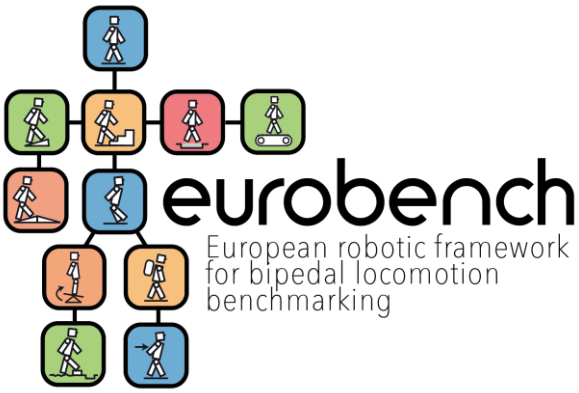
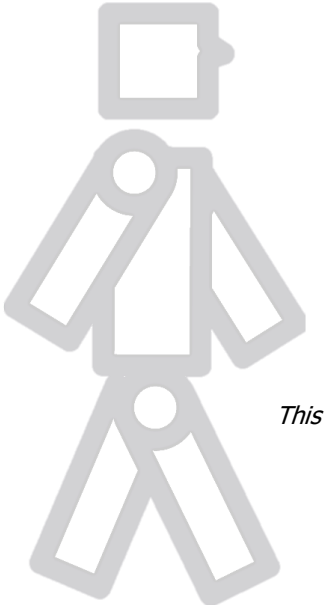


EUROBENCH "European Robotic Framework for Bipedal Locomotion Benchmarking"
H2020 Project - Grant Agreement No 779963

FSTP-1 Open Call "DEVELOPMENT of the benchmarking framework"

Guide for applicants



July 15, 2018

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Executive Summary

This document includes instructions for preparing proposals to be submitted to the EUROBENCH FSTP-1 Open Call.

Section 1 reports general information on how to participate in this Open Call.
Section 2 includes a list of the expected outcomes with highest priority for the EUROBENCH project.
Section 3 describes the necessary steps to submit the proposals.
Section 4 describes the evaluation and selection process.
Section 5 highlights specific communication and confidentiality matters.
Section 6 describes the Grant Agreement.
Section 7 describes how payments to sub-projects Consortia will be executed.
Section 8 specifies the different responsibilities of the sub-projects Consortia members.
Section 9 describes the different EUROBENCH Boards and Committees.
Section 10 provides a Checklist to help applicants to quickly verify the correctness of the proposal draft.

Disclaimer

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Introduction

Goals of EUROBENCH

The EUROBENCH project aims to create the first unified benchmarking framework for robotic systems in Europe. This framework will allow companies and/or researchers to test the performance of their robots at any stage of development. The project is mainly focused on bipedal machines, i.e. exoskeletons, prosthetics and humanoids, but aims to be also extended to other robotic technologies. To this aim, EUROBENCH will develop:

- Two Testing **Facilities**, one for wearable robots (located in Spain) - including exoskeletons and prostheses - and the other for humanoid robots (located in Italy), to allow companies and/or researchers to perform standardized tests on advanced robotic prototypes in a unique location, saving resources and time.

- A unified Benchmarking **Software**, to easily design and run the tests, and automatically obtain relevant scores on robot performance. This software will also allow to perform the tests in any laboratory settings, and compare the results with similar systems in the state of the art.

To realize these goals, the EUROBENCH Consortium will count on the collaboration of external entities, a.k.a. Third Parties, offering them financial support for developing and validating specific sub-components of the Facilities and the Software. This Cascade Funding action, called "FINANCIAL SUPPORT TO THIRD PARTIES" (FSTP) will be organized in two competitive Open Calls:

- **1st Open Call (FSTP-1)**, also titled "DEVELOPMENT of the benchmarking framework". This Call is looking for Third Parties interested in designing and developing testbeds, algorithms and datasets to allow the benchmarking bipedal platforms performance. This call will be open from July 15, 2018 until October 31, 2018.

- **2nd Open Call (FSTP-2)**, also titled "VALIDATION of the benchmarking framework". This Call will offer Third Parties the opportunity to use the benchmarking facilities and/or software, at zero-costs, to test and improve their own robotic/control systems. This call will be open from June 1, 2020 until August 31, 2020.

This document provides specific instructions for participating in the FSTP-1 Open Call.

Instructions for applying to the FSTP-2 Open Call will be provided later in the project.

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1 Preparing the proposal

1.1 General information

Applicants have two different options to participate in the FSTP-1 Open Call (see Figure 1.1):
OPTION 1. Developing a benchmarking solution for one specific benchmarking scenario (see Table 1 and Section 2.3 for further details).
OPTION 2. Developing a benchmarking solution that can be used across several scenarios (see Table 2 and Section 2.3 for further details).

To apply for **OPTION 1**, you should:

- Focus on **one** benchmarking scenario, preferably among those listed in Table 1. If strongly motivated, applicants may also cover more than one scenario (e.g. datasets spanning different motor skills), or propose a new scenario not included in Table 1 (e.g. a complex and domain-specific condition).
- For the selected scenario, design and develop one or more (all is desirable) of the following outcomes:
  - A **testbed**, namely "a platform for conducting replicable and repeatable testing experiments". The testbed may include:
    - Structures and/or devices that physically reproduce the environmental conditions (terrains, perturbations) typical of the selected scenario.
    - Actuators needed to induce dynamic changes in the structures (e.g. changing dimensions) or to generate specific perturbations (e.g. pushes).
    - Any *special* sensor specifically developed to be used with the proposed testbed. Please consider that:
      i. Traditional sensors (e.g. standard motion capture system) do not need to be delivered with the testbed, because they are already owned by the EUROBENCH Consortium (see Table 3 for a detail list of the EUROBENCH equipment).
      ii. All sensors should be accompanied by pre-processing algorithms that transform raw data into data that are compliant in content and format with the EUROBENCH framework (see Section 2.1.2 and 2.1.3 for details).
  - A set of **software routines**, which include algorithms and protocols able to calculate specific performance scores from experiments performed on the testbed. These algorithms will be integrated in the EUROBENCH Software.
  - Experimental **datasets**, which include data obtained by real experiments on bipedal systems (either humans and/or robots). These datasets will be integrated in the EUROBENCH Database.

To apply for **OPTION 2**, you should:

- Propose a benchmarking device, composed of sensors and/or actuators, that can be applied indistinctly to different benchmarking scenarios. Table 2 shows a list of relevant devices, but applicants are free to propose any other solution that may be relevant.

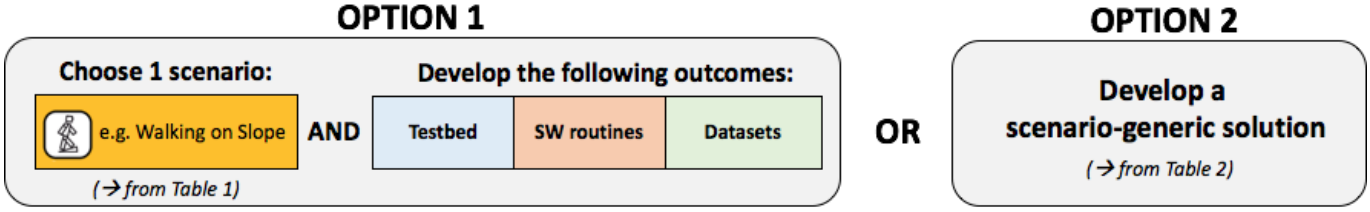

Figure 1.1. Decisional process to apply for the EUROBENCH FSTP-1 Open Call.

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IMPORTANT: All the outcomes developed by the applicants (hardware and/or software) will be integrated in the EUROBENCH framework for their evaluation during the execution of the 2nd call and for their use in after the project end. The EUROBENCH consortium will study and define potential agreements with Third Parties whose outcomes will have been successfully validated, to ensure further exploitation and sustainability as part of the EUROBENCH facilities and software. If the testbeds addresses both fields (i.e. Wearable Robots & Humanoids), two prototypes should be developed, to allow their integration in both the EUROBENCH Facilities.

Table 1. Non-exhaustive list of benchmarking scenarios relevant for OPTION 1. The required outcomes are specified with an "X". The applicability to the Wearable Robots (WR) and/or Humanoid fields is indicated with the "▪" symbol. The specific requirements of each of these scenarios are detailed in Section 2.2.

Benchmarking scenarios *Choose preferably only 1 row*	**Outcomes** *Choose at least 1 outcome (column)*			**Applicability** *Choose 1-2 fields*	
	1. Testbeds	**2. SW Routines**	**3. Datasets**	**WR**	**Humanoids**
Walking on Slopes	X	X	X	▪	▪
Walking on Stairs	X	X	X	▪	▪
Overcoming Obstacles	X	X	X	▪	▪
Walking on Irregular Hard Terrains	X	X	X	▪	▪
Walking on Treadmill	X	X	X	▪	
Walking/Standing on Moving Surfaces	X	X	X	▪	▪
Walking/Standing during Pushes	X	X	X	▪	▪
Standing during manipulation skills	X	X	X	▪	▪
Picking and Carrying objects	X	X	X	▪	▪
Sit-to-stand, Stand-to-sit	X	X	X	▪	▪
Walking on Laterally Inclined Surfaces	X	X	X	▪	▪
Walking on Virtual Terrains	X	X	X	▪	
Walking on Soft Terrains	X	X	X	▪	▪
Opening/Closing Doors	X	X	X	▪	▪
Moving in Narrow Spaces	X	X	X	▪	▪
Pushing a Shopping Trolley	X	X	X		▪
Helping People Stand Up	X	X	X		▪
OTHER: Applicants can propose a new scenario not listed here (please motivate your choice).					

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Table 2. Non-exhaustive list of possible scenario-generic equipment needed in the EUROBENCH Facility, and relevant for OPTION 2. The applicability to the WR and/or Humanoid fields is indicated with the "▪" symbol. Specific requirements are detailed in Section 2.3.

Scenario-generic solutions	Applicability	
	WR	Humanoids
Multidirectional Body Weight Support System	▪	▪
Robot Actuation Characterization System	▪	▪
Wearable Motion Capture System	▪	▪
Neuromuscular Activity Sensor	▪	
Wearable Foot-Ground Interaction Sensor	▪	▪
Instrumented Crutches	▪	
OTHER: Applicants can propose a new device not listed here. Please motivate your choice.		

Table 3. Sensors already included in the EUROBENCH Facilities. If these sensors are compatible with those used by the applicants, they do not need to be delivered with the testbed (contact the EUROBENCH team for technical details).

