Beslut om ett strategiskt forskningsinitiativ, KTH Wireless beyond telecommunication

Detta beslut har undertecknats elektroniskt.

Beslutet

KTH:s vicerektor för forskning beslutar att:

- Finansiera *KTH Wireless beyond telecommunication* med 1 mnkr centrala medel under 2025.

- Utse Joachim Oberhammer, EECS-skolan, som ansvarig forskningsledare för satsningen.

- Återrapportering enligt utvärderingskriterier, för dialog om fortsatt bidrag ska vara Forskningsberedningen tillhanda 13 april 2026.

Ärendet

KTH:s initiativ för forskningssatsningar inrättades enligt förslag från Översyn av KTH:s särskilda forskningssatsningar (Dnr: KTH-RPROJ-0276016). Förslaget innebär att centrala medel ska kunna användas till direkt finansiering av tre- till femåriga forskningsinitiativ med det huvudsakliga målet att dra in externa forskningsanslag.

Under föregående år har Forskningsberedningen arbetat vidare med att konkretisera förslaget, och kommit fram till ett antal kriterier för ett KTH Strategiskt initiativ samt kriterier för utvärdering (Protokoll 10/2024):

Kriterier för KTH Strategiskt forskningsinitiativ:

- Strategiska forskningsinitiativ är ett sätt för KTH att kraftsamla inom områden där det krävs nya samarbeten som är viktiga utifrån KTH:s vision och mål. Det kan dels vara att förstärka ett område som redan finns eller utveckla ett nytt.

- Strategiska forskningsinitiativ ska kunna initieras av både forskare, KTH:s ledning och forskningsberedningen.

- Strategiska forskningsinitiativ är satsningar med central finansiering på 0,5 - 3 mnkr per år i max fem år.

- Målsättningen för en beviljad satsning är att generera betydande externa bidrag till KTH om totalt minst 100 mnkr. Det kan vara externa bidrag från flera olika finansiärer som tillsammans stärker området för forskningsinitiativet. Utväxlingen blir den viktigaste indikatorn som följs upp årligen.

Kriterier för utvärdering av beviljat KTH Strategiskt forskningsinitiativ ska ske efter ett år enligt nedan:

- Projektansökan – En eller flera projektansökningar.
- Kraftsamling - Vilka PI´s är med i projektansökan/ansökningar?
- Förberedelsearbete inför utlysningar.
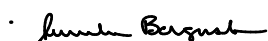- Exempel på nya forskningssamarbeten.

Dessutom kommer behov av central finansiering, budgetutrymme och strategisk relevans att vägas in vid Forskningsberedningens bedömning.

Till Forskningsberedningens möte den 26 mars inkom förslaget KTH Wireless beyond telecommunication, med professor Joachim Oberhammer, EECS-skolan, som ansvarig forskningsledare, se bilaga 1.

Baserat på Forskningsberedningens diskussion rekommenderas Vicerektor för forskning att stödja att förslaget beviljas sökt budget, 1 mnkr för år 2025. En utvärdering ska ligga till grund för diskussion om fortsatt finansiering och i vilken omfattning. (KTH-RPROJ-0276016 Protokoll 10/2024).

Detta beslut har fattats av vicerektor för forskning Annika Borgenstam efter föredragning av forskningsrådgivare Johan Schuber.

Kungl. Tekniska högskolan

Annika Borgenstam, vicerektor för forskning KTH

Johan Schuber, forskningsrådgivare, avdelningen för forskningsstöd inom Verksamhetsstödet

Bilaga 1: projektförslag

Sändlista

<u>För åtgärd:</u>

Joachim Oberhammer, EECS-skolan

<u>Kopia till:</u>

Skolchef EECS-skolan

Controllergruppen, <u>controller@kth.se</u>

Chefen för avdelningen för forskningsstöd Maria Gustafson

Tf Kommunikationschef Gunilla Iverfelt

Anna Aminoff

Sanna Pehrson, avdelningen för forskningsstöd

<u>Expeditionsdatum:</u>

 2025-04-03

Wireless beyond telecommunication

PI:

Joachim Oberhammer	EECS-IS-MST (Micro and Nano Systems)

Co-PIs:

Emil Björnson	EECS-CS-COS (Communication Systems)
Oscar Quevedo Teruel	EECS-EE-EMF (Electromagnetic Engineering and Fusion Science)
Dimos Dimarogonas	EECS-IS-DCS (Decision and Control Systems)
Panagiotis Papadimitratos	EECS-CS-SCS (Software and Computer Systems)
James Gross	EECS-IS-ISE (Information Science and Engineering)
Gabor Fodor	EECS-IS-DCS and Ericsson Research

Annual funding request: SEK 1 million

Budget plan for first year:

Description	*#*	*SEK each*	*SEK total*
Project manager, 25%			395 000
KTH-internal workshop (brainstorming, identifying synergies)			15 000
National Swedish workshop (teaming up with other universities)			35 000
Organization of dedicated International workshop, incl. invited speakers			85 000
Travel support for workshops at EC, standardization bodies**	5	20 000	120 000
EU project and national center proposal writing contribution***	7	50 000	350 000
Total budget			**1 000 000**

*   nominated: Dr Umer Shah, EECS-IS-MST
**   request to be internally approved by management group.
***   request to be internally approved by management group; eligibility criteria to be defined by the management group, for instance KTH project share at least EUR 500 000 / SEK 5 000 000, proposal submission confirmation.

The PI and Co-PIs comprise the Management group of the Project, with equal votes on decisions on how to use the funding requests for travel and proposal writing grants.

- **Purpose**

Wireless communication is continuing its predicted growth with global mobile data transport predicted to grow from 58 Exabytes/month in 2020 to 473 Exabytes/month in 2030 (CAGR of 19%). New mobile communication generations, such as 6G with scheduled large scale deployment in the 2030s, will need to utilize large new frequency bands. New hardware and software technology needs to be continuously developed to keep pace with the roadmaps and user demands. The use of machine learning techniques for hardware and network optimization is becoming widespread. New large-scale user scenarios need directed communication at high data rates, energy efficiency, reconfigurability, ad-hoc connectivity, and low latency. Sweden has historically been having a strong industrial weight in telecommunication, and is characterized by a high degree of innovation originating from strong industrial and academic collaboration on telecommunication, which is important to maintain industrial leadership into the future. Compared to the other technological universities in Sweden, KTH has recently been very dominant in Sweden with securing large-scale research funding in 6G technologies, with the two recently started VR 6G research environments ("Sustainable and Energy Efficient 6G Integrated Antennas", SEE-6GIA; "Distributed MIMO with Intelligent Edge Computing Services enabling Energy- and Cost-Efficient 6G Networks", DICE-6G), two ongoing SSF centres and framework projects ("THz communication – NOW"; "Sustainable Mobile Autonomous and Resilient 6G SatCom"), and the VINNOVA centres ("Swedish Wireless Innovation Center", SweWIN, as well as "Trustworhy Edge Computing Systems and Applications", TECoSA), all of which are managed by the applicants of this proposal.

Moreover, the progress in wireless technology is predicted to have an impact in new application fields far beyond traditional telecommunication. A major research focus currently is, for instance, on joint communication and sensing (JCAS), a.k.a. integrated sensing and communication (ISAC). Furthermore, utilizing of new technologies developed for new telecommunication applications, for instance beam-steering and multi-beam communication, as well as new frequency bands, can be beneficially utilized for large-bandwidth and thus high-resolution sensing (remote sensing, radar, spectral analysis). This enables various new applications in a sustainable society, for instance remote sensing for drone-based agricultural surveillance, non-destructive testing, energy-efficient smart cities, as well as the growing demand for distributed security and defence solutions in a less secure world.

> **The purpose of this project is to unite the most successful research leaders at KTH in different domains in wireless communication and related technology fields, for creating synergy effects and for exploiting the upcoming potential in the above mentioned emerging application fields where advanced telecommunication technology, in new frequency spaces and for new applications, can be utilized to the benefit of society beyond traditional wireless communication. The vision of this "wireless beyond telecommunication" initiative is to utilize outside-the-box thinking and have an early grip on emerging research fields which are enabled by the advancing telecommunication technology and techniques. It is our vision that KTH plays a leading-edge role in research for utilizing wireless technology beyond telecommunication, and to be the dominat player in Sweden for attracting research funding in these emerging opportunities.**

Telecommunication is a priority focus area for KTH, as is achieving a sustainable society through digitalization; two essential goals which are ideally combined in this proposal.

