

# DELIVERABLE D5.1.1

## TRAINING PLAN

VERSION 1

# TeRABIT

JUNE 2023

Stefano Salon, Chiara Scaini (OGS)  
Silvia Calegari (INFN)

Eccetto dove diversamente specificato, il contenuto di questo sito è  
concesso in licenza con Attribuzione Creative Commons - 4.0 internazionale.



## **Executive Summary**

The deliverable presents a preliminary plan for the training events that will be organized during the project lifecycle, and the updated status of the agreements with universities or other research entities that TeRABIT partners have finalized so far for the high-level training and capacity building.

---

## Table of Content

1. TRAINING PLAN.....	1
<b>1.1. Exploitation and Training activities .....</b>	<b>1</b>
<b>1.2. High level training grants plan.....</b>	<b>2</b>
<b>1.3. Federated services training plan.....</b>	<b>3</b>

## List of Tables

Table 1 - Updated status of PhDs co-funding agreements.....	3
Table 2 - List of MHPC students and related projects.....	3

## 1. TRAINING PLAN

The ambitious goal of WP5 is to build a clear identity of TeRABIT and to appear to end-users as a single computing infrastructure, geared into the Italian territory and oriented to the research and industry demands requiring a fast access to pre-Exascale resources, fully complementary to the state-of-the-art Tier-0 capability developed within the ICSC National Centre.

The training plan is one of the two main documents of WP5 (together with the dissemination plan, D5.2.1). This plan specifically addresses to Activity A5.1, whose fundamental outcome is enabling users to get the necessary knowledge to efficiently exploit the TeRABIT services, and up-scale their expertise on the TeRABIT infrastructure. The exploitation and training activities will benefit from the vast multi-disciplinary network covered by the project partners, capable to intercept an heterogenous diversity of user requests.

### 1.1. Exploitation and Training activities

The exploitation of the upgraded research infrastructures developed jointly by WP2, WP3 and WP4 (the GARR-T network, the PRACE-Italy Tier-1 system and the distributed HPC-Bubbles of HPC-BD-AI), and consequently of the federated TeRABIT services (including the GARR-T Infrastructure User Portal, the HPC Cloud services, and the PaaS Orchestrator), has to be aligned to the training activities planned in WP5. The training activities will be organized by OGS and INFN in collaboration with the Cineca HPC department, which is one of the PRACE Training Centres, and GARR. To empower users to approach and use the TeRABIT infrastructure, a specific IS CRA access will be dedicated to small HPC projects aiming at exploiting the federated infrastructure and its services: details about this specific access will be provided in the Preliminary report on exploitation activities (D5.1.2).

For the PRACE-Italy Tier-1 system, the training activities will benefit of the long-term collaboration of Cineca with key players and vendors involved in the exploration and testing of new HPC technologies (GPUs, CPU with High Bandwidth Memory). Building on the experience in modelling and data analysis for Earth Sciences applications of the research groups participating to the HPC-TRES community, we plan to work on the porting, adaptation, test and pre-production of a selection of applications over the new TeRABIT infrastructure, testing the TeRABIT services after their deployment. The investment in high level training grants and capacity building will be part of the exploitation action. The current status of the agreements with Italian universities is detailed in section 1.2.

For the distributed HPC-Bubbles of HPC-BD-AI, the training activities will focus on courses and schools related to the self-creation, administration, security hardening and customization of distributed resources and applications in a cloud environment. Specifically, emphasis will be put on the integration of HPC and HTC applications with both HPC-Bubbles and PRACE-Italy resources. The training courses will address: i) how to handle sensitive data and applications in distributed ISO-

certified cloud resources; ii) how to write and maintain scalable distributed computing models for big data applications; iii) how to develop and apply Machine Learning techniques in a federated environment. A tentative plan detailing the target audience, the venue, the dates and the program of the training events is described in section 2.3.

## 1.2. High level training grants plan

The exploitation and training activities of TeRABIT are related to the enrolment of new specialized workforce for INFN and OGS, and the co-funding of PhD and HPC masters students. The enrolment of workforce is proceeding, the updated plan for the agreements with Italian universities is illustrated in Table 1.

