Letter of Intent (DRAFT v.0.1)

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To the Management Committee of EIT Digital:

Further to discussions held between Edinburgh Napier University ("Napier"), and EIT Digital, an opportunity has been identified to establish additional strategic cooperation via the establishment of a new Doctoral Training Program ("DTP") as below.

The DTP will focus on Trust, Blockchain and Cryptography and will enable the commercial deployment of system which respect to the right to consent and privacy in Europe and other regions by developing new decentralized systems for IOT and tokenization, and which are more reliant, secure and trustworthy. Professor Bill Buchanan will oversee the new program which will be associated with the Digital XXXXX action line within EIT Digital's organisation.

Therefore, subject to the relevant formalities, the parties to this letter now wish to submit their intention to the Management Committee of EIT Digital to establish and support a DTP as follows and in accordance with relevant EIT Digital policies

Location	The DTP will be based at EIT Digital's DTC in Edinburgh. Approximately 30% of individual student time will be spent at this location. Students may also spend time at the premises of Edinburgh Napier University, the relevant Industrial Sponsor and other universities in order to meet the requirements of the DTP.
Strategic focus	The DTP will focus on decentralized models for IOT and which are more reliant, secure and trustworthy and the enablement of commercial deployment of new decentralized systems for IOT and tokenization, and which are more reliant, secure and trustworthy. Please refer to the program specification set out within Appendix I.
Access	The DTP will receive students from across Europe and other regions. It is expected that in due course the DTP will be offered by other Scottish universities subject to the relevant conditions of the EIT and EIT Digital.
Student costs	EIT Digital will fund up to 50% of individual student costs (estimated by £20K per student per year, and over a three-year funded PhD studentship) according to its policies. The balance of individual student costs will be funded by the relevant Industry Sponsor (30%) and by the host university (20%). No additional costs will be borne by EIT Digital.
Schedule	Subject to the necessary approvals, the initial intake of students to the DTP will commence in Q1 2020 and a minimum of seven students will be actively participating in the DTP by end 2020. In order that critical momentum and impact are achieved, it is intended that the number of concurrently participating students

	will increase by five students per year such that a strong cohort of 12 is established after two years.
Organisational Capabilities & Roles	**Edinburgh Napier University** has a strong track record of creating high impact outputs from its research work. This has included three highly successful spin-out companies (Zonefox, Symphonic and Cyan Forensics). They have recently created a laboratory seven current PhD students focused on areas of trust networks, cryptography, identity and blockchain (Blockpass ID Lab). Edinburgh Napier University will devise and deliver the DTP in accordance with the EIT Quality Assurance and Learning Enhancement Model Handbook, provide academic supervision to the students, and issue the degree certificate. **The IOTA Foundation** is a leading research entity and integrates third generation Blockchain methods into the creation of large-scale IOT network which have fast consensus, and which are quantum-robust. They will participate in the EIT Digital ecosystem as a Member and will support the DTP as an Industrial Sponsor selecting, hosting and providing industrial supervision to DTP students. They have strong links with industry leads and will focus on applying the research focus into key industry sectors, including within health care, the energy sector, and within supply chains.
Terms	The parties to this letter intend to support the DTP for a minimum period of four years from 2020 to 2023 and understand that the arrangement will be subject to review based upon performance against the mutually agreed aims and objectives after this period.

It is hereby requested that the Management Committee of EIT Digital considers this letter of intent and provides approval for the establishment of the DTP in accordance with the approach set out herein.

Signed on behalf of Edinburgh Napier University: _____ Name: _____ Title: _____ Date: _____	Signed on behalf of Leonardo ITG  Name: John Innes Title: VP Technology Innovation Date: 21st November 2019

Trust: Privacy, Blockchain and Cryptography

1. Vision & rationale for the Doctoral Training Programme

Vision: While there has been rapid and continuing growth in service provision, this has often been at the expense of privacy and trust. The existing Internet infrastructure has little in the way of embedded trust: many of the services that we use cannot be fully trusted and have been designed with too little care for privacy. With the advent of GDPR, NIS and other directives that will place severe financial penalties on data breaches, there will be an increasing focus on protecting data, and on creating public services that give citizens more control of their digital world. This includes citizen-enablement for the provision of public services and mechanisms to enable citizens to engage more fully in a digital manner with governments and communities. Without building a new infrastructure that builds trust at the lowest layers, and then integrates this to the provision of services, we will not be able to scale to a new hyper-connected world.

