Industrial PhD Student and Industrial Postdoc Calls 2023

Webinar 2023-01-23

Program

- **13:00   Introduction**
  Danica Kragic, WASP Co-director - KTH

- **13:15   General presentation about WASP Industrial PhD Student program**
  Karl-Erik Årzén, WASP Co-director - Lund University

- **13:40   General presentation about WASP Industrial postdoc program**
  Karl-Erik Årzén, WASP Co-director - Lund University

- **13:50   WASP Graduate School**
  Fredrik Heintz, WASP Graduate School Director – Linköping University

- **14:10   Perspectives from industry**
  Per Skarin, industrial PhD student, Johan Eker, industrial supervisor at Ericsson

- **14:40   Questions and discussion**

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AFFILIATED GROUPS OF EXCELLENCE at

Vision

Excellent research and competence in artificial intelligence, autonomous systems and software for the benefit of Swedish industry.
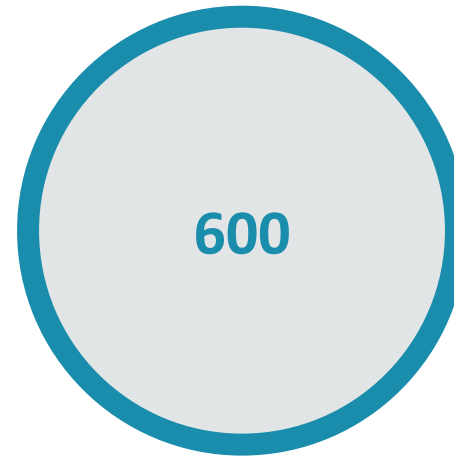
Mission

Build a world leading platform for academic research that interacts with leading companies in Sweden to develop knowledge and competence for the future.
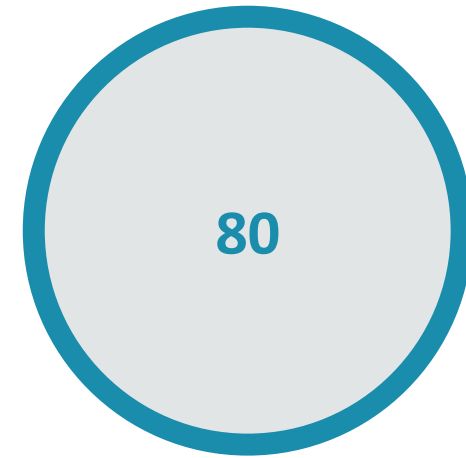
WASP in Numbers

6.2
Billion
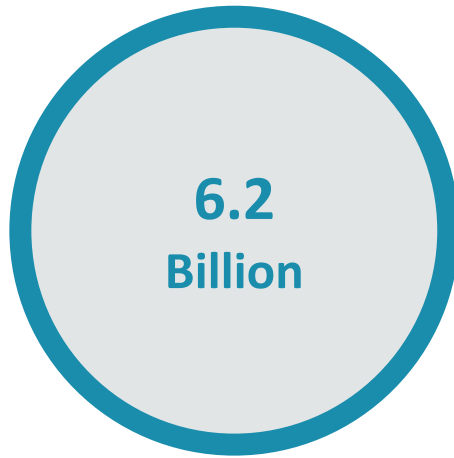
6.2 billion SEK for 15
years until 2031

600

600 Graduated PhDs

80

80 Faculty
Recruitments

WASP – Providing Enabling Technologies

New technologies and methodologies are needed to address key societal challenges in:

- Transport and transport systems
- Energy production and distribution
- Manufacturing and production
- Healthcare and medical discovery
- Finance and societal governance
- IT infrastructure and communication
- ….

WASP is contributing by paving the way for Sweden in:

- Artificial intelligence
  - Machine Learning
  - Mathematical Foundation
- Autonomous Systems
- Software

WASP is playing a fundamental role in the sustainability transformation of the planet

2023 WASP Top Research Challenges

Research Challenges AS:

- Optimal combination of data-driven and model-based approaches
- Resource-efficient distributed modeling and execution
- Collaborative heterogeneous agents/robots in mixed domains
- Scalability

Research Challenges Software:

- Adaptive systems aware of humans and their preferences
- Monitoring systems that ensure safety and security
- Automated verification of (AI-intensive) software systems
- Reducing environmental impact of AI/ML systems development & deployment

Research Challenges AI/MLX

- Models that are explainable
- Relevant and tractable sampling from learned representations
- Learning from multimodal data
- Learning representations over short and long-time horizons

Research Challenges AI/Math:

- Mathematics for provably efficient optimization in AI and Machine Learning
- Mathematics for explaining what NN-s do and their sensitivity to input noise
- Geometry for identifying and analysing complex data structures

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WASP Instruments

➢ Research program

➢ Graduate school

➢ Recruitment

➢ Research arenas

➢ Internationalization

➢ Communication events networking

WASP Status 2023

- Recruitment of **13** professors in autonomous systems and software.

- Top-level recruitment of Wallenberg Chairs, now **9** in total (**4** guest professors)

- Recruitment of assistant/associate professors in AI, now **34** in total

- Growth of Graduate School, now with **409** active PhDs students, 100 industrial PhD students (72 have defended).

- **41** active postdocs

- **9** NESTs initiated

- **80** companies and agencies engaged in WASP

- New arenas in Robotics, Software and Media and NLP

Continued and increased collaboration with Data Driven Life Science (DDLS)

- Funding increased to 225 MSEK until 2031

- Kickoff October 4th 2022 for the 15 approved projects

- A joint working group with representatives from WASP and DDLS is planning for future activities
  - New call for collaborative projects open
  - Networking activity spring 2023
  - Discussion about a continuous open call for research visits (staff exchange between WASP and DDLS research environments nationally and internationally)

New collaboration with Wallenberg Initiative Materials Science for Sustainability (WISE)

- 120 MSEK allocated 2024-2031

- Kick-off meeting for the collaboration during Q1 2023.

- Preliminary postdoc twinning-project announcement in 2023, with aim to start in 2024.

