

SFI2 - SLICING FUTURE INTERNET INFRASTRUCTURES

MULTIINSTITUTIONAL COLLABORATIVE RESEARCH PROJECT

SFI2 Project Summary

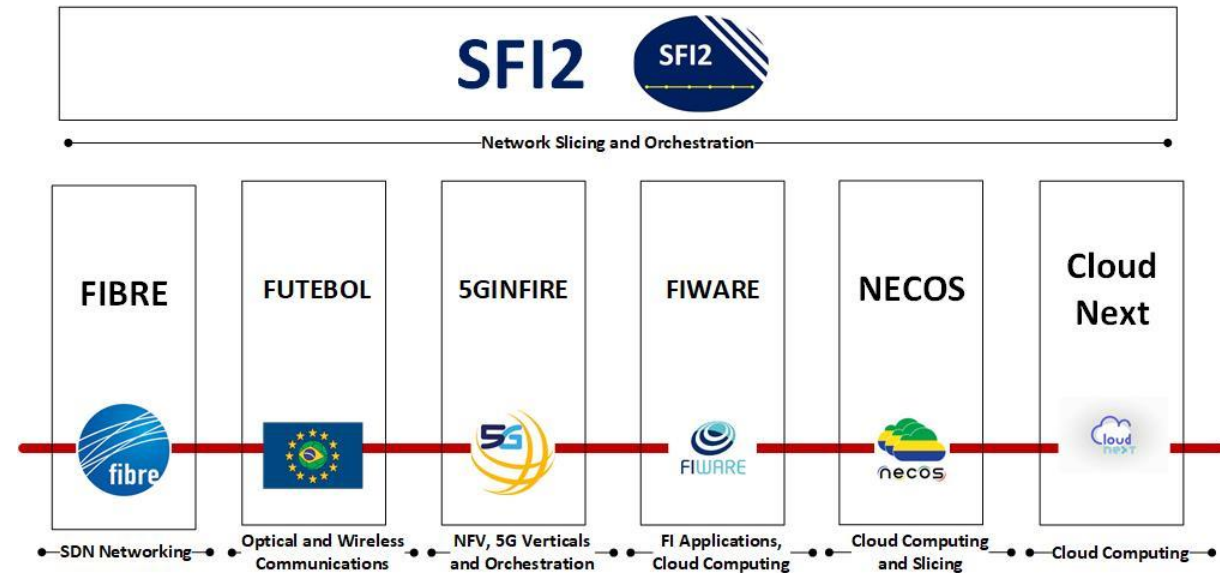


<https://sites.google.com/view/sfi2/home>



Agenda

- Objectives
- Context
- Working Packages
- Use Cases 1, 2, 3 and 4
- SFI2 Team

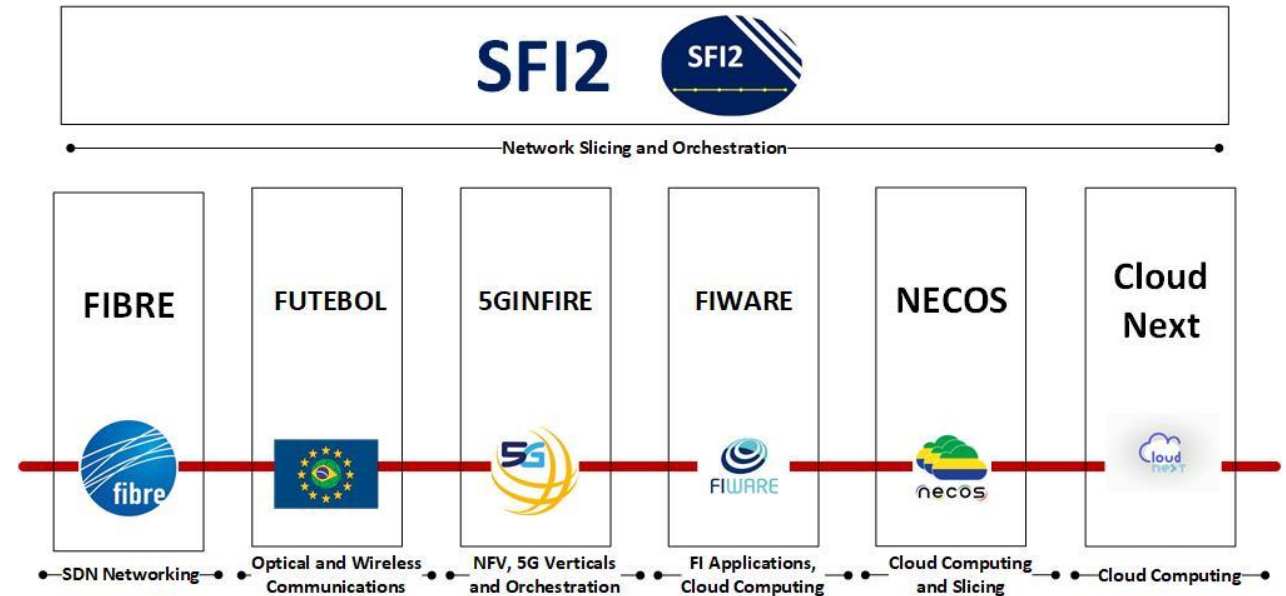


SFI2 project: 01/03/2020 a 28/02/2025

Objectives

SFI2 research's leading technical and breakthrough emphasis is to **develop a network slicing solution that provides orchestration and allocation of resources in multi-domain experimentation network infrastructures.**

Machine learning techniques will assist slicing in multi-domain network infrastructures to provide **near-automatic resource identification and allocation.**



Context

Aware of the need to evolve towards new network infrastructure demands, the scientific community has developed research on the Future Internet. In Future Internet, network infrastructures for experimentation (testbeds) supporting new technologies are added to the academic Internet in a controlled manner, with mechanisms of isolation (from traditional Internet traffic) and monitoring (for the collection of associated metrics). This allows the assessment of the impact of these new technologies on the current Internet and the experimentation of new disruptive protocols and architectures

There are currently several **infrastructures for experimentation** in Brazil linked to **SDN** concepts, **NFV**, **cloud computing**, and **5G** (FIBRE, NCOS, 5GINFIRE, FUTEBOL, CloudNEXT, FIWARE)