Equipment available in the EUROBENCH Facilities	Facility in which equipment is included	
	WR	Humanoids
Standard camera-based motion capture system	▪	▪
Standard force platforms for gait analysis	▪	
Standard multi-channel electromyographic (EMG) sensor	▪	
Remote-controllable gantry system		▪

1.2 Applicants eligibility

The following eligibility rules apply to all EUROBENCH Open Calls:

- Participants can apply individually or as part of a consortium.
- Consortia can include partners from the same country, as well as partners from different countries.
- Applicants must be previously registered in the Participant Register of the Participant Portal and have a 9-digit Participant Identification Code (PIC).
- Applicants cannot request any funding for activities that are already funded by other grants (principle of no double funding).
- Applicants can participate in more than one proposal according to budget limitations established in Section 1.3
- Countries eligible for funding are specified in the Section A of H2020 Work Programme.

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1.3 Budget - Funding and Financial eligibility

Each sub-project (defined as funded proposals to be implemented) will receive the funding on a **lump sum** scheme**,** as defined by the EU Commission pilot 2018-2020[1]. Each proposal should include a detailed work plan and a cost estimate. For the definition of this work plan participants should take into account the following phases and duration of sub-projects:

- **Phase 1: Development**. The maximum duration of this phase will be **12 months**. Participants will develop the components (test beds, software routines and/or datasets) during this phase.
- **Phase 2: Integration**. Participants will have **6 months** to integrate their outcomes into the EUROBENCH Software and/or Facilities.

These phases will be separated by a 2-month reporting period (including reporting and evaluation) as better described in Section 7.

The estimated costs of the third parties to develop the defined work plan should be reasonable and comply with the principle of sound financial management, in particular regarding economy and efficiency.

All proposals should comply with the following budgetary limits:

- Each proposal can request a **maximum contribution of 300k€**, which can cover up to 100% of the total budget.
- Each participant can receive a **maximum contribution of 100k€.**
- Participants can submit more than one proposal. However, the total required contribution of the same legal entity (i.e. identified by the same PIC number) should not exceed **100k€ across all proposals** submitted (i.e. it is not allowed to ask for 60k€ in one proposal and 50k€ in another proposal, because the sum is 110k€). This limitation is to avoid the situation in which one applicant is participating in two winning proposals, and one of the two should be rejected for budgetary limits.
- If you are planning to participate in the 2nd FSTP Open Call (opening in June 2020), please do not request 100k€ now, because this will impede, in the case you are funded, your future participation (the 100k€ limit applies to all EUROBENCH Open Calls as a whole).

General criteria for budget definition are:

- Consumables costs will include materials for structure, mechatronic components, and sensors needed to build the testbed. Applicants should carefully adjust the required contribution to the number and complexity of the testbed(s) proposed. This aspect will be seriously considered during the evaluation process, since no negotiation phase will be admitted after proposal selection. We expect that **consumables costs for one testbed prototype will not exceed 75k€**. This limit can be exceptionally overcome, if strongly motivated. No costs for consumables could be allocated to SW Routines or Datasets, since these outcomes usually result from human efforts. Exceptions can be made, if motivated.
  Important: Please consider that hardware that will be an operating part of the prototype should be purchased as consumables. E.g. If you need to buy a commercial treadmill as part of your prototype, it can be considered as consumable.
- Personnel costs will also depend on the complexity of the testbed, algorithms and datasets developed. As a general estimation, being the duration of the sub-project 18 month (of them 12 for development, and 6 for integration in the EUROBENCH framework), we expect total personnel efforts ***per sub-project*** between 12 and 24 person-months (PM). According to this estimate, we expect **total personnel costs per sub-project between 60 and 120k€**. This figure may change, if appropriately motivated.
- Travel costs: A travel should be planned to deliver each testbed to the corresponding Facility, and make it operative.

[1] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/lump_sum_factsheet_2018-2020.pdf

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1.4 Templates

To prepare your proposal, please use the template available at http://eurobench2020.eu/ftsp-open-calls/fstp-1/. Submission guidelines are provided in Section 3 of this document.

1.5 Communication and FAQ

A good communication between Participants and the EUROBENCH Consortium will be crucial to get to a proposal that matches the project goals and priorities. There will be several opportunities to get in touch with the EUROBENCH Consortium and receive direct feedback on your idea/proposal draft (see Figure 1.2). In particular, we strongly recommend participants to submit the Declaration of Interest form as soon as possible (at http://eurobench2020.eu/ftsp-open-calls/). Check also the EUROBENCH FAQ section (http://eurobench2020.eu/ftsp-open-calls/fstp-1/faqs/), to look for continuously updated questions and answers.

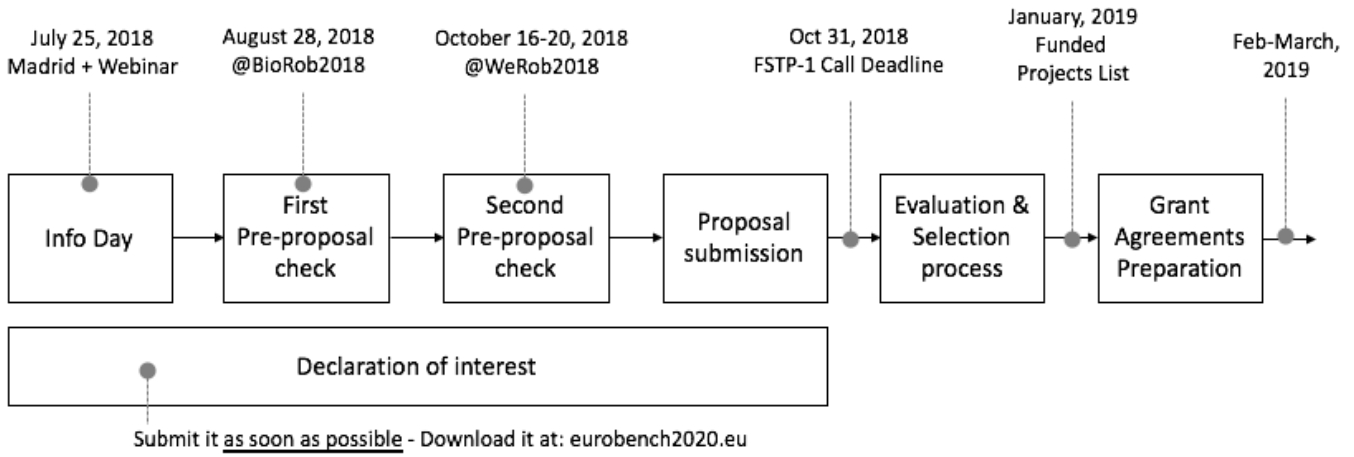

Figure 1.2. The different steps an applicant should undergo from idea conception until sub-project selection and execution.

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2 Expected Outcomes

This section includes the aspects that have been considered of highest priority by the EUROBENCH Team. Nevertheless, **the information here provided has to be taken as a general advice. Applicants are free to propose alternative solutions**. If you are proposing something that differs considerably from the scheme, please provide a valid motivation.

2.1 Common requirements

The following requirements apply in general to all benchmarking scenarios. Please look at each scenario (Section 2.2) to check for more specific indications.

2.1.1 Testbeds

A testbed should include all those structures, actuators and sensors needed to conduct replicable and repeatable testing experiments and provide relevant kinematic, kinetic and/or physiological data of the bipedal system. The following requirements should apply, provided that they do not compromise the correctness, efficiency and effectiveness of the outcome proposed:

- HW interface: All surfaces that can enter in contact with the bipedal system should be made of non-ferromagnetic (e.g. plywood) boards of 30 mm thickness, with a grid of holes of 10 mm diameter at 150 mm of distance to each other (see Figure 2.1), and 75 mm of distance from the outer border. Why? This standardized interface will allow to add any kind of terrain/obstacles on top of it, allowing a great variety of combinations of test environments.

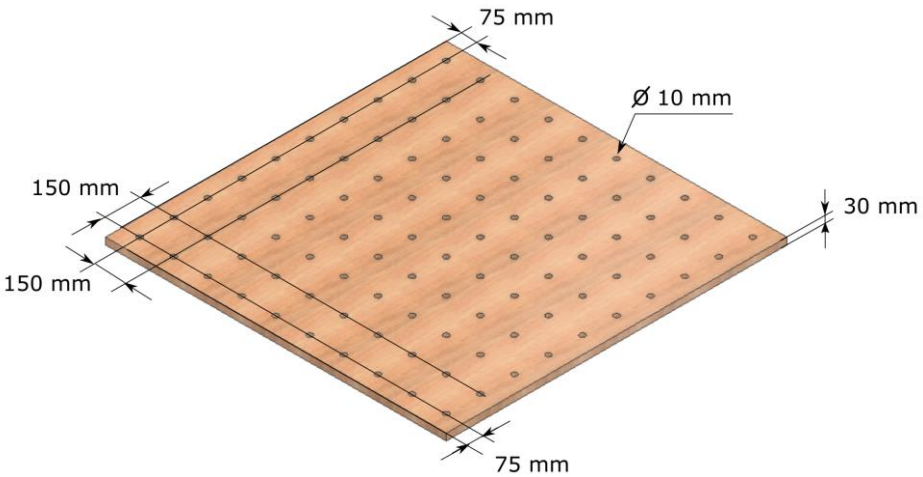

Figure 2.1. Standardized board to be used for all surfaces that may enter in contact with the bipedal system. Board can vary in dimensions, whereas holes should have fixed diameter and distance.

- SW interface: If the testbed includes sensors, these should be accompanied with algorithms for pre-processing the raw data of the specific sensing device (e.g. c3d file from motion capture system with all markers positions, IMU accelerations, ground reaction forces, etc...), providing as output a set of 'sensor-agnostic' pre-processed data (e.g. joint angles). See next Section and Figure 2.2 for further details.
- ROS-compatible: All sensors and actuators should (if possible) provide a ROS package(s) ready for communicating and commanding the device.