<i>PhD program (cycle, University)</i>	<i>Title of PhD project</i>	<i>Tutor(s)</i>	<i>Status</i>
ESFM (38 <sup>th</sup> , Univ. of Trieste)	Numerical simulation of sediment transport by thermohaline bottom currents	M. Rebesco (OGS), S. Salon (OGS), F. Roman (UNITS), F. Falcini (ISMAR-CNR)	Antonio Ammendola, since Jan 2023
ESFM (39 <sup>th</sup> , Univ. of Trieste)	Numerical modeling of crustal deformation	G. Rossi (OGS), A. Magrin (OGS), A. Martinez Calomardo (UNITS)	Candidate withdrawal
ESFM (39 <sup>th</sup> , Univ. of Trieste)	Earth System projections and uncertainty in a changing climate: focus on the Mediterranean Sea biogeochemistry	D. Canu (OGS), S. Salon (OGS)	Gaia Buccino, from Nov 2023
ESFM (39 <sup>th</sup> , Univ. of Trieste)	Generation and propagation of anthropogenic noise in the marine environment	V. Armenio (UNITS), S. Parolai (UNITS), A. Camerlenghi (OGS)	Ines Addeo, from Nov 2023
ADSAI (39 <sup>th</sup> , Univ. of Trieste)	Artificial Intelligence (AI) and Machine Learning (ML) on Big data seismology	M. Sukan (OGS), L. Bortolussi (UNITS)	Ken Tanaka, from Nov 2023
SSGE (39 <sup>th</sup> , Politecnico di Milano)	Development of an urgent high-performance computing framework for the rapid physics-based simulation of earthquake impact at regional scale	V. Poggi (OGS), C. Scaini (OGS), S. Parolai (UNITS)	Ileana Elisabeth Monsalvo Franco, from Dec 2023
FECCSC (39 <sup>th</sup> , Univ. of Bologna)	Hierarchies of models and optimization methods for the study of 'tipping points' in the climate system	S. Corti (ISAC-CNR), V. Lembo (ISAC-CNR), P. Ruggieri (UNIBO)	Irene Trombini, from Nov 2023
FECCSC (39 <sup>th</sup> , Univ. of Bologna)	Rapid climate transitions in the North Atlantic: circulation in the subpolar basin as a 'tipping element' of the climate system	S. Corti (ISAC-CNR), A. Bellucci (ISAC-CNR)	Marco Buccellato, from Nov 2023
CGES (39 <sup>th</sup> , Univ. of Milano Bicocca)	Intensification rate in tropical cyclones	C. Pasquero (UniMiB)	Andrea Davin, from Nov 2023
CEG (39 <sup>th</sup> , Politecnico di Torino)	Development of a low-resolution Earth System Model for paleoclimate and tipping points studies	J. von Hardenberg (PoliTO)	No candidate, re-open position
INDICEE (39 <sup>th</sup> , Univ. of Firenze)	Ocean modeling in support of digital twin	C. Brandini (ISMAR-CNR)	Rebecca Agati, from Nov 2023

Table 1 - Updated status of PhDs co-funding agreements.

Note: ESFM is “Earth Science, Fluid-Dynamics, and Mathematics. Interactions and Methods”, ADSAI is “Applied Data Science and Artificial Intelligence”, SSGE is “Structural, Seismic and Geotechnical Engineering”, FECCSC is “Future Earth, Climate Change and Societal Challenges”, CGES is “Chemical, Geological and Environmental Sciences”, CEG is “Civil and Environmental Engineering”, INDICEE is “International Doctorate in Civil and Environmental Engineering”.

Beside the agreements to co-fund PhD courses, OGS has finalized an agreement with the Scuola Internazionale Superiore di Studi Avanzati (SISSA) to cover the tuition fees of maximum 15 students of the Master in High Performance Computing (MHPC) in the 2023/24 and 2024/25 academic years. For 2023/24, six students chose projects funded by TeRABIT (see Table 2).

