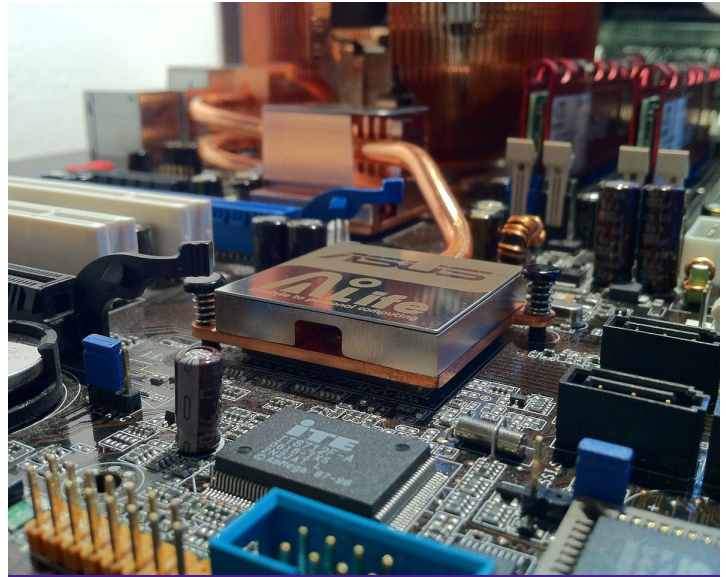# Handbook for ESRs

APROPOS project handbook

Revised 20 October 2021

ESR handbook

Horizon 2020 research and innovation on programme H2020-MSCA-ITN-2020

Marie Skłodowska-Curie Actions

Project no.: 956090

Project acronym: APROPOS

Project title: Approximate Computing for Power and Energy Optimisation

Start date of the project: 01/11/2020

Duration of the project: 48 months

Organization name of lead beneficiary for this task: TAU

Table of Content

Introduction

Dear ESR, welcome to the APROPOS training network. This document serves as your basic introduction to APROPOS and aims to guide you through the project, the collaborations and the training programme. The document is dynamic and may be revised during the project duration.

APROPOS is a four-year (2020-2024) H2020 Marie Skłodowska-Curie (MSCA) Innovative Training Network (ITN) bringing together 14 beneficiaries and 12 partner organizations from Finland, Sweden, Netherlands, Austria, Italy, Switzerland, UK, Spain, France, Poland, and Ireland with the aim of educating, supervising, and training 15 ambitious and creative Early Stage Researchers (ESRs) to face the challenges of future embedded and high-performance computing by using disruptive methodologies. The project is coordinated by Tampere University from Tampere, Finland.

Welcome aboard!

The first step and **obligation** for you to do is to request and **read** APROPOS **Grant Agreement** and **Consortium Agreement** from the Coordinator. We know that it is a heavy task (you have also to understand what is written there), so, take your time but do it as early as possible. If you would have any question – contact the Project Managers from the Coordinator's team: they are your best pals for the oncoming years.

Otherwise, this handbook is a very light version of the mentioned documents enhanced with some hints on how to make your path towards graduation easier.

Topic

Following the current trend, by 2040 computers will need more electricity than the world energy resources can generate. On the communications side, energy consumption in mobile broadband networks is comparable to datacenters. To make things worse, Internet-of-Things will soon connect 20 to 50 billion devices through wireless networks to the cloud.

APROPOS aims at decreasing energy consumption in both distributed computing and communications for cloud-based cyber-physical systems. We propose adaptive Approximate Computing to optimize energy-accuracy trade-offs. Luckily, in many parts of the global data acquisition, transfer, computation, and storage systems there exists the possibility to trade off accuracy to either less power or less time consumed – or both. As examples, numerous sensors are measuring noisy or inexact inputs; the algorithms processing the acquired signals can be stochastic; the applications using the data may be satisfied with an "acceptable" accuracy instead of exact and absolutely correct results; the system may be resilient against occasional errors; and a coarse classification or finding the most probable matches may be enough for a data mining system. By introducing a new dimension, accuracy, to the design optimization, the energy efficiency can even be improved by a factor of 10x-50x.

We will train the spearheads of the future generation to cope with the technologies, methodologies, and tools for successfully applying Approximate Computing to power and energy saving. The training, in this first ever ITN addressing approximate computing, is to a large extent done by researching energy-accuracy trade-offs on circuit, architecture, software, and system-level solutions, bringing together world leading experts from European organizations. In addition, we will provide network-wide and local trainings on the substance and on the complementary skills needed in both industrial and academic work life. APROPOS

is organized by means of the network research allowing for inter-project and cross-institutional collaboration. Each ESR has an established role between the PhD enrolment university and industrial beneficiary or company partner(s).

Network objectives

All ESRs are expected to actively participate towards the achievement of the scientific and training objectives of APROPOS, listed below.

The scientific objectives of APROPOS are

1. **Algorithms and Applications:** The objective of this avenue is to develop a solid understanding of algorithmic formulations and the nature of mathematical models and foundations that enable approximation.
2. **System Software and Runtime:** The objective of this avenue is to develop system software support and runtime support to enable and efficiently exploit error resilience characteristics for performance enhancement, power and energy savings and other system parameters such as life-time extension and reliability and functional safety constraints.
3. **Hardware and Devices:** The objective of this avenue is to design and implement various classes of approximate hardware including transprecision circuitry, inexact and simplified logic blocks, and modules to support extensions from preceding layers of system and application software.

The training objectives of APROPOS are

1. To gain research skills needed to obtain an internationally recognized PhD and to become recognized scientists in their field;
2. To gain an entrepreneurial and innovation-oriented attitude through exposure to SME and spin-off partners in and around the network;
3. To gain experience in applying their research both at academic and non-academic sector by secondments and research visits;
4. To gain transferrable skills such as entrepreneurship, scientific publishing, grant applications, career paths, CV writing, project management, managing IP, technology transfer, research ethics, and communication skills;
5. To provide and appreciate a working atmosphere that cherishes diversity, gender balance, multi-cultural skills and versatility to work in a global environment;
6. To acquire an open approach to research, through open publication of research papers, data and software and a "reproducible research" mindset;
7. To promote excellence and prepare them for applying to prestigious European and national fellowships;
8. To be aware of the pros and cons of academic vs. industrial careers and learn from the experiences of their supervisory team.

