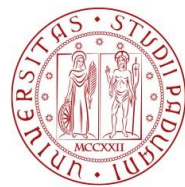# Results of PEQIH

:: Pan-European Quantum Internet Hackathon ::

Andrea Martini :: Ben Krickler :: Bilge Demirkoz :: Cenk Tuysuz :: Daniel Dobos :: Fabio Fracas
Federico Carminati :: Karolos Potamianos :: Kristiane Novotny :: Sofia Vallecorsa

6. October 2019

TIME SAVING · KNOWLEDGE OVERVIEW · UNEXPECTED INSIGHTS

Make Complexity Irrelevant

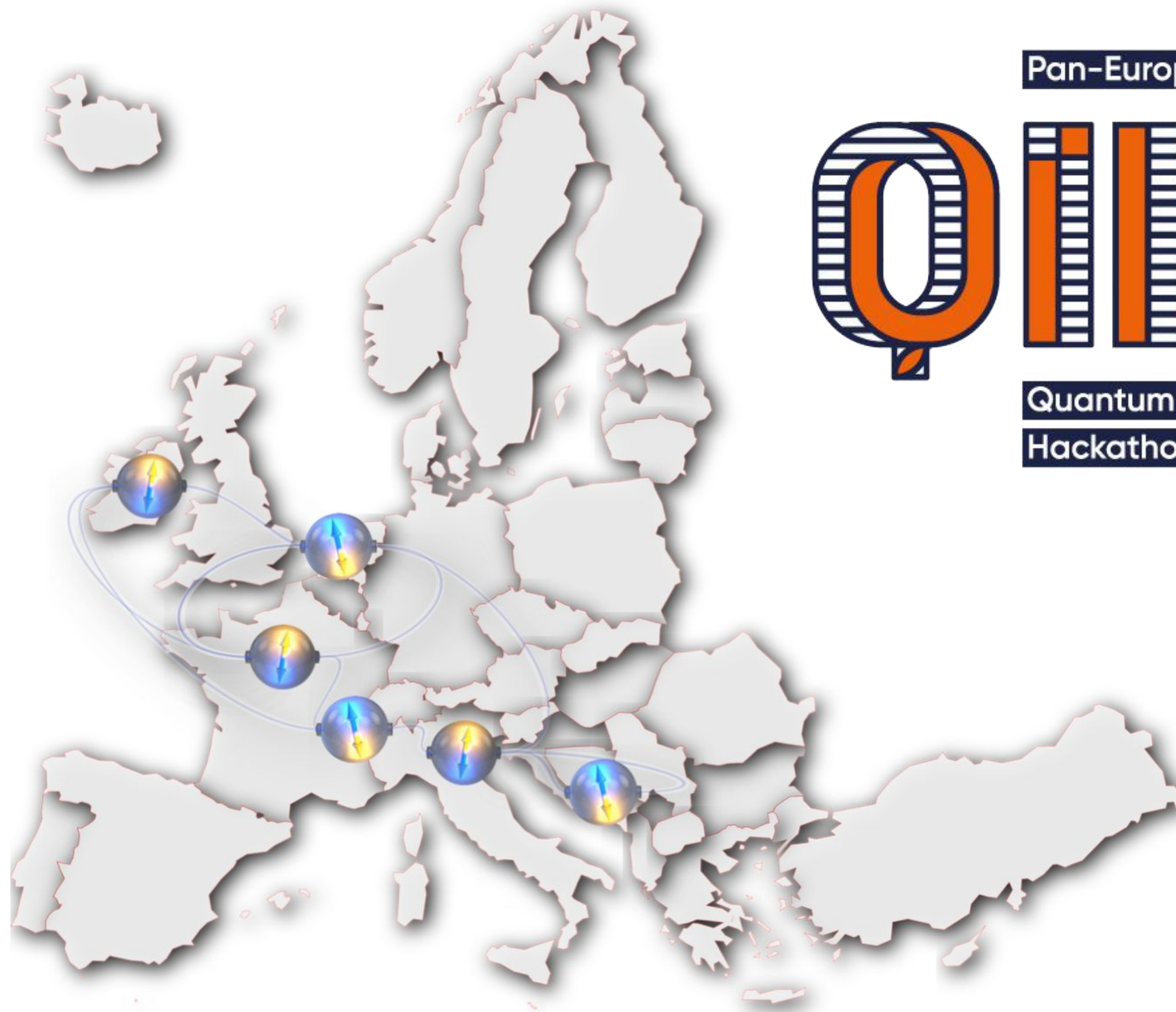**Dublin**
Delft
Geneva
Padua
Paris
Sarajevo