Ericsson and SAAB, two strategic partners of KTH, are in a constant dialog with EECS about shaping KTH's education of future young professionals towards the future needs of Swedish industries. EECS has recently established new MSc courses in telecommunication technologies, shaped by the applicants of this proposal. The constant dialogue between KTH and key industrial partners will help KTH to identify future education needs early in new application scenarios of wireless technologies, not only for educating engineers but also young professionals creating innovative startup companies exploring new emerging market opportunities.

- **Why at KTH?**

As outlined above, KTH has been very dominant in Sweden with securing research funding in 6G technologies, managed by the applicants. Together with earlier strong initiatives on wireless technology, such as the former "Wireless@KTH" centre, KTH can truly be considered to be the leading technical university in telecommunication in Sweden. Thus, it is important that KTH maintains that leadership and that KTH has an early grip on upcoming, unconventional application fields of telecommunication technologies.

KTH has strong research infrastructure for wireless communication, including an antenna measurement laboratory for microwave frequencies (Quevedo Teruel), a millimeter-wave/THz lab for device and antenna characterization for sub-THz and THz frequencies (Oberhammer), the 5G-enabled TECoSA edge computing testbed (Björnson, Gross), the Electrum Laboratory ELAB (Oberhammer), the Kista Innovation Park (Björnson), the KTH Centre for High-Performance Computing (HPC), and the Sustainable Power Lab (SPL), which are seminal for the type of research projects to be applied for by this research initiative.

Wireless communication technologies have recently reveived a very strong research funding focus both on national level (SSF, VR, VINNOVA; see the centres of the PI/co-PIs listed above), but also on a European level, with the European funding instruments of the annual 6G-SNS calls, EIC related challenges calls, and Pillar-II/Cluster-4 calls. Resilience of European industries on these technologies has been emphasized by recent Joit-Undertaking calls between 6G cluster funding and the European Chips Act.

- **Research team**
  - *Joachim Oberhammer*, Professor in Microwave and THz Microsystems since 2015, <u>ERC Consolidator Grant 2013</u>, 8 Best Paper Awards since 2010, guest professor "Chair of Excellence" UC3M, visiting researcher NASA-Jet Propulsion Laboratory, post-doc Kyoto University and Nanyang Technological University, member Young Academy Sweden. PI of two SEK 35 million SSF framework grants, scientific coordinator of several EU projects; accumulated external funding (as PI or co-PI for KTH) of over SEK 110 millions since 2010, main supervisor of 23 PhD students since 2010. H-index 33.
  - *Emil Björnson*, Professor in Wireless Communication since 2022, IEEE Fellow, Digital Futures Fellow, <u>SSF Future Research Leader</u> (2020), <u>Wallenberg Academy Fellow</u> (2019), Clarivate Highly Cited Researcher, director of SweWIN center, 2018 and 2022 IEEE Marconi Prize Paper Awards in Wireless Communications, 2019 IEEE Communications Society Fred W. Ellersick Prize, 2024 IEEE Stephen O. Rice Prize. H-index 85.
  - *Oscar Quevedo Teruel*, Professor in Electromagnetic Theory since 2021, IEEE Fellow, Associate/Track Editor IEEE Trans on Antennas and Propagation, vice-chair of European Association on Antennas and Propagation (EurAAP) Board of Directors, distinguished lecturer IEEE Antennas and Propagation Society. H-index 51.
  - *Dimos Dimarogonas*, Professor in Automatic Control since 2017, IEEE Fellow, <u>ERC Starting Grant 2014</u>, <u>ERC Consolidator Grant 2019</u>, <u>KAW Fellow</u> (2015 and 2020), post-doc MIT, Assoc Editor Automatica and IEEE Trans Control of Network Systems, 3 Best Paper Awards since 2019. H-index 70.
  - *Panagiotis Papadimitratos*, Professor in Networked Systems Security since 2017, <u>KAW Academy Fellow</u> (2013 and 2018), Fellow Young Academy Europe, PhD Cornell Univ (USA), positions at Virginia Tech, EPFT, Politech Torino, steering committee of Security Link Center, coordinator of ICES Center Security Industrial Competence Group, member ACCESS Center Executive Committee. H-index 60.
  - *James Gross*, professor in machine-to-machine communications, Assoc. Director KTH Digital Futures, co-director KTH center TECoSA, board of KTH centre for Embedded Systems, previous position at RWTH Aachen, 3 Best Paper Awards, ITG/KuVS dissertation award. H-index 40.
  - *Gabor Fodor*, Adjunct Professor in wireless systems, employed at Ericsson Research (Radio Department); Fellow IEEE; editorial positions IEEE Com. Magazine and IEEE Trans Wireless Com.; IEEE Com. Socierty Stephen O Rice Prize 2018, 200+ granted US and EU patents. H-index 55.