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- Safety: All testbeds that include a surface should also include bilateral handrails, for safety reasons. The height of this handrail should be adjustable. The handrail should be connected to the board using the grid of holes, so that the position of the handrails can be varied.
- Life-like: Testing devices should replicate as close as possible conditions of the everyday life.
- Innovation: Applicants should demonstrate that the device proposed is beyond the state of the art in *one or more* of the following aspects:
    - New functions. The device should provide functionalities that are not available in existing commercial devices, at hardware (e.g. a new kind of perturbation dynamics) or software (e.g. data processing/representation) level.
    - Replicability. The device should be easily reproduced from other groups (i.e. using off-the-shelf components, or 3D printable, or replicable with other material, e.g. wood). In this case, testbeds should be described in a document to enable their reproduction.
    - Low cost. The device should have considerable lower cost with respect to similar devices in the market.
- Portability: If possible, the testbed should be easily movable, requiring the efforts of 1-2 persons.
- Flexibility: Testbeds able to cover many configurations will be given priority over fixed testbeds.
- Simulated version: It will be desirable to have the model of the testbed defined as URDF (Unified Robot Description File) and the plugins requested to simulate it within Gazebo 3D simulator.

2.1.2 Software routines

The software routines will be part of the EUROBENCH Benchmarking Software, and should automatically compute performance scores on the data recorded during a benchmarking experience (and uploaded by previous users).

- Input: data obtained by pre-processing algorithms of each sensor included in the testbed, (e.g. joint angles, body limb poses, center of mass trajectory, heel strike event, etc...). Such data should be independent from the measurement device, meaning that the same pre-processed data can be obtained by different sensors (e.g. the same joint angle can be obtained from either an optical or IMU-based motion capture system). This should also include relevant measurements from external devices (e.g. inclination of the ground, position of external obstacle, velocity of a perturbation device, etc..).
- Output: post-processed data, i.e. quantitative scores on one or more performance indicators (see Figure 2.2 for an example list).

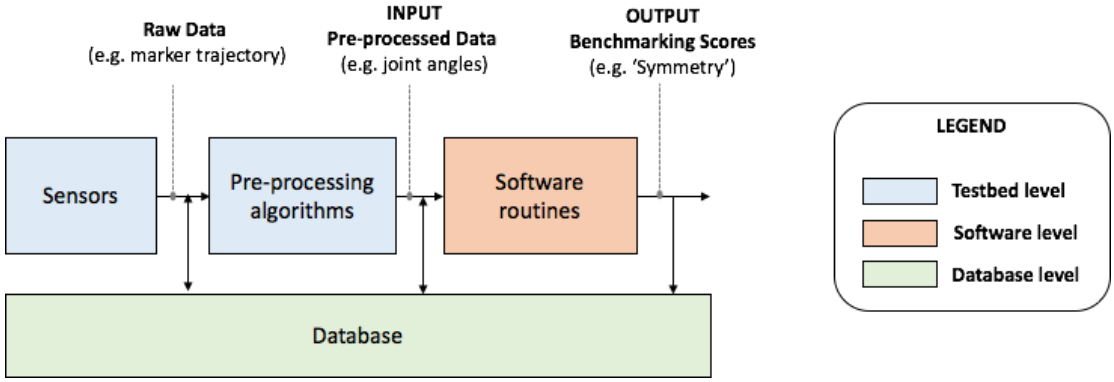

Figure 2.2. Main elements of the data processing chain (example).

Required features:

- Access to the source code, to enable the EUROBENCH Consortium any posterior code adjustment.
- The source code should not rely on plugin/modules whose licensing restricts the use of the code. In particular the code should only rely on plugin/modules whose use is free of charge.

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- If the code use is not free of charge, an offer for free-of-charge use should be provided to the EUROBENCH Consortium, at least during the project lifetime. Possibilities of agreements for further use should be mentioned.
- The benchmarking algorithm should be launched through a script or executable without particular additional interaction from the user.
- The dependencies of the source code should be explicitly listed.
- In the case of Matlab code, the participants should demonstrate the possibility to generate a standalone application, or the possibility to run the code using Matlab alternatives, such as octave.
- The benchmarking algorithm should be provided with some reference input data and related output data, to enable detecting any output deviation due to possible code change.
- The benchmarking algorithm should be provided with a "User's manual" describing (i) the steps for installing and running the software and (ii) the mathematics behind it, preferably with references to relevant scientific literature demonstrating its soundness.
- The software should be associated to a standard license defining the type of uses.

Desirable features:

- Version control: the use of version control is strongly suggested to ease the control of the potential code evolution during the integration. Having the code already under version control would thus be a plus.
- Unit testing-like mechanisms: in relation with the delivery of reference input-output data, having them embedded in a unit testing mechanism would ease the potential evolution of the code during integration.
- Continuous delivery-like mechanisms: the procedure to go from the core source code towards a standalone script or executable should be documented. Tools enabling the automatization of such process would be a plus.
- The preferred operating system is Linux, but Windows can be used if participants are reluctant to Linux.
- If the EUROBENCH consortium explicitly requires access to source code, it would be preferable to have the development in open source, to share such knowledge with the community. If we can accept the code to be not open-source, we would appreciate the applicants to comment the reasons why.

Table 4. Non-exhaustive list of examples of relevant performance indicators, variables to be measured, and suggested protocols. Please consider that this list is just an example. Applicants are completely free to propose any other relevant indicator.

Performance indicator	Pre-processed variables	Protocol
Max speed	Speed (m/s)	Sprint 10-20-30 m
Minimum time for task completion	Time (s)	
Max distance	Distance (m)	6 minute walking test (6MWT)
Max cadence	Cadence (steps/minute)	
Energy efficiency	Energy consumed (Watt/hour)	6MWT
Spatial parameters (e.g. ankle/knee/hip range of motion, step length, swing velocity, step width)	Joint angles profiles (rad) Heel strike, Toe off, Foot flat events (s) Anthropometric measures (m)	6MWT
Temporal parameters (e.g. step time, stance time, swing	Heel strike, Toe off, Foot flat events (s)	6MWT

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time, double support time)		
Kinetics	Ankle/knee/hip torques (Nm) Ground reaction forces (N)	6MWT
Precision	End-effector position (m), Joint angles profiles (rad) + desired position/angles.	
Symmetry/coordination	Joint angles (rad), Heel strike, Toe off, Foot flat (s), limbs accel. (m/s^2), Anthropometry (m)	6MWT
Metabolic cost	Oxygen consumption (VO2 mL/kg/min)	6MWT
Ergonomics	Human-robot interaction forces (N), Human-robot relative motion (m), Questionnaires	
Comfort	Questionnaires	Different tasks
Muscle effort/coordination	EMG signals (V)	Different tasks
Physical Interaction	Human-robot interaction forces (N)	Different tasks
Cognitive effort	Questionnaires, EMG (V), EEG (V)	Different tasks
Usability	Time (s), Questionnaires	Different tasks

2.1.3 Experimental datasets

The experimental datasets provided by the applicants are expected to populate the EUROBENCH database, and should include all relevant data obtained by testing experiments together with the output of software routines.
The exact structure of the EUROBENCH database and datasets structure is still to be agreed by the Consortium. The applicants should commit themselves to perform adjustment of their data structure during the integration phase, to fit with the EUROBENCH constraints.

Required features:
Any experimental dataset should be provided with:

- Experimental meta-data:
  - Description on the experimental task (nº trials, magnitude and frequency of the external disturbance, indications given to the user/operator, ...).
  - Description of the sensors used (type of sensor, manufacturer).
  - Description on the positioning of the sensors on the bipedal system and on the testbed.
  - All required information for understanding and processing raw and pre-processed data.
  - Description of variations from a recorded experimentation to another.
- Anthropomorphic data:
  - All relevant anthropomorphic information for each bipedal system (robot and/or human) involved.
- Raw data (see Figure 2.2):
  - Recorded signals from all sensors. There is no restriction on the file format, even though standard structures are encouraged (and should be described).
  - Description of the file content, to help the user open and use these file.
- Pre-processed data (see Figure 2.2):

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  - The pre-processed data should be stored in consistent and ASCII format (i.e. Human Readable format). The concrete file structure will be adjusted during the integration phase with the consortium.
  - Data should be timestamped.
  - The stored data should use Standard Measurement Unit.
  - In the case of biomechanical measurements, reference to standard kinematic models should be provided.
  - Data recorded from external devices (e.g. ground force measurement or pushing devices), should be synchronized with all other data recorded.
  - The attachment of captured videos, for all or some illustrative experiments is a plus. Naturally, User consent should be provided accordingly.
  - Reference on the pre-processing algorithms used to obtain such data.
- Post-processed data (see Figure 2.2):
  - If the applicants are proposing also a software routine, they should provide the resulting scores obtained by the application of each software routine on the pre-processed data.
- Confidentiality
  - The access to such datasets is to be provided to the Community using the EUROBENCH ecosystem. For this reason the applicants should take into consideration confidentiality matters (in particular for data obtained by experiments on human users).

Desirable features:

- An access to the code used for generating the pre-processed data from the raw data is encouraged. Agreement of open access to this code (according to the proper license property) for the community is also encouraged. If not accepted, this should be at least discussed.

IMPORTANT: Data will be sensible to be used open source, therefore, prior to development you should accept that these data cannot be confidential, and ensure, during data generation, that no sensible information is contained into them (and compliant with the latest GDPR policies).