List of Beneficiaries and Partner Organizations

Consortium Member (Beneficiary)	Short Name	Country
Tampere University	TAU	Finland
Turun Yliopisto	UTU	Finland
Royal Institute of Technology in Stockholm	KTH	Sweden
Delft University of Technology	TU Delft	Netherlands
WIREPAS (nonacademic)	WIREPAS	Finland
University of Amsterdam	UvA	Netherlands
Vienna University of Technology	TU WIEN	Austria
Polytechnic University of Milan	POLIMI	Italy
Polytechnic University of Turin	POLITO	Italy
University of Bologna	UNIBO	Italy
IBM Research GmbH (nonacademic)	IBM	Switzerland
Queen's University Belfast	QUB	UK
Polytechnic University of Valencia	UPV	Spain
École Centrale de Lyon	ECL	France

Partner Organization	Short Name	Country
IS Wireless	ISW	Poland
Minima Processor	MIN	Finland
Thales Netherlands	THN	Netherlands
TTTech Computertechnik AG	TTT	Austria
Xilinx Ireland	XILINX	Ireland
Centro Regionale Information Communication Technology scrl	CERICT	Italy
Arduino SA	ARD	Switzerland
Methority AB	MET	Sweden
Ericsson AB	ERIC	Sweden
Telefónica Investigación y Desarrollo SAU	TID	Spain
IBT Systems srl	IBT	Italy
EXAFORE	EXAFORE	Finland

Main contact persons at network level

In addition to the supervisors listed in the table from 'ESR rights' section, you can find below a list of contact persons in charge of various coordination and ethical tasks, such as the network coordinator, the Project and Training Manager (PTM), the Equality Officer, the Data Protection Officers, Working Package (WP) leaders, etc.

Name	Role in the Network	Email address
Jari Nurmi	APROPOS project coordinator	jari.nurmi@tuni.fi
Aleksandr Ometov	APROPOS PTM WP5 leader	aleksandr.ometov@tuni.fi
Camilla Halinoja	TAU administrative and financial project manager	camilla.halinoja@tuni.fi
Enrique Salvador Quintana Ortí	WP1 leader	quintana@uji.es
William Fornaciari	WP2 leader	william.fornaciari@polimi.it
Georgios Karakonstantis	WP3 leader	G.Karakonstantis@qub.ac.uk
Cristiano Malossi	WP4 leader	ACM@zurich.ibm.com
Elena Simona Lohan	Equality Officer	elena-simona.lohan@tuni.fi
~	APROPOS network and TAU Data Protection Officer (DPO)	dpo@tuni.fi

ESR rights

General rights

The ESR rights are listed in the APROPOS Grant Agreement (GA) and its Annexes. Each ESR is entitled to receive upon their hiring the full GA text and to ask clarifying questions (if any) about it. Each ESR is hired according to a full-time contract at a single Beneficiary where (s)he was recruited. The working conditions and salary level depend on the Beneficiary and on the recruitment country and they can be found in the GA and in the MSCA-related web pages. The EU MSCA funding covers the followings:

- The total EU contribution to hire the ESR, let us call it here the **ESR 'super-gross' salary**, is formed by a living allowance (3270 EUR/month, adjusted by a country-specific coefficient), a mobility allowance (600 EUR/month), and (if applicable) a family allowance (500 EUR/month). The salary contributions of the EU are depicted in the

following figure and the 'super-gross' terminology[1]. Note that the 'super-gross' salary still includes all employer statutory fees (e.g. social security charges, taxation) that the Beneficiaries must pay and are organisation- and country-dependent. Therefore, the real 'gross' salary of the ESR, stated in the ESR employment contract, is lower.
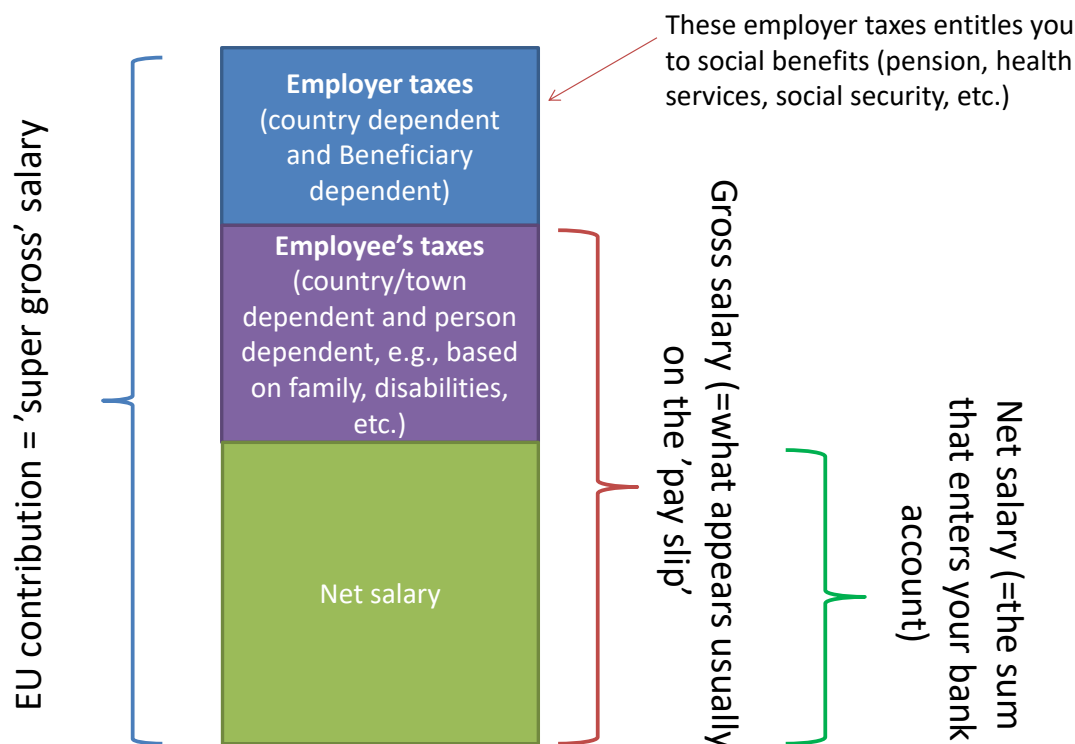
Therefore, a formula to estimate own gross salary per month is as follows

$$GS = \frac{c*3270 + 600 + f*500}{1+s},$$

where c is a country-specific coefficient given by the EU (i.e., c = Finland 1.208; Sweden 1.218; Netherlands 1.079; Austria 1.067; Italy 1.044; Switzerland 1.212; United Kingdom 1.398; Spain 0.954; France 1.157[2]), f is a 0/1 flag (f=0 if no spouse or children <u>at the date of recruitment, i.e., date of starting the contract</u>, f=1 otherwise), and s is an employer-

APROPOS

specific index covering the employer social charges, also time varying (of up to 35%, to be checked locally with each Beneficiary). A visual representation of the formula is portrayed in the following figure.

