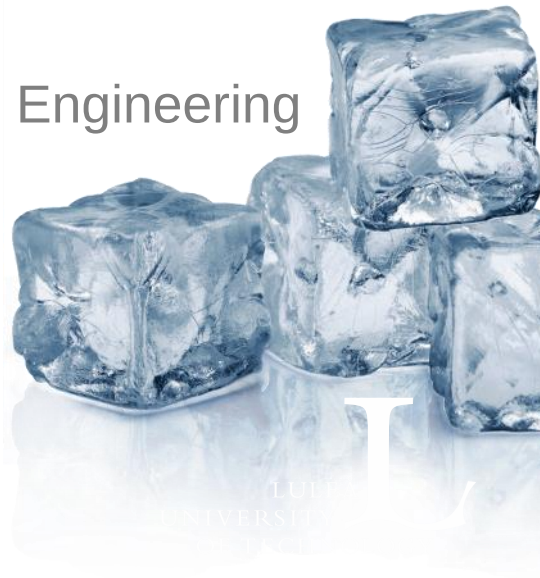
the Signal Processing group

Dept. of Computer Science, Electrical and Space Engineering
Luleå University of Technology

Prof. Jaap van de Beek



our areas of expertise

Radio communications – the physical layer

cellular systems: 3G, LTE, 5G

Modulation, coding, receiver algorithms

Radio interference

Radio channel analysis, measurements

Software radio, SDRs


the *inclusive* connected society
mobile broadband for all

fixed and mobile broadband access

European commission – fixed access goals for 2020:
All EU citizens: at least 30 Mbit/s

Swedish government – fixed access goals for 2025:
98% of households: at least 1 Gbit/s
1.9% of households: at least 100 Mbit/s
0.1% of households: at least 30 Mbit/s

Swedish government – mobile access goals for 2023:
whole of Sweden: stable mobile services

My concerns:

How **will Sweden offer the rural 2% of its citizens a 30-100 Mbit/s connection by 2020? (172 000 households)**

How **to interpret the mobility goal? – and who will have first right**

30Mbit/s	households	working places	area (km^2)	access	within 'tätort/småort'	outside 'tätort/småort'
Arjeplog	1 585	718	13 700	42%	57%	8%
Arvidsjaur	3 388	1 103	6 030	67%	76%	24%
Boden	14 653	3 213	4 220	87%	96%	27%
Gällivare	9 416	2 134	16 700	83%	88%	23%
Haparanda	5 106	1 072	902	64%	78%	4%
Jokkmokk	2 600	1018	19 600	69%	78%	32%
Kalix	8 399	2 313	1 830	71%	79%	22%
Kiruna	11 665	2 631	20 500	87%	91%	24%
Luleå	38 944	8 187	2 030	88%	93%	31%
Pajala	3 396	1 249	8 150	58%	80%	19%
Piteå	20 215	4 980	3 250	85%	92%	45%
Älvsbyn	4 126	1 207	1 750	48%	57%	21%
Överkalix	1 878	727	3 000	33%	47%	3%
Övertorneå	2 522	956	2 550	60%	69%	35%
Norrbotten	**127 893**	**31 508**	**104 250**	**79%**	**88%**	**26%**

October 2015

112 / emergency response


blue-light services
POLIS
SNF 373


turism /
betaltjänster


economic values: mining
(but also: power, forestry)

Why cover the rural?

EU goal: 30Mbps for all

tourism

security / safety

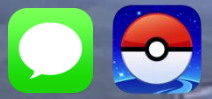
e-health

economic values

attraction

100Mbit/s to *all* homes

Coverage everywher



Blue-light services

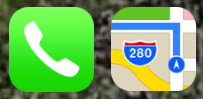
e-health

Education

Forestry, mining,

agriculture, logistics

Safety, 112



Tourism, paying services

***but who* will cover the rural?**

who will build infrastructure?
who will operate the network?
who will provide local services?
how do *all* customers get access?

Is *5G* the solution?

rural potential revenue:

$ 262 /square mile /year *

urban potential revenue:

$248,000 /square mile /year *

* A.-M. Kovacs, "Regulation in Financial Translation: Will the Incentive Auction Increase Mobile-Broadband Competition in Rural America?", May 2014

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+ academic research

Broadband satellite services

latency – LEO ?

rural regions: polar orbits ?

cost ?

most importantly: a cross-disciplinary process

3GPP:

New “Study Item” on “*Using Satellite Access in 5G*”

Starts soon.

