



Lessons learned 2000 – 2010

What differences can we observe in Sweden

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Aspects to discuss

- Service mix and traffic mix
- Radio access technologies
- Coverage and capacity
- Investments
- Network sharing
- Spectrum
- Cost of radio equipment
- Number of sites

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Service and traffic mix

- 2000
 - Voice and sms
 - > 99% of the traffic is voice
- 2010
 - Voice, SMS and MMS + mobile data
 - Mobile services for enterprizes, craftsmen
 - > 90% of the traffic is data



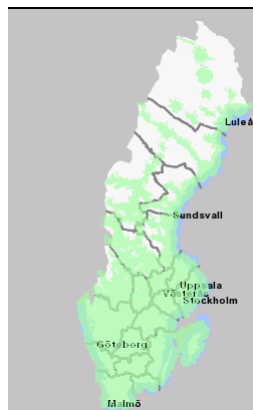
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GSM coverage

Tele2 - Telenor - Telia



~70% covered area



~65% covered area



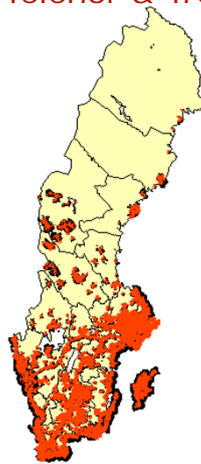
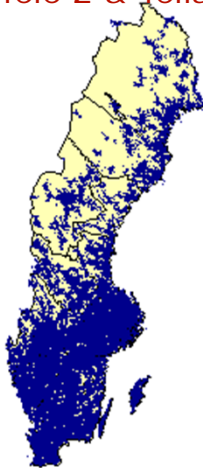
~90% covered area

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3G Coverage Turbo 3G, Turbo 3G+ (HSPA)

Tele 2 & Telia

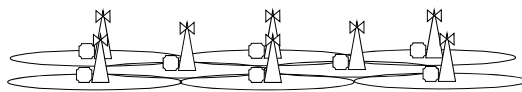
Telenor & Tre



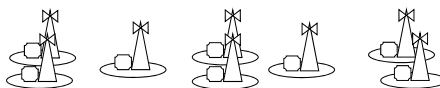
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Density of base station sites

- Deployment for low or medium data rates



- Coverage for high data rates with existing sites

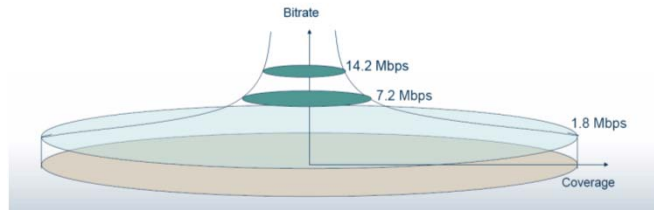


- Deployment needed for high data rates

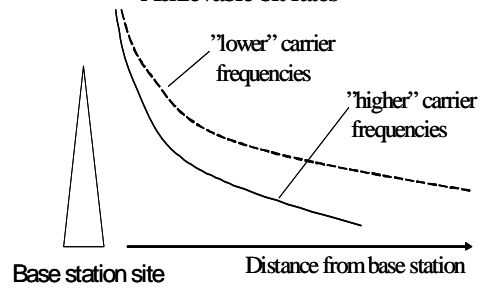


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Bit rates, coverage and carrier frequency



Achievable bit rates

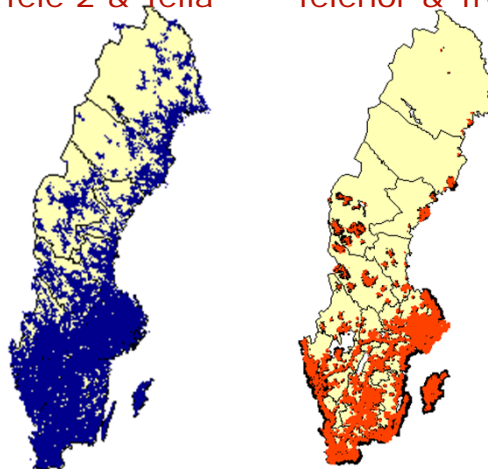


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3G Coverage Turbo 3G, Turbo 3G+ (HSPA)