ESR's monthly gross salary formula

= **A1 Living Allowance * Country Correct Coeff** + **A2 mobility allowance** + **(A3 family allowance)** - **employer statutory fees***

Note: the *monthly* salary may slightly variate from the above formula, but a correction is to be done at the end of each year in such a way that the final exact sum will correctly reach the ESR. The fluctuations are due to the fact that *s* in the formula above is a time-varying index, which can fluctuate monthly.

The net salary is computed after deducting the country/town-specific taxes, social contributions, and other possible costs that the ESR must pay from the gross salary.

- The **research, training, and networking costs: "…:** these are available to the host institution as a flat rate per person-month (pm) (i.e., 1500 EUR/pm) and it is meant to cover **all training-related costs in the network, thus they are not ESR specific**. Such training costs include, but are not limited to:
    o Training events organization costs (premises, food, lecturing fees, travel costs of lecturers and participating ESRs);
    o ESR visa costs (both when recruited and when participating to APROPOS network events and secondments);
    o Open-access fees for publications in conferences and journals;
    o Conference fees and travel costs of ESR and possibly associated supervisors to participate to conferences where there is a publication co-authored by an ESR;

- o Laptops/computers and needed software and hardware tools for the purpose of ESR research and training;
- o Costs related to secondments (travel, accommodation – when relevant, partner organization possible fees, etc.);
- o Coordination between participants;
- o Tuition fees (when applicable);
- o PhD defense related fees (e.g., travel costs and fees of opponents/examiners).
- The **management costs** of the network (600 EUR/pm): these are fully meant to cover the management tasks and the overheads at each Beneficiary Unit. The training costs together with the management costs are also called "**institutional costs**".

The employment contract of each ESR should be treated as work, not as study with scholarship (e.g., for visa procedures, for employment benefits, etc.).

Each ESR is entitled to active supervision within the network. To facilitate the interaction with multi-supervisors, a main supervisor has been appointed for each ESR position and this main supervisor will act as the main contact point/manager in all interactions with the additional supervisors. Each ESR is also entitled to access the relevant training for his/her research topic in order to acquire skills fulfilling the needs of both academia and the non-academic sector and in order to enhance her/his inter-sectoral employability at the completion of her/his PhD.

In addition, please check the Sections "Expectations from Beneficiaries' side" and "Expectations from Partner Organization' side" to see how each Beneficiary and each Partner organization take concrete action points regarding the ESR rights.

Rights to participate to conferences and workshops

It is highly advised that the participation to additional conferences and workshops to those mentioned in the table from Section "ESR obligations related to training events" will comply with the following rules, which will maximize the training benefits for the ESRs. The ESR and

APROPOS 13

their supervisor decide in mutual understanding about the conferences, workshops, and other possible events where the ESR could participate. A 'reasonable cost/reasonable benefit' principle should always be considered.

Rights to software and hardware needed for training

Each Beneficiary unit is in charge of providing the ESRs the needed software and hardware tools to support their research and training goals as outlined in each ESR topic in the GA plan. **The acquired hardware/software is at the discretion of the Beneficiary unit, as long as it covers the ESR's needs.** The ESR can come with own **motivated** proposals regarding additional software/hardware tools that might be needed to conduct the work. **This has to be discussed with and approved by** the Beneficiary team.

ESR duties

General duties

Each ESR should read Grant Agreement (GA), related Annexes, and due Milestones and Deliverables. Those contain significant information about the project implementation.

Each ESR should complete her/his Personal Career Development Plan (PCDP) individually and according to the deadlines, as set in the GA. The PCDP is a dynamic document which will be amended and changed over the course of the research project. It should be authored by the ESR and discussed and agreed with his/her supervisors (academic and industrial). The PCDP should:

1. Include the research plan, methodology and overview of key state-of-the-art references;
2. Define the role of the industry collaboration and secondment programme;

3. List the planned courses to attend;

4. Outline a plan in the format of a Gantt chart (see GA for the APROPOS Gantt);

5. Outline a dissemination plan in accordance with the expectations outlined further;

6. The ESR PCDP should be prepared with the supervisors at the moment of employment but signed and delivered to the Coordinator's team no later than **01.10.2021**.

Each ESR will be evaluated during his/her trial period (typical trial periods are between 6 and 12 months and they are Beneficiary specific) and also annually (e.g., through an annual reporting or presentations). In case of poor performance, there is the possibility of termination of the contract. Main supervisors should discuss in due time with under-performing ESRs in order to see if timely mitigation actions are possible.

Sick leaves and other justified leaves should be duly informed to the Beneficiary and the Coordination team. The ESRs can take sick leaves or maternity/paternity leaves in accordance with national legislation. If an ESR is in a justified leave for more than 30 consecutive days, the payment is suspended by EU for the full duration of absence: "the costs of the maternity/parental leave **are not eligible** under the action. The researcher's activity in the action is suspended during the maternity/parental leave. This period should be reflected in the Researcher's Declaration and their contract **might** be extended with the corresponding period **within the action's duration**".

ESR working hours and time sheets

The ESRs must work at the Beneficiary premises or at the agreed secondment premises at least during the working hours specified in each ESR contract.

The ESRs should fill in their working time sheets in accordance to each Beneficiary rule and must keep proofs of their travels during secondments (accommodation and travel tickets receipts, signed secondment agreements, etc.).