The applicants hold a total of three ERC grants (excl. PoC), three Wallenberg Academy Fellowships and a SSF research-leader fellowship, have an average H-index of 56.3, and, with an average age of 48.1 years, are in the middle of their professor careers.

Synergy effects: the applicants are all working at different divisions at EECS, with a different approach to telecommunication and wireless technology, addressing multiple dimensions of the competency matrix: (1) hardware to software; (2) theoretical to applications, incl. industrial research; (3) telecommunication to sensing, incl. joint communication and sensing; (4) devices to systems to networks. Furthermore, Prof. Papadimitratos addresses specifically security related questions, and adj. prof. Fodor addresses specifically the academic industrial relationship. Furthermore, the applicants are either directors, co-directors, or in the management groups of the following KTH centers: Digital Futures (digital technologies), TECoSA (edge computing), ELAB (semiconductor/microsystems). It should be mentioned that there has only been very little collaboration between only a few of the applicants, i.e. this research initiative has a large potential of creating new synergy effects. The individual fields of expertise, clearly different and complementing each other, are:

- *Prof. Joachim Oberhammer:* micromachined sub-THz and THz devices and systems (75 to 750 GHz); THz antennas & beam-steering; radar; THz imaging; sub-THz car radar; radiometers.
- *Prof. Emil Björnson:* multi-antenna/MIMO communications and radio resource management, using methods from communication theory, signal processing, and machine learning.
- *Prof. Oscar Quevedo Teruel:* antenna theory and applications, transformation optics, lens antennas, periodic structures.
- *Prof. Dimos Dimarogonas:* Multi-agent control systems, robot navigation and task planning, unmanned vehicles, autonomous robots, hybrid systems, networked control, formal verification and control of hybrid systems.
- *Prof. Panagiotis Papadimitratos:* secure networked systems using theoretical methods, protocol analysis and information-theoretic results
- *Prof. James Gross:* machine-to-machine communications, ultra-reliable low latency communications, edge computing, network calculus, age-of-information, wireless networking, cyber-physical networks.
- *Adj. Prof. Gabor Fodor:* Physical layer, radio resource management,; mmWave communications, joint communication and sensing, industrial perspective.

- **Strategy for funding**

  With several VR/VINNOVA/SSF research centres, 3 KAW Fellowship projects, 3 ERC projects, and several large EU collaboration projects, the applicants have shown an excellent track record in securing external research funding in a wider area of topics within wireless communication, sensing, network, autonomous systems, secure networks.

  Goals and key performance indicators (KPI) of this research initiative for the first year:
  - Organization of 3 workshops and networking events: (1) a KTH-internal workshop for brainstorming and identifying synergy effects as well as identifying additional core members to the initiative; (2) a Swedish National workshop for identifying synergy effects between universities (targeting national research funding); (3) a European-level international workshop (targeting EU project funding).
  - Submission of at least 5 EU project proposals and 5 national proposals within the initiative's scope.
  - Meetings by the management group every 3 months, discussing state of the project.

  Furthermore, this initiative will give travel contributions to participate at European Commission workshops, standardization body meetings, etc., as well as proposal writing grants (details see budget plan on page 1).

  As a mid-term goal (subsequent years), large-scale, more fundamental and prestigious research programmes will be targeted, in particular KAW and ERC Synergy Grants. It is the long-term strategical goals of this initiative that: (1) KTH maintains its dominant academic position in Swedish research in telecommunication; (2) KTH will become the dominant academic body in Sweden in research on new emerging wireless technologies beyond classical telecommunication.

KTH internt beslut med e-signatur: kth-proj-0276016_ KTH Wireless beyond telecommunication

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"KTH internt beslut med e-signatur: kth-proj-0276016_ KTH Wireless beyond telecommunication" – historik

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