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Standardization Report (intermediate)

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History of Changes

ED.	REV.	DATE	PAGES	REASON FOR CHANGES
RG	0.1	2014-11-18	5	Initial version
RG	0.2	2015-03-16	8	Input Docea
RG	0.3	2015-03-19	10	Input OFFIS
RG	0.4	2015-03-23	10	Formatting and additional input OFFIS
FH	0.5	2015-03-23	14	Input UC
RG	1.0	2015-04-02	12	First final version.
PA	1.1	2015-04-14	13	Update EUTH
JM	1.2	2015-04-15	13	Update Figure 3

Contents

1 Introduction

This document summarizes all standardization activities that were undertaken by CONTREX project partners in the first 18 month of the project execution. This includes standards proposals planned or under preparation and interactions with standardization committees. In addition to past activities, an outlook on ongoing and future activities within the CONTREX project is given.

2 Standardization Activities

2.1 OMG, SysML, UML/MARTE

2.1.1 UML/MARTE Profile

Up to M18, progress on providing UML capabilities for the modelling of mixed-criticality systems and system-of-systems has been done by UC. Specifically, the goal is to achieve a proposal of a synthetic and clearly necessary set of extensions to the MARTE profile [1].
The activity until M18 has been oriented to find the required modelling elements (CONTREX metamodel reported in D2.1.1 [2]), and relying on such a metamodel to detect the lacks of MARTE. Once the lacks have been defined, the required extensions have been already defined. They cover modelling elements to capture:

- **Criticalities.** The proposal is sufficiently generic to cover the needs of current research work, and of the practices that can be derived from partners and from safety standards.

- **Network:** The proposal includes elements to model abstract communication channels and network nodes at different levels of abstraction. Additional novel concepts like zones, contiguity are also present.

- **Design Space Exploration:** The proposal includes minor extensions of VSL expressivity for describing the design space, and specific elements to model DSE rules.

As well as providing new and necessary concepts, there has been an important work to ensure that the proposed MARTE extension is synthetic and necessary. Specifically, for design space exploration (DSE) the CONTREX UML/MARTE modelling methodology (first report given in D2.2.1 [3]) improves the results of the most related background [6]. This work did not fully exploit all the expressiveness of MARTE for DSE. The development of the CONTREX modelling methodology makes a better use of MARTE and minimizes the profile extension requirements.

In order to tackle the actual implementation of the profile the following strategy is followed. In order to enable the production of models for former proof-of-concept, and as a convenient mechanism to separate the extension from the current standard, until the formal standardization proposal is delivered, the extension is being implemented as a separated profile: the CONTREX profile. In the longer term, the current MARTE profile will be extended with the elements of the CONTREX profile (upon success of the standardization proposal).
A first draft of the CONTREX profile for network modelling was reported in [4], and shown in Figure 1. As shown, novel concepts of the metamodel, like zones, contiguity, resistance, etc, have they direct expression in terms of new specific stereotypes.