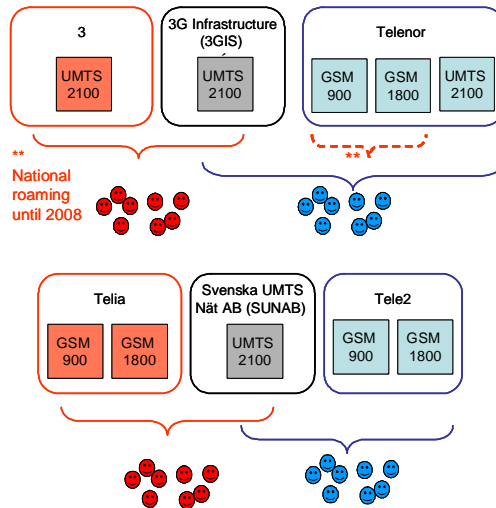
Tele 2 & Telia

Telenor & Tre



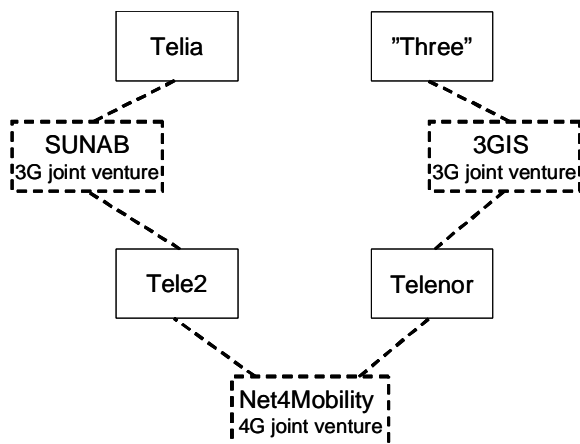
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Network sharing in Sweden



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Many partnerships and joint ventures



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Network sharing - Why cooperation ?



- Drivers for network sharing
 - To reduce network costs
 - To get access to spectrum license
 - To get access to the competence and network of an established operator
 - Aggregated spectrum means that operators can "offer more", i.e. higher bit rates
- Anti-drivers for network sharing
 - Less independence
 - Decision making takes more time and effort

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Investments in mobile networks in Sweden 2000-2009 (Million SEK)



Operator	Investments
Telia	10334
Tele2	4006
SUNAB	5797
Telenor	2945
Hi3G access	13384
3GIS	8786

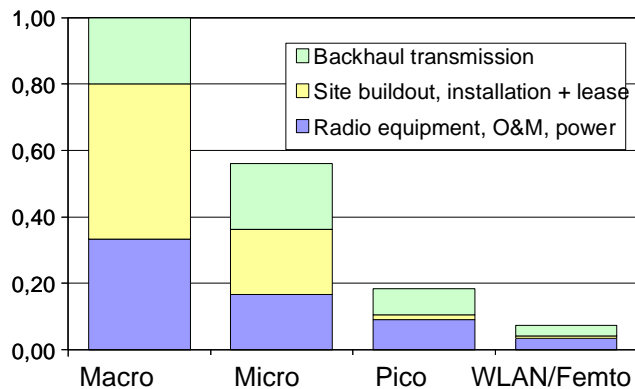
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Cost structure of radio access networks

- It is not only costs for the base station equipment (the radio) but also for the transmission & sites



From
Klas Johansson
PhD thesis 2007



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Cost of radio equipment is decreasing rapidly

512 MSEK (50 MEuro)
~ 6 KEuro per base station

News article: 05 November 2009

Telenor to replace its infrastructure for mobile services in Norway

(Oslo/Fornebu, 5 November 2009): Telenor is going to replace its entire mobile services infrastructure in Norway during the next years, with the aim of creating a flexible and cost efficient platform for mobile services. Huawei and Starent Networks have been chosen as the technology providers for the wireless network and mobile core network, respectively.