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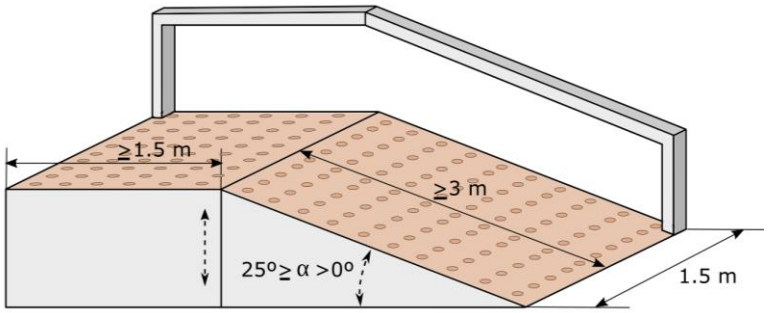
2.2 Scenario-specific requirements (if you are applying to OPTION 1)

Benchmarking scenario (motor skill): **Walking on Slopes**		
Definition	Walking on surfaces that are inclined (uphill and downhill) along the gait direction.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Length of the slope: minimum 3 m. • Include an horizontal surface at the end of the slope, of minimum 1.5 m length. • Inclinations: testbed should cover all the following inclinations: 0º-15° (with 1º incremental steps), 20°, 25°. • Including one handrail (to be attached to the board).	
Desirable features	• Allowing inclination values on a continuous scale. • Low setup times (e.g. fast to change inclination). • Motorized changes in inclination. • Including slope angle sensors.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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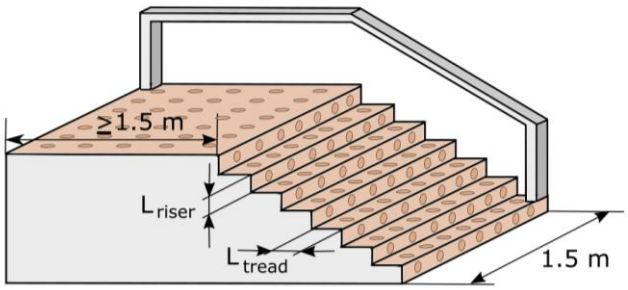
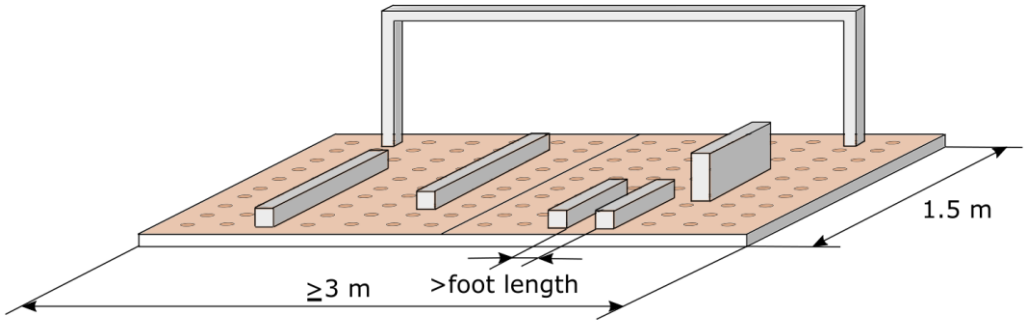
Benchmarking scenario (motor skill): **Walking on Stairs**		
Definition	Walking across consecutive ascending and/or descending steps.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Include an horizontal surface at the end of the stairs: minimum 1.50m. • Variable tread and riser lengths. • Number of steps: minimum 5. • Including one handrail (to be attached to the horizontal board).	
Desirable features	• Tread and riser dimensions variable on a continuous scale. • Variable number of steps. • Low setup times (e.g. fast to change tread and riser dimensions). • Motorized changes in tread and riser lengths.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

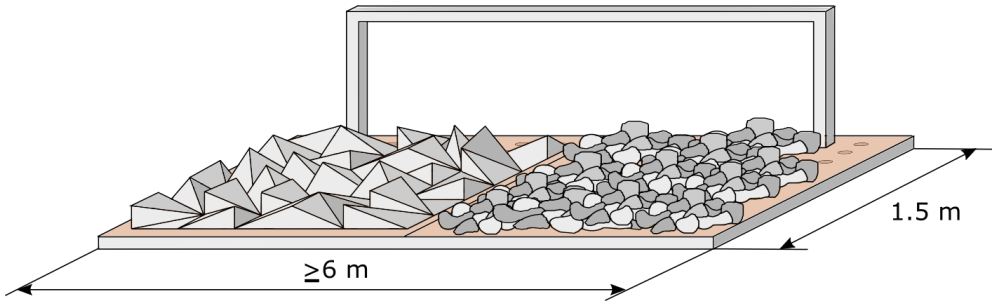
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Overcoming Obstacles**		
Definition	Walking on a non-deformable surface composed of objects separated to each other by a distance higher than foot length, so that obstacles can be overcome by either stepping on, circumventing or stepping over them.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Surface should be composed of modules of 1.5 length. • Length of the surface: minimum 3 m in total (2 modules, as shown in the figure) • Obstacles should be attachable to the grid of holes of the board. • Position of the obstacles should be easily modifiable. • Including one handrail (to be attached to the horizontal board).	
Desirable features	• Possibility of using the modules in combination (as shown in the figure), or used independently. • Modules should be storable one of top of the other, when they are not used. • Variable dimensions of the obstacles. • Low setup times (e.g. fast to modify the position of the obstacles). • Sensorized obstacles (to detect contact time/forces between foot and object).	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

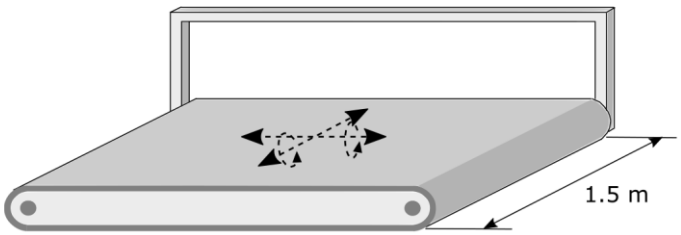
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill):

Walking on Irregular Hard Terrains

Definition	Walking on a non-deformable surface composed of non-horizontal surfaces separated to each other with a distance smaller than foot length (and therefore unavoidable).	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Surface should be composed of modules of 1.5 m length. • Length of the surface: minimum 6 m in total (4 modules). In figure, two modules are shown. • Applicants should reproduce one or more of the following conditions: a. Gravel. b. Rocky. c. Disaster-like. • Terrains should be mounted on the grid of holes of the surface. • Including one handrail (to be attached to the horizontal board).	
Desirable features	• Possibility of using the modules in combination (as shown in the figure), or used independently. • Low setup times (e.g. fast to change terrain). • Modules should be storable one of top of the other, when they are not used. • Variable dimensions and shape of the terrain (e.g. gravel with N different diameters). • Sensorized platform (to measure foot ground interaction forces/timing).	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

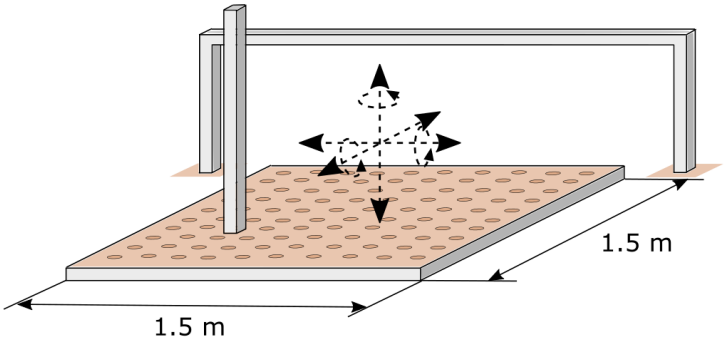
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Walking on Treadmill**		
Definition	Walking on a surface that translates continuously along the gait direction.	
Applicability	▪ Wearable Robots	
Required features	• Width: 1.5 m. • Surface moving with different speeds. • Including two handrails (one on each side). • Sensors for monitoring in real time the motion of the surface. • Sensors for monitoring the foot-ground interaction (e.g. force plates)	
Desirable features	• Surface able to produce lateral translations horizontally. • Surface able to tilt around sagittal and/or frontal direction. • Ability of giving impulsive perturbations (high accelerations in any of the above directions) • Split belt. • Surface speed depending on the walking speed of the bipedal system. • Surface compatible with the placement of additional objects on top of it (e.g. obstacles).	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

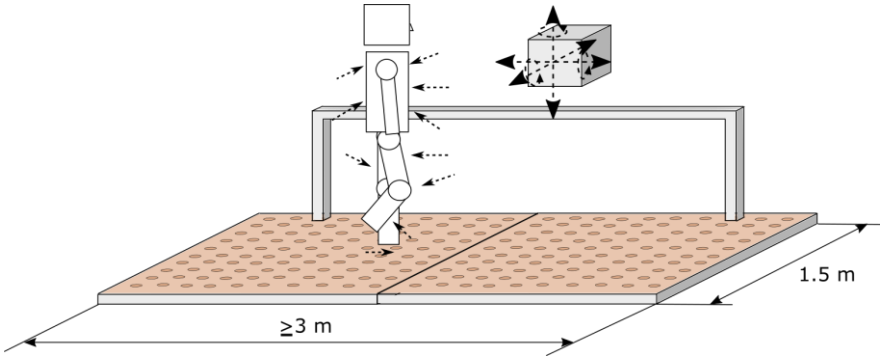
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill):