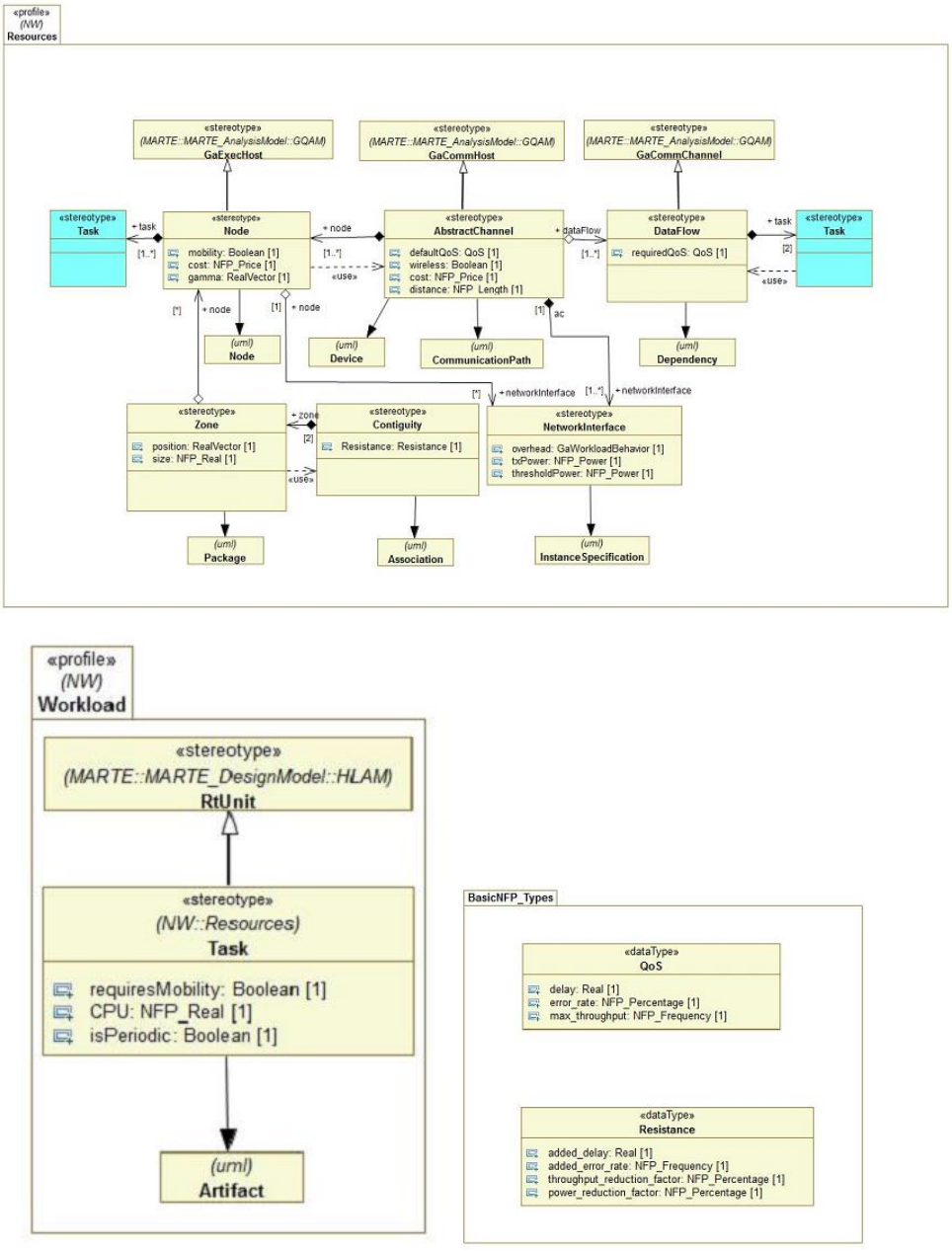


Figure 1. Profile for distributed embedded systems reported in [4].

Work on the production and completion of the network profile is on-going. The development of the modelling methodology (task T2.2) is providing additional feedback for the polishing of the profile and for enabling a more versatile network modelling. For instance, recent work on the network modelling methodology is posing the convenience of an extension to enable the capture of zones and contiguities through composite diagrams (the version in Figure 1 only supports to express them in deployment diagrams). Figure 2 shows the additional extension required.