The scope of the agreement includes the delivery of equipment across technology generations and frequency bands, as well as multi-base stations for 2G, 3G/UMTS and 4G/LTE. The change of providers will also entail digitisation, with the entire wireless network and core network being migrated to an IP-based platform.

"This is the biggest upgrade of the mobile network in Norway we have ever carried out. It will create a solid and flexible base for further developing the services offered by the Telenor mobile network and the quality of those services. Our aim is to provide customers with better, more innovative services across the country. This means better in terms of capacity, speed and stability," explains Ragnar Kårhus, head of Telenor Norway.

The replacement of infrastructure will represent a moderate increase in investments over the next two years, and thereafter improve our cost and

TELE2



~ 750 MSEK

Press release

Stockholm, 18th of December, 2009

Tele2 and Telenor select Huawei to deploy 4G network

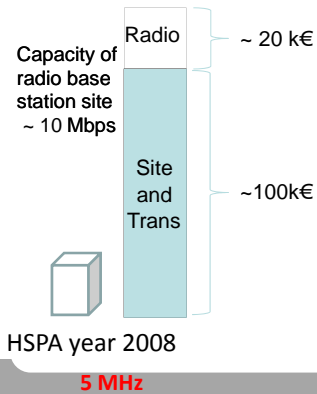
Net4Mobility, the joint venture by Tele2 and Telenor, today announced that Chinese telecom equipment vendor Huawei will supply infrastructure and modems for next generation mobile communications, 4G, in Sweden. The agreement with Huawei comprises the deployment of the first nationwide 4G network in Sweden and modem services for the new network.

By combining the procurement of a network- and modem vendor, the operators secure an effective deployment and a commercial launch of high-quality 4G services in 2010. For customers, 4G enables increased mobility and use of high capacity services, with up to ten times the current speed of turbo-3G initially.

- Huawei provides high technology and cost efficiency, both vital components in our investments to build a nationwide 4G network. Tele2's customers will be able to access high-quality and affordable mobile services at speeds equivalent to some of today's fixed broadband connections, said Niclas Palmsterna, CEO, Tele2 Sweden.

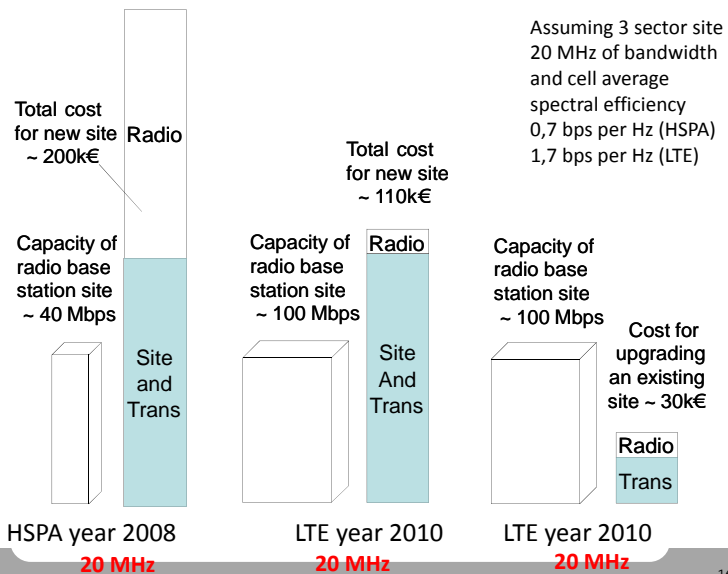
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Capacity, cost and cost structure



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