Collaborative Embedded Systems
CrESt
GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

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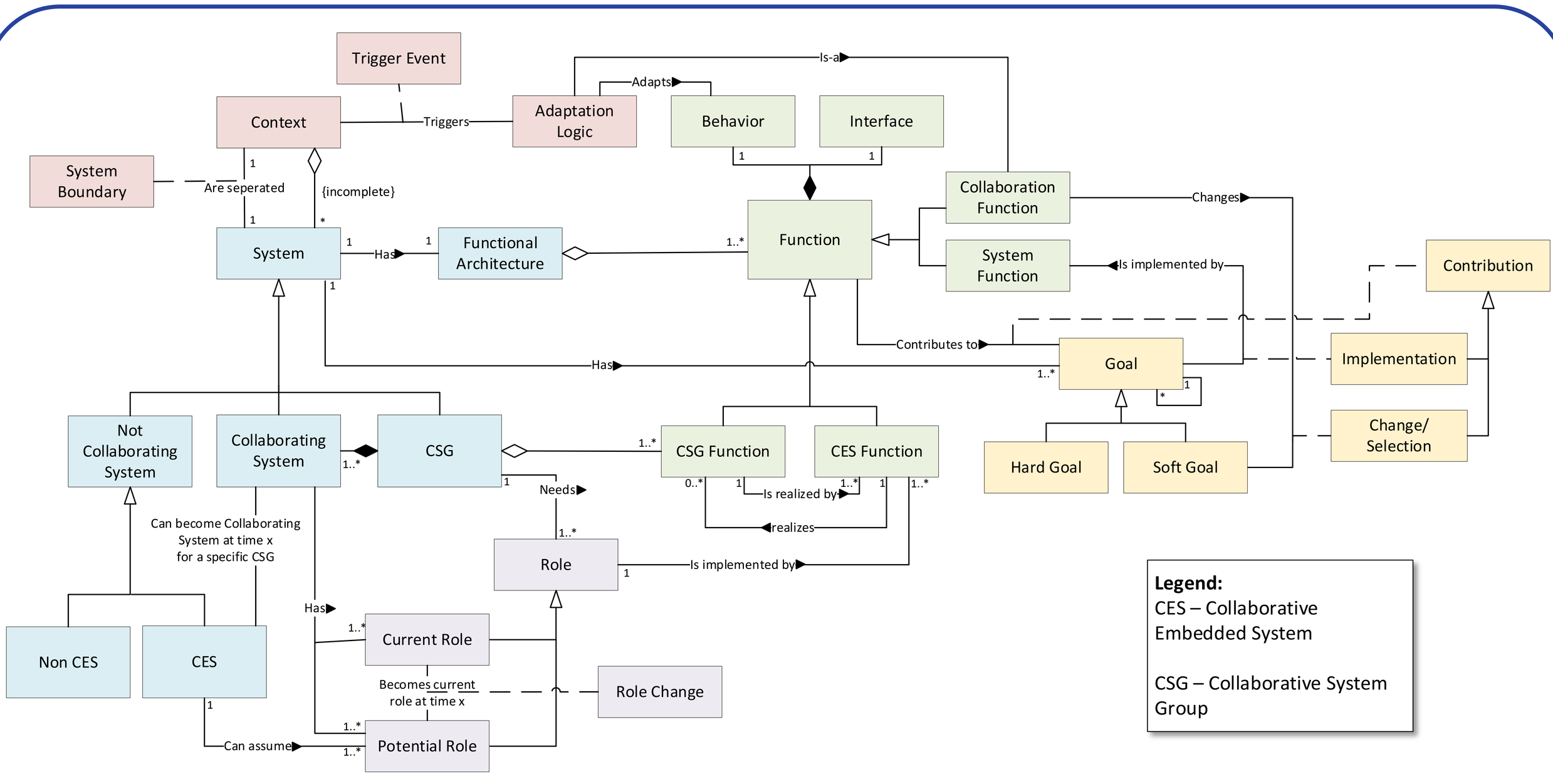
Function Meta-Model for Collaborative Embedded Systems and Groups

System, CES, CSG

- A system can be a not collaborating system, a collaborating system or a CSG. The system has goals and a functional architecture.
- A not collaborating system is a system that is not operating collaboratively (not contributing to a CSG) at a given point in time. It can be divided between a CES and non CES.
- A collaborating system is part of a CSG at a current point in time.
- A CSG consists of multiple collaborating systems. Within the CSG, the systems work together and share information to achieve common goals, that the single system could not achieve by itself.
- A non CES is not able to collaborate with other systems at any time.
- A CES can become a collaborating system at a later point in time *t+1* during the runtime of the system.
- A functional architecture describes how functions interact with each other to achieve the goals of the system.

Functions

- A function describes the purpose of the system and can be divided into further sub-functions.
- Each function has an interface with inputs and outputs through which energy, material and information can be transformed.
- Functions are interconnected by their interfaces. The functions form the functional architecture through their connections with each other.
- Functions can be further described by its behaviour, which can include the order of execution of thereby different states, dependencies, temporal or event-based aspects.
- A function can be divided into a system function or a collaboration function. A system function represents the individual purpose of a system, whereas a collaboration function contains a set of functions necessary for collaboration (e.g. communication, negotiation, etc.)
- Furthermore it can be distinguished whether a function is a CES or a CSG function. A CES function belongs to a specific CES, while a CSG function is implemented during operation by CES functions within a CSG.



Goals

- A system (CES as well as CSG) has goals it has to fulfill by means of its functions.
- Goals of the CES and/or the CSG may differ from each other or may even be conflicting.
- Goals may be negotiated and may change during runtime in order to cooperate in the CSG.
- “Soft Goals” may be adjusted during runtime.
- “Hard Goals” are not subject to negotiation.
- The collaboration functions are responsible for goal negotiation and dynamically mapping of goals to functions.

Roles

- For a group to fulfil its purpose, it must perform various tasks that require specific functions.
- The tasks are assigned to certain roles within the group, which are responsible for the fulfilment of the tasks.
- A collaborating system has a current role within a CSG.
- A collaborating system may, if necessary, change from the current role to another potential role.

Context & Adaptivity

- A system is separated from its context and other systems by its system boundary.
- The context of the system describes the environmental surrounding relevant for the system.
- Modern systems, like CESs and CSGs operate in and consider changing and dynamic contexts.
- Besides the dynamicity of the contexts where the systems are operating, the structure of the system itself is also dynamic.
- The systems need to adapt to deal with the dynamicity and the run-time changes, which cannot be completely anticipated at design-time.

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