- Promote recruitment of postdocs/researchers from WASP to WISE (taking advantage of the 5-year difference in start dates between WASP and WISE).
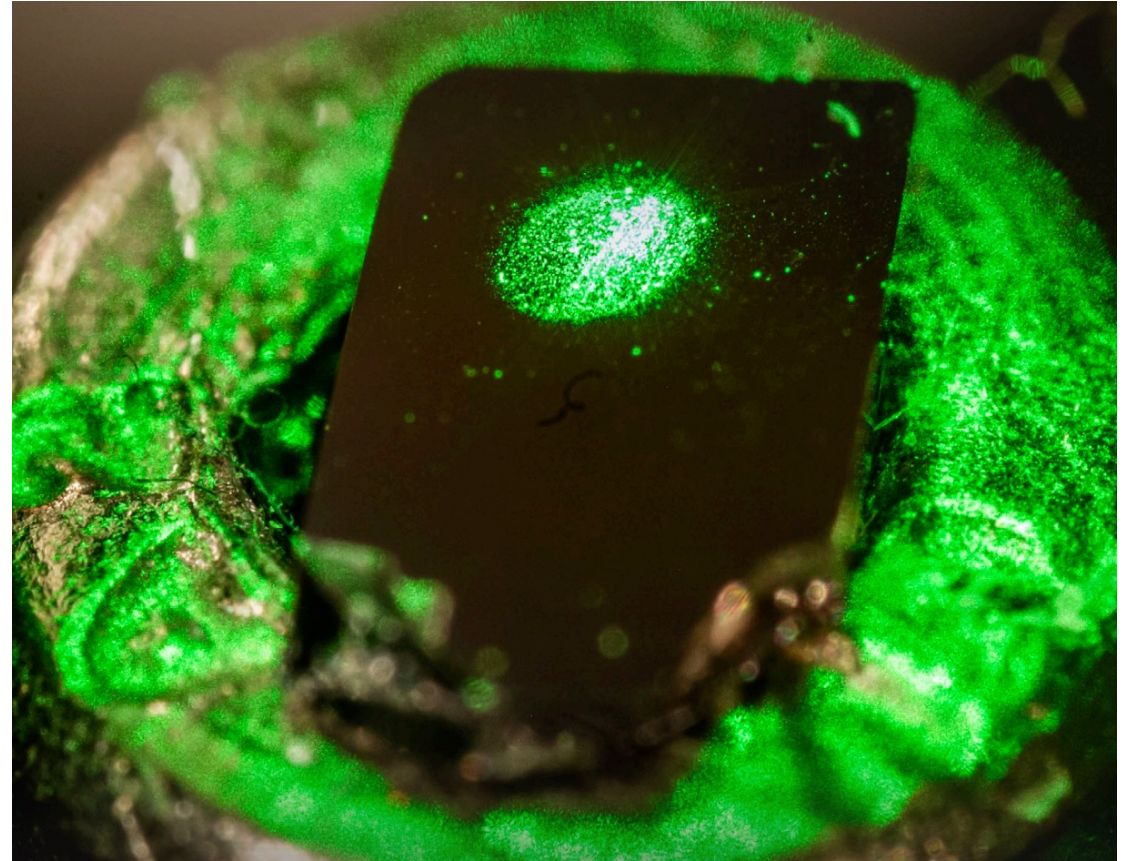
Cyber Security Initiative

- 180 MSEK until 2031
- Identification of strong researchers and research groups
    - Bibliometric analysis (Program Office)
    - University survey (URG)
- Other initiatives in Sweden
    - Foundation for Strategic Research
    - RiSE
    - KTH
    - ....
- Possibilities
    - Recrutiments, Arena, NESTs

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Industrial PhD Student Call

Swedish PhD Education

- Four years at 100% level
- Normally done at 80% level and takes five years
    - University PhD students do 20% teaching
    - Industry PhD students work 20% at the company doing non-research related tasks
- Four years correspond to 240 high school credits (hp)
- All PhD students are required to take 60-120 hp courses
    - Varies depending on department
    - Normally 90 hp (corresponds to 1.5 year full time studies)
    - Normally the departments require that certain mandatory courses are included
    - The WASP mandatory courses are 27 hp, i.e., most courses are not WASP courses
- The rest constitutes the research and the PhD thesis

WASP Industrial PhD Students

- Employed by a company
- PhD studies at a university department of a WASP university
- Four years if 100% research
- Five years if 80% research (20% for other non-research related tasks at the company) – the normal case
- The company receives 600k SEK / year from WASP (100%) or 480k (80%)
  - Includes a travel budget of 30k / year
  - The PhD student should be allowed to travel also if the company has a travel ban
- The academic advisor gets funding from WASP corresponding to 15% for the academic supervision

- The PhD student has an university PhD advisor and an industrial PhD advisor (ideally a person with some research experience)
- The PhD student must spend at least 20% of the time physically at the university and at least 20% at the company
  - However, in practice, spending only 20% at the university is not enough
- A contract is signed between the company and the university
- No contract between the company and WASP
- There should be an individual development plan ("utvecklingsplan") for the PhD student at the company that treats, e.g., main contact person, industrial supervisor, the role of the closest manager, the role of the project in the overall company strategy
- At the university there will be an individual study plan (ISP) for the PhD student that details issues such as time spent, research results obtained etc

Companies Involved

- 102 active industrial PhD students from 46 companies
  - 23 industrial PhDs produced (+ 3 that ended after licentiate exam)
- Companies with large involvement
  - Ericsson
  - Saab
  - Zenseact
  - ABB
  - Astra Zeneca
- Most industries have only one PhD student each
- Research institutes, e.g., RISE, and public organizations may not participate
- Not only the traditional system industry but also, e.g., finance, media, consulting, health, ...

This Call

- Up to 15 positions
- Call opened: 16 January
- Application deadline: 7 April
- Decision by the WASP Board communicated: 3 June
- Earliest start date: 1 August 2023
- Latest start date: 1 January 2024

Applications

- Submitted through the WASP application portal
  - https://wasp-sweden.org/calls/wasp-industrial-phd-student-positions-2023/
  - Use the application form available there
- Should be signed by both the academic and the industry supervisor

WASP Research Areas

- Autonomous Systems (AS)
  - Research on autonomy, including enabling technologies for autonomous systems
  - Transport systems, self-driving vehicles, perception, interaction, visualization, human-machine collaboration, multi-agent systems, robotics, autonomous clouds and networks, security, localization, optimization, ...
  - Strong systems focus
  - Data-driven and/or model-based approaches ("WASP is not only AI")

- Artificial Intelligence (AI)
  - MLX
    - Machine Learning, Deep Learning, and Next Generation/Explainable Learning
  - MATH
    - Mathematical Foundations of AI/ML
    - Theoretical Computer Science foundations of AI

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WASP Research Areas

- ## Software (SW)
    - Software methodology and software technology.
    - Software for the modelling, analysis, development, training, verification, and deployment of autonomous or AI and ML-based systems.
    - Software that contains or utilizes autonomy, automation, AI, learning, or feedback.

- ## Cyber-Security (CS)
    - Of relevance to AS, AI and SW

What the Autonomous Systems and Software students actually do

What the AI students actually do

Evaluation Criteria

- Three aspects of the proposal are evaluated
  - Project
    - Scientific excellence
    - Uniqueness, visionary and novelty nature
    - Relevance to WASP
    - Potential to collaborate with other WASP initiatives such as WARA
  - PhD student candidate
    - Grades from Master Education
  - Supervisors
    - Scientific merits
    - International research experience
    - Pedagogical skills and merits
    - Ability and experience to collaborate with academia and industry
    - Doctoral student and supervisor constellation with underrepresented gender are encouraged

News 2022

- The industrial PhD student instrument is primarily aimed at students who already are employed at the company

- Some, e.g., small, companies have no internal candidate. In that case it is also possible to employ a student candidate especially for this position.