Pan-European QiH

Quantum Internet Hackathon

Judges : Mentors

with Quantum :: Internet :: Hackathon backgrounds

Our hackathons are:

non-commercial; we are a not-for-profit organisation and have no monetary prizes

all resulting software and tools are released under non-commercial licenses

non-competitive; we prefer cooperation and teamwork

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Bilge Demirkoz

Professor of High Energy Physics at
Middle East Technical University

> " A UNESCO-L'Oreal International Rising Talent researcher, Bilge Demirköz is a leading physicist, science outreach activist and educator in Turkey. With her team, she is building a particle irradiation facility for space radiation tests, with support from CERN under the CERN associate membership bill she helped pass through parliament. Demirköz is a role model for the next generation of scientists in Turkey and seeks to change the government's approach to science. She is a Young Global Leader of the WEF and is interested how in the quantum revolution will effect scientific computing.

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MIDDLE EAST TECHNICAL UNIVERSITY

Paul-Olivier Dehaye

Collective intelligence • Personal Data Protection
Founder & Director PersonalData.IO

Pan-European
QIH
Quantum Internet
Hackathon

PersonalData.IO

HESTIA AI
FOR DATA COLLECTIVES

> " Paul-Olivier Dehaye works on collective
> intelligence and personal data protection. He
> is the founder and director of PersonalData.IO
> and Hestia.AI, and sits on the board of
> MyData Global. Working with journalists, he
> has been an integral part of uncovering the
> Cambridge Analytica scandal, and features in
> the documentary: 'The Great Hack'.

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Fabio Fracas

Physicist at CERN openlab

> Dr. Fabio Fracas is a CERN physicist with extensive experience in Quantum Physics. Currently, he is working on Quantum Computing applications within CERN openlab, a public-private partnership between CERN and leading ICT companies. Dr. Fracas is also a professor for the Italian Unversity of Padua, where he is teaching Physics applied to Radio-therapy and Radio-protection at the Department of Medicine. He is the author of the sage "The world according to quantum physics", published in Italy in 2017.

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CERN openlab

Mélissa Gaillard

CERN IT Department Communications Officer

" Mélissa Gaillard has spent the last 20 years in strategic technology communication. She started her career working as the Latin America Marketing Manager and the International Division Business Intelligence Manager with Renault Trucks. Before joining CERN as openlab Communications Officer in 2008, she has worked as a Consultant and Project Manager with Frost & Sullivan, focusing on technology communication, as well as strategic foresight and innovation. She has been the architect of the communication strategy of this unique public-private partnership through which CERN collaborates with leading ICT companies and other research organisations to accelerate the development of cutting-edge ICT solutions for the research community. In 2016 she took the position of CERN IT Department Communications Officer.

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Mary Georgiou

CERN Systems Engineer • Machine Learning

> "Maria Georgiou's works as a developer for the new Identity Management infrastructure of CERN. In addition, she previously worked for the CERN security team as a Ph.D. student, where she researched anomaly detection methods in security data with deep learning and parallelly supported the CERN users with security-related issues. Her prior work includes development for the CERN WLCG Transfers Dashboard and the CERN File Transfer Service.