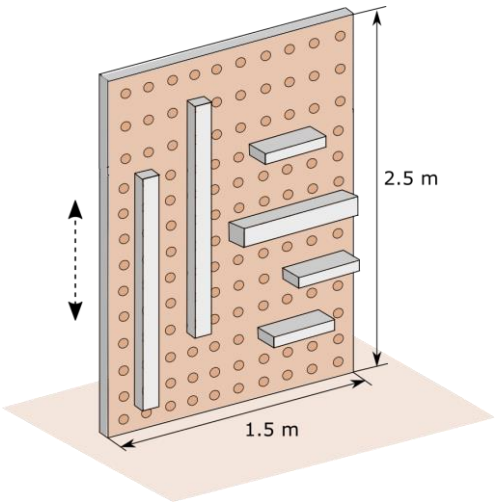
Walking/Standing on Moving Surfaces

Definition	Keeping balance while standing or walking on a surface that is changing its position and/or pose over time.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Length: 1.5 m. • Including one handrail. • Applicants should reproduce one or more of the following conditions: a. Impulsive translation. b. Impulsive tilt. c. Pseudorandom tilt/translation. d. Foam-like tilting (maintaining constant ankle angle). e. Vibrations. f. Seesaw/Rocker board (passive-like tilting). g. Slippery-like surface (zero shear forces). h. Whole in the floor.	
Desirable features	• Motorized motion of the platform. • Covering more conditions with the same hardware. • Presence of extra elements on the surface that can simulate real scenarios (e.g. support in a bus). • Extra elements mounted on the grid of holes of the surface that simulate daily live scenarios (e.g. security bar in a bus). • Motion sensor on the platform (acceleration, velocity, inclination). • Motion of the platform reacting to specific motion of the bipedal system (e.g. moving only when touched).	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Walking/standing during Pushes**		
Definition	Keeping balance while standing or walking during impacts with external objects.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width of the terrain: 1.5 m. • Length: minimum 3 m (2 modules). • Variable position of the object that produces the pushes. • Structure of the support surface should be composable in pieces of 1.5 m x 1.5 m to allow storage. • Sensors able to measure the force exerted by the object on the system. • Including one handrail.	
Desirable features	• Motorized change of position of the object that produces the pushes. • Sensors able to grasp the effects of perturbations on bipedal system (e.g. force plates). • Sensors able to measure the position of the object with respect to the bipedal system.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Standing During Manipulation Skills**		
Definition	Standing while reaching, grasping and manipulating objects with the upper limbs.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Height: 2.5 m. • Manipulation objects located in the grid of holes of the vertical surface. • Compatible with (attachable to) the horizontal board included in the other scenarios.	
Desirable features	• Manipulation skills representing different bimanual and unimanual daily-life activities. • Low setup times (e.g. fast to change objects). • Sensors measuring the relative motion between objects and person.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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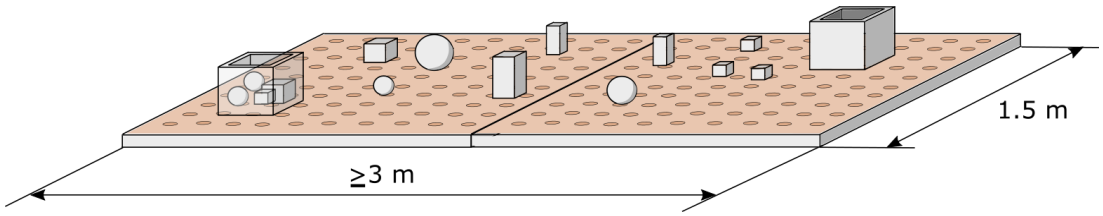
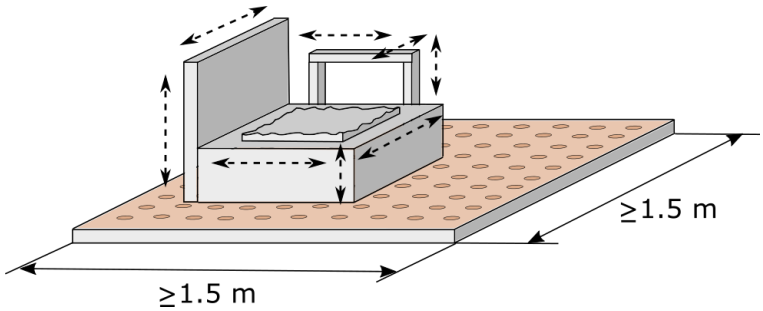
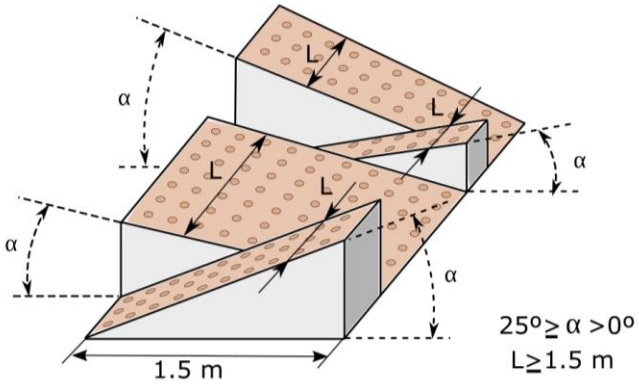
Benchmarking scenario (motor skill): **Picking and Carrying Objects**		
Definition	Taking an object from the floor, transporting it to another location, and placing it on the floor again.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Length: minimum 3 m. • Objects of different masses, dimensions and shapes. • Structure of the support surface should be composable in pieces of 1.5 m x 1.5 m to allow storage.	
Desirable features	• Sensors measuring the object motion (e.g. with IMUs) • Sensors measuring the relative motion between object and person. • It would be recommendable to have scenarios that replicate daily-life activities.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Sit to stand/stand to sit**		
Definition	Sitting down and standing up from a sofa.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Floor Width: 1.5 m. • Floor Length: 1.5 m. • Structure replicating most of the chairs/sofa/benches dimensions, shape and • Chair/Sofa adaptable to the grid of holes of the surface. • Bilateral supports of variable heights.	
Desirable features	• Material of different stiffness on the seat of the sofa. • Sensors the measure interaction between sofa and bipedal system.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Walking on Laterally Inclined Surfaces**		
Definition	Walking on surfaces that are inclined perpendicularly to gait direction.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Development of at least 3 modules (in figure below, 4 modules are represented). • Length of the slopes: minimum 1.5 m for each single module. • Inclination angles of each slope: 0º-15° (with 1º incremental steps), 20°, 25°. • Including one handrail.	
Desirable features	• Possibility of using the modules in combination (as shown in the figure), or used independently. • Allowing inclination values on a continuous scale on each of the slopes independently. • Low setup times (e.g. fast to change inclination). • Motorized changes in inclination. • Including slope angle sensors. • Sensors to measure foot ground interaction forces/timing.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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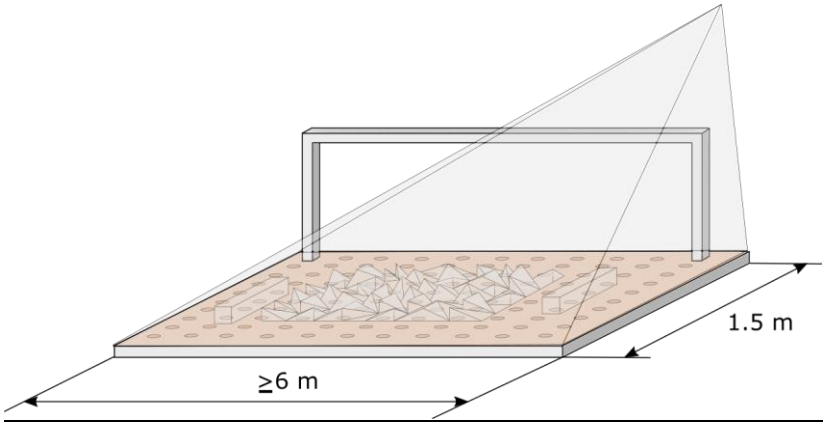
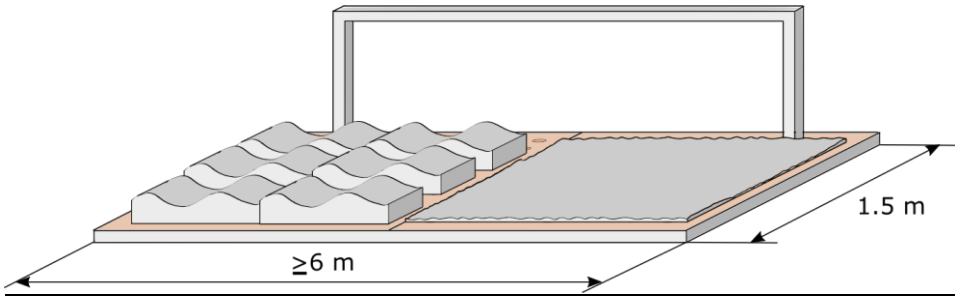
Benchmarking scenario (motor skill): **Walking on Virtual Terrains**		
Definition	Walking across a virtual environment either projected on the floor or created with augmented reality.	
Applicability	▪ Wearable Robots	
Required features	• Width: minimum 1.5 m. • Length of the surface: minimum 6 m in total (4 modules). In figure, two modules are shown. • Structure of the support surface should be composable in pieces of 1.5 m x 1.5 m to allow storage. • Applicants should reproduce one or more of the following conditions: a. Curved paths b. Objects to avoid or hit c. Dynamic elements of daily life situations (e.g. a cat crossing the street).	
Desirable features	• Compatible with other benchmarking scenarios (e.g. slopes, stairs). • Projected paths should be challenging (e.g. different difficulty levels). • Sensors to measure foot ground interaction forces/timing.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779963

Benchmarking scenario (motor skill): **Walking on Soft Terrains**		
Definition	Walking on compliant surfaces with constant stiffness.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Width: 1.5 m. • Surface should be composed of modules of 1.5 m length. • Length of the surface: minimum 6 m in total (4 modules). In figure, two modules are shown. • Applicants should reproduce one or more of the following conditions: a. Grass. b. Carpet. c. Mattress. d. Sand. • Terrains should be mounted on the grid of holes of the surface. • Including one handrail (to be attached to the horizontal board).	
Desirable features	• Possibility of using the modules in combination (as shown in the figure), or used independently. • Low setup times (e.g. fast to change terrain). • Modules should be storable one of top of the other, when they are not used. • Including different densities. • Sensors to measure foot ground interaction forces/timing.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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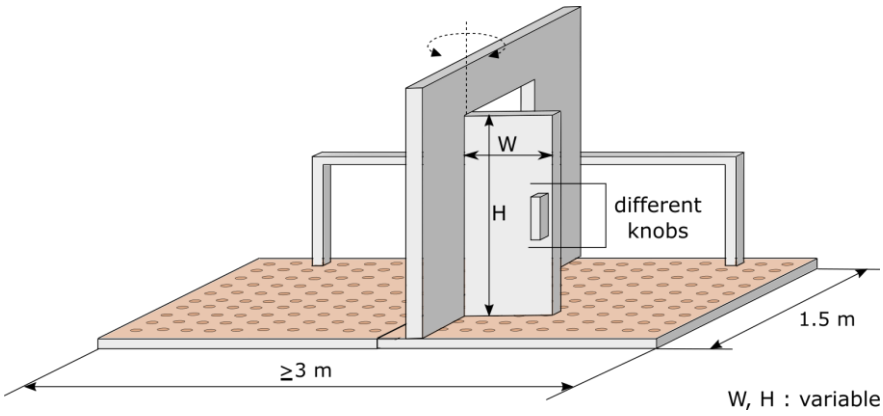
Benchmarking scenario (motor skill):