- The candidate must be identified at application time, but need not be employed until the latest start date (1 January 2024)

- In the latter case there is a risk that the student disappears after the proposal has been accepted but before the latest start date

- In that case the company is allowed to propose a new candidate if that candidate has at least as good qualifications as the original one

- If the student decides to quit after the start, then the project will be terminated

Elements of a Good Proposal

- Fits into the WASP research program

- Clear and well-described scientific problem / research questions

- Novelty

- Explain why the applicants are the best parties to address this problem – how they complement each other

- Added value to academia, industry, and Sweden

- And above all
  - A strong PhD student candidate

Furher Information and Questions

General Questions
- info@wasp-sweden.org

Further Information and Guidance from the WASP University Representative Group:

- Chalmers: Per Stenström – per.stenstrom@chalmers.se
- KTH: Bo Wahlberg – bo@kth.se
- Linköping University: Michael Felsberg – michael.felsberg@liu.se
- Lund University: Karl-Erik Årzén – karl-erik.arzen@control.lth.se
- Luleå University: Marcus Liwicki - marcus.liwicki@ltu.se
- Umeå University: Erik Elmroth – elmroth@cs.umu.se
- Uppsala University: Thomas Schön – thomas.schon@it.uu.se
- Örebro University: Amy Loutfi – amy.loutfi@oru.se

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Some Questions and Issues

- How should the project topic be defined?
  - Sufficiently long-term so that the results still are of value to the company after five years
  - Sufficient research depth for publications

- How handle deviations?
  - Very few PhD students end up with a thesis that is exactly about the problem that was initially formulated
  - Deviations occur due to several reasons

- What is a good PhD student candidate?
  - An ideal PhD student candidate should have a couple of years of experience of the company but still have the graduate education fresh in mind
    - However, WASP accepts industry PhD students also if they have shorter or longer experience
  - Good analytic competence, excel at problem solving, good oral and written communication skills
  - Good grades, in particular in the courses of relevance
    - Have in mind that many of the WASP courses are rather mathematical in nature

Some Questions and Issues

- What is the objective for the company?
  - Initiate a long-term collaboration with a leading research group in order to improve the company's innovation capacity
  - Solve a challenging problem
  - Increase the knowledge within an area that is of relevance to the company
  - Competence buildup for a promising employee
  - Obtain persons with sufficient skills to take a leading R&D role after 5 years
  - ....

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Some Questions and Issues

- The company must be aware of the realities of PhD studies
  - Around 1.5 years full time are spent on taking courses
  - Some of the courses may be of less interest to the company (and the student) but they must still be taken
  - An important part of the studies consists of travels to conference, summer schools, study trips, meetings of different kind, in order to discuss, present, and learn
  - The PhD student must have the possibility to travel also if the company has a travel ban

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Some Questions and Issues

- How should one guarantee that the PhD student remains to be relevant to the company during these five year?
  - Involved in a research-related "shadow" project where intermediate research results can be evaluated and which can generate new research questions
  - Formalize the knowledge transfer using, e.g., regular presentations by the PhD student at the company

Some Questions and Issues

- How can we be sure that the PhD stays with the company afterwards?
  - Well, ...
- How do we start?
  - Start by identifying the PhD student candidate and the academic supervisor
  - If you do not have contacts in academia yourself then ask the WASP university representatives
  - Start the project discussions with the academic supervisor as early as possible
    - He/she knows best which research problems that fit into WASP and which don't

- More information about industrial PhD studies in WASP can be found at

https://wasp-sweden.org/wp-content/uploads/2019/12/IndustrialPhD_Final_print.pdf

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Industrial Postdoc Call

Industrial Postdocs

- Targeting newly graduated PhDs who have not decided on career path.

- Enables hosting company to "get to know" the postdoc and at the same time conduct a two-year academic project.

- The hosting company applies together with a university research group. There should be identified mentors at both the company and the university.

- Industrial relevance and academic quality are key priorities.

- The postdoc will be employed by the company, but the time should be shared between the company and the university (nominally 50-50)
  - At least 50% of the time at the university
  - At least 20% of the time at the company
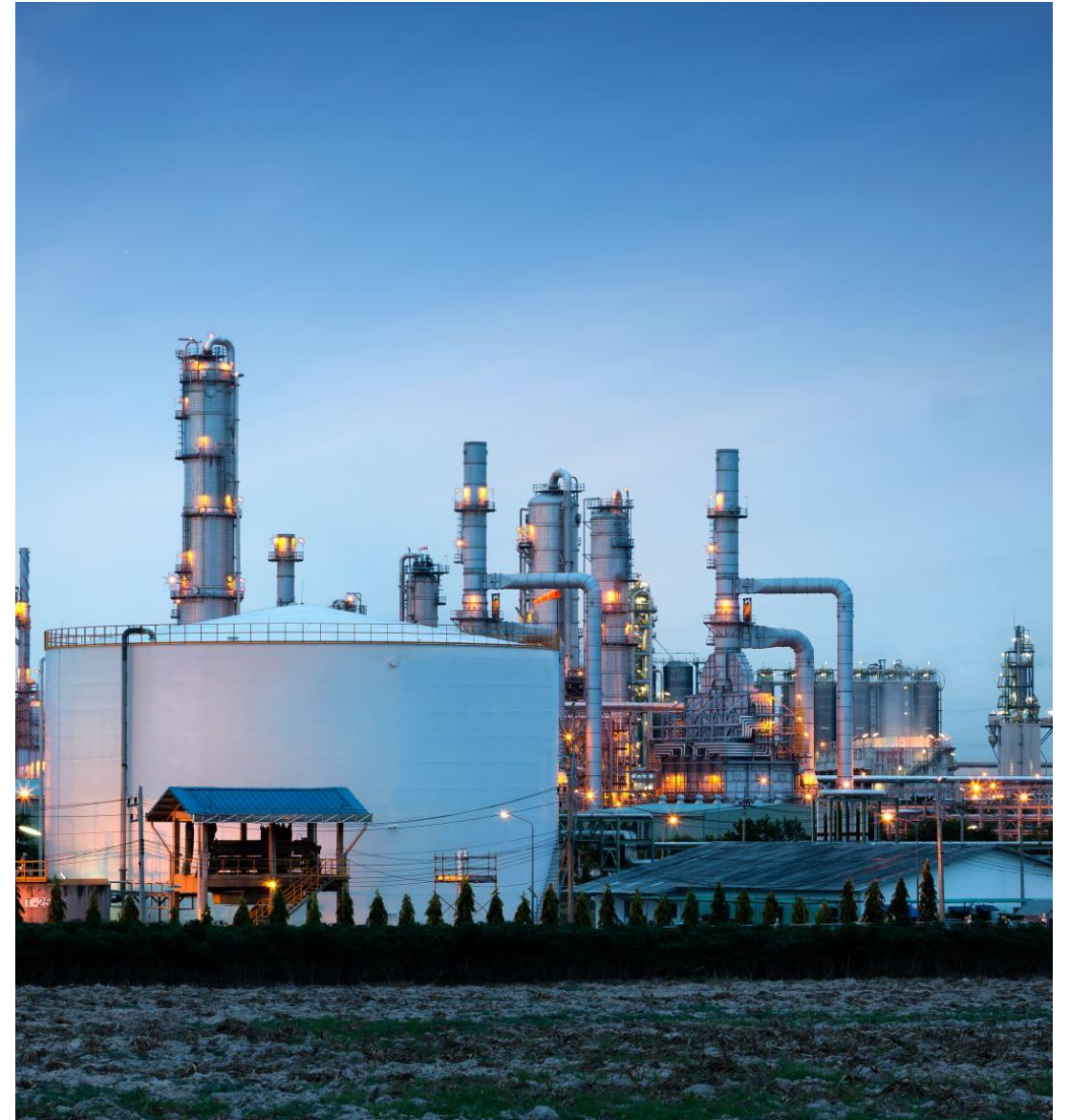
Industrial Postdocs

