Software Verification

Using MU-FRET for Parent-Child Relationship, and comparisons with EARS

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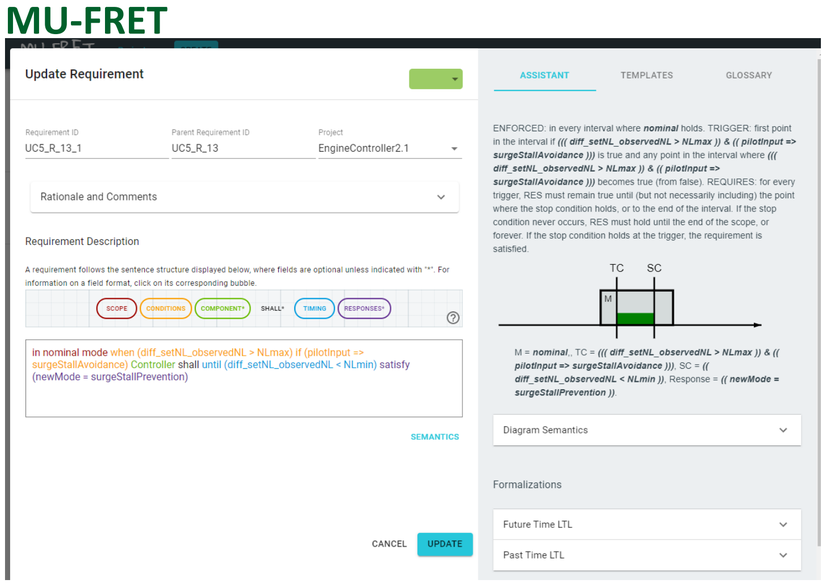
MU-FRET



What is FRET?

- Stands for Formal Requirement Eliciation Tool
- A tool/framework for elicitation, requirements, refactoring, and understanding the requirements.

What is MU-FRET?

- A fork of FRET from NASA.
- Extends FRET by adding refactoring feature.
- Enables to extract requirements to a new requirement.
- The language for MU-FRET is FRETish.

Installation for MU-FRET

- Install NuSMV and make sure it is on the system's path.
- Install NodeJS
- Install python 2.7.18
- Open a terminal (cmd) in the fret-electron.
- Run npm run fret-install, or npm run fret-reinstall if FRET is already installed.
- For more detailed instruction, see the Mu-FRET GitHub.

Using MU-FRET for Parent-Child relationship

UC5_R_13	if (trackingPilotCommands) Controller shall satisfy newMode=nominal | newMode=surgeStallPrevention		EngineController2.1
UC5_R_13_1	in nominal mode when (diff_setNL_observedNL > NLmax) if (pilotInput => surgeStallAvoidance) Controller shall until (diff_setNL_observedNL < NLmin) satisfy (newMode = surgeStallPrevention)		EngineController2.1

- FRET allows the user to define a parent-child relationship between requirements.
- For the VALU3S use case, this relationship is analogous to formal refinement where a child requirement acts as a more concrete version of its parent, with details closer to the implementation of the system.
- The exact semantics of the relationship isn't prescriptively defined, which gives flexibility to the user when creating a hierarchy among the requirements.

MU-FRET on GitHub:

FRETish and EARS

- EARS stands for **Easy Approach Requirement Syntax**.
- Created by Alistair Mavin and his colleagues from Rolls-Royce.
- The first notation was published in 2009.
- Reduces/ eliminates common problems found in natural language, and resultant requirements are easy to read.
- Provides structured guidance for authors to write high quality textual requirements.
- Lightweight, little training, and no specialist tools required.