The key focus of this DTP will be to create a cognitive focus on the need to integrate **digital trust** (rights and identity) and **human trust** (governance and services), along with the requirement to protect data and its associated access rights as it traverses systems. A core part of the industrial integration will be to focus on applied research within the integration of IOT devices within large-scale infrastructures, and which are able to create a fast consensus.

The core vision of the DTP is to completely integrate digital and human trust across both trusted and untrusted system infrastructures. Its key objectives are to produce a cohort of Doctoral students who collectively have the skills to:

- provide a citizen-focused approach to the creation of an integrated trust and governance infrastructure;
- protect data with integrated policies that allows processing and verification but does not reveal the original data;
- create demonstrator services that engage the interest of citizens, and that create new models of citizen engagement;
- automate computation elements, while preserving rights, ownership and consent.

It thus directly targets the priority area of ”Establishing Trust, Identity, Privacy and Security for a Hyper-connected Digital World”.

Rationale: The grand challenges of our modern society include: **AI and Data Economy**; **Clean Growth**; **Future of Mobility** (to support the movement of people, goods and service); and an **Ageing Society** (to harness the power of innovation to help meet the needs of an ageing society). All of these depend on the provision of reliable and trustworthy infrastructure. Unlike today’s systems, this must be intrinsic: trust must be developed as an essential part of a system, not a bolt-on afterthought. The TRUST DTP aims to provide a vision of the integration of software, hardware and services as part of a trust infrastructure, with a key focus of training Doctoral students with a focus on the creation of trustworthy citizen-centric systems. Key application areas are: e-Commerce; Fintech; digital

health and well-being; energy supply systems; and public services. The essential skills that will be developed by all TRUST students will include:

- Data anonymization and zero-knowledge proof skills with integration into a trust infrastructure.
- Integration of security by design in creating secure, robust and resilient systems which integrate across both trusted and untrusted infrastructures.
- The building of models that properly integrate trust and governance into digitally verifiable spaces, for both hardware and software.
- Understanding the key risks to current and future systems and constructing robust and resilient systems that can migrate to cope with evolving threats.

The timing of this DTP is well matched to the development of new cryptography methods, blockchain integration, and IOT integration.

2. Regional Need

We are moving into a world which increasingly requires a focus on the citizen and to address key societal challenges (including supply chain risk, climate change, and an ageing society). This DTP aim to build new trust infrastructure which address these challenges, and which puts the citizen at the core. This will ensure compliance with GDPR related issues and aim to improve the sharing of information in a way which respects governments, ownership and delegation.

There is a huge economic need for talented and highly skilled individuals to drive the research and industry agenda. In the UK, for example, MSc and PhD graduates provide around two-thirds of all the employees in spin-out companies. Future economic growth depends on producing a pipeline of expertise, on growing the research and industry leaders of the future, as well as expanding training capacity within universities. This requires growth in the provision of Doctoral graduates who understand the importance of trust, and can place it at the heart of their research and business. It is predicted that there will be a global shortfall of 3.5 million cyber security jobs by 2021.

The collaborative TRUST CDT will provide multidisciplinary training for an cohort of a minimum of 12 students each of whom will undertake a three-year doctoral programme (in two main cohorts). The programme involves an intensive study in advanced technical areas of cybersecurity/trust/blockchain and general research techniques.

3. Leadership and organization

Research Programme and Leadership:

Key leadership outputs from the DTP cohort will include advances in:

- Articulation of the requirements for trustworthy trust infrastructure, and how cryptography and hardware trust platforms can be used to build systems that respect citizen rights and build confidence in their safe and secure operation.
- Defining economic development platforms which create new business opportunities, and which are built on trustworthy systems.

- Strong binding of how identity is mapped from real spaces into digital domains.
- Development of a complete anonymization and zero-knowledge proof infrastructure, using full homomorphic encryption and zero-knowledge proofs.