- Although the main target is newly graduated PhDs also candidates with an older PhD exam may apply
    - The PhD does not have to performed in WASP

- The projects are expected to address fundamental research problems with industrial relevance within any of WASPs research areas

- Total grant over two year: 2.2 Mkr out of which 300k goes to the university and 1.9 Mkr to the company for partial salary funding

- For SMEs the total grant is 2.7 Mkr, and 2.4 Mkr goes to the company

- Nominally five positions in the first call

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Evaluation Criteria

• The academic qualifications of the industrial postdoc candidate. (must be a PhD)

• The industrial relevance of the project.

• The scientific level of the project.

• The industrial and academic qualifications of the industrial and the academic supervisors as well as their potential to support the candidate and the project.

• Mobility, i.e., to what extent the candidate has changed research group between the most recent university appointment and the planned industrial postdoc.

For work permit and residence reasons it may be necessary for applicant to submit the application prior to obtaining the PhD. In such cases, a statement from the PhD advisor regarding planned date for defense should be provided.

More information

- CTH　Per Stenström　per.stenstrom@chalmers.se
- KTH　Bo Wahlberg　bo@kth.se
- LU　Karl-Erik Årzén　karl-erik.arzen@control.lth.se
- LiU　Michael Felsberg　michael.felsberg@liu.se
- LTU　Marcus Liwicki　marcus.liwicki@ltu.se
- UmU　Erik Elmroth　erik.elmroth@umu.se
- UU　Thomas Schön　thomas.schon@it.uu.se
- ÖrU　Amy Loutfi　amy.loutfi@oru.se

Timeline

- 2023-01-16 Call opens
- 2023-01-23 Information & Q/A Webinar
- 2023-04-07 Application deadline
- 2023-05-23 Board decision
- 2023-06-03 Decision communicated
- 2023-08-01 Earliest Start date
- 2024-06-30 Latest Start date

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The Graduate School Mission

The mission of the WASP Graduate School is to educate PhDs with skills in strategically important disciplines within WASP, together with a broad knowledge of AI, autonomous systems and software development.

Goals – Students

Students should become knowledgeable **researchers** in the area of **AI, autonomous system or software**.

Students should form a strong sense of **belonging** to WASP connecting you together.

Students should get to know Swedish **industry**.

Students should form a strong and valuable **international** academic-industrial **network**.

Students should strive for **excellence.**

Goals – Graduate School

We will organize **courses** and **activities** to provide you with **state-of-the-art knowledge** in **AI, autonomous systems and software**.

We will organize **courses** and **activities** that **respect** the needs of a **heterogeneous** group of students spread out over Sweden

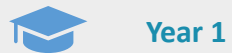**We** will provide **added value** to **your PhD** education.

We will provide **opportunities** to those that really want to **excel.**

WASP Graduate School Activities: General Offer

Winter Conference

Introduction to WASP
Get to know WASP and other students

🎓 **Year 1**

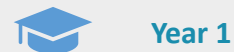**Poster Presentations**
Receive friendly feedback on research

🎓 **Year 2 and on**

Diploma
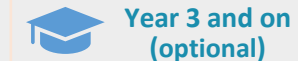Celebrate your accomplishments with a diploma

🎓 **Year 5**

Summer Schools

Community Building summer school
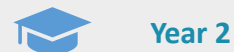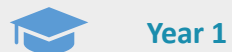Get to know WASP and other students

🎓 **Year 1**

Thematic summer schools
Deepen knowledge in an area

🎓 **Year 2**

🎓 **Year 3 and on (optional)**

International Study Trips
(Two centrally arranged and two student arranged)
New knowledge and international networking

🎓 **Year 1**

🎓 **Year 2**

🎓 **Year 3 and on (optional)**

Research Stints Abroad

Conduct research and networking

🎓 **Year 3 and on (optional)**

WASP Graduate School Activities: Courses

Introductory courses
- Introduction to logics for AI
- Mathematics for Machine Learning

Mandatory course
- Ethical, Legal, Societal and Economical aspects on AI and Autonomous Systems

Foundational courses
(2 out of 3)
- Autonomous Systems
- AI and Machine Learning
- Software Engineering and Cloud Computing

Advanced courses
- Deep Learning
- Deep Learning for NLP
- Graphical Models, Bayesian Learning and SRL
- Interaction, Collaboration, and Visualization
- Learning Feature Representations
- Learning Theory
- Reinforcement Learning
- Scalable Data Science
- Topological Data Analysis
- WASP Project Course

Course Schedule

Yearly courses

Spring
- Mathematics for Machine Learning (4hp)
- Introduction to logics for AI (2hp)
- Artificial Intelligence and Machine Learning (6hp)
- Software Engineering and Cloud Computing (6hp)
- Ethical, Legal, Societal and Economical aspects on AI and Autonomous Systems (3hp)

Autumn
- Autonomous Systems (6hp)

Courses given odd years only

Spring
- Deep Learning (6hp)
- Interaction, Collaboration and Visualization (6hp)

Autumn
- WASP Project Course (6hp)
- Topological Data Analysis (6hp)
- Graphical Models, Bayesian Learning and Statistical Relational Learning (6hp)

Courses given even years only

Spring
- Learning Theory (6hp)
- Deep Learning for Natural Language Processing (6hp)

Autumn
- Reinforcement Learning (6hp)
- Learning Feature Representations (6hp)
- Scalable Data Science and Distributed Machine Learning (6hp)