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CERN

Christophe Peschoux
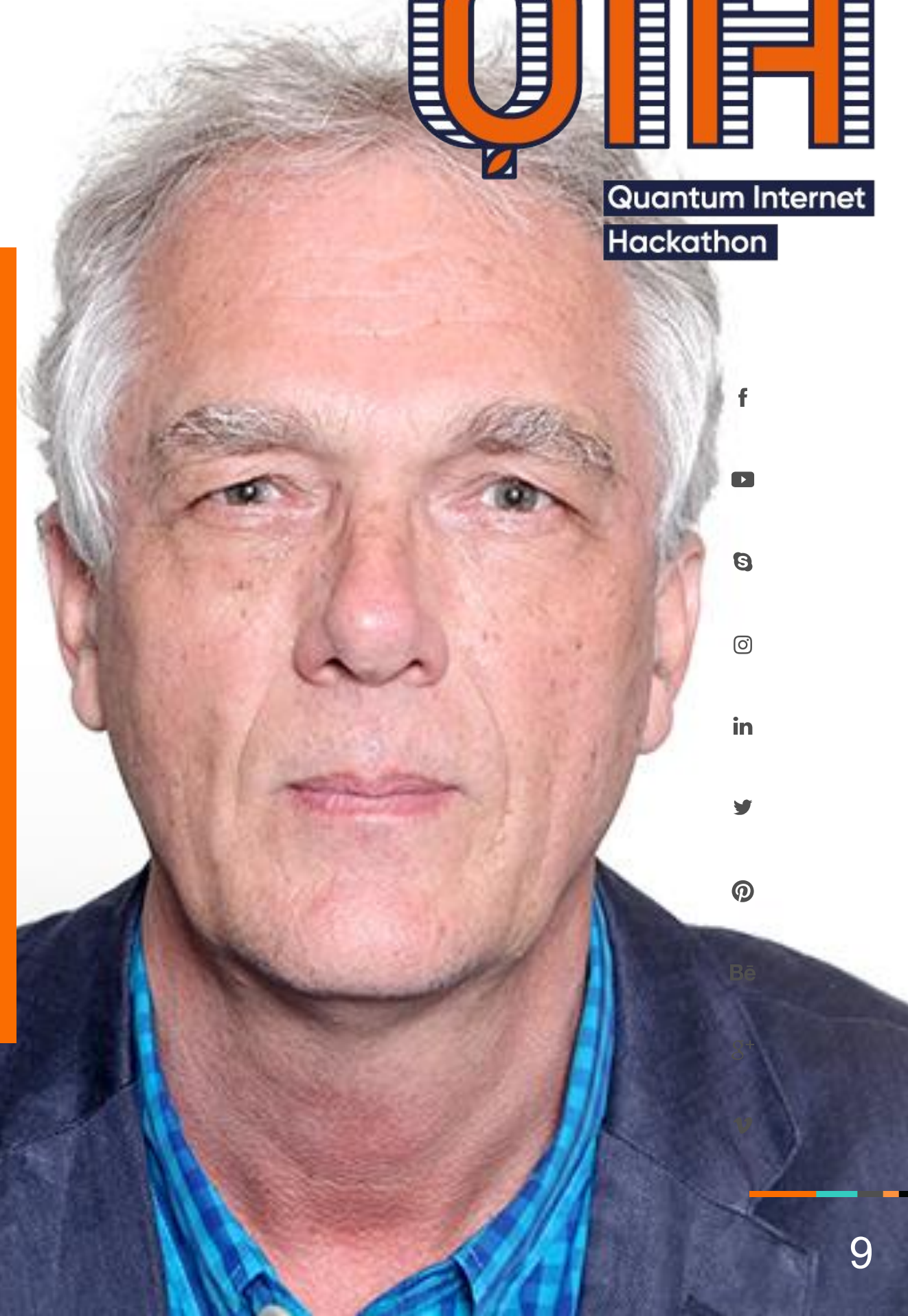
Human Rights Practitioner

> Christophe Peschoux has been working for the past 36 years in the fields of humanitarian, refugees and human rights protection. He worked for more than 20 years with the Office of the High Commissioner for Human Rights (OHCHR) and several years with the UN High Commissioner for refugees, the International committee of the Red cross, Amnesty international and other non-governmental organizations. He is currently the chief of the section at the office of the High Commissioner for Human Rights, supporting the work of seven special procedures mandates: torture; summary executions; arbitrary detention; enforced disappearances; freedom of religion and belief; human rights protection in the context of counter-terrorism; and protection of the right to privacy. Previously, he lead OHCHR's Universal Periodic Review unit and was the Chief in Cambodia of the OHCHR.