Multi-disciplinarity:

The multidisciplinary nature of the DTP will be focused on integrating with key application areas, including with health care, energy and within supply chains. Along with this, the PhD projects will be created with a key focus on integrating human trust with digital trust. It is expected that each studentship will have a multi-disciplinary supervision team, and that the IOTA Foundation will provide an industrial sponsor who will define key research problems, and possible routes to commercialization.

Structure, Skills and Experience to Lead the Centre:

The Centre Director will be **Professor Bill Buchanan and the co-Director will be Professor Amir Hussian,** and who will work on a day-to-day with an Innovation Manager. Bill is a Professor in the School of Computing at Edinburgh Napier University, and a Fellow of the BCS. He currently leads the Centre for Distributed Computing, Networks, and Security and The Cyber Academy (http://thecyberacademy.org). In 2017 he was awarded an OBE in 2017 for his services to Cyber Security, and in 2018 received an Outstanding Contribution to Knowledge Exchange award. His main research focus is around information sharing, such as using Trust and Governance Policies, threat analysis, blockchain, cryptography, and triage within digital forensics. He has received research grants of over £3 million over the past five years, and his work has led to several UK/World-wide patents, and three highly successful spin-out companies: Zonefox (zonefox.com); Symphonic Software (symphonicsoft.com); and Cyan Forensics (cyanforensics.com). He is currently working on a fourth spin-out and which focuses on the discovery of encryption keys in running memory on virtualised system, and has more than 20 PhD completions.

Professor Amir Hussian has a proven track record of leading and managing major interdisciplinary projects (with a £3M+ grant portfolio, funded by EPSRC, EU, charities and industry), including the related EPSRC AV-COGHEAR project (EP/M026981/1: 2015-19 in collaboration with MRC IHR clinicians and Sonova). He is founding Chief Editor of internationally-leading (Springer-Nature) journals: Cognitive Computation (SCI IF: 4.29) and BMC Big Data Analytics. He also serves on Editorial Boards of other prestigious journals, including the IEEE Trans. on Neural Networks and Learning Systems and (Elsevier) Information Fusion.

The core of the Centre will be built around the Centre for Cyber Systems which has core skills around blockchain, cryptography, identity and trust. This foundation knowledge will be used to scale into a range of application domains, including with health care, supply chains, and energy supply. Both Bill and Amir have a long-track record of applying security into areas such as health care, and they will use their knowledge to focus on key societal problems, and which best need a strong trust infrastructure. IOTA will then provide the key industrial partners, in order

to make the research work relevant within a commercial world, while using state-of-the-art methods. Bill's track record in spin-out companies, will provide a good focus on identify IP at each stage of the PhD work, and make sure there are strong routes for exploitation. Bill and Amir will work with an innovation manager, and who will identify possible routes to commercialization, and will generally interface with enterprise agencies and innovation centres.

The DTP will integrate the following:

- **Executive Board:** This will be chaired by the Director, and include the co-Director, a represented from IOTA, and three other industry members (of those involved in the studentships). This board will meet formally every two months, and aim to report to the governance board.
- **Innovation Board:** This will be chaired by the Director, and include the co-Director, and Innovation Manager, along with representatives from innovation enterprises. This board will meet formally every two months, and aim to report to the governance board.
- **Governance Board:** This will be chaired by an experience industry lead, and will include the Director and co-Director, along with two IOTA Foundation leads, and two other independent elected members. This board will meet every six months and review progress, and formally report.

4. Quality of the research training environment

Proposed Doctoral Training Programme Model:

The proposed model is to start with, at least, seven students with Year 1, and, at least, another five students within Year 2. The IOTA Foundation will provide 30% funding for four years, and Napier will commit 20% to their funding.

Skills Development Approach and Cohort Building:

The students will undertake a common training programme and which is defined in Appendix 1. In order to develop key cybersecurity and data science skills, each student will be able to understand modules within MSc programmes in Advanced Security and Digital Forensics, and in Data Science.

User Engagement:

This Doctoral Training Programme will benefit from partnerships with enterprise agencies and Innovation Centres within Scotland, such as with Interface Online and Scottish Enterprise. These will help support further industry contacts, and enterprise activities.