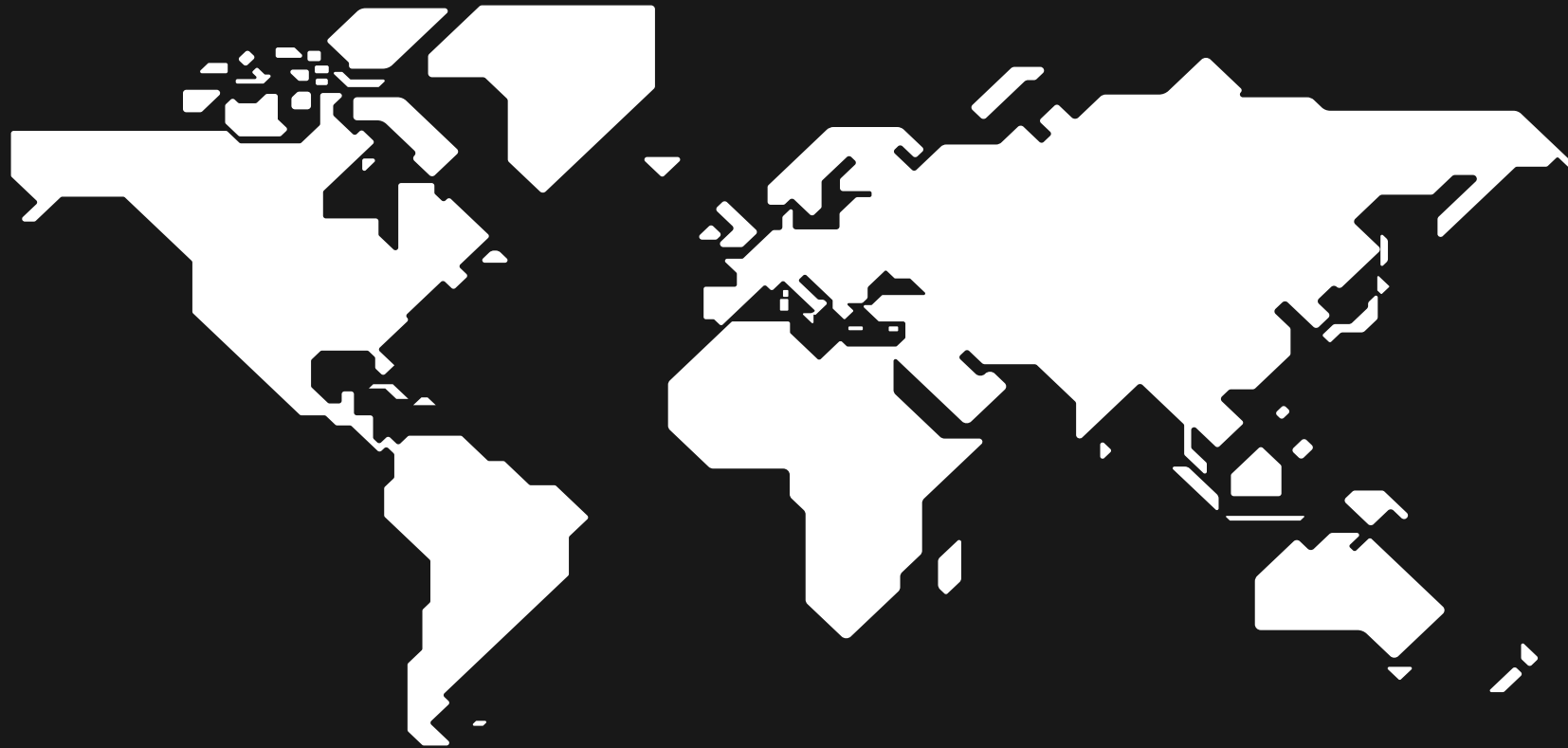Take the opportunity that WASP is and strive to do the most of it!

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Reflections on an industrial PhD project at Ericsson Research

Johan Eker (Industrial supervisor)
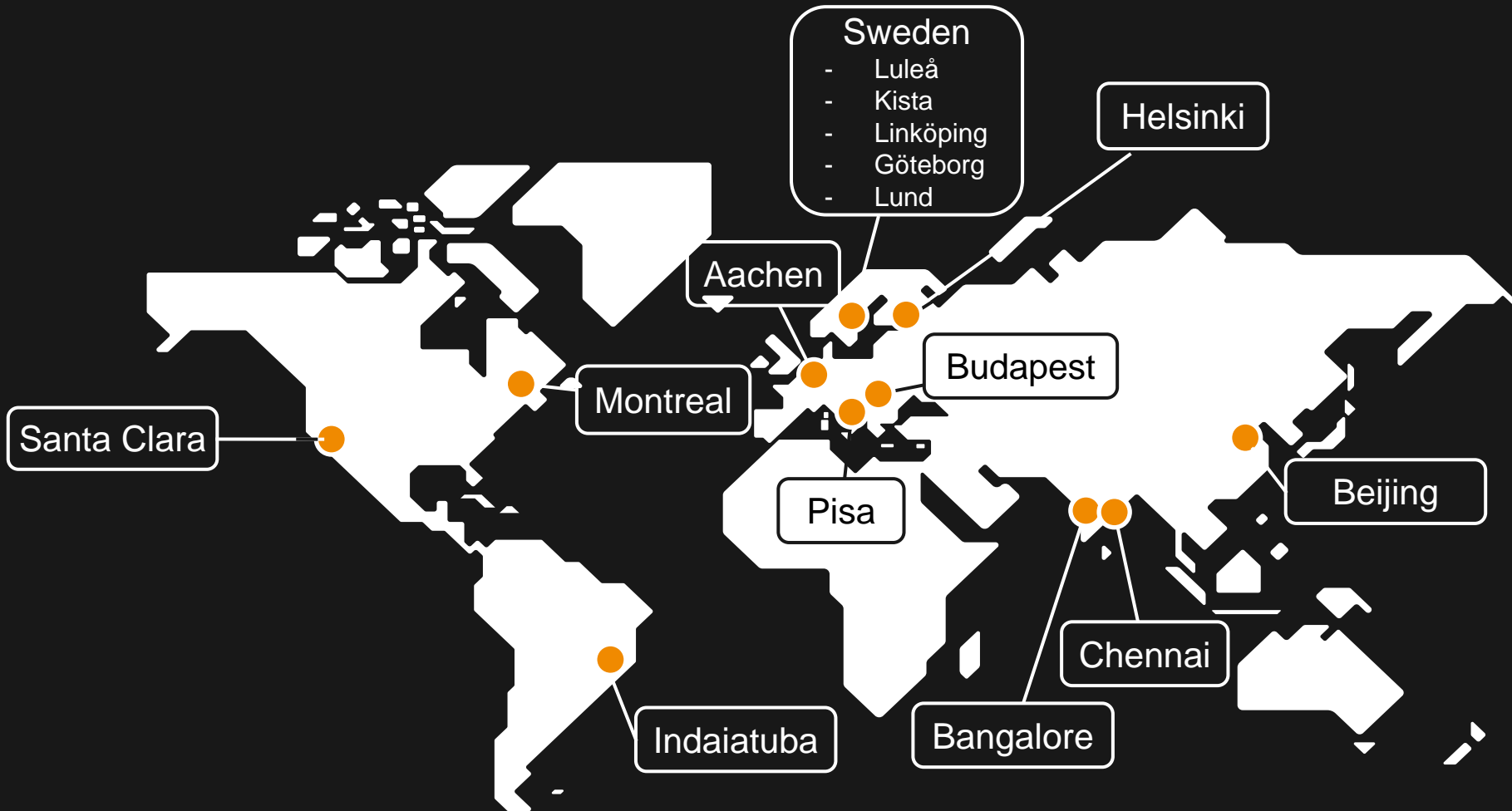
Per Skarin (iPhD)