APROPOS 15

ESR duties related to training events

Network training events 1, 2, 4, 6, 7, 10, 11, 12, and 15 are compulsory for the ESRs, while the other events are **strongly recommended** and it is possible to attend them also without having a paper (unlike participation to other conferences or workshops).

#	Main Training Events & Conferences, Location Topics (contributing beneficiary / partner)	Days	ECTS (*if any*)	Lead Institution *(Assistance)*	Action Month (*estimated*)
1	**Kick-off training week and 1st workshop, Tampere FI** Introductions of fellows, supervisors and sites (all), APROPOS overview (TAU), Multi-cultural communications at work (IBM), Research methodology (UVA), Responsible research practices, research integrity (TAU), Ethical issues and ethical clearance (UTU), Open science and open publishing (POLITO), Open data (TAU), PCDP (TAU), Presentation and poster preparation hints (QUB), Overview of AC/TC conferences and workshops (QUB, ECL-INL), Popularization of research (TAU), Social media for researchers (TAU), Promoting female careers in science (QUB), ESR representative elections (ESRs). **Introduction to approximate computing:** Cloud and Edge Computing (UNIBO), Big Data (UPV), Introduction to embedded computing (IBT), Digital design for Internet-of-Things (POLIMI), Reconfigurable technologies (XILINX), Transprecision computing for ML and Deep Learning applications (IBM), Energy-aware computing (TUW), Software approximation (UTU), Approximate computing hardware solutions (ECL-INL), Approximation opportunities in automated driving (TUD), Error evaluation in approximate computing (POLITO), Fault tolerance and approximation (UVA), AC benchmarks (KTH, MET, ERIC), Significance-driven programming framework for AC (QUB), Sensor and IoT networks (Wirepas).	5	4	TAU (UTU)	M9
2	**2nd workshop and midterm review, Milano IT** Brief fellow status presentations (all), Group working. Complementary skills: project reviews, research presentation.	2	2	POLIMI (TAU)	M14
3	**WAPCO within HiPEAC 2022, t.b.d.**[3] Workshop on Approximate Computing: Continuation of WAPCO, the main venue on approximate computing in Europe that attracted the interest of several attendees and invited speakers in the past. PhD students will have the chance to i) learn about the latest developments on approximate computing from researchers around the world who will be invited in WAPCO and ii) discuss their work with the invited researchers in interactive poster sessions.	1	n/a	QUB (IBM, POLITO)	M16
4	**1st Winter School, Ruka FI** **Approximate computing and machine learning**: Approximate computing overview (TAU), Constrained AI models for IoT applications (IBM), Approximation in edge computing for wearables network (UTU), ML and deep neural networks (UNIBO), Hardware acceleration of ML (IBM), Near-memory and in-memory computing (IBM), ML applications (UPV, POLIMI), Approximate computing benchmarks in machine learning (KTH), Benchmark objectives, roadmap and AC opportunities (KTH)	3	2	TAU (IBM)	M17
5	**Special session in DATE 2022, Dresden DE** Presentation of the project and its first results.	½	n/a	ECL-INL	M18
6	**3rd workshop, Valencia ES** European research programs (TUD), Writing research proposals (UPV), National research proposals (POLITO, UVA, ECL-INL, TAU, QUB, UPV, KTH, TUW), Project and research grant budgeting (UPV), Commercial R&D practices (IBM, CERICT, TID), Technology transfer (CERICT), Licensing agreements (POLIMI), Entrepreneurship and start-up companies (TAU, partners), Brief fellow status presentations (all), PCDP updates (all), Group working.	2	2	TUD (UPV)	M24
7	**1st Summer School, Valencia ES** **Hardware and software approaches to approximate computing:** Green computing (ECL-INL), Design Space Exploration for AC (ECL-INL), Advanced software approaches to AC (UPV), Advanced AC hardware approaches and testing implications (ECL-INL), Safety implications deriving from the application of approximate computing in IoT domain (TID), Dependable networking issues (TTT), Low-power processors (MIN), Efficiency measures for approximation (UTU), Coarse-grained reconfigurable accelerators (TAU), Approximation opportunities in communications hardware (TAU), Bayesian estimators in approximate computing (POLITO), Modelling and verification techniques based on virtual prototyping (ARD).	4	3	UPV (ECL-INL)	M24
8	**Special session in IEEE NorCAS 2022, Stockholm SE** Presentation of the first full fellow year results.	½	n/a	KTH	M25
9	**WAPCO within HiPEAC 2023, t.b.d.**[40] Public workshop in collaboration with HiPEAC community	1	n/a	QUB (IBM)	M28
10	**2nd Winter School, Zurich CH** **Transprecision computing for energy efficiency:** Transprecision floating-point computation (UNIBO), Compiler-based precision tuning (POLIMI), Transprecision computing in IBM POWER architecture (IBM), Low-power multicore solutions	3	2	UNIBO (IBM)	M30

APROPOS 16

	for approximation (UNIBO), Hardware design for multi-precision arithmetic (QUB), Heterogeneous accelerators for AC/TC (UNIBO), Exploiting adjustable precision in iterative numerical computations (UPV).				
11	**2nd Summer School, Tampere FI** **Applications of approximate computing:** Fault tolerance and approximation (UVA), Surveillance technologies and applications (THN), Adaptive approximation in sensor applications (TUW), RAN virtualization as key building block of 5G (ISW), Approximation in healthcare wearables and fog gateways (UTU), Protocol processing issues (TAU, WIREPAS), Genome research and molecular biology applications (KTH), Positioning and navigation (TAU), Autonomous driving (TID), Augmented Reality and AI (ERIC).	4	3	UTU (UVA)	M33
12	**4th workshop, Tampere FI** Data management (UTU), CV clinic (UVA, KTH, TUW, TAU), Fellow status updates (all), Career prospects in industry (WIREPAS, ERIC, ISW, ARD), Academic career after PhD (TAU), PCDP updates (all), Discussion on future prospects of AC/TC (all), Group working.	2	2	WIREPAS (TAU)	M33
13	**Special session in SAMOS 2023, Samos GR** Presentation of the second fellow year results.	½	n/a	TUW	M34
14	**WAPCO within HiPEAC 2024, t.b.d.** Public workshop in collaboration with HiPEAC community	1	n/a	QUB (IBM)	M40
15	**3rd Winter School, Torino IT** **Future research challenges in approximate computing:** Future-oriented topics to be identified during the first 3 years of the project (and brainstormed at the 4th workshop).	3	2	POLITO (QUB)	M41

In addition to the above-mentioned events, each ESR should complete the required amount of courses for his/her PhD by attending the local courses offered by her/his Beneficiary and/or Secondment Unit. A list of recommended courses can be found in the D7.1 Training deliverable displayed in the GA.