Opening/Closing Doors

Definition	Walking to a door, opening it, going through it, closing it and continuing walking.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Floor Width: 1.5 m. • Floor Length: minimum 3 m. • Different kind of knobs adaptable to the door. • Door with variable weight. • Door opens in two directions. • Structure of the support surface should be composable in pieces of 1.5 m x 1.5 m to allow storage.	
Desirable features	• Compatible with (attachable to) the horizontal board included in all other scenarios. • Variable friction at the hinge of the door.	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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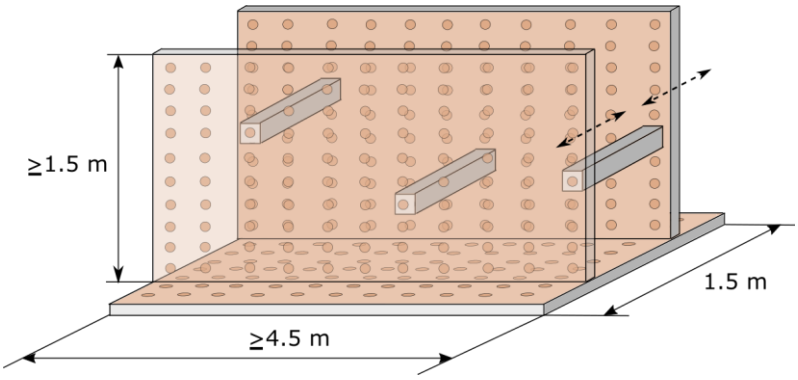
Benchmarking scenario (motor skill): **Moving in Narrow Spaces**		
Definition	Walking and/or crawling along narrow corridors and/or in presence of hurdles.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Floor Width: variable (max 1.5m). • Walls Height: minimum 1.5m • Length: minimum 4.5 m: • Structure of the support surface should be composable in pieces of 1.5 m x 1.5 m to allow storage. • Hurdles attachable in different locations and height.	
Desirable features	• Motorized change of width between vertical boards. • Sensorized hurdles and/or walls (to monitor the contact between robot and the testbed)	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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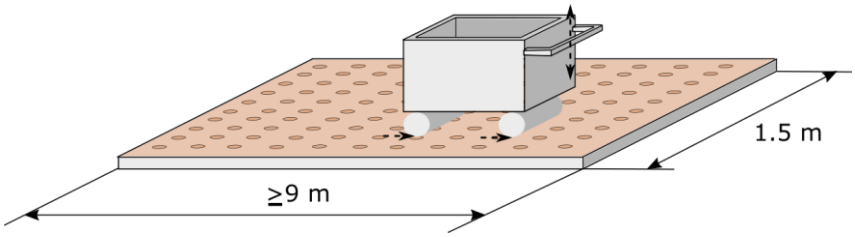
Benchmarking scenario (motor skill): **Pushing a Shopping Trolley**		
Definition	Walking while pushing a trolley along a trajectory.	
Applicability		▪ Humanoids
Required features	• Width: 1.5 m. • Length: minimum 9 m. • Variable height of the handlebar. • Variable friction to advancement. • Trolley with variable weight. • Structure of the horizontal surface should be composable in pieces of 1.5 m x 1.5 m to allow storage.	
Desirable features	• Compatible with other benchmarking scenarios (e.g. slopes, stairs). • Walking while pulling the trolley. • Sensorized handlebar to monitor robot-trolley interaction • Sensorized speed/position of the trolley	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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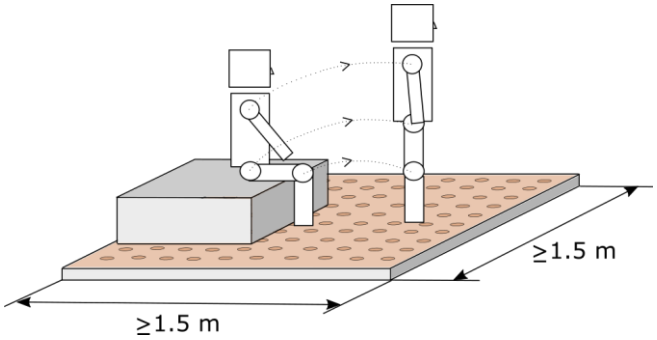
Benchmarking scenario (motor skill): **Helping People Stand Up**		
Definition	Lifting a person safely from a seated position to an upright standing position.	
Applicability		▪ Humanoids
Required features	• Floor Width: 1.5 m. • Floor Length: 1.5 m. • Consider people of different weights.	
Desirable features	• Compatible with other benchmarking scenarios (e.g. slopes, stairs). • (Passive) Mannequin emulating a person	
Conceptual drawing *The purpose of this drawing is to provide a general understanding of the testbed functionality. The final testbed may have a different appearance.*		

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2.3 Scenario-generic devices (if you are applying to OPTION 2)

Multidirectional Body Weight Support System		
Definition	System able to support the bipedal system by providing vertical forces while allowing its/his/her motion in all directions.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Generating a support between 0-100% of body weight along a continuous scale. • Allowing bipedal system to navigate around an area of 30x30 meters • Very low friction to advancement • Compatible with most scenarios (e.g. it should overcome any testbed included in the list) • Compatible with a wide range of Exoskeletons and/or Humanoids robots	
Desirable features	• Providing pushes (be used as a perturbation device) • The system may be either attached to the ceiling (e.g. cable driven system), or being ambulatory (e.g. on wheels) • Providing ROS package(s) ready for communicating and commanding the device.	

Robot Actuation Characterization System		
Definition	System able to measure the actuation characteristics of the robot.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Providing measures of main characterization parameters of the actuators (e.g. maximum torque, maximum speed, bandwidth, power, range of motion…) • Compatible with a wide range of Exoskeletons and/or Humanoids robots.	
Desirable features	• Compatible with different actuation typologies • Adaptable to the actuator when it is detached from the robotic system • Adaptable to the actuator when it is mounted on the robotic system • Providing ROS package(s) ready for communicating and commanding the device	

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Wearable Motion Capture System		
Definition	Wearable system able to measure the whole-body kinematics of a bipedal system.	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	• Completely wearable (no external elements). • Compatible with a wide range of Exoskeletons, prostheses and/or Humanoids robots • Compatible with electromagnetic fields that can be generated by motors.	
Desirable features	• Providing ROS package(s) ready for communicating and commanding the device	

Neuromuscular Activity Sensor		
Definition	System able to measure the activity of the human neuromuscular system through surface electromyography.	
Applicability	▪ Wearable Robots	
Required features	• Compatible with a wide range of exoskeletons and prostheses (electrode location not interfering with the device)	
Desirable features	• Including both lower and upper limb monitoring. • Wireless. • Providing automatic calculation of muscle coordination. • Fast donning and doffing. • Providing ROS package(s) ready for communicating and commanding the device	

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Wearable/Portable Foot-Ground Interaction Sensor		
Definition	System able to measure foot ground interaction forces applicable to any bipedal system and testbed	
Applicability	▪ Wearable Robots	▪ Humanoids
Required features	We are looking for two types of systems: • A sensor attachable to the foot of the bipedal system, compatible with a wide range of Exoskeletons, prostheses and/or Humanoids robots • A (set of) force platform(s) attachable to the board structure (See Figure 2.1) able to measure the ground reaction force vector.	
Desirable features	• Providing ROS package(s) ready for communicating and commanding the device.	

Instrumented Crutches		
Definition	A pair of crutches able to measure the interaction forces between the floor and the upper limbs of the subject.	
Applicability	▪ Wearable Robots	
Required features	• Compatible with a wide range of Exoskeletons and prostheses	
Desirable features	• Providing ROS package(s) ready for communicating and commanding the device • Able to estimate joint torques through inverse dynamics. • Able to estimate the spatiotemoral parameters during walking.	

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3 Submission of proposals

The first Open Call under the EUROBENCH project will be open from **July 15th 2018** and with deadline on **October 31st 2018 at 17h00 CET**.

3.1 Open Call publication

A specific section of the EUROBENCH website (http://eurobench2020.eu/ftsp-open-calls/fstp-1/) give proposers the full call details including:

A general description of the FSTP Call requirements
Any restrictions on participation in any part of each FSTP call. Especially regarding maximum contribution to each Third Party and sub-project
The amount of funding available for each FSTP call;
This Guide for Applicants
The coordinates (email address) of a helpline that will be maintained for proposers during the call
A public FAQs section that will be regularly updated
Proposal technical templates and facsimiles
Link to the web platform to which proposals should be submitted
The deadlines for proposal submission, clearly specifying the local time involved (Central European Time (CET))

3.2 Proposal submission

The submission of proposals will be effected online through the online platform linked in the EUROBENCH website http://eurobench2020.eu/ftsp-open-calls/fstp-1/ . Please check manuals and facsimiles available in the website for details.
On receipt of each proposal the proposer receives an electronic acknowledgment of receipt. Applicants can submit their proposal as many times as they wish prior to the call deadline, but it is strongly recommended not to wait until the last minute to submit the proposal.
Late submissions will not be accepted; late submitters shall receive a "call closed" message in response to their submission. The proposals will be evaluated as submitted: after the close of call no additions or changes to received proposals shall be taken into account.

3.3 Helpline

For more information about the Open Call, please, check the FAQ section included in:
http://eurobench2020.eu/ftsp-open-calls/fstp-1/faqs/
For further information on the call or if you have any doubts relating to the eligibility rules, technical specifications or the information to be provided in the Application Form, please contact the Helpdesk: fstp@eurobench2020.eu

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4 Evaluation and selection of proposals

The evaluation and selection of proposals will be divided in three phases, performed by different committees, as described in Figure 7.1 and the following sections.

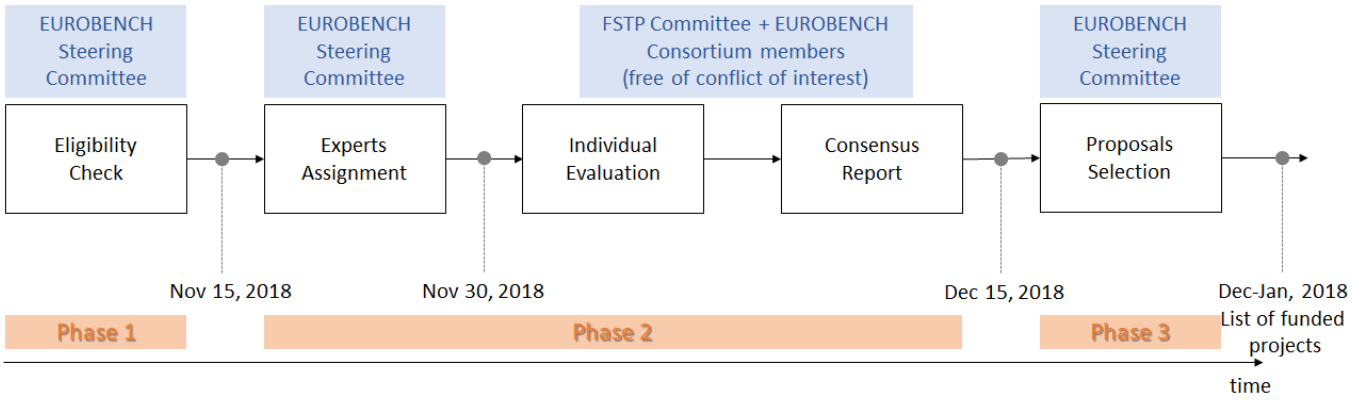

Figure 4.1. The different phases and subphases of the evaluation and selection of proposals

4.1 Phase 1: Eligibility Check

In order to define the list of eligible proposals, the EUROBENCH Steering Committee will perform the eligibility check according to the requirements defined in Section 1.