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Sofia Vallecorsa

High Energy Physicists at CERN openlab

> " Dr. Sofia Vallecorsa is a CERN physicist with extensive experience on software development in the High Energy Physics domain, in particular on Quantum Computing and Deep Learning applications within CERN openlab, a public-private partnership between CERN and leading ICT companies. Before joining openlab, Dr. Vallecorsa has been responsible for the development of Deep Learning based technologies for the simulation of particle transport through detectors at CERN and she has worked on optimisation of the GeantV detector simulation prototype on modern hardware architectures.

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Challenges

Failing Forward Fast Development Cycles

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RemotelyGreen

Pan-European Quantum Internet Challenge

Purely virtual meetings are becoming more and more common, as businesses, research institutions, and other organisations choose them over air travel. On the one hand technologies like increasing internet bandwidth and virtual or augmented reality are helping to improve the user experience; on the other, virtual meetings offer big reductions in the organisation's environmental impact and are cheaper to attend. However, in the era of AutoTune and DeepFakes these platforms come with potentially major security challenges. How can quantum key distribution, encryption and signatures help tackle this problem?
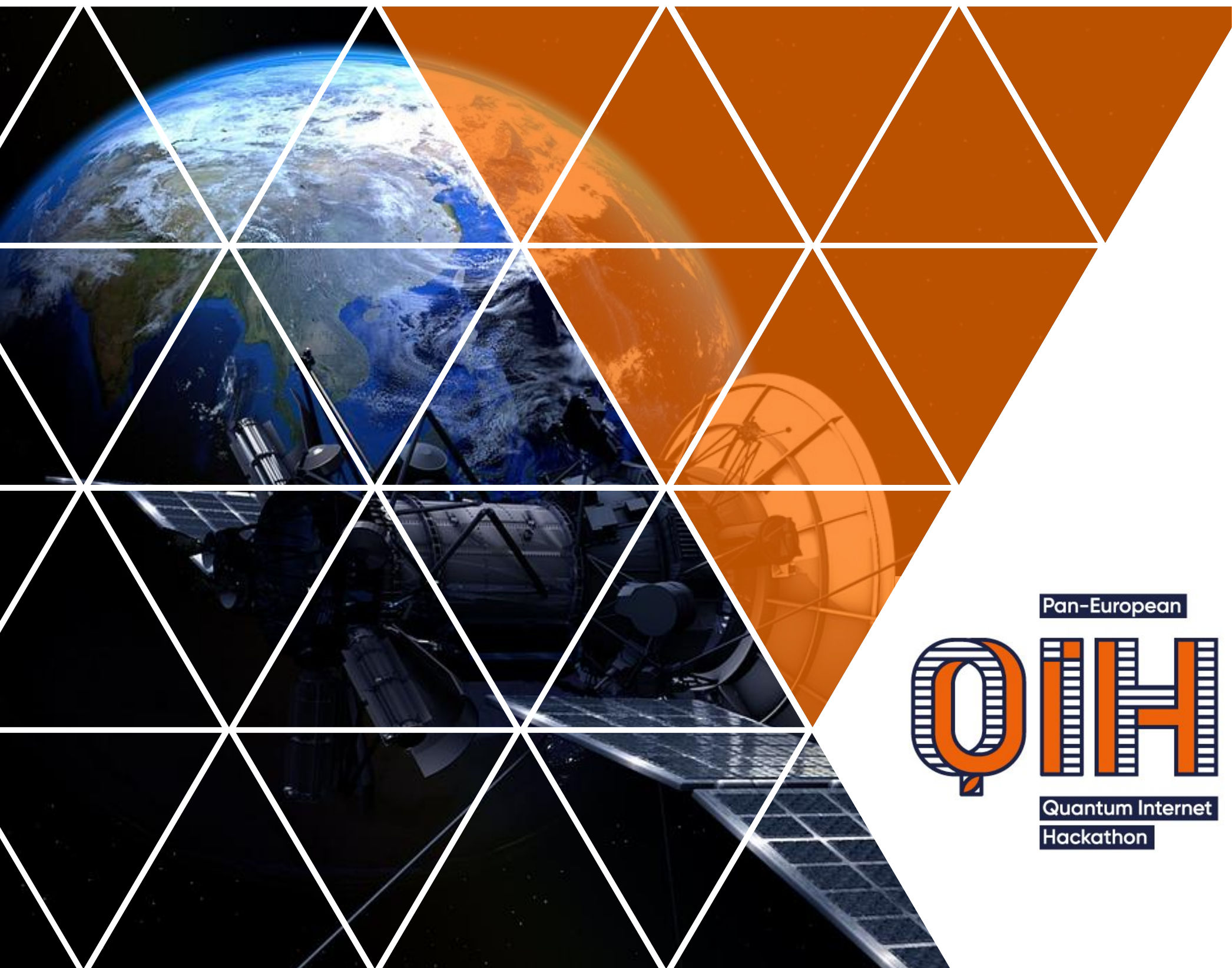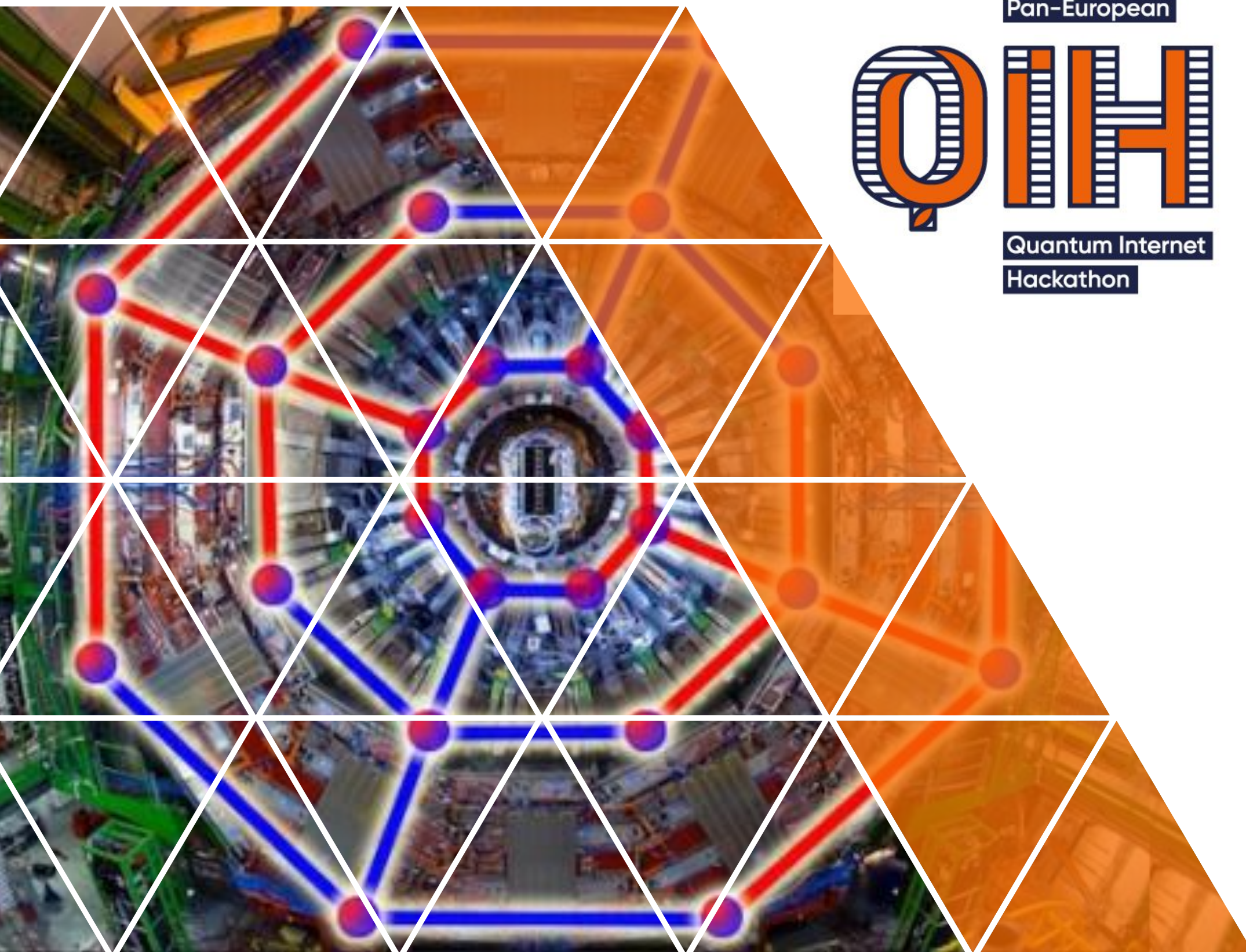
Satellite QKD