ESR duties related to secondments

Each ESR should perform the academic and industrial secondments defined in her/his topic description in the GA. The overall duration of the secondments **is fixed according to the GA**; however, the splitting of the long secondments into multiple smaller parts can be discussed and negotiated case by case (discussions to be coordinated by the main supervisor of each ESR). Explicit agreement of the Supervisory Board is needed in case of changes of secondment periods compared to the GA. Secondments must be planned well in advance, in order to have time to apply for visa (if needed) and to find reasonable-cost accommodation.

The following EU rules apply to secondment costs:

- Economy travel costs (flights, train/buses) are covered for the secondment trips.
- "Institutional costs are covering also costs (e.g. travel and accommodation costs) arising from each secondment of 6 months or less which require mobility from the place of

residence"[4]. Accommodation budget is based on the rules at each Beneficiary and should be discussed beforehand with each Beneficiary. Accommodation costs are not covered for secondments longer than 6 months in a row, as it is expected that ESR will not keep two accommodations for long secondments. Normally, the ESRs are expected to find out the accommodation options by themselves and to agree with the Beneficiary on the costs. In case there is disagreement between the ESR and the Beneficiary regarding what a budget-type accommodation is, the Beneficiary is entitled to propose to the ESR a budget-type accommodation. If ESR declines the accommodation offer(s) that might be made by the Beneficiary unit, then ESR should cover the accommodation costs by herself/himself.

- No daily allowances are covered during secondments, as they are already covered by the mobility allowance of ESR salary.

- Visa costs (when needed) are covered by the APROPOS project (training funds/institutional costs).

- While finding an accommodation is entirely the ESR responsibility, the ESR may ask advice/help in finding reasonable-cost accommodations from his/her supervisors.

Taxation issues during secondments

- EU countries often apply the so-called '183 days' taxation rule, meaning that no matter on the source of revenues/salary, a person spending more than 183 cumulated days in a EU country (counted typically within any 12-month window) will start paying taxes on the global revenue in that country where (s)he spends 183 days or more per year.

---

[4] According to the EU slides at the Coordinator Info day; Bruxelles, Oct 2018

- Each fellow, with the help of his/her main supervisor should investigate the taxation rules applicable in their case (Beneficiary country/country of secondment) and take an informed decision regarding the split of secondments.

ESR duties related to technical publications

During the ESR phase of the career, each ESR should publish the results of his/her research, **by complying with research ethics** at every step. When applicable, ESRs should apply for the ethical approval to the Committee of Ethics at the host university. No plagiarism is accepted in any published work by an ESR (self-plagiarism also counts as 'plagiarism'). We recommend that similarity check tools available at each Beneficiary (such as Turnitin similarity check web-based tool) are to be used regularly.

Each venue for technical publications (conference/journal/magazine/etc.) should be preapproved by the supervisor since the budget is limited and venue may not be of significant value/might not be accepted as a part of a PhD by the corresponding Beneficiaries' units. Each ESR should discuss the publication plans with the supervisors prior to submitting and should get the approval of the main supervisor for submitting

APROPOS aims to have at least 60 publications in total from the ESRs during their work in the project, i.e., minimum 4 per ESR. However, each ESR should follow requirements of the corresponding university's regulations in terms of graduation requirements (e.g., typically a minimum of 2 publications/year are expected on average from PhD students at TAU).

The list of more detailed requirements regarding technical dissemination is given in GA and re-listed below. Please note that **ESRs are responsible for these**:

Indicator	Target (precise value if quantifiable)
Research activities	
Research results obtained (progress of the individual projects)	Reaching all the objectives
Scientific highlights and achievements	5 patents, awards, or prizes
Decrease in energy consumption in IoT networks via approximate computing methods	At least 80% compared to non-approximating methods.
Individual and joint publications, directly related to the project, with appropriate acknowledgment of the funding source	60 international publications of which 20 joint papers. Publication list will be maintained.
Inter-sectoral and multidisciplinary collaboration	20 joint papers of which 10 cross-sectoral
Training activities	
Implemented training events/activities and deviations, if any	Planned events with minimum 20 participants each
Supervising and mentoring activities	Supervisory teams functioning as planned
PCDPs of the ESRs	PCDPs created and updated according to the schedule
Participation of the fellows in training events and meetings from the network and at international conferences outside the network	150 fellow participations in total. List of training events and conference participation will be maintained.
Transferable skills training	At least one training contribution from each beneficiary and training partner
Implementation of visits/secondments undertaken within the network to both full beneficiaries and associated partners	60 months of visits and secondments
Management activities	
Status of ESR recruitments at each participant, and relevant issues related to the recruitment strategy/process and gender balance	Recruitments completed at M9, gender balance at 40%
Effectiveness of networking, communication and decision-making	Unanimous decisions achievable in management organs
Effectiveness of the financial management and compliance with Marie Curie salary rates	Payments to beneficiaries in due time, any minor deviations in salary rates corrected annually if any
IPR management and commercial exploitation of research results	5 IPR transfers to take place
Communication, dissemination and outreach activities	
Effectiveness of the training events and conferences to reach research community	External participants in half of the events. Average number of participants in the training and dissemination events 30.
Community outreach	Number of high-school visits, open-door days, public talks, Researchers' Night participations. Total 30 targeted.
Dissemination through social media	Number of members/followers in LinkedIn, twitter, blog. Minimum 200 in each. Number of Youtube videos (15) and views (1,500), web portal accesses (1000).