Ericsson

Ericsson

~100k

employees worldwide

~50k

patents

180

countries

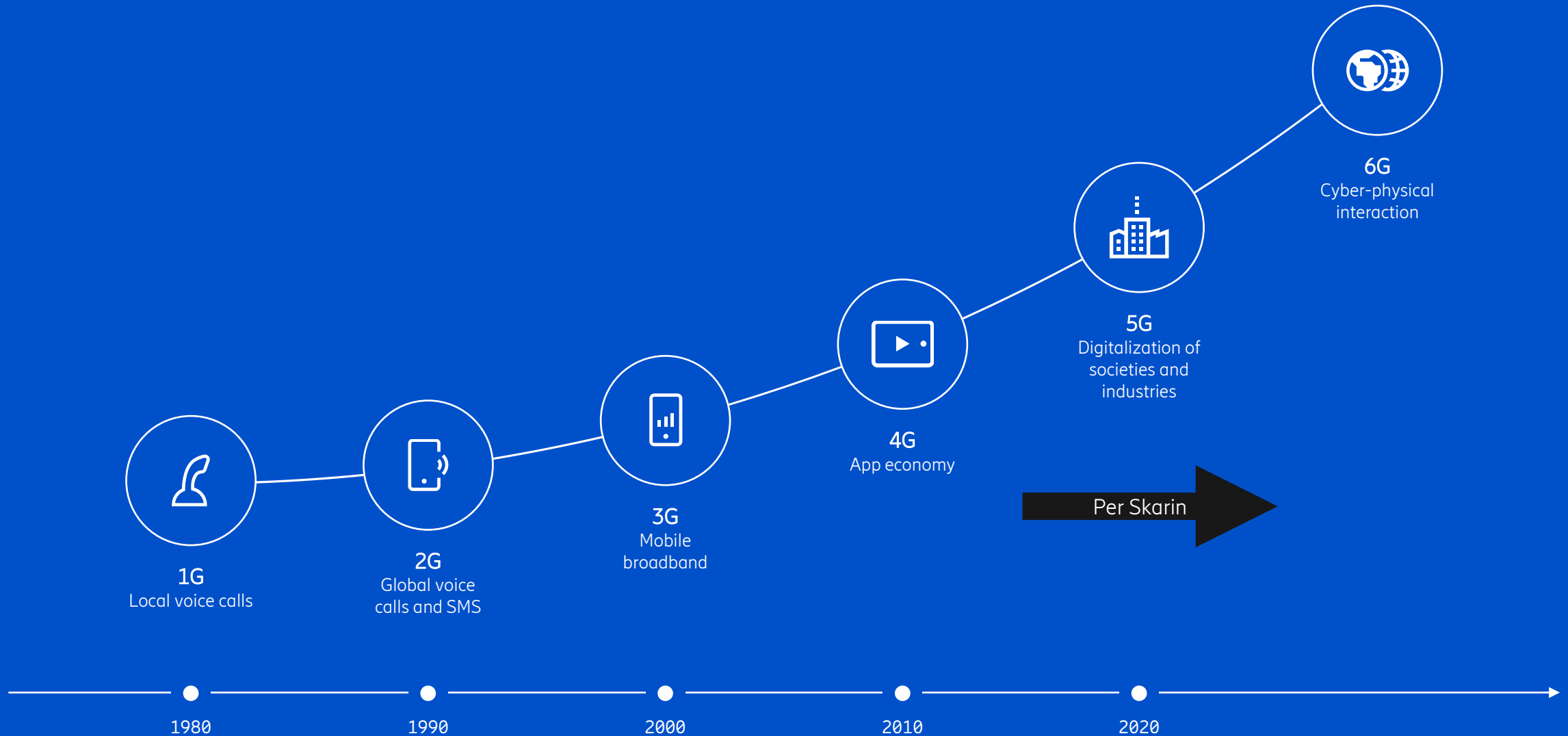2G, 3G, 4G, 5G

Ericsson Research

Sweden
- Luleå
- Kista
- Linköping
- Göteborg
- Lund

Helsinki

Aachen

Budapest

Montreal

Santa Clara

Pisa

Beijing

Chennai

Indaiatuba

Bangalore

800+
employees worldwide

~50%
PhDs

10
countries

Driving mobile networks for new waves of innovation

1G
Local voice calls

2G
Global voice calls and SMS

3G
Mobile broadband

4G
App economy

5G
Digitalization of societies and industries

6G
Cyber-physical interaction

Per Skarin

1980   1990   2000   2010   2020

Why?

- Extending our horizons (both mentally and timewise)