Pan-European Quantum Internet Challenge

Whose airplane or logistic drohne should be hacked next? Or: How could this be prevented? This project aims to explore the possibility of integrating Quantum Key Distribution into flight safety. Can it secure flight data transmission (e.g. like ADS-B) in the future? We would like to explore the possibility of a secured transmission of broadcasts between airplanes that might secure, extend, and eventually replace current Traffic Collision Avoidance Systems (TCAS) and Air Traffic Management (ATM) systems. The application of such systems are expected to extend to drones carrying freights and other autonomous flights.

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Project
Sunflower

9 Quantums

Pan-European Quantum Internet Challenge

9 Men's Morris is a 2000 years old strategy game where players have millions of options to choose from. Having so many options for every move makes the game computationally difficult to model and implement. Recent developments in Quantum Computing showed that it can provide speed-ups when training Machine Learning models. In this challenge the aim is to build a Quantum Machine Learning agent that can play the game by the rules and build it in such a way, that it can be trained using a Quantum Computer Simulator with a good moves dataset. How can we remotely interact (and play remotely) with graph engines in a quantum key distributed and encrypted way?

KnowledgeEX

Pan-European Quantum Internet Challenge

AI & ML technologies are already transforming the structures and collaborations inside of organizations, but recently an increased focus is set of how they can foster interdisciplinary, inter-sectorial and inter-organizational knowledge and innovation exchange. The AI supported digital transformation has redefined how organizations generate, share and consolidate data and innovation across organization borders. These date-driven systems help to manage the complexity of international partnerships of Knowledge Management and Exchange. How can Quantum Key Distribution facilitate to build the TRUST needed for such systems?