As soon as a paper is published, the ESR who is the main author **should add this publication without delays on zenodo.org repository**, under the APROPOS project as well in the corresponding reporting Excel sheet in OneDrive folder. This should be done as soon as possible, but no later than 6 months following the acceptance of the publication. In addition,

the ESRs are strongly encouraged to add their work on ResearchGate (under APROPOS folder), on ArXiv repository (pre-print versions), and in the open-access repositories at each Beneficiary (e.g., tunicris at TAU, etc.). The created open-access software must also be added at least at zenodo.org, but preferably also on GitHub. The software results created within APROPOS network should be made available to the research community as much as possible.

APROPOS goals set by EU (see GA article 29.2) are that "Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results**", i.e. either green, fully, or gold open access. Publications not fulfilling green/open access rules cannot be funded by APROPOS or reported under APROPOS project.**

In order to fulfill the FAIR principles of EU (See D5.2 deliverable for details), the bibliographic metadata (e.g., added on zenodo.org) must be in a standard format and must include all of the following:

1. the terms "Marie Skłodowska-Curie Actions (MSCA)";
2. the name of the action, acronym and grant number (Approximate Computing for Power and Energy Optimisation; APROPOS; grant 956090)
3. the publication date and a persistent identifier (e.g., DOI, etc.).

Regarding the publication co-authored by an ESR

- It is highly recommended that at least one supervisor from APROPOS contributes to the paper and appears as co-author (these are typically the main supervisor(s) of the ESR(s) co-authoring the paper);
- Publications topics and research work related to publications should be approved by the main supervisor;

- A good ethical practice is to add as co-authors all those who have contributed substantially to the research work (minor editing or spell check are not counted as substantial contribution);
- Each publication should have an acknowledgement to APROPOS.
- Collaboration with 1 or 2 other ESRs when writing a paper is highly encouraged, by pre-agreeing beforehand who will use that publication in his/her thesis. Such collaboration not only will foster better research ideas and improve your scientific writing skills, but it will also increase your number of publications in your CV.
- A paper with many authors might be not so well seen by some publication forums and by some PhD thesis reviewers, thus the team of co-authors must be chosen based on actual contributions. In case of publications with more than 5 authors, please include a section clarifying the contribution of each author.

ESR duties related to social media /dissemination activities

Each ESR is expected to actively participate to all the social media activities from the GA and re-listed in the following table:

Additional dissemination activities besides webpage, scientific publications, conference & workshop participation, and patents. All ESRs will be involved in all these activities. One or two ESRs/task will lead the efforts	Lead ESRs[5]
Blog publications	1,2
Facebook open group	3,4
LinkedIn open group	5,6
Twitter	7,8
Zenodo	9
Project Manager Support	10
ResearchGate	11

APROPOS 22

ESRs will maintain a **YouTube** channel with video clips and fellows testimonies related to the main topic of the project, providing lessons and general-purpose talks, to spread the relevance of the activities carried out in the network	12,13
ESRs will attempt contact with **local mass-media** to spread the activities of the consortium, the Marie Curie Actions, and of individual activities	14,15

In addition, the last column of the table above specifies which fellow(s) should take a leadership role regarding each of the above-mentioned social media activities. A leadership role implies to actively collect inputs from other fellows, to come with ideas regarding the content, etc.

The list of more detailed requirements regarding non-technical dissemination is given in Annex 1of GA and re-listed below. Please note that **ESRs are responsible for these**:

1. Appropriate dissemination: minimum 30 blog entries for non-scientific audience (to be visible at APROPOS website), i.e., minimum 2 blog entries/ESR during the project duration
2. Outreach: Min 10 articles in newspapers and general interest magazines, min 200 subscribers and 1500 views at APROPOS YouTube channel, i.e., each fellow to write at least one article in a newspaper or a general interest magazines and to participate to the other social media activities listed in the table above.
3. IPR: 5 IPR transfers to take place.

Acknowledgements

The following text together with the EU flag must be added as Acknowledgements in each non-technical article, whenever possible:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 956090.

APROPOS 23

European Union, and the European Union is not responsible for any use that might be made of its content."

Each paper should be supplemented by the acknowledgement as:

LATEX (copy as it is):

The authors gratefully acknowledge funding from European Union's Horizon 2020 Research and Innovation programme under the Marie Sk\l{}odowska Curie grant agreement No. 956090 (APROPOS: Approximate Computing for Power and Energy Optimisation, \url{http://www.apropos-itn.eu/}).

Short, Word

The authors gratefully acknowledge funding from European Union's Horizon 2020 Research and Innovation programme under the Marie Skłodowska Curie Grant Agreement No. 956090 (APROPOS, http://www.apropos-itn.eu/).

Long, Word

The authors gratefully acknowledge funding from European Union's Horizon 2020 Research and Innovation programme under the Marie Skłodowska Curie Grant Agreement No. 956090 (APROPOS: Approximate Computing for Power and Energy Optimisation, http://www.apropos.eu/). This work does not represent the opinion of the European Union, and the European Union is not responsible for any use that might be made of its content.

ESR duties related deliverables and milestones

The APROPOS network has committed to produce and submit 38 deliverables to the Commission. Deliverables are documents or other formats of information that act as proof of the project's progress. A list of deliverables and milestones can be found from the following table and the GA at the beginning of the network.