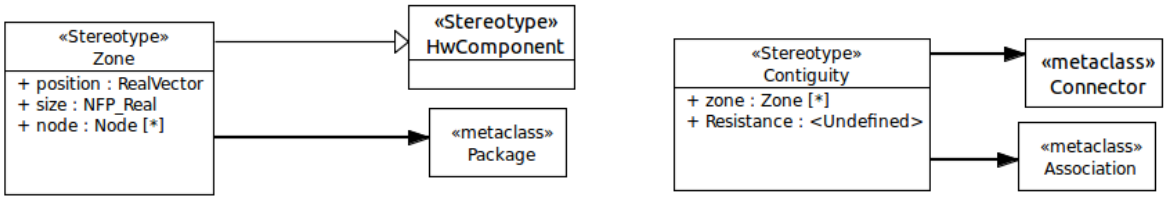
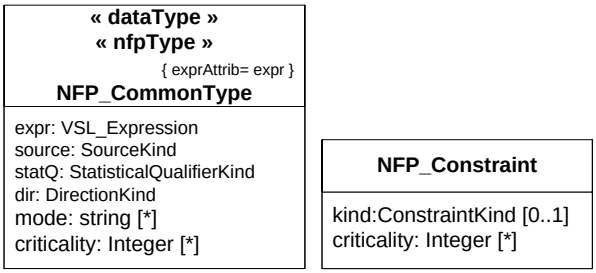


Figure 2. Extension of the profile to enable the description of Zones and Contiguities in composite diagrams.

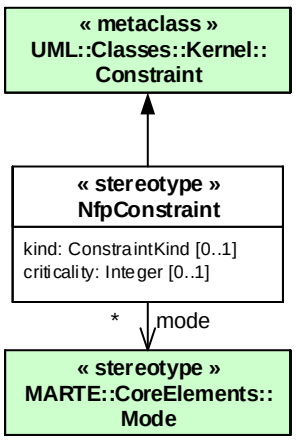
These extensions are under discussion though. In any case, they are incremental changes of the profile, and do not mean a significant variation of the metamodel.

There has been also a specific advance on the profile-based implementation of other key aspects of the metamodel reported in [3].

Fehler! Verweisquelle konnte nicht gefunden werden. shows the extension for the support of criticalities, which corresponds to the domain view in [2], also showed in the figure for convenience. Notice that the NFP_CommonType extension refers to an extension of the capabilities of the VSL expressions used to annotate properties, e.g. a WCET, which can have associated a criticality now. However, it does not required a specific stereotype in the profile



(a) Domain view extension (reported in D2.1.1)



(b) UML view extensions to be proposed to the OMG

Figure 3. Stereotypes provided for modelling of criticalities.

extension provided.

Moreover, there are a number of aspects for which the methodology uses a set of stereotypes which are relevant and candidates for a final standardization proposal. Figure 4 shows the

stereotypes which are used to enable the delimination of the modelling views, referring to system modelling aspects and network modelling aspects.