SFI2 Project aims to **integrated these experimental facilities in Brazil**



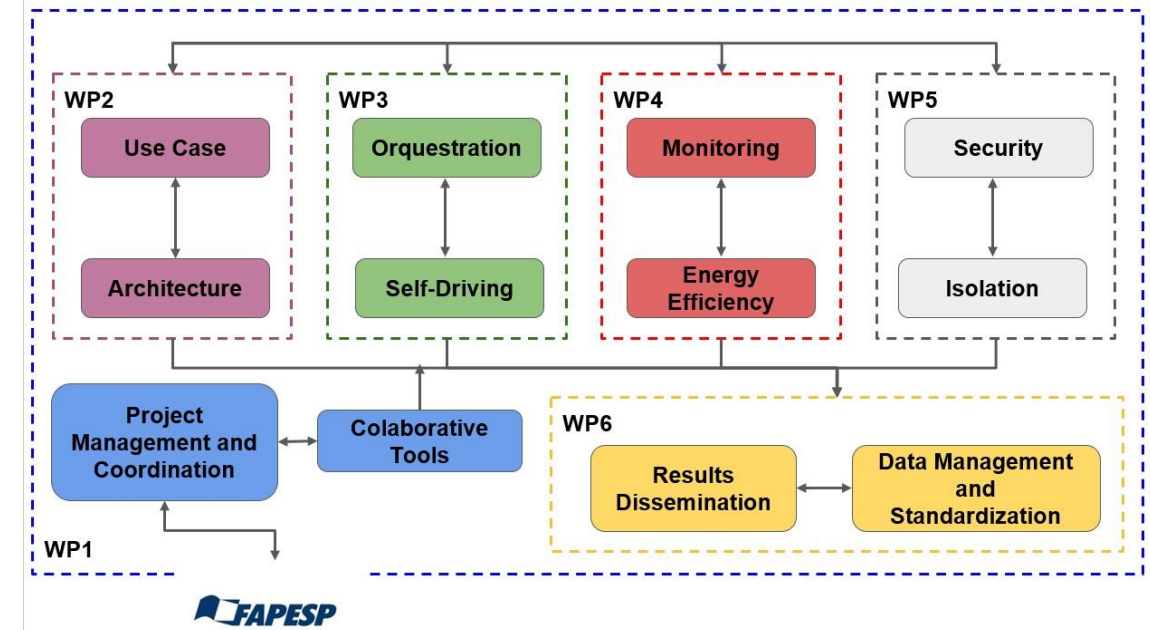
SFI2 Working Packages

- **WP 1 - Project Management:**

- The main objective of this work package (WP) is to ensure efficient project management and to monitor the progress of the activities described in its proposal
- USP

- **WP 2 - SFI2 Architecture:**

- This work package's main objective is to define an architecture for SFI2 encompassing the different technologies present in the testbeds that support the project and a set of use cases for experimentation and validation of SFI2
- UFG, UFU, UFPA, UFRGS and UFES



SFI2 Working Packages

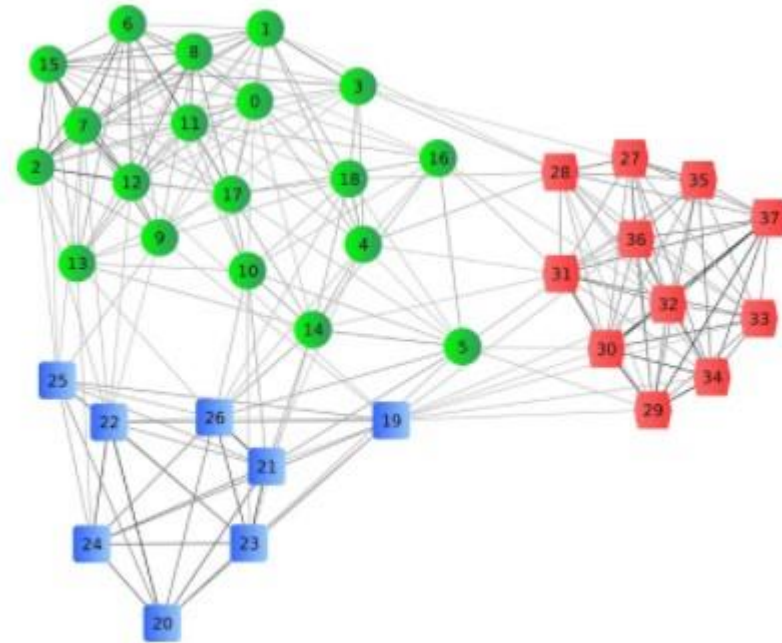


- **WP 3 - Intelligent Infrastructure for Experimentation:**

- This work package's main objective is to provide intelligent mechanisms for provisioning and maintaining slices in a multi-domain environment with the support of machine learning techniques. Multi-domain network slicing providing slice as a service (SlaaS) is the main target
- ITA, UNIFACS, UFU, UFMG, UFRJ and PUC-RS

- **WP 4 - Monitoring and Energy Efficiency:**

- The main objective of this work package is to monitor the SFI2 infrastructure and orchestrate energy efficiency mechanisms applied to the resources of this environment based on multi-domain slicing
- UFPE, USP, UFMG, UFRGS, UNISINOS and UFF