- Explore new business directions

- Networking

- Educating ourselves – access to expertise

- Contributing and being a good citizen

- Influencing research and education
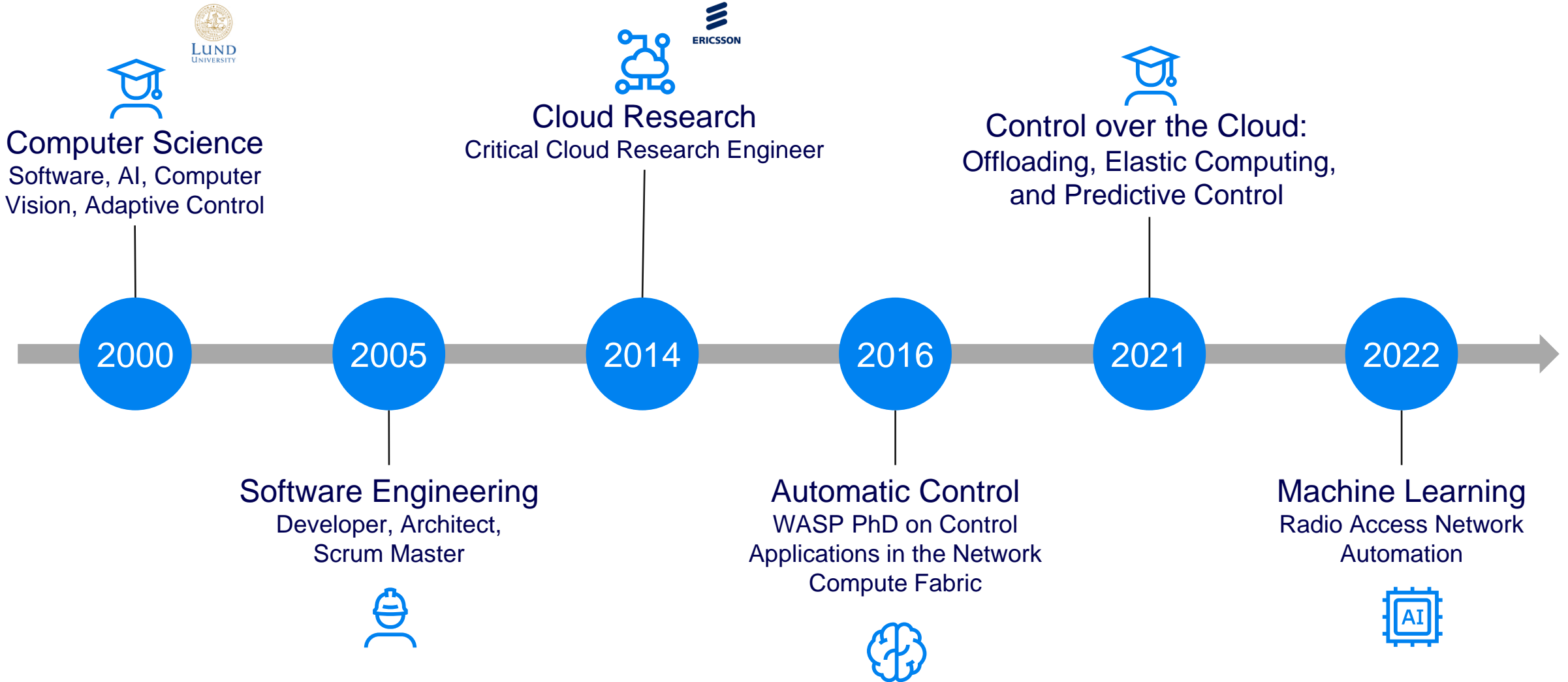
- Recruitment

- Inspiring and fun

Industrial PhD

Timeline

Computer Science
Software, AI, Computer Vision, Adaptive Control

Cloud Research
Critical Cloud Research Engineer

Control over the Cloud:
Offloading, Elastic Computing, and Predictive Control

2000 — **2005** — **2014** — **2016** — **2021** — **2022**

Software Engineering
Developer, Architect, Scrum Master

Automatic Control
WASP PhD on Control Applications in the Network Compute Fabric

Machine Learning
Radio Access Network Automation

Industrial PhD

National Activities

WASP

- Course curriculum
  - Autonomous Systems, AI/ML, Software & Cloud, Projects
- Winter conferences
  - Poster sessions and cluster meetings
- WASP WARAs on Autonomous Transports and Public Safety
  - Course project, engineering activities, research ideas

Other

- Workshops
- Invited seminars
- Tech Talks
- Media coverage

International Activities

WASP

- International study trips
    - Europe, USA, Japan and Singapore
    - Highly ranked universities
    - Major tech companies and startups

Other

- Conferences
    - Two in person, four virtual
    - Build professional character
    - Limits of virtual interaction, video presentations
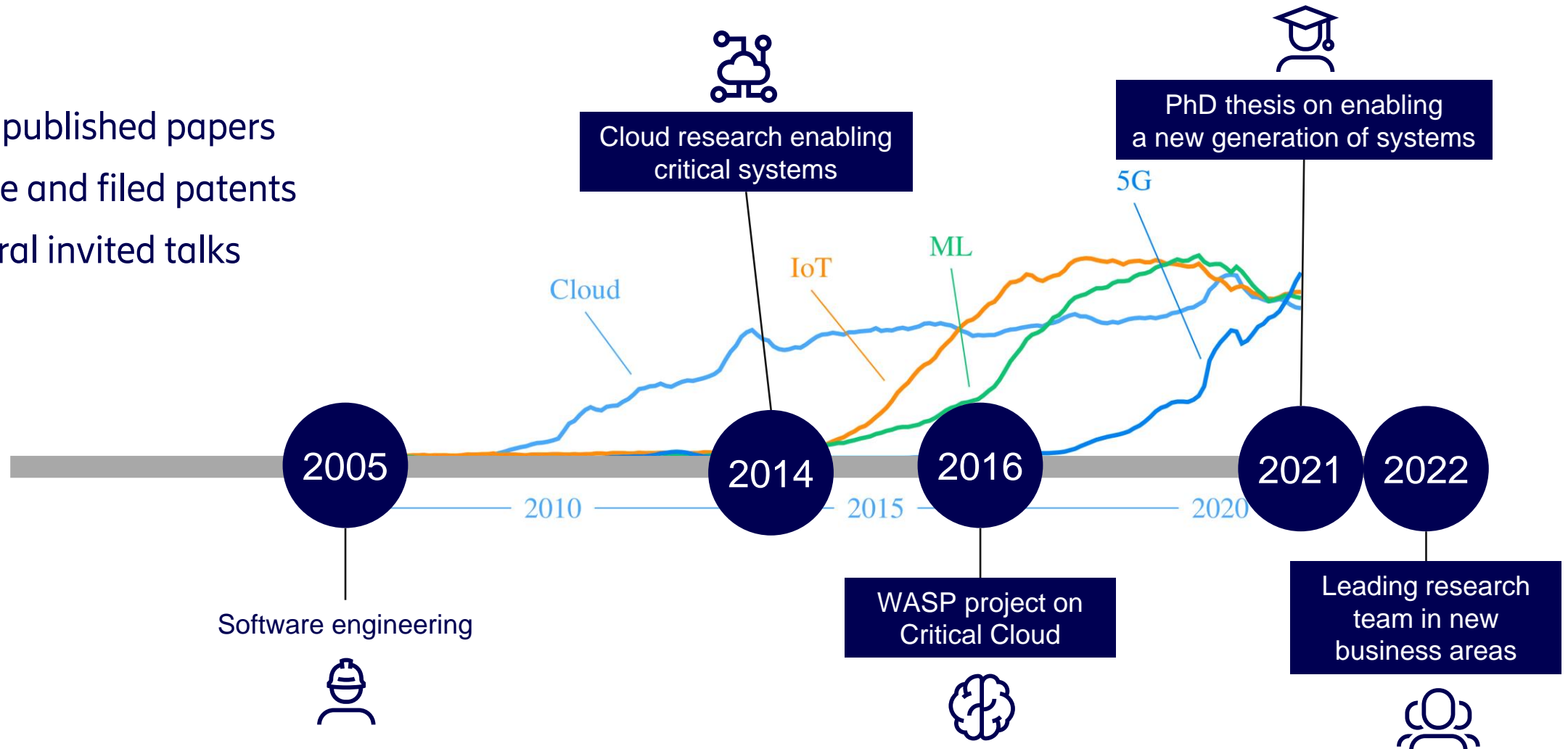- Journal publishing