Table 1 List of Deliverables

Del Rel. No	Del No	Title	Lead Beneficiary	Dissemination Level	Est. Del. Date (annex I)
D6.5	D34	Consortium Agreement	TAU	Confidential	31 12 2020
D6.6	D35	Supervisory Board of the network	TAU	Confidential	31 12 2020
D5.1	D22	Project website	TAU	**Public**	31 01 2021
D5.2	D23	Dissemination Plan and Data Management Plan initial version (with updates every 12 months)	TAU	Confidential	30 04 2021
D6.1	D30	Project Handbook	TAU	Confidential	30 04 2021
D6.2	D31	Report on recruitment of ESRs	TAU	Confidential	31 08 2021
D4.1	D19	Initial PCDPs of the ESRs	TAU	Confidential	31 10 2021
D5.3	D24	Press release on the network launch (after recruitments)	TAU	Public	31 10 2021
D7.1	D36	H - Requirement No. 1	TAU	Confidential	31 10 2021
D7.2	D37	POPD - Requirement No. 2	TAU	Confidential	31 10 2021
D7.3	D38	DU - Requirement No. 3	TAU	Confidential	31 10 2021
D6.3	D32	1st year Progress Report	TAU	Confidential	30 11 2021
D5.4	D25	Intermediate List of Publications, first 18 months	TAU	Public	31 05 2022
D1.1	D1	State-of-the-art report on models of approximation (WP1 midterm report)	UPV	Confidential	30 06 2022
D2.1	D5	State-of-the-art report on tools and evaluation methods for approximate computing (WP2 midterm report)	POLIMI	Confidential	30 06 2022
D3.1	D11	State-of-the-art report on applications for adaptive approximation (WP3 midterm report)	QUB	Confidential	30 06 2022
D5.5	D26	Intermediate List of Publications, first 36 months	TAU	Public	30 11 2023
D6.4	D33	3rd year progress report	TAU	Confidential	30 11 2023
D5.6	D27	Press release on selected research results	TAU	Public	31 12 2023
D4.2	D20	Final PCDPs of the ESRs	TAU	Confidential	29 02 2024
D5.7	D28	Report on Approximate Computing Research Excellence Award	QUB	Public	29 02 2024
D1.2	D2	Efficient deep learning inference models for low-energy applications (ESR1 final report)	IBM	Confidential	30 04 2024
D2.2	D6	Industrial and scientific applications for benchmarking approximate computing strategies (ESR5 final report)	KTH	Confidential	30 04 2024
D3.2	D12	Reconfigurable approximating accelerators for secure edge computing (ESR10 final report)	TAU	Confidential	30 04 2024
D3.3	D13	Approximation at the edge for automated driving (ESR4 final report)	TU Delft	Confidential	30 04 2024
D1.3	D3	Fault-tolerant approximate computing techniques (ESR2 final report)	UvA	Confidential	31 05 2024
D2.3	D7	Design Space Exploration for accuracy-aware computing (ESR6 final report)	ECL	Confidential	31 05 2024
D3.4	D14	Approximating techniques in low-cost GNSS receivers (ESR11 final report)	TAU	Confidential	31 05 2024
D2.4	D8	Fast and accurate prediction of the impact of approximate operators on a complex computation (ESR7final report)	POLITO	Confidential	30 06 2024
D3.5	D15	Design of reconfigurable and approximate functional units for wearable applications (ESR12 final report)	UTU	Confidential	30 06 2024
D1.4	D4	Machine learning and optimization for approximate and transprecision computing (ESR3 final report)	UNIBO	Confidential	31 07 2024
D2.5	D9	Compiler technologies for approximate computing (ESR8 final report)	POLIMI	Confidential	31 07 2024
D2.6	D10	Transprecision algorithms and software tools for graph analytics (ESR9 final report)	UPV	Confidential	31 07 2024
D3.6	D16	Predictive approximate smart sensor (ESR13 final report)	TU WIEN	Confidential	31 07 2024
D3.7	D17	Approximate computing for communications (ESR14 final report)	WIREPAS	Confidential	31 07 2024
D3.8	D18	Design for dynamic data-dependent precision scaling (ESR15 final report)	QUB	Confidential	31 07 2024
D4.3	D21	Status report on the PhD degrees from the network	IBM	Confidential	31 10 2024
D5.8	D29	List of Publications	TAU	Public	31 10 2024

Each ESR should actively participate in the writing of deliverables (according to the WPs where they are involved, see GA) and to participate in the achieving of the milestones as given in the GA and its Annexes. The main supervisor of each ESR, the WP leaders, and the PTM are in charge with the timely collection of the deliverables and milestones inputs. The ESRs should comply with the internal deadlines as set by their supervisors, the WP leaders, the PTM, and

the Coordinator in order to ensure a smooth functioning of the network and the best outputs in terms of training and research.

Milestones mark the central tasks that need to be completed along the way of the project in order to ensure timely progress of it. APROPOS has set 25 milestones that are visible in Table 2. Many of the milestones require certain types of documents or outcomes that need to be prepared in order to achieve the milestone. The ESR and/or the Beneficiary responsible for a particular milestone takes care of the preparation of the required material and for collecting relevant information from others and work towards achieving of the milestones as given in the GA and its Annexes. Once completed, the responsible Beneficiary or ESR then report the achieved milestone to the Coordinator who reports it in the Funding and Tenders Portal's continuous reporting functionality.

Table 2 List of Milestones

Number	Name	Lead Beneficiary	Delivery Date (Annex I)
1	Supervisory Board kick-off meeting	TAU	2020 12 31
2	ESR positions published	TAU	2021 01 31
3	First recruitments completed	TAU	2021 04 30
5	First training event	IBM	2021 08 31
4	All recruitments completed	TAU	2021 10 31
24	All recruited fellows enrolled in PhD programme	TAU	2021 10 31
6	2nd workshop	POLIMI	2021 12 31
25	Project Check	TAU	2022 01 31
7	Special session (WAPCO workshop) within HiPEAC 2022	QUB	2022 02 28
8	1st Winter school	TAU	2022 03 31
9	Special session at DATE 2022	ECL	2022 04 30
10	First ESR publications accepted	TAU	2022 04 30
11	3rd Workshop	TU Delft	2022 10 31
12	1st Summer school	UPV	2022 10 31
13	Special session at NorCAS 2022	KTH	2022 11 30
14	All ESRs have publications	TAU	2022 12 31
15	Special session (WAPCO workshop) within HiPEAC 2023	QUB	2023 02 28
16	2nd Winter school	UNIBO	2023 04 30
17	2nd Summer school	UTU	2023 07 31
18	4th Workshop	WIREPAS	2023 07 31
19	Special session at SAMOS 2023	TU WIEN	2023 08 31
20	Special session (WAPCO workshop) within HiPEAC 2024	QUB	2024 02 29
21	3rd Winter School	POLITO	2024 03 31
22	All secondments completed	TAU	2024 04 30
23	All ESR final reports completed	UPV	2024 07 31

Additional tasks related to deliverables or milestones might appear during the project duration (e.g., at the requirements of the EU project officer). These additional tasks may form also a part of the ESR duties.