4.2 Phase 2: Evaluation of proposals

Two experts, one member of the FSTP Committee (see Section 9.3 for details) and one among the EUROBENCH Consortium, will be assigned to each proposal for its evaluation, avoiding conflicts of interest.
To ensure fairness and impartiality, the reviewers will be independent of the organisations involved in any proposal. In this sense, note that the EUROBENCH Consortium can only finally confirm the assignment of the experts after the close of the call, once discovered who all the proposers are and therefore the experts can be selected without risk of conflict of interest. Each reviewer will evaluate the proposal according to the following four evaluation criteria (and associated weight):

1. Innovation of the concept (Weight: 20%):
    a. Is the benchmarking problem clearly stated?
    b. Are the sub-project outcomes well identified and measurable?
    c. To what extent do the sub-project outcomes solve the benchmarking problem?
    d. What is the advance with respect to existing benchmarking solutions?
2. Integrability with the EUROBENCH framework (Weight: 30%):
    a. To what extent does the solution meet the EUROBENCH goals/priorities?
    b. Does the solution cover one or more of the required outcomes (Testbeds, Algorithms, Datasets, Multi-purpose device)?
    c. Will the outcome(s) be fully integrable with the EUROBENCH framework after 12 months from sub-project starting?
    d. Are resources and technologies for integration in the EUROBENCH framework properly identified?

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3. Feasibility of implementation (Weight: 20%):
    a. Does the team have sufficient technical background/equipment/capability to achieve the claimed goals?
    b. Are the resources well assigned with respect to number and typology of outcomes proposed?
    c. Is the technical work plan realistic?
    d. Will the outcomes reach a sufficiently high TRL to be fully operational at the end of the 12 months of development?
    e. Are the risks related to team and technology described?
4. Exploitation and sustainability of results (Weight: 30%):
    a. Does the sub-project foresee the participation of people from the corresponding Application Domain (e.g. patients for Healthcare, or workers for industrial applications) to ensure that proposed solutions meet real users' needs?
    b. Does the Consortium commit to provide technical support on the released outcomes at least during sub-project duration (e.g. to solve technical problems that may occur during the FSTP-2 "Validation")?
    c. Is there high confidence that the outcomes will be still functional during the following 5 years after sub-project ending? Is there a risk analysis on this aspect?
    d. Is evidence of realistic measures to ensure 'freedom to operate' (i.e., possibility of commercial exploitation, convincing knowledge-protection strategy, current IPR filing status, IPR ownership and licensing issues) reported?

Evaluation scores of up to 5 points (5 marks representing the highest quality) are awarded for each criterion:

- **0 Fail** The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information;
- **1 Poor** The criterion is addressed in an inadequate manner, or there are serious inherent weaknesses;
- **2 Fair** While the proposal broadly addresses the criterion, there are significant weaknesses;
- **3 Good** The proposal addresses the criterion well, although improvements would be necessary;
- **4 Very good** The proposal addresses the criterion very well, although certain improvements are still possible;
- **5 Excellent** The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor

An overall score will be assigned to each proposal, according to the following equation:

$$\text{Overall Score} = (S1*W1 + S2*W2 + S3*W3 + S4*W4)*3$$

where:
S_i is the evaluation score for the i-th Criterion and W_i is the weight associated to the i-th Criterion.

The maximum overall score will be 15 points. To ensure a minimum level of quality in the proposals, a global threshold of 8 will be applied. Proposals below this threshold will not be eligible for funding, independently from the number of submitted proposals.
Each expert will record his/her individual opinion of each proposal on the evaluation form. The (typically) two experts involved in the evaluation of a given proposal will then meet or communicate together to prepare a single **consensus form** for each proposal, representing opinions and scores on which both agree and which both will sign. If the individual reviews are heavily disagreeing, a third expert can be assigned to the proposal.
The final consensus report will be released to the Steering Committee (SC).

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4.3 Phase 3: Selection of proposals

The final review and selection of proposals will be performed by the Steering Committee (SC) of EUROBENCH based on the evaluations performed during the previous phase (see Figure 4.1). The SC will elaborate the list of funded and non-funded proposals using overall scores for each proposal and selecting the highest ranked proposals for the call. The ranking order may be overruled, in order to ensure a portfolio of testbeds available in the EUROBENCH framework as complete as possible. This process may happen in the following cases:

1. If two (or more) proposals propose highly overlapping outcomes (e.g. the same testbed). In this case, the SC can decide to choose only one proposals, based on the number/quality/integrability of the expected outcomes. In case some funding still remains, the proposals discarded from this rule may be funded.
2. If the list of highly ranked proposals is strongly unbalanced in terms of outcomes (e.g. very few proposals covering testbeds). In this case, the SC can exclude one or more proposals with lower scores, and substitute them with others that include the necessary outcomes.
3. If the SC identify any serious inconsistencies not previously identified by the reviewers.

The SC may conclude that there are not enough proposals with an adequate quality, in which case it will make no selection or select less proposals than the call allows for. This conclusion is obligatory if there are not enough proposals scored above the threshold given on the evaluation criteria.

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5 Communication with proposers

The applicants will receive the communications after Phase 1 and Phase 3 of the evaluation process (see Figure 4.1) indicating if they passed the phase or not.
Specific communication will be sent to the applicants eliminated from the process after the eligibility check. An individual communication will be sent to all participants passing the eligibility check. After completion of the selection process, the Consortium will get into contact with the successful proposer(s) to prepare the conclusion of third party agreements. The Consortium will also communicate to the other proposers that their proposal was not successful in the call, and will enclose to each an anonymous version of the evaluation summary report for their proposal.
The sub-project coordinator should communicate (using the address fstp@eurobench2020.eu) about:

- Any notice be in writing to the EUROBENCH Consortium Notify immediately.
- Any change of persons or contact details to the EUROBENCH consortium.

5.1 Appeal procedure

If, at any stage of the evaluation process, an applicant considers that a mistake has been made or that the evaluators have acted unfairly or have failed to comply with the rules of EUROBENCH FSTP-1 Open Call, and that her/his interests have been prejudiced as a result, the following appeal procedures are available.
A complaint should be drawn up in English and submitted by email to: fstp@eurobench2020.eu. Any complaint made should include:

- Contact details (including postal and e-mail address).
- The subject of the complaint.
- Information and evidence regarding the alleged breach.

Anonymous complaints will not be accepted. Complaints should also be made within three (calendar) days of you becoming aware of the grounds for a complaint. As a general rule, the EUROBENCH Team will investigate complaints with a view to arriving at a decision to issue a formal notice or to close the case within not more than ten days from the date of reception of the complaint, provided that all required information has been submitted by the complainant. Where this time limit is exceeded, the EUROBENCH Team will inform the complainant by email.

5.2 Data Protection

This relationship of Financial Support to Third Parties constitutes a treatment of personal data on request, being the applicants responsible for the treatment in accordance with Regulation (UE) 2016/679 of the European Parliament and of the Council, of 27 April 2016, Concerning the protection of natural persons with regard to the processing of personal data and the free movement of these data and repealing Directive 95/46/EC (General Data Protection Regulation), hereinafter GDPR, and other applicable regulations on Protection of personal data.

5.2.1 Instructions from the person responsible (applicants)

Taking into account the nature and scope of the call, the personal data will be treated by the EUROBENCH Consortium only in accordance with the instructions of the person responsible (applicants) and used only for the fulfillment of the object of the call.

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5.2.2 Duty of confidentiality

The EUROBENCH Consortium as in charge of the treatment guarantees that the persons authorized to treat personal data have been committed, in an expressed way to respect the confidentiality, maintaining the duty of secrecy, even after the end of its object. The fulfillment of this obligation is documented and available to the person in charge.
No data shall be communicated to third parties not included in these Guidelines unless it is expressly authorized by the person responsible or by legal imperative.

5.2.3 Security measures

The EUROBENCH Consortium has adopted the measures and implemented mechanisms for:

- Guarantee the confidentiality, integrity, availability and permanent resilience of treatment systems and services.
- Restore availability and access to personal data as soon as possible in the event of a physical or technical incident, except for the causes of force majeure.
- Verify, evaluate and assess, on a regular basis, the effectiveness of the technical and organizational measures implemented to guarantee the safety of the treatment.
- Pseudonymize and encrypt personal data, if applicable.

5.2.4 Collaboration with the person in charge to demonstrate compliance

The EUROBENCH Consortium will collaborate and make available to the responsible all the necessary information to demonstrate the fulfillment of its obligations in matter of personal data protection.

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6 Grant Agreement

The standard contract will notably regulate: (i) the conditions of transfer and usage of the cascade funding, (ii) the IPR rules, and (iii) any other collaboration mechanisms.
The Grant Agreement (G.A.) will defined the funded proposals to be developed as **sub-projects.**
The contract (G.A.) will be signed by each partner of the Consortium implementing the sub-project.
An initial template of this Grant Agreement is available at www.eurobench2020.eu/fstp-open-calls.

6.1 Intellectual Property Rights (IPR)

The standard contract, or Grant Agreement as defined in Section 6, will have to protect the intellectual property of third parties and beneficiaries involved.
The standard contract will also protect the background of both beneficiaries and third parties.
Provisions regarding Access Rights will be set forth in accordance with the provisions of the EUROBENCH Consortium Agreement.

6.1.1 Originality of the sub-project

The applicants base their proposals on original works and going forward any foreseen developments are free from third party rights, or they are clearly stated. The EUROBENCH consortium is not obliged to verify the authenticity of the ownership of the future products and services and any issues arising from third party claims regarding ownership are the solely responsibility of the sub-granted parties.

6.1.2 Access Rights for implementation

Access Rights to Results and Background Needed for the performance of the own work of a Party under the Project shall be granted on a royalty-free basis, unless otherwise agreed for Background in the Consortium Agreement.

6.1.3 Ownership of the sub-projects results

Third parties will own the exclusive intellectual property of the results. However, they should allow the integration of the generated prototypes on royalty-free basis in the EUROBENCH Framework (facilities and/or software) for the subsequent validation during FSTP-2. The EUROBENCH Consortium will study and define potential agreements with third parties whose testbed prototypes will have been successfully validated, to ensure certification, further exploitation and sustainability of the EUROBENCH facilities and software.

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7 Sub-projects execution and payments

EUROBENCH will provide sub-granted Third Parties with financial support under a lump sum scheme contributing up to 100% of each sub-project costs. All payments Will be made in euro.
Payments along the sub-project duration will be transferred to the sub-project Coordinator. Payments to the coordinator will discharge the EUROBENCH Consortium from its payment obligation.
The coordinator must distribute the payments between the beneficiaries (partners of the sub-project) without unjustified delay.

