MANUAL

FARM RTM Number (to be generated)
Revision 0
Printed February 16, 2022

FARM Requirements Traceability Matrix

Haoyu Wang (ANL), Roberto Ponciroli (ANL), Andrea Alfonsi

Prepared by
Idaho National Laboratory
Idaho Falls, Idaho 83415

The Idaho National Laboratory is a multiprogram laboratory operated by
Battelle Energy Alliance for the United States Department of Energy
under DOE Idaho Operations Office. Contract DE-AC07-05ID14517.

Issued by the Idaho National Laboratory, operated for the United States Department of Energy by Battelle Energy Alliance.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

FARM RTM Number (to be generated)
Revision 0
Printed February 16, 2022

FARM Requirements Traceability Matrix

Haoyu Wang
Argonne National Laboratory
haoyuwang@anl.gov

Roberto Ponciroli
Argonne National Laboratory
rponciroli@anl.gov

Andrea Alfonsi
Idaho National Laboratory
andrea.alfonsi@inl.gov

Contents

1 Introduction

The ***FARM*** plug-in is a generalized module for supervised control within RAVEN.
The plug-in is aimed to compute the admissible actuator range for a system control, which is important to avoid operational constraints violation.
This document is aimed to report the traceability matrix between software requirements (see FARM SRS) and requirement tests (tests that testify the module/plug-in is compliant with respect its own requirements).

1.1 Dependencies and Limitations

The plug-in should be designed with the fewest possible constraints. Ideally the plug-in (in conjunction with RAVEN) should run on a wide variety of evolving hardware, so it should follow well-adopted standards and guidelines. The software should run on any POSIX compliant system (including Windows POSIX emulators such as MinGW).
In order to be functional, ***FARM*** depends on the following software/libraries.

- RAVEN (`https://raven.inl.gov`) and all its dependencies (listed in "RAVEN Software Design Description" - SDD-513)

2 References

- ASME NQA 1 2008 with the NQA-1a-2009 addenda, "Quality Assurance Requirements for Nuclear Facility Applications," First Edition, August 31, 2009.
- ISO/IEC/IEEE 24765:2010(E), "Systems and software engineering Vocabulary," First Edition, December 15, 2010.
- LWP 13620, "Managing Information Technology Assets"
- SDD-513, " RAVEN Software Design Description "
- PLN-5552, " RAVEN and RAVEN Plug-ins Software Quality Assurance and Maintenance and Operations Plan "

3 Definitions and Acronyms

3.1 Definitions

- **Baseline.** A specification or product (e.g., project plan, maintenance and operations [M&O] plan, requirements, or design) that has been formally reviewed and agreed upon, that thereafter serves as the basis for use and further development, and that can be changed only by using an approved change control process. [ASME NQA-1-2008 with the NQA-1a-2009 addenda edited]
- **Validation.** Confirmation, through the provision of objective evidence (e.g., acceptance test), that the requirements for a specific intended use or application have been fulfilled. [ISO/IEC/IEEE 24765:2010(E) edited]
- **Verification.**
  - The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.
  - Formal proof of program correctness (e.g., requirements, design, implementation reviews, system tests). [ISO/IEC/IEEE 24765:2010(E) edited]

3.2 Acronyms

ANL Argonne National Laboratory

API Application Programming Interfaces

ASME American Society of Mechanical Engineers

CG Command Governor

DOE Department of Energy

HDF5 Hierarchical Data Format (5)

LWRS Light Water Reactor Sustainability

NEAMS Nuclear Energy Advanced Modeling and Simulation

NHES Nuclear-Renewable Hybrid Energy Systems

IES Integrated Energy Systems

INL Idaho National Laboratory

IT Information Technology

MOAS Maximal Output Admissible Set

NQA Nuclear Quality Assurance

O&M Operation and Maintenance

POSIX Portable Operating System Interface

PP Post-Processor

QA Quality Assurance

RAVEN Risk Analysis and Virtual ENviroment

RG Reference Governor

ROM Reduced Order Model

SDD System Design Description

XML eXtensible Markup Language

4 Pre-test Instructions/Environment/Setup

The test of the requirements are performed automatically through the CIS (Continuous Integration System) for each CR (Change Request). The tests are performed on each supported Operative System (see [**?**]).

5 FARM:SYSTEM REQUIREMENTS

5.1 Requirements Traceability Matrix

This section contains all of the requirements, requirements' description, and requirement test cases. The requirement tests are automatically tested for each CR (Change Request) by the CIS (Continuous Integration System).

5.1.1 Minimum Requirements

Requirment ID	**Requirment Description**	**Test(s)**
CF-M-1	Computer: Any POSIX (and POSIX-like) system	1)"RAVEN User Manual", INL/EXT-15-34123 2)Continous Integration System
CF-M-2	RAM: 2 GB per core execution (depending on the type of analysis and data genarated)	1)"RAVEN User Manual", INL/EXT-15-34123 2)Continous Integration System
CF-M-3	Language: Python 3.x	1)"RAVEN User Manual", INL/EXT-15-34123 2)Continous Integration System

Minimum Requirements

5.1.2 Functional Requirements

Requirment ID	**Requirment Description**	**Test(s)**
CF-F-1	The FARM plug-in shall allow user to provide parameterized state-space matrices XML file as input.	1)D:_fork_RefGov_para_xmlABC.xml
CF-F-2	The FARM plug-in shall allow user to provide un-parameterized state-space matrices XML file as input.	1)D:_fork_RefGov_unpara_xmlABC.xml

Framework and I/O

5.1.3 Usability Requirements

Requirment ID	Requirment Description	Test(s)
CF-SC-1	The FARM plug-in shall support for user-defined instructions for adjusting the actuator value and provide admissible actuator range without violating any operational constraints.	1)D:_fork_RefGov_para_xmlABC.xml 2)D:_fork_RefGov_unpara_xmlABC.xml

Supervisory Control

5.1.4 Performance Requirements

Requirment ID	Requirment Description	Test(s)
CF-IS-1	The FARM plug-in shall be able to be executed in parallel via RAVEN.	1)D:_fork_RefGov_para_xmlABC.xml 2)D:_fork_RefGov_unpara_xmlABC.xml

Infrastructure Support


INL
Idaho National Laboratory