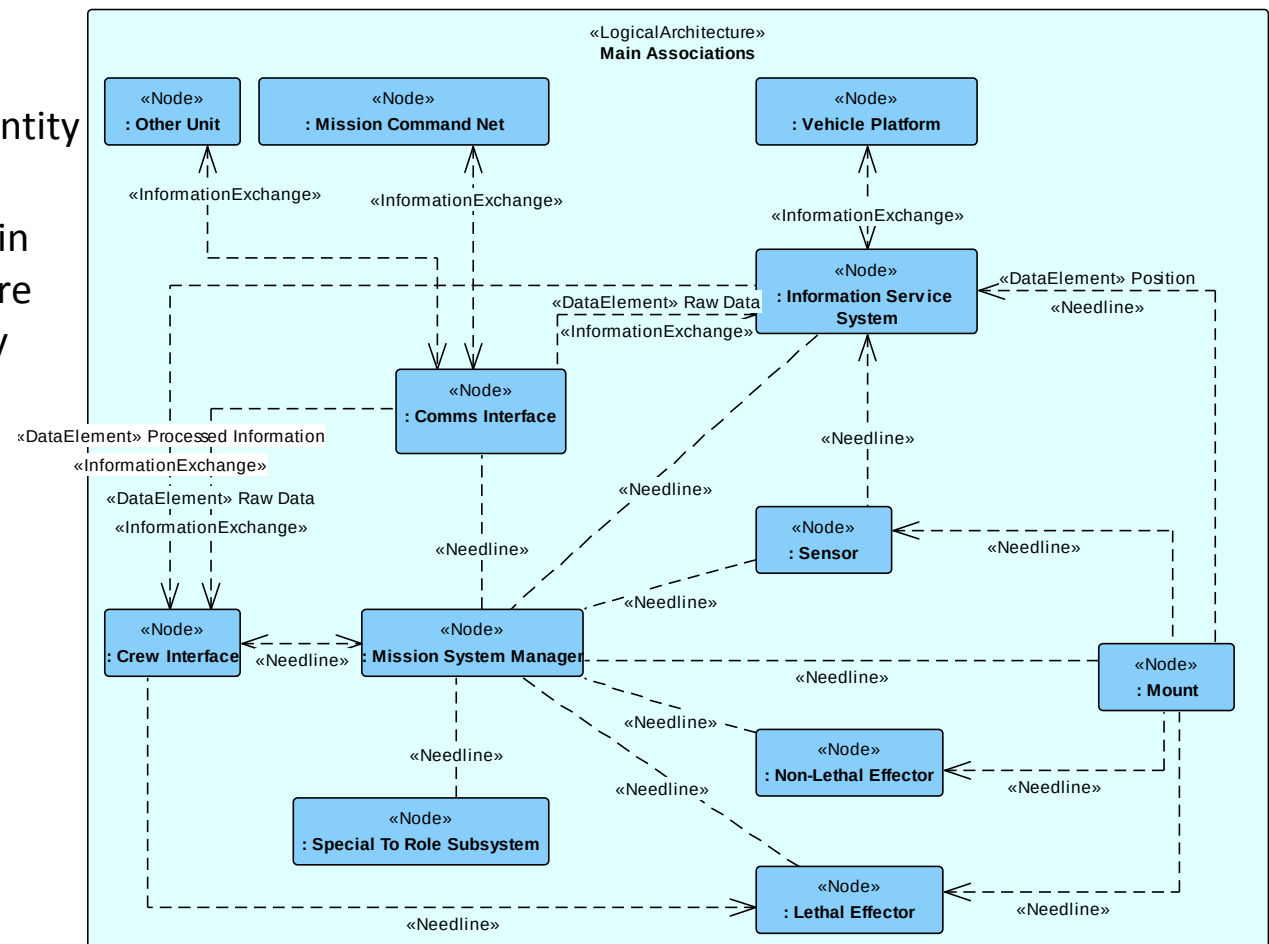
- **Mapping between Services/Use Cases and their realization through systems**
 - E. g. “Develop local situation picture” is a use case in the mission system, but no realizing hardware/software is defined
 - For the “Manage stores” use case a “Logistics Database” would have to exist



LAVOSAR II – Constraints and Opportunities

■ Mapping between abstract design decisions to systems & services

- There are some more concepts that lack some kind of physical entity
- “Information Service System” is defined but in contrast to sensors there exists no physical entity





LAVOSAR II – Documentation Generation

- **Sparx EA supports automated generation of a documentation of the architecture**
 - Based on the model and predefined templates is a possible to generate descriptions for
 - Views
 - Model elements
 - Packages
 - Links between model elements
 - Etc.
 - As long as the model is consistent the documentation will be consistent, too.
 - Changes in description of system, elements, etc. will be automatically reflected in the documentation
- **Not every information must be in the architecture, but every information that relates to some model element or concept should be available**

LAVOSAR II – Documentation Generation

- Started with the first steps to generate a documentation from the architecture automatically

Layout (Table of contents):

- Introduction
NAV-01
How to read the architecture
- Reference Architecture
Views, Elements and their description
- Target Architecture
Views, Elements and their description
- Model element catalog
Elements, views and their description

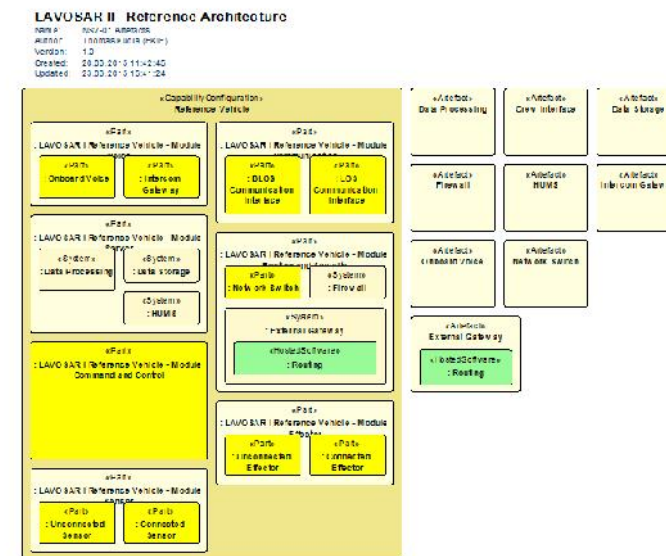


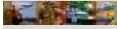
Figure 2: NAV-01 - Introduction

<anonymous>

Text in package 'LAVOSAR II Reference Vehicle'

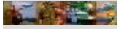
LAVOSAR II - Reference Architecture

<anonymous>



Summary

- **Enterprise Architectures and NAF**
- **LAVOSAR II - Architecture Content**
 - Taxonomies and Use Cases
 - Reference and example LAVOSAR vehicle
- **Constraints and Opportunities**
- **Documentation Generation**



Questions?