ESR duties related to their PhD degree

Each ESR must register to a PhD program according to his/her topic description and must pay annual PhD fees (if any) at the universities where (s)he is registered. These annual fees are reimbursed by APROPOS training costs.

Each ESR must actively pursue the completion of his/her PhD studies, which typically requires

- a certain number of publications (to be discussed with the supervisory team)
- a certain number of ECTS credits (to be discussed with the supervisory team)
- a certain number of presentations and workshop participation (to be discussed with the supervisory team)
- a unique thesis writing in compound or monograph format (to be discussed with the supervisory team)
- a thesis defense at the beneficiary/affiliated university

While the APROPOS team will strongly support the ESR training, the full completion of the steps required for the PhD degree is up to each ESR as this will basically highly benefit his/her career and training goals, and therefore ESRs must proactively follow the completion of their PhDs.

Expectations from the Beneficiaries' side

The beneficiaries are expected to support the implementation of the actions outlined in the GA and the Consortium Agreement for APROPOS. Of specific relevance for the ESR's rights, the beneficiaries are expected to (more detailed description is available in GA Article 32):

1. Ensure that the researchers enjoy at the place of the implementation at least the same standards and working conditions as those applicable to local researchers holding a similar position;

2. Ensure that the employment contract, other direct contract, or fixed amount-fellowship agreement (see GA Article 6) specifies:

    a. The starting date and duration of the research training activities under the action;

    b. The monthly support for the researcher under this Agreement (in euro and, if relevant, in the currency in which the remuneration is paid);

    c. The obligation of the researcher to work exclusively for the action;

    d. The obligation of the researcher not to receive for activities carried out in the frame of the action, other incomes than those received from the beneficiary (or other entity mentioned in Annex 1 of the GA);

    e. The obligation of the researcher to inform the beneficiary as soon as possible of any events or circumstances likely to affect the Agreement (see Article 17 of GA);

    f. The arrangements related to the intellectual property rights between the beneficiary and the researcher — during implementation of the action and afterwards;

    g. The obligation of the researcher to maintain confidentiality (see GA Article 36);

h. The obligation of the researcher to ensure the visibility of EU funding in communications or publications and in applications for the protection of results (see Articles 27, 28, 29 and 38 of GA);

3. Inform the researchers about:

    a. the description, conditions, location and the timetable for the implementation of the research training activities under the action and the name of the supervisor;

    b. the rights and obligations of the beneficiary toward the researcher under this Agreement;

    c. the obligation of the researcher to complete and submit — at the end of the training — the evaluation questionnaire and — two years later — follow-up questionnaire provided by the Agency;

4. Ensure that the researchers do not receive, for activities carried out in the frame of the action, other incomes than those received from the beneficiaries (or other entity mentioned in Annex 1 of GA);

5. Ensure that the researchers do not have to bear any costs for the implementation of the action as described in Annex 1;

6. Host the researchers at their premises (or at the premises of an entity with a capital or legal link);

7. Provide training and the necessary means for implementing the action (or ensure that such training and means are provided by entities with a capital or legal link);

8. Ensure that the researchers are adequately supervised;

9. Ensure that a Personal Career Development Plan (PCDP) is established and support its implementation;

10. Ensure an appropriate exposure to the non-academic sector;

11. Keep required records of the recruitment and implementation of the action – valid proof of, e.g., the recruitment process, the ESR's eligibility and family status, correctly paid salary, time records – for up to 5 years after the final payment of the balance.

Additionally, the Beneficiaries are expected to

- fill in the Researcher Declaration for each ESR in the EU Portal within 20 days after the employment contract has been signed.
- provide an explicit explication of how the ESR's salary is composed.
- sign a secondment agreement with the Partner Organisation(s) and report the secondments in the EU Portal.
- participate in the SB, General Assembly, and MG.
- take care of other possible duties listed in the Grant Agreement and CA.

Expectations from the industrial Partner Organizations' side

Industrial partners are also expected to support and contribute to the implementation of the activities initiated by the APROPOS network as described in the GA and Consortium Agreement for the network. It is to be remarked that Partner Organizations do not receive any direct funding for the implementation of APROPOS, thus their expected benefit is the valuable ESR work while in the industrial secondments.

Of special relevance for the ESR's, the industrial partners are expected to:

1. Make available their research environment to the hosted ESR and possibly support synergy between the independent research project and existing projects;
2. Co-supervise the ESRs in their individual research projects and be in dialogue with;
3. Host secondments as agreed in GA;
4. Provide feedback on scientific and project progress when applicable;
5. Support and enable access to available workshops and toolsets where necessary to the research;
6. Support the dissemination activities of the research project.

Additional rules about spending during the events

Attending APROPOS events and conferences typically involve travelling and accommodation costs. It is a must to follow a good practice while attending such events, thus the ESR should:

1. Agree with the supervisor on the available funds that could be spent on the events prior to the paper/participation request submission;
   a. Follow this agreement;
   b. Follow the regulations related to travelling plan and report according to the beneficiary rules.
2. Plan the trip in advance;
   a. Use economy flights/travel;
3. Select the hotel of a reasonable price;
4. Taxi's use is generally not allowed, unless there is no public transport available; several of the Beneficiaries do not reimburse taxi travel costs as a part of their units' policies.
5. Visit to a conference implies:
   a. Attending the keynote speakers;
   b. Presenting your paper or poster;
   c. Socialization with other attendees – establishing new connections and extending personal network;
   d. Not sightseeing or staying in the hotel room/bar/beach/etc. during the sessions' time.
   e. A short report to the main supervisor about your conference activity following a conference travel
6. Generally, to be reasonable and avoid spending more than supervisors.

Conflict resolution process

It is our aim that conflicts will be solved at the lowest level possible, and preferably amicably. In case an agreement cannot be reached at a task or at a WP level, then the coordinator and the PTM must be informed immediately, and the PC will take the action point to mediate and lead the conflict resolution process. In situations pertaining to ethics, the local and/or TAU DPOs should be also contacted.

Non-compliance with regulations

Non-compliance with the rules and regulations specified in the ESR's Grant Agreement and the obligations as specified in this APROPOS project handbook for ESRs may result in punitive actions according to the host institution's work regulations, and in the worst case, in the termination of the work contract.