Industrial PhD

Research outcome

Nine published papers

Active and filed patents

Several invited talks

Cloud research enabling
critical systems

PhD thesis on enabling
a new generation of systems

Cloud

IoT

ML

5G

2005

2010

2014

2015

2016

2020

2021

2022

Software engineering

WASP project on
Critical Cloud

Leading research
team in new
business areas

Value of Industrial PhD

## Research

- Staying ahead of the curve
- Builds innovation
- Company values and culture
- Interact with talent

Research into the potential of next generation infrastructure

Driving change for intelligent networks

Skills

- Engineering, research, writing and presenting
- Collaboration and management
- Perspective (engineering, science, cooperation)
- Lifelong learning (find, produce, and deduce)
- Respect, humble attitude, professionalism
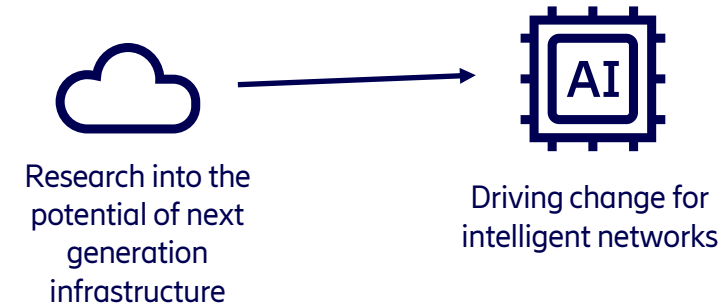
WASP

- Large network (students, academia, engineers, international)
- Graduate school curriculum
- Great platforms to collaborate
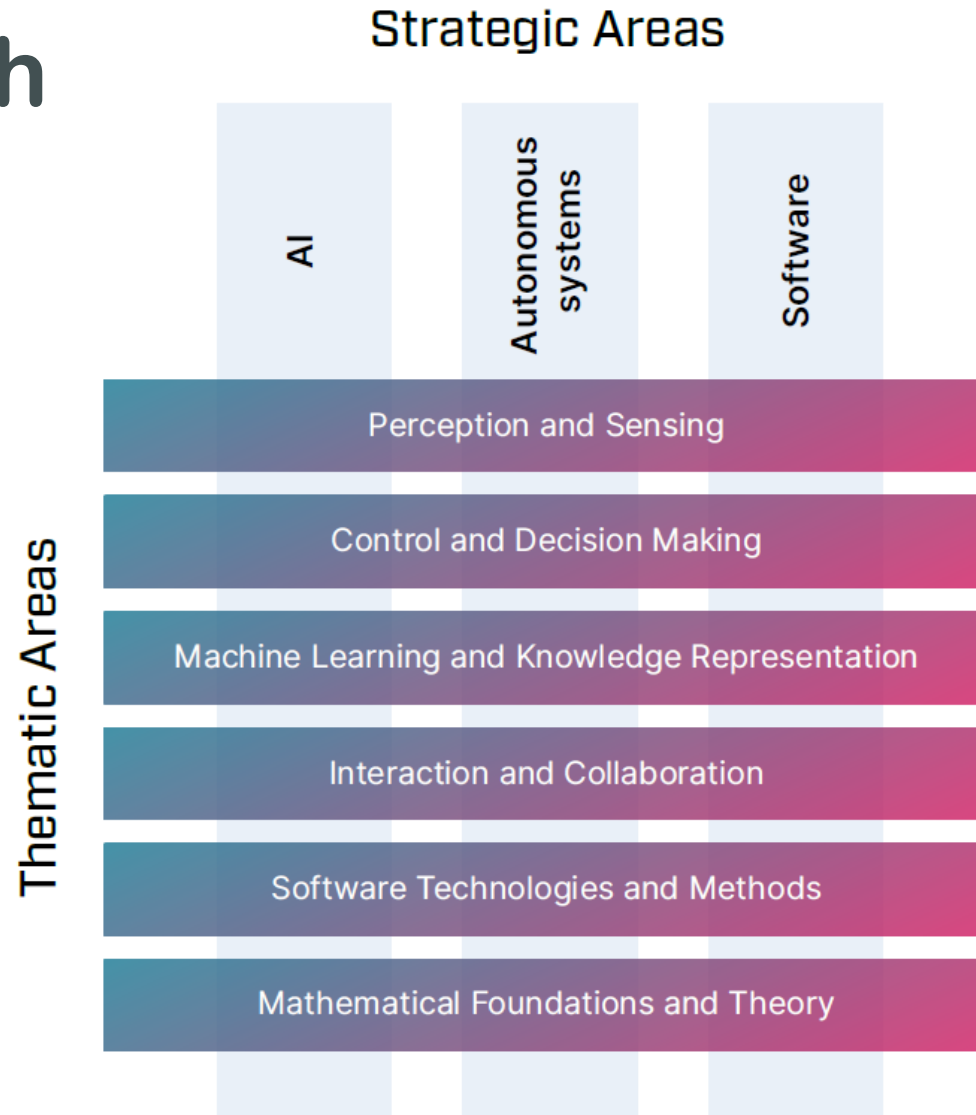- Awareness, inspiration, rewarding, fun

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Q & A

WASP Structure

- WASP
  - Autonomous Systems and Software
    - The original part of WASP
    - AI and Machine Learning included but mainly as tools or methods in Autonomous Systems and Software
  - AI
    - Added to WASP in 2017 with substantial budget increase
    - Increased emphasis on AI and Machine Learning in WASP
    - WASP-AI/MLX
      - Focused on Machine Learning
    - WASP-AI/MATH
      - Mathematical Foundations of AI/ML

WASP Autonomous Systems

- Research on autonomy, including enabling technologies for autonomous systems
- Transport systems, self-driving vehicles, perception, interaction, visualization, human-machine collaboration, multi-agent systems, robotics, autonomous clouds and networks, security, localization, optimization, ...
- Strong systems focus

WASP Software

The software research in WASP falls primarily within two areas:

1. Software methodology and technology for the modeling, analysis, development, training, verification, and deployment of autonomous or AI and ML-based systems.

2. Software methodology or technology that contains or utilizes autonomy, automation, AI, learning, or feedback. This includes, for example, experiment-driven development practices, self-reflection, self-adaptive software systems, self-repairing software, and automatic programming.

WASP AI-MLX Scientific focus

- Representation learning and grounding

- Sequential decision-making and reinforcement learning

- Learning from small data sets, GANs and incremental/active learning

- Multi-task and transfer learning

- 'Established' 2018 – to be updated given transformers, contrastive l, explainability, ☺