

## SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

**Action number: CA15127**

**STSM title: Exploring a FRAMework for DIaster Resilience (FRADIR) to enhance end-to-end availability**

**STSM start and end date: 01/04/2019 to 12/04/2019**

**Grantee name: Teresa Gomes**

### **PURPOSE OF THE STSM:**

The objective was to continue the collaboration with researchers at Budapest University of Technology and Economics (BME), Hungary.

Jointly we explored the recently proposed FRAMework for DIaster Resilience (FRADIR).

During my stay it was also possible to revise chapter 3.7 (Enhancing Availability for Critical Services) where the FRADIR approach is described.

### **DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS**

During my stay in BME I had daily meetings with Alija Pasic, joined on some occasions by János Tapolcai or Ferenc Mogyorosi (a student of Alija Pasic). Moreover Rita Girão-Silva (from Coimbra) also joined us by skype on two occasions. This work was done also remotely in collaboration with Balazs Vass.

My stay in Budapest made possible fruitful discussions regarding relevant aspects of the planned work, both regarding the RECODIS book chapter and FRADIR (Pasic et al., 2018).

The work on RECODIS book chapter 3.7 (Enhancing Availability for Critical Services) progressed well, some revisions and extensions of the text were made by several co-authors; namely the introduction was extended and a missing section was added by some of the co-authors, the abstract and conclusions were also added. This chapter has presently 24 pages (the maximum recommended), and was submitted in EDAS as a first complete draft.

After meeting with Alija Pasic and János Tapolcai it was agreed that the new enhanced version of FRADIR would consider the following aspects:

- 1) A cost function would be used to select the new high availability links on the spine (a spanning tree); the value of availability increase of the links in the spine would be determined jointly by the minimization of the upgrade cost while satisfying the working path (WP) end to end availability, in a similar way to what was done in (Alashaikh et al, 2018), but without requiring that a link disjoint backup path must exist for each WP.
- 2) The relevant SRLGs, representing regional failures, are identified, using a new regional failure model, where each link availability is translated into a distance of the link from the epicenter area.
- 3) To ensure no SRLG contains a cut-set, a heuristic was proposed to select links from the spine to have their availability upgraded. The idea is to reduce the likelihood of links in the spine being part of an SRLG, thus ensuring the network remains connected.

During my stay we started writing a first draft of a paper, with the main results of this STSM, which is planned to be submitted to an international conference.

Moreover, other research directions were discussed during the meetings with János Tapolcai and Alija Pasic: possible alternative models of regional failures taking into account the spine based design and the differentiated link's availability; a recalculation of the spine after some links are upgraded to ensure connectivity in the presence of regional failures; a solution where the spine is no longer a spanning tree.

I also had the opportunity to meet with Tibor Cinkler.

#### References

A. Alashaikh, D. Tipper, and T. Gomes, “Designing a high availability subnetwork to support availability differentiation,” in 14th International Conference on the Design of Reliable Communication Networks (DRCN 2018), Paris, France, 19 February 2018.

A. Pasic, R. Girão-Silva, B. Vass, T. Gomes, and P. Babarczy, “FRADIR: A novel framework for disaster resilience,” in 10th International Workshop on Resilient Networks Design and Modeling (RNDM 2018), Longyearbyen, Svalbard (Spitsbergen), Norway, Aug. 27-29, 2018.

#### **DESCRIPTION OF THE MAIN RESULTS OBTAINED**

A first complete draft of chapter 3.7 (Enhancing Availability for Critical Services) was submitted in EDAS (with 24 pages, summary and conclusions).

An enhanced version of the FRAMework for DISaster Resilience (FRADIR), first proposed in RNDM 2018, was jointly developed during my stay in Budapest, and is planned to be submitted to an international conference.

#### **FUTURE COLLABORATIONS (if applicable)**

During the meetings with János Tapolcai and Alija Pasic, some possible research lines were discussed, namely possible alternative models of regional failures taking into account the spine based design and the differentiated link’s availability. It is expected that RECODIS researchers in Coimbra and BME researchers will jointly continue to explore the FRADIR framework in this context.