The sub-projects execution will be divided in two phases, which also characterize the payments to Third Parties (Figure 7.1).

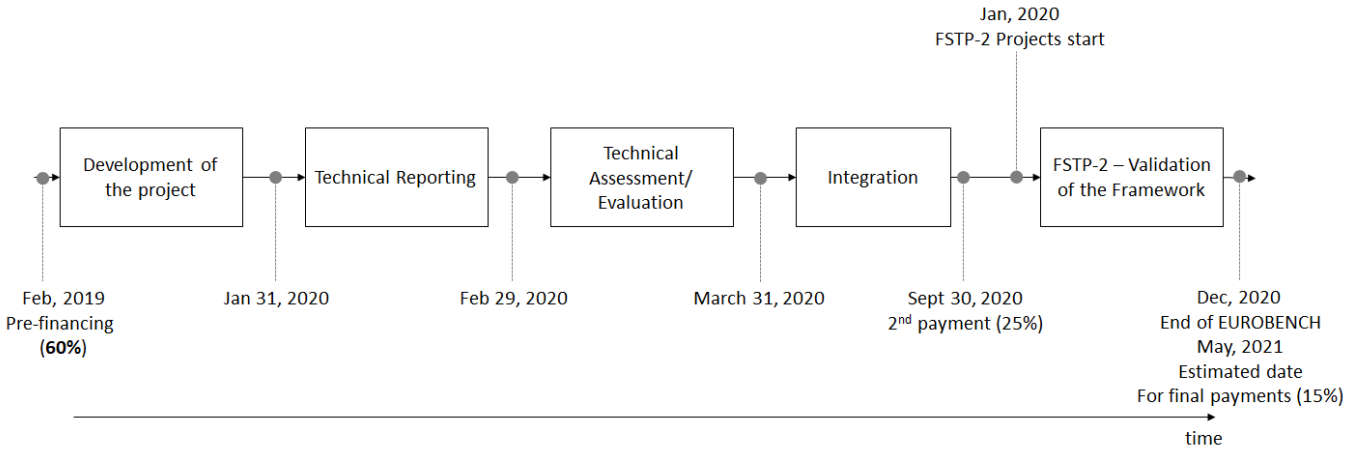

Figure 7.1. The different phases of the sub-project execution

7.1 Phase 0 - Pre-financing

Third parties can receive pre-financing of 60% of their respective total funding amount.

7.2 Phase 1 - Development

After sub-project selection, the Development phase will start and last 12 months. At the end of this phase, the Coordinator of each sub-project will have 1 month to submit a Technical Report, which should include:

- A description of the activities carried out by the beneficiaries.
- A detailed technical description of the outcomes and the necessary procedures for their integration.
- A description of the degree of achievement of the sub-project objectives and any deviation from them.

Specific templates for technical reporting will be prepared and published by the EUROBENCH Consortium.
The EUROBENCH Consortium will assess the Technical Report in a period of 1 month. If the evaluation succeeds, the Development Phase will be considered completed and the second phase (namely Integration) will start.

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7.3 Phase 2 - Integration

Third Parties that received a positive evaluation on the Development phase will have 6 months to integrate their outcomes into the EUROBENCH Software and/or Facilities. In particular:

- Testbeds and devices should be brought to the corresponding EUROBENCH Facility(ies), be installed and tested with at least one of the bipedal robotic prototypes available in the facility(ies).
- Software routines should be fully integrated in the EUROBENCH Software and tested with the reference input-output data provided together with the code.
- Experimental datasets should be integrated in the EUROBENCH Database, and tested with at least one of the software routines available.

After successful integration, Third Parties will be made eligible for receiving the remaining payment (40%) of the EUROBENCH fund. However, due to project funds retained by EC, Third Parties will only receive a 25% (reaching the 85% of the requested contribution). The final 15% of the sub-project funding will be released only after the EC transfers the final funding to the EUROBENCH consortium in 2021.

During the sub-project execution, the partners of the EUROBENCH Consortium will perform consulting/guidance activities to Third Parties, including technical support for the development of testbeds and methods, the integration in the Framework, the analysis of the results, and for design/improvement suggestions.

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8 Responsibilities of Consortia members

8.1 Conflict of interest

Third Parties must take all measures to prevent any situation where the impartial and objective implementation of the sub-project is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('conflict of interests'). They must formally notify to the EUROBENCH Consortium, without delay, any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation. The EUROBENCH Consortium may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline. If the Third Party breaches any of its obligations, the sub-contract, Grant Agreement with the Third Party, may be automatically terminated.

8.2 Assessment and integration in the EUROBENCH Framework

The costs of the sub-project, which are clearly specified in the proposal and Grant Agreement, become eligible.
If the outcomes of the technical reporting are not accepted after the assessment performed at month 13 of Development phase (see Section 7.2), the following scenarios are possible:

- The technical report reflects that the sub-project outcomes have not been (either totally or partially) developed: the technical report and sub-project outcomes will be re-evaluated during the initial stages of the integration phase together with the applicant. If this last review doesn't succeed, the integration phase won't take place and the second round of payments could take the form of recovery.
- The technical report reflects that the sub-project has been developed, but with unsuccessful results: the technical report and sub-project outcomes will be re-evaluated during the initial stages of the integration phase in order to help the applicant achieve the objectives. If this last review doesn't succeed, the integration phase won't take place and the second round of payments won't take place.

8.3 Confidentiality

During the implementation of the sub-project and during four years after its termination, both the Third Parties and the EUROBENCH Consortium must keep confidential any data, documents or other material (in any form) that is identified as confidential at sub-contract signing time ('confidential information'). Under Third Party request, the Commission and the EUROBENCH consortium may agree to keep such information confidential for an additional period beyond the initial four years. This will be explicitly stated in the Grant Agreement. If information has been identified as confidential during the sub-project execution or only orally, it will be considered to be confidential only if this is accepted by the EUROBENCH Consortium and confirmed in writing within 15 days of the oral disclosure. Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement (to execute the sub-project). The sub-project consortium may disclose confidential information to the EUROBENCH consortium and to the selected reviewers, who will be bounded by a specific Non-Disclosure Agreement.

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8.4 Financial Audits and controls - EU Commission Access

The beneficiaries will ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) have the right to exercise their powers of control on documents, information, even stored on electronic media, or on the final recipient's premises according to the General Annex K of the Horizon 2020 Work Programme. The beneficiaries must also ensure that the Commission has the right to make an evaluation of the impact of the action measured against the objective of the work program.

8.5 Visibility of the EU Funding and the EUROBENCH Project

Communication or publication of the Beneficiaries shall clearly indicate that the sub-project has received funding from the European Union and the EUROBENCH project, therefore displaying the EU and EUROBENCH logo on all printed and digital material, including websites and press releases. Moreover, Beneficiaries should agree that the non-confidential information regarding the sub-projects selected for funding, such as title, abstract and partners of the consortium, can be used by EUROBENCH for communication purposes.

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9 EUROBENCH Boards and Committees

9.1 Steering Committee

The Steering Committee is the governing body of EUROBENCH, and chaired by the project coordinator. It will decide on modifications of the work plan and budget distribution. It will oversee innovation, communication and dissemination procedures. As to the FSTP programme, the SC will:

- Appoint the FSTP Committee,
- Perform the final review and selection of FSTP proposals based on the evaluations performed by the experts, and
- Prepare the final list of funded and not-funded proposals avoiding conflicts of interest.

If concerns or conflicts arise, the SC will be the body to deal with it and provide a decision. In the unlikely case that a scientific, industrial, or ethical concern or issue should fail to be resolved within an institution or WP, it will be brought to the Project Coordinator who will in turn present it to the SC for discussion and decision making and if necessary to the General Assembly (all partners) for the final decision.

9.2 Scientific Advisory Board

The Scientific Advisory Board (SAB) is an independent group composed by senior experts chaired by the Project Coordinator. The SAB will be instrumental in dissemination and exploitation of project results as well as quality of deliverables and overall project status.
The SAB will also support the EUROBENCH Consortium in disseminating the project results and the FSTP actions. With respect to the FSTP actions, the SAB members will help the Steering Committee in choosing the evaluating experts. Due to conflict of interest issues, SAB members cannot participate personally in the open calls. At the same time, SAB members will not be involved in the proposal evaluation process.

9.3 FSTP Committee

A FSTP Committee will be appointed by the EUROBENCH Steering Committee advised by the Scientific Advisory Board. A pull of experts will be contacted and selected according to specific requirements previously defined in integrated in D7.1 FSTP Procedures Manual of the EUROBENCH project.
The evaluation experts will be individuals from the fields of science, industry and/or with experience in the field of innovation and also with the highest level of knowledge, and who are recognized authorities in the relevant technology areas.

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10 Checklist

Please ensure that all questions below are addressed positively by your proposal. Proposals that do not comply with one or more items will be rejected.

1) **Does your proposal address a relevant Expected Outcome?** Ensure that your proposal is addressing the development of:
   - *(if you are applying to OPTION 1)* One or more of the following expected outcomes: i) Testbeds, ii) Software routines, iii) Datasets.
   - *(if you are applying to OPTION 2)* One scenario-generic device.

2) **Is your consortium eligible?** The eligibility criteria are given in Section 1.3.2. In particular, make sure that all partners of your proposal belong to eligible countries.

3) **Are you in the budgetary limits?** Check that you comply with all budgetary limits as expressed in Section 1.3.3. In particular, if you are participating in more than one proposal, check that the total sum of amounts requested by your legal institution is lower than 100k€. Remember that this limit applies to all EUROBENCH Open Calls as a whole. Remain below 100k€ if you intend to participate in the Second Open Call (FSTP-2) in 2020.

4) **Is the required budget realistic?** Check that your budget is well justified (the more detailed the better) according to the complexity and number of the proposed outcomes.

5) **Is your proposal complete?** Your proposal will be scored according to the Evaluation Criteria included in Section 4.2. Please address them comprehensively.

6) **Is you proposal compliant?** Please make sure that your proposal meets page and font size limits, as well as addresses all mandatory sections, as specified in the proposal template available in the website http://eurobench2020.eu/ftsp-open-calls/fstp-1/.

7) **Have you submitted your proposal before the deadline?** It is strongly recommended not to wait until the last minute to submit the proposal. The time of receipt of the message as recorded by the submission system will be definitive.

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