- roaming
  between terrestrial and satellite access
- spectral interference
- new power management
- delay requirements

a global challenge, really

the arctic perspective

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Europeiska regionala utvecklingsfonden

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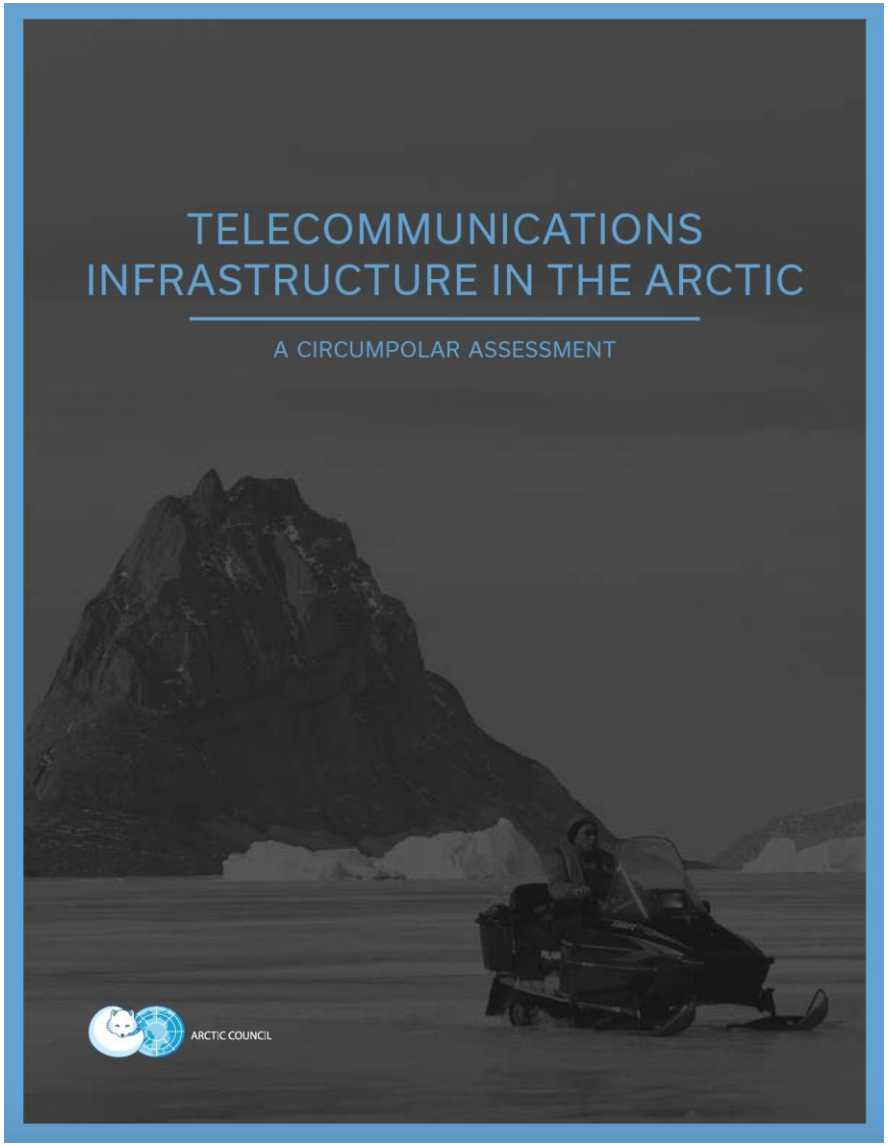


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people @ Signal Processing

Jaap van de Beek	professor, chair	joined group in 2013
Johan Carlson	professor	joined group in 2007
Matthew Thurley	associate professor	joined group in 2006
Rickard Nilsson	senior lecturer	joined group in 2010
Medhat Mohamad	Ph.D. student	joined group in 2014
Tayebeh Taheri	Ph.D. student	joined group in 2015
Nils Beyer	undergraduate trainee	2016-2017
adjunct / in industry:		
KubilayOvacikli	Ph.D. student	since 2011, *Rubico Consulting*
Tor Björn Minde	adjunct professor	since 2002, *Ericsson*, *LTU Business Innovation*