Selected Challenges

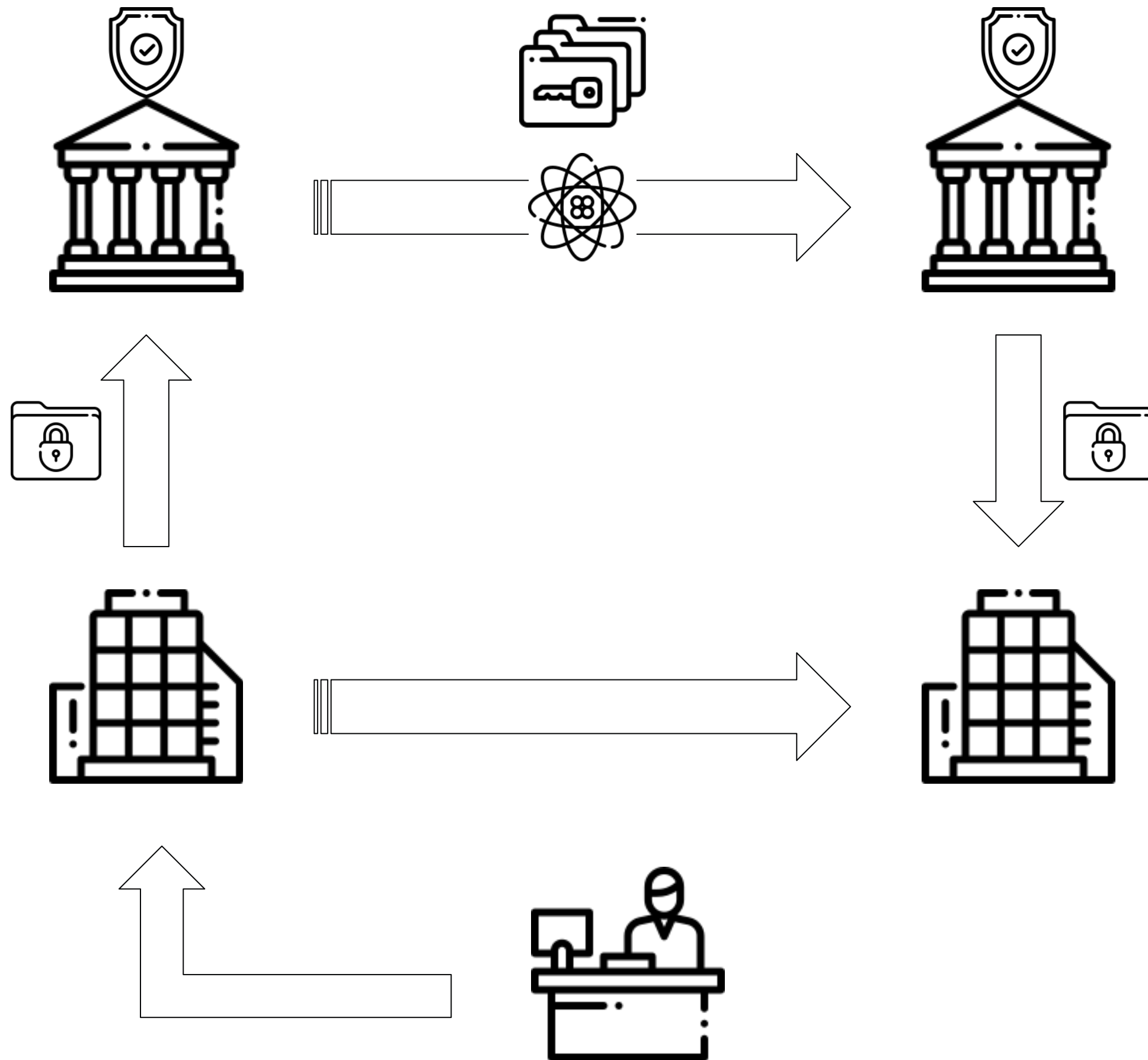Failing Forward Fast Development Cycles

PersonalData

Pan-European Quantum Internet Challenge

Design best-in-class architecture in a personal data portability scenario for establishing an authenticated and secure channel of communications, even in cases where one player is reluctant, by using the latest quantum computing tools. In an era of personal data portability (GDPR Art 20), an individual is legally entitled to ask a company to transfer the own data to another company. How can both companies and the individual make sure that this personal data transfer is secure, despite having never talked to each other before? How can Quantum Technologies make these systems more secure? How might the rollout of those technologies drive business dynamics?