SFI2 Working Packages

- **WP 5 - Security:**

- This WP aims to bring functional aspects essential for good performance of the infrastructure and ensure the integrity and reproducibility of the experiments from the point of view of safety and slice isolation
- UFBA, UFES, ITA e UFU

- **WP 6 - Dissemination, Data**

Management and Standardization:

- This WP will be responsible for using different communication strategies to disseminate results, increase SF12 visibility and adoption, exploit its results, manage the data generated, and timely propose topics of interest to standardization bodies.
- USP, UFRJ and RNP

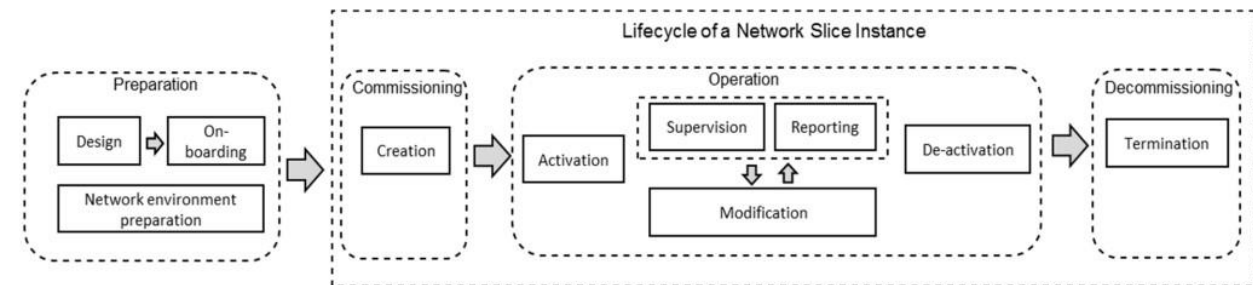
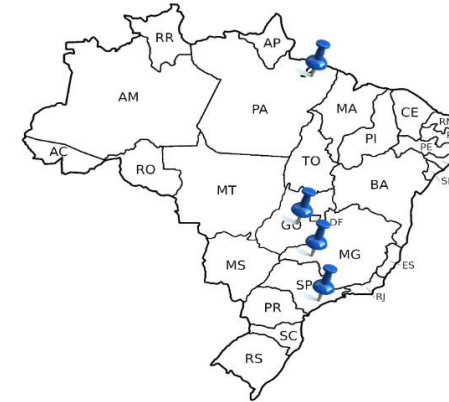


Use Case 1

SLICING ORCHESTRATION USING MACHINE LEARNING



- The objective of Use Case 1 (UC1) is to use machine learning to orchestrate network slicing. The SFI2 architecture, derived from the NECOS project architecture, supports the Use Case deployment. Architectural components must be explicit about embedding machine learning (ML) techniques and methods in the SFI2 architecture. In this context, the proposition is to **extend the NECOS architecture** to explicitly deal with **machine learning** techniques for **slice orchestration** and other phases of the network slicing life-cycle.
- UC1 Setup:
 - Backbone: FIBRE Backbone
 - Docker/Kubernetes based
 - Monitoring: CASANDRA/Prometheus
 - Pseudo-Domains: FIBRE islands: UFU, UFG, UFPA, USP
- Partners: UFU, UFPA, UFV, UFPE and UNIFACS



Use Case 2

ULTRA RELIABLE LOW LATENCY COMMUNICATION



- Use case 2 aims to provide **reliable and low latency communication for Industry 4.0 and Smart City** environments:
 - Drone flight control
 - Remote operation of machinery
 - Virtual and augmented reality, games
- The main research challenge is the **orchestration of different types of networks**, using machine learning and network virtualization techniques, while keeping tight **QoS requirements**. Key enablers are:
 - Deep reinforcement learning
 - Time-sensitive networking
 - In-band telemetry
- Partners: UFMG, ITA