Supervisory Capacity:

Across the School of Computing we have 60 academics working in areas in the field of this proposed Doctoral Training Programme, along with many academics within the other five schools across the university. The IOTA Foundation, too, have strong links to many universities across the world. Imperial College, London, is one university who would be keen to provide additional supervision capacity, and build up strong collaborative bonds.

Quality of ENU Environment:

The research environment at ENU has a core focus on applied research, and which has strong industry engagement and focus. It has a strong track record in commercializing high-impact research outputs.

Quality of Wider Training Environment:

Edinburgh Napier has well-established structures for student training, including workshops in research methods, research writing, and presenting at conferences. Along with this, students will be given training around teaching methods, and have the opportunities to gain HEA (Higher Education Academy) accreditation.

Appendix I – DTP Specification

Year 1:

A key focus is:

- Definition of the supervision team, and the election of a panel chair, and who will organize and report every six months.
- Registration of the topic area and an outline of the key problem statement defined jointly between the academic and industrial supervisor.
- Undertake a literature review jointly with the academic supervisor.
- Undertake a review document which defines the proposed contribution, the key literature, work done to date, and a proposed time plan.
- Meeting with supervisors and panel chair every six months.
- Dissemination of work within a conference.
- Draft of the ethics, supervision and IP guidelines.

Outcomes:

- Submission of RD2 (Authorization of Student Admission). Submitted around Month 1. Contains details of the supervision team, university authorization, and the financing of the studentship.
- Submission of RD4 (Determination of Thesis Topic and Programme of Study). Submitted around Month 4. Contains research content, research questions, methodology, and initial conclusions.
- Submission of RD5 (Determination of Target Degree). Submitted around Month 12. This will include a full literature review, research questions, work done to date, likely research contribution, and a time plan to the completion.
- Submission of RD6 (Report on progress). Submitted in Month 6 and Month 12.

Year 2:

A key focus is:

- Implementation of existing research methods.
- Small scale evaluation of new methods.
- Analysis of results.

- Dissemination of findings within a respected conference or journal.

Outcomes:

- Submission of RD6 (Report on progress). Submitted in Month 18 and Month 24. Status reports submitted and which provide an updated literature review, new work, projected contribution, and a revised time plan.
- Conference or journal publication.

Year 3:

A key focus is:

- Large-scale evaluation of proposed novelty.
- Possible drafting of a patent.
- Thesis writing.
- Understanding of the impact and/or commercial exploitation of the work as a collaboration between the industry partner and academic team.
- Submission of RD12 (PhD Examination arrangements). This defines the arranges for an external and internal examiner for the PhD Viva.

Outcomes:

- Submission of RD6 (Report on progress). Submitted in Month 30 and Month 36. Status reports submitted and which provide an updated literature review, new work, projected contribution, and a revised time plan.
- Conference or journal publication.
- PhD submission and Viva.

Appendix I – Student Time Allocation

Year 1

- 7 x 16 week blocks in the EIT Digital DTC for research and business training under the direction of the relevant university and Industrial Sponsor.
- 7 x 28 week blocks in Edinburgh Napier University in order to attend teaching modules and cohort building events.
- 7 x 2 week blocks in industry.
- 7 x 2 week block in international partner university.

Year 2

- 12 x 16 week blocks in the EIT Digital DTC for research and business training under the direction of the relevant university and Industrial Sponsor.
- 12 x 28 week blocks in Edinburgh Napier University in order to attend teaching modules and cohort building events.
- 12 x 2 week blocks in industry.
- 12 x 2 week block in international partner university.

Year 3

- 12 x 16 week blocks in the EIT Digital DTC for research and business training under the direction of the relevant university and Industrial Sponsor.
- 12 x 28 week blocks in Edinburgh Napier University in order to attend teaching modules and cohort building events.
  12 x 2 week blocks in industry.
- 12 x 2 week block in international partner university.

Year 4

- 5 x 16 week blocks in the EIT Digital DTC for research and business training under the direction of the relevant university and Industrial Sponsor.
- 5 x 28 week blocks in Edinburgh Napier University in order to attend teaching modules and cohort building events.
- 5 x 2 week blocks in industry.
- 5 x 2 week block in international partner university.