PersonalData

Pan-European Quantum Internet Challenge

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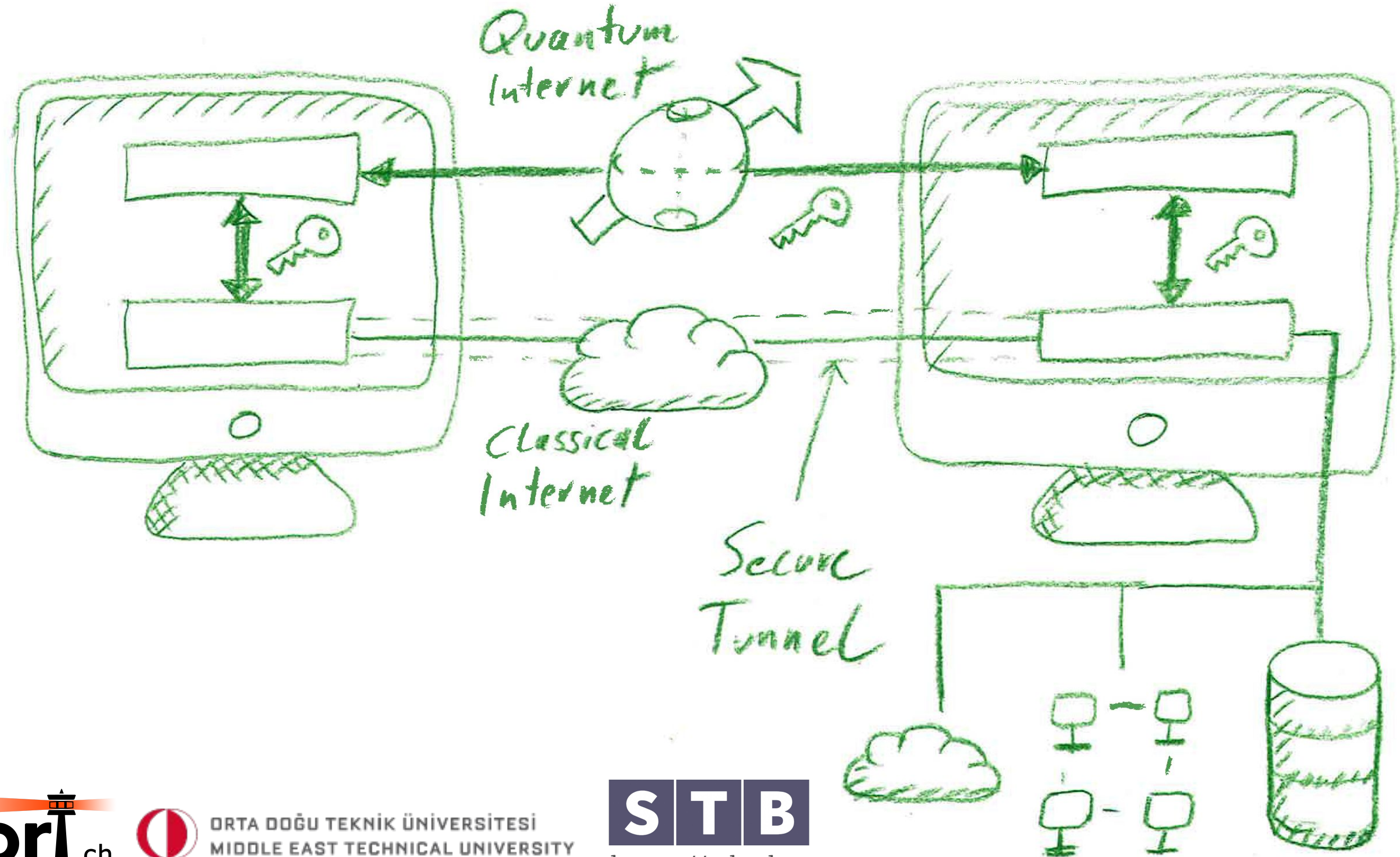unite innovators · impact future · act today

PERSONALDATA.IO

QuantumVPN

Pan-European Quantum Internet Challenge

The goal of this challenge is to implement an encrypted Layer 3 point-to-point network tunnel, where key exchange is done using Quantum Key Distribution. The network tunnel can be used to establish a secure channel between two hosts connected over an insecure network (we are leaving secure authentication as a future development).

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STB
https://stb.plus

QuantumVPN

Pan-European Quantum Internet Challenge

Backup slides

More Details for more questions

Nine Quantum's Morris

Turning an ancient game - into a Quantum Machine Learning Challenge

9 Men's Morris is a 2000 years old strategy game where players have millions of options to choose from. Having so many options for every move makes the game computationally difficult to model and implement. Recent developments in Quantum Computing showed that it can provide speed-ups when training Machine Learning models. In this challenge the aim is to build a Quantum Machine Learning agent that can play the game by the rules and build it in such a way, that it can be trained using a Quantum Computer Simulator with a good moves dataset.

Alfonso X: Libro del axedrez dados et tablas

1283

Challenge Description

Nine Quantum's Morris

Nine Men's Morris game is an ancient game, where players have lots of options to choose from every turn. The amount of available moves makes the game computationally difficult to solve. Many Machine Learning methods proved themselves for many similar problems before, but there are still some fields which are still hard to solve for them. Quantum Computing provides advancements in such fields to boost Machine Learning. In this challenge the aim is to build a Quantum Machine Learning agent that can play the game by learning from a set of good moves.

Although the main promise of Quantum Computing is speed-ups in computation time, the main motivation in this challenge is to learn and improve what we can do with Quantum Machine Learning. Nine Men's Morris is especially suited for such studies, as the complexity of the problem is scalable in different levels (Three / Six / Nine Men's Morris) as well as by limitations to different phases (with different rules) of the game.