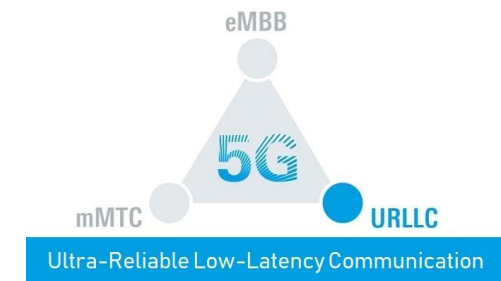
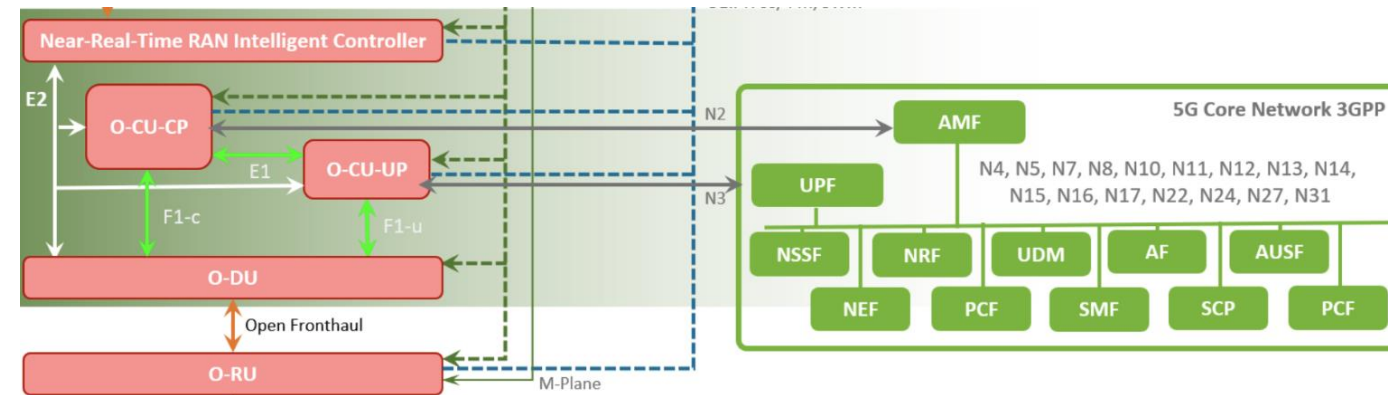


Use Case 3

5G Slicing



- The main objective of Use Case 3 (UC3) is to study the use of **slicing in 5G networks** and to propose and evaluate mechanisms that guarantee the requirements of different slices in a **dynamic environment**.
- UC3 Current Actions
 - Design, deploy, and evaluation of **5G Core and O-RAN RIC support for 5G slicing**
 - System modeling and formalization of **URLLC guarantees**
- Partners: UFRJ, UFG, UNISINOS, UFU, UFMG, and UFRGS



Use Case 4

ENERGY-EFFICIENT SLICING

- The main objective of Use Case 4 (UC4) is to introduce slicing as a new enabler supporting the **deployment of efficient distributed network infrastructures** while enforcing energy efficiency in the slicing **3GPP life-cycle** phases of **preparation, commissioning, operation, and decommissioning**
- UC4 Slicing Premises:
 - **Energy Efficiency** requirements and policies are essential criteria for **slicing**
 - UC4 approach for slice's requirement specification uses an **intent-based** style
 - The UC4 slicing approach fosters **renewable energy** use (green computing)
- Partners: USP, UFG, IFSP, UFPE, UNIFACS and PUC-RS



SFI2 TEAM AND SUPPORT (by March 28th, 2020)



- **Fifteen (15) Brazilian research institutions:**

- 24 researchers directly involved
- One (1) PosDoc
- One (1) PhD student
- Three (3) master students

- Networking and Technical support:

- RNP – Rede Nacional de Pesquisa
- FIBRE project





Discussion

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