Name	Title of MHPC project	Tutor(s)
Andrea Carducci	DEEP LEARNING APPLIED TO TIME-SERIES ANALYSIS	M. Sugan (OGS)
Mohammad Enayati	PARALLELIZATION OF THE PRE-STACK DEPTH MIGRATION CODE	U. Tinivella (OGS)
Ahmed Fathi Ibrahim Mohamed	DEVELOPMENT OF AN EARTH SYSTEM MODEL OF INTERMEDIATE COMPLEXITY	R. Farneti (ICTP)
Behzad Salmassian	PARALLELIZATION OF THE WAVE EQUATION DATUMING CODE	U. Tinivella (OGS)
Ken Tanaka Hernandez	DEEP LEARNING APPLIED TO TIME-SERIES ANALYSIS	M. Sugan (OGS)
Natalia Tilinina	DEVELOPMENT OF AN EARTH SYSTEM MODEL OF INTERMEDIATE COMPLEXITY	R. Farneti (ICTP)

Table 2 - List of MHPC students and related projects.

All the students enrolled in the PhD course and the MHPC will be actively involved in the exploitation, training and test of the TeRABIT infrastructure and federated services. The students, together with the researchers and technologists from INFN and OGS specifically dedicated to port and test their applications in the new infrastructure, will constitute the TeRABIT internal users group. Dedicated mailing lists will be prepared and two surveys (aligned with the two workshops, see section 1.3) will be oriented to match their expectations before and after the deployment of the TeRABIT federated services.

### 1.3. Federated services training plan

The training plan will be mainly oriented to empowering the new users of TeRABIT in the exploration, testing and efficient exploitation of the federated services. Basically, the services will allow users to interconnect their workloads from the edge computing (i.e., the HPC Tier-2 systems or HPC Bubbles, developed in WP4) to the central HPC-Cloud node (i.e., the upgraded Tier-1 at Cineca, developed in WP3), through the GARR-X network (developed in WP2). Researchers will be trained to acquire the necessary skills to access the TeRABIT infrastructure via the User portal, build their workflows, store both raw and processed sensors data, analyse them, integrate the data with model or machine learning approaches, and scale their workloads up to the ICSC resources. The new Cloud infrastructure (developed within WP3 and whose co-design process is described in

Deliverable D3.1.1) will be able to guarantee the required flexibility to become the interface layer between the HPC Bubbles, distributed in the territory and close to data sources, and Tier-1/Tier-0 systems located in CINECA.

TeRABIT federated services will be based on the services already provided by the INFN and Cineca Cloud catalogues (see respectively <https://www.cloud.infn.it/service-catalogue/> and <https://wiki.u-gov.it/confluence/display/SCAIUS/UG3.5%3A+ADA+Cloud+UserGuide>).

A preliminary plan for the training events follows:

- 1<sup>st</sup> workshop on TeRABIT infrastructure – The present capability
  - Date: June 2024, 2 days
  - Venue: Bologna, organized by Cineca and INFN, with support of OGS and GARR
  - Target audience: Day 1 will be open to the highest number of perspective users, while Day 2 will be reserved to the TeRABIT internal users group (students, researchers and technologists already users of the three infrastructures, including those involved in WP5 exploitation use cases)
  - Program focussed on the presentation of the federated infrastructure and the preliminary exploitation of services provided by the three infrastructures, showing the expected evolution towards the federated services
- 2<sup>nd</sup> workshop on TeRABIT infrastructure – The federated services
  - Date: May 2025
  - Venue: Trieste, organized by OGS, with support from INFN, Cineca, GARR
  - Target audience: TeRABIT internal users group
  - Program focussed on the exploitation of federated services provided by the TeRABIT infrastructure
- Hackathon on TeRABIT infrastructure
  - Date: May 2025, back-to-back to the 2<sup>nd</sup> workshop
  - Venue: Trieste, organized by OGS, with support from INFN, Cineca, GARR
  - Target audience: users of the National Centre of HPC, Big Data and QC – ICSC and other perspective users
  - Program focussed on demonstration and efficient use of the capability of TeRABIT federated services

In the period between the two workshops, a series of interactive sessions (e.g., every 2-3 months) will be organized to prepare both the internal users and those who expressed interest for the hackathon.

This draft plan will also be included and reviewed into the dissemination plan, and in order to ensure the largest promoting action for the perspective TeRABIT users, the organization of the events and the dissemination activities will be carried out in synergy with ICSC. This will request a tight link between the personnel of the two project consortia involved in such actions.