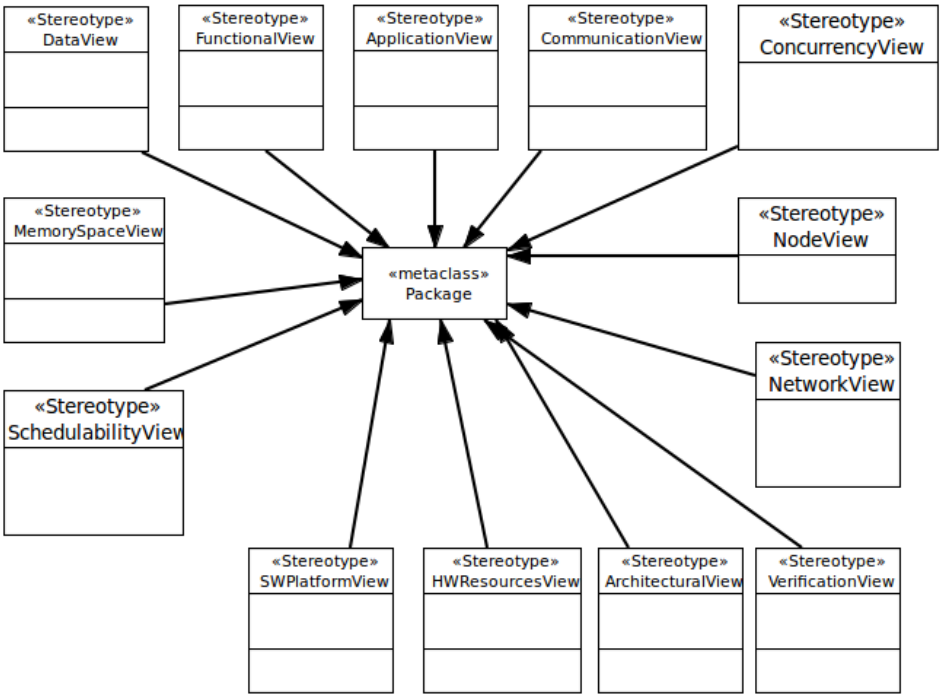


Figure 4. Stereotypes for supporting views for system and network modelling.

Figure 5 shows some additional useful stereotypes. The <<System>> stereotype is recurrently used for delimiting and distinguishing the system parts from the environment (or test) components (standard UTP profile [7] is used for the latter). Figure 6 shows an extension required for the detailed modelling of communication services of the SW platform. Figure 7 illustrates the DSE rule stereotype, which enables a flexible mechanisms for modelling a constrained design space.

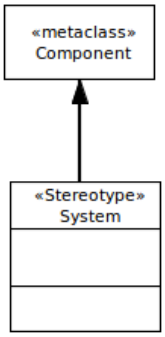


Figure 5. Stereotypes for supporting system component specification, and OS specific attributes.

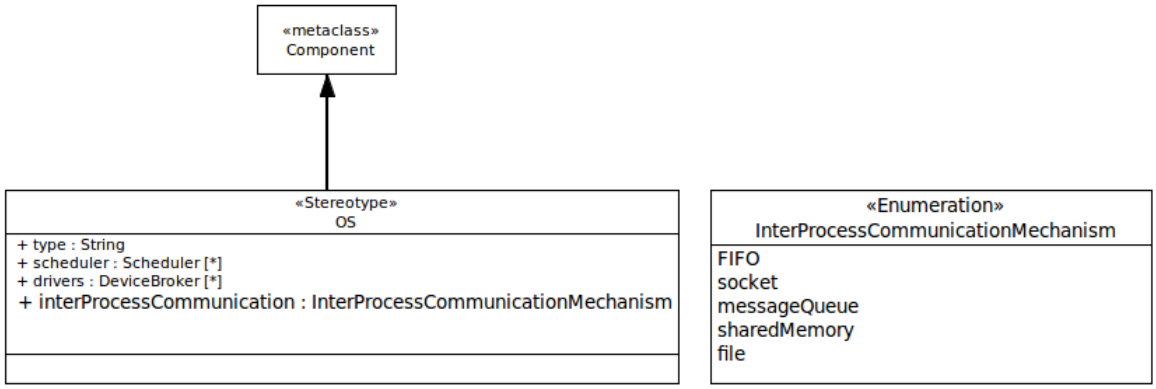


Figure 6. Stereotypes extending the modelling of the SW platform.

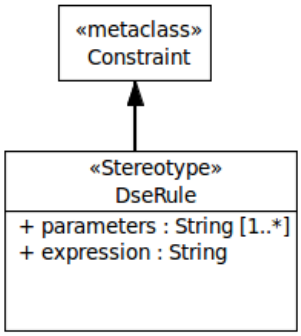


Figure 7. Stereotypes for supporting a flexible constraining of the design space.

2.1.2 Extrafunctional Properties in SysML

Intecs has applied part of the CONTREX meta-modelling solutions for system modelling with SysML, and derived some extensions to SysML for the modeling of extra-functional properties, quantities and units beyond time (e. g. temperature, power) and definition of contracts. These extensions could be submitted to OMG in the next period.

2.2 IEEE 1801 SLP, IEEE 2415

Docea Power participates in IEEE 1801 SLP and IEEE 2415.

2.2.1 Software Access to Power Management

The IEEE 2415 initiative targets a better cooperation between hardware and software in order to design more power and energy efficient electronic systems. This especially consists in abstracting hardware design in order to adequately present implemented low power capabilities to power management (and thermal throttling) software. The work conducted in the group thus relates to system design at high levels of abstraction and consideration of power and energy (and temperature) from the software runtime perspective. The group formed mid-2014 and several technical subgroups are being defined (requirements, power states, device enumeration, clock intent).

2.2.2 Enablement of System Level Power Estimation

The IEEE 1801 SLP (System Low Power) initiative allows behavioral, functional or implementation representations of electronic system designs to be augmented with power models for the various system constituents (the IP blocks), so the simulation of the system representations can generate power consumption estimates. A typical targeted application is to turn SystemC-TLM platforms into power-aware platforms (meaning able to perform power estimation). This initiative is still in its infancy but working prototypes exist that show how the format can be used and which benefits it brings. The standard is due to be submitted for ballot middle of this year (2015).

2.3 Accellera Systems Initiative – SystemC

CONTREX provides inputs to the standardisation of SystemC/TLM. OFFIS has directly participated in relevant Accellera Systems Initiative SystemC working groups, namely the SystemC Language Working Group (LWG), the SystemC Transaction-Level Modelling Working Group (TLMWG), and the SystemC Control Configuration and Introspection Working Group (CCIWG).
More information available at: http://www.accellera.org/
Until end of 2015, the position of the LWG chair was held by an OFFIS employee. Since he left OFFIS, the opportunities to influence the SystemC standardization process are reduced. But OFFIS still participates actively in the Accellera Working Groups and relevant conferences like DVCon or SystemC User Group Meetings.

2.3.1 SystemC Tracing and Introspection

The tracing capabilities of SystemC are very limited when it comes to extra-functional properties. Therefore, OFFIS developed a concept and framework for stream-based simulation and tracing, supporting

- Hierarchical tracing of extra-functional properties,
- Flexible adaption of granularity,
- Strongly typed physical unit support (C++) to avoid composition errors.

A detailed description is given in D3.4.1, Section 3.2 [8].
The general idea of the stream-based tracing has been presented at the Indian SystemC Users Group Meeting 2013. More details of the framework have been presented and discussed in the Accellera SystemC Language Working Group. Furthermore, the concept and framework has been presented in the IEEE Low Power Study Group, the predecessor of IEEE 2415 and IEEE 2416 working groups.

2.3.2 SystemC Simulation Phase Callbacks

The integration of advanced introspection and tracing facilities into SystemC requires a more fine grained control over the simulation and time advance. The already standardized `sc_trace` functionality is integrated in the simulation cycle after the update phase. But the integration of custom introspection code is not possible in standard SystemC without changing the implementation of the simulation kernel. To overcome this limitation, an extended simulation callback mechanism has been proposed by OFFIS to the Accellera working group (Figure 8).Figure 8). The proposed mechanism adds callbacks similar to existing callbacks like `end_of_elaboration()` after the evaluate phase (1), after the update phase (2), when the simulation time is increased (3), and when `sc_pause` is called(4).