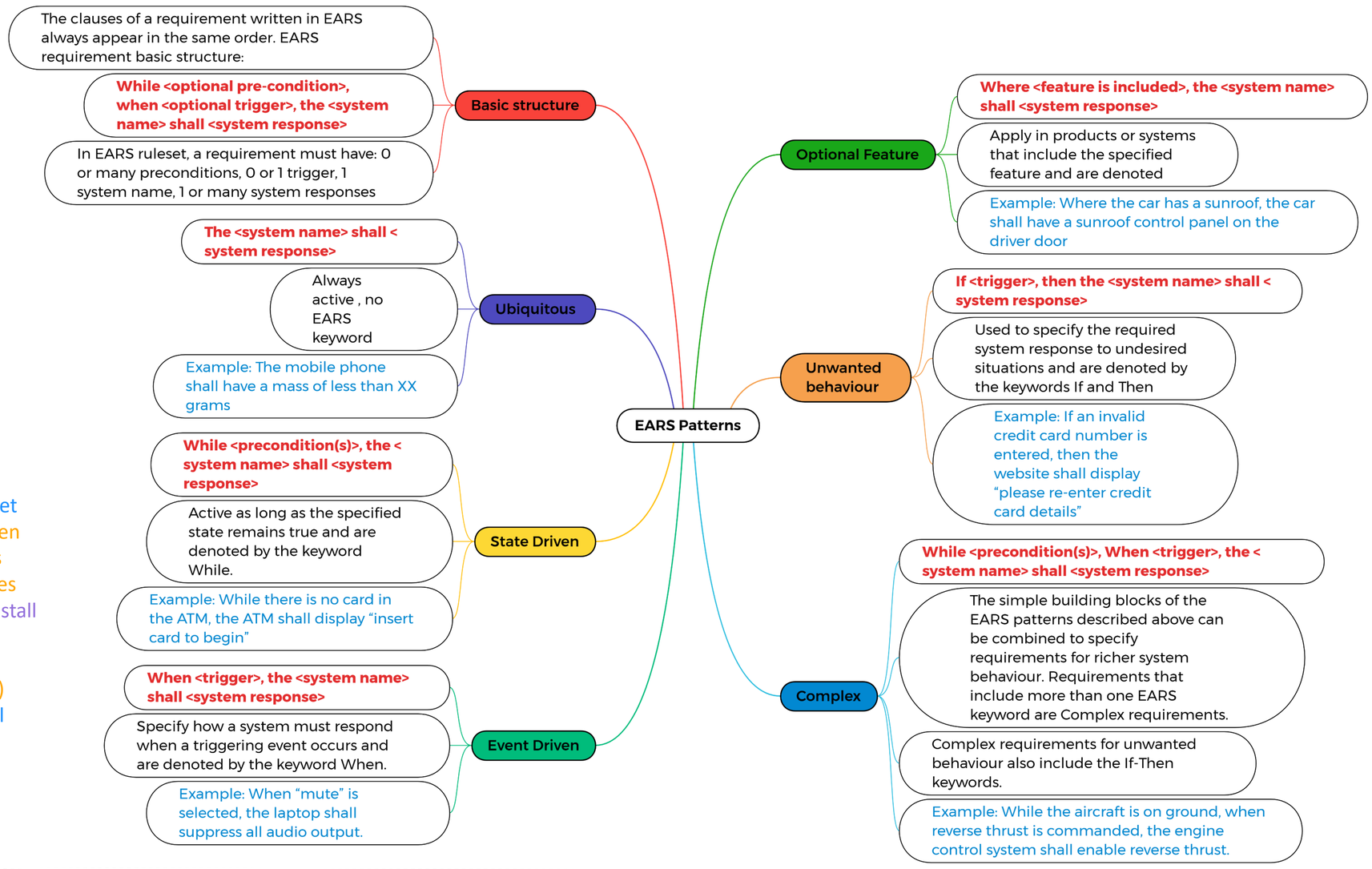
FRET and EARS Comparison

EARS:

While in nominal mode and the difference between the set NL and the observed NL is less than the minimum NL, when the difference between the set NL and the observed NL is greater than the maximum NL, and the pilot's input implies surge stall avoidance, the controller shall prevent a surge stall

FRETISH:

In nominal mode when (diff_setNL_observedNL > NLmax) if (pilotInput => surgeStallAvoidance) Controller shall until (diff_setNL_observedNL < NLmin) satisfy (newMode = surgeStallPrevention



Evaluation

- EARS provides better yet easy looking syntax compared to Mu-FRET.
- FRET has better requirement/ verification testing.
- Compared to EARS, Mu-FRET has functionality of refactoring
- EARS do not need any tools, but FRET requires tool for requirements.
- FRETish has less wordiness than EARS, in representing the requirements.

References

- https://repo.valu3s.eu/tools/improved-developed-tool/mu-fret
- https://alistairmavin.com/ears/
- https://www.researchgate.net/publication/224079416_Easy_approach_to_requirements_syntax_EARS
- https://www.iaria.org/conferences2013/filesICCGI13/ICCGI_2013_Tutorial_Terzakis.pdf

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