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CHROMOSOME Middleware

Product information

In the past, the focus of embedded system development has often been the realization of clearly separated systems with defined interfaces. However, recent trends indicate that integration of systems with each other in order to form larger systems becomes more and more important: the automation line gets increasingly connected with logistics and warehousing, intelligent cars will communicate with other vehicles and the traffic infrastructure. In the future, systems need to be designed in a way such that they may be easily embedded into a larger context without jeopardizing their functionality with respect to safety, security and real-time capabilities. For this purpose, a powerful and cross-domain middleware solution is required that flexibly adapts to the respective use case. CHROMOSOME delivers this functionality.

Characteristics:

- Open source license
- Universal communication middleware
- Model-driven development methodology
- Data centric paradigm
- Platform independence from microcontrollers to industrial PCs
- Suitable for small and tiny systems, full flexibility for more powerful systems
- Quality of service support and real-time capability
- Self monitoring with fault correction mechanisms
- Easily extensible

Sample applications:

- Integration of heterogeneous components in industrial and home automation
- Data acquisition in wireless sensor networks
- Communication between automation system and high-level control

CHROMOSOME architecture

CHROMOSOME consists of two main components, the *XME* runtime system and the *XMT* modeling tool.

The *XME runtime system* (Fig. 1) provides a runtime environment for the software components of the distributed application. Platform specific aspects are hidden behind an abstraction layer. Hence, software components can be implemented in a platform independent manner. This concept boosts the reusability of the software components. Furthermore, the runtime system realizes the communication between the nodes in the distributed system and the plug & play functions of the middleware.

The graphical modeling tool *XMT* (CHROMOSOME Modeling Tool, Fig. 2) allows specifying the structure and requirements of the distributed application and generates source code that is used to configure the initial state of the XME runtime system.

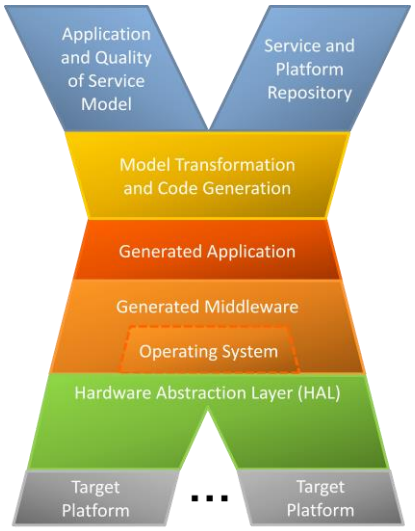

Fig. 1: CHROMOSOME architecture: optimized runtime system through model-based code generation

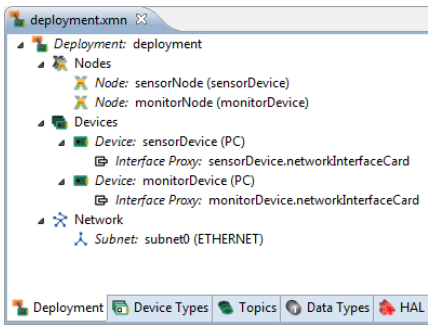

Fig. 2: Deployment model of the CHROMOSOME Modeling Tool (XMT)

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Architecture

- Hardware abstraction layer (HAL) abstracts from execution platform (compare Fig. 3)
- CHROMOSOME core services provide data centric communication and operating system functionalities
- Higher-level components implement application logic

Platform support and development tools

- x86: Linux, Windows, e.g., with GCC, Visual Studio
- ARM: FreeRTOS, e.g. with Eclipse, ARM-GCC (under development)

Data centric communication

- Based on principles of *publish/subscribe* and *request/response* (client/server)
- Supports Ethernet (IP), easy extendibility (compare Fig. 4)
- Configuration of communication relationships by filtering of data streams via attributes (compare Fig. 5)

Development process

- Tool supported specification and implementation of software components
- Model-based development of distributed application
- Selection of suitable target platform(s)
- Generation and automatic deployment of application
- Distributed debugging (under development)

Operation

- Configuration of runtime system and system optimization
- Specification of quality of service measures
- Integration of fault tolerance mechanisms (under development)
- Optionally static generation of the distributed system

Self-organization

- Communication paths are created dynamically and recalculated in case of node or link outage (under development)

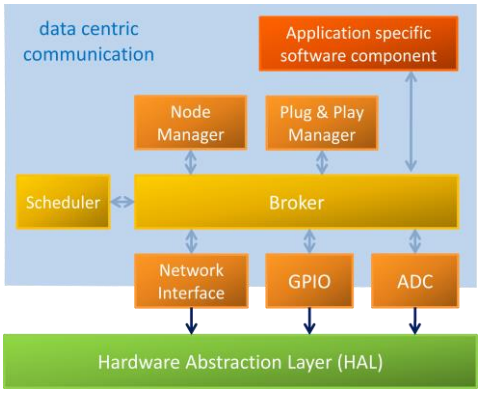

Fig. 3: Sample configuration of software components on a sensor node

CHROMOSOME is open source!

CHROMOSOME is being distributed under the Apache License version 2.0, which permits commercial use, for example. Development of the relevant functions of the middleware is expected to be finished by the end of the year 2013.

Check out CHROMOSOME!

You would like to know more or try out the middleware? You will find current releases and a tutorial at http://chromosome.fortiss.org/. In case of questions, please do not hesitate to contact us directly:

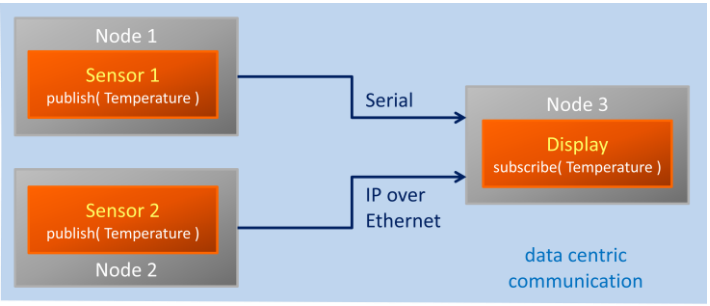

Fig. 4: Abstraction of communication medium

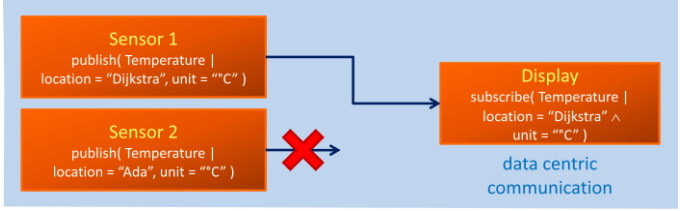

Fig. 5: Filtering of data streams via attributes

You want to learn more about CHROMOSOME and how to apply it to your use case? Please get into contact with us! Find more information at http://chromosome.fortiss.org/. Please understand that the information on this sheet are provided for information purposes only and may change without notice.

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