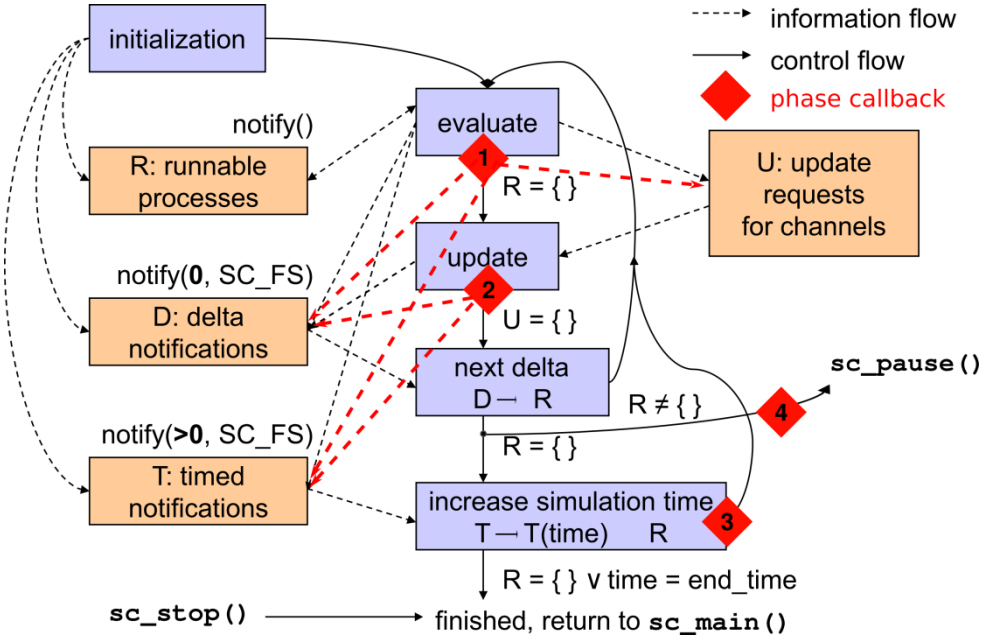


Figure 8: Extended SystemC simulation cycle

A proof-of-concept implementation of this extension has been provided to the Accellera and is already integrated in the current release of the Accellera Proof-of-Concept simulator. The proposed extension a very good candidate to be integrated into the SystemC standard (IEEE 1666) with the next revision.

2.3.3 SystemC Configuration

The CCIWG is currently working on an initial draft standard to define a standard configuration API for SystemC. OFFIS contributes to this by actively participating in discussions in the working group, especially regarding the configuration of extra-functional property models, e.g. support for physical units. Furthermore, OFFIS contributed to the proof-of-concept implementation, e.g. by providing a new concept and implementation for the serialization of configuration values.

2.4 MQTT M2M Telemetry Protocol

MQTT (http://mqtt.org) is a protocol designed by Eurotech and IBM from the ground up for M2M applications and is currently in the process of standardization by the OASIS standards body under the supervision of IBM, Eurotech, Cisco, VMWare, RedHat, and others. Its main benefits can be summarized as follows:

- Optimized for M2M applications: only 2 bytes of overhead per packet and integrated management of "quality of service". Through a session-oriented connection to the broker, the communication latency is only limited by the available bandwidth.
- Firewall friendly: the installation of devices within corporate intranets doesn’t require opening additional incoming network ports since the device initiates the connection.

- Publish/Subscribe messaging: the message pattern to provide one-to-many message distribution and decoupling of message producers (Devices) from consumers (Applications).
- Session awareness: the system automatically generates events when a device disconnects abnormally and provides the ability to fully re-establish the session upon reconnection.
- Security: the connection is protected by SSL and authenticated with username and password.
- Data Agnostic: the independence from data enables transmission of any type or content of data, in any user-defined form.
- Open standard protocol, based on TCP/IP.
- Quality of Service (QoS) levels determines how messages will be delivered and are used to assure of delivery of messages.
- Built-in mechanism for connection monitoring.

The MQTT protocol has been selected for data communication in the automotive use case (UC2), it represents the link between the vehicle, with the Kura IoT framework, and the data broker of the cloud platform.

During the first part of CONTREX project, Eurotech has been involved in the OASIS Consortium standardisation activities related to MQTT.

The OASIS Message Queuing Telemetry Transport (MQTT) Technical Committee members have recently approved a Committee Specification Draft (CSD) and submitted this specification for 30-day public review: MQTT Version 3.1.1, Committee Specification Draft 01 / Public Review Draft 01, 12 December 2013.

The related press release can be found at the following address [9]:

https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=mqtt

The MQTT Version 3.1.1 OASIS Standard has been released on 29 October 2014 is available at the address:

http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/mqtt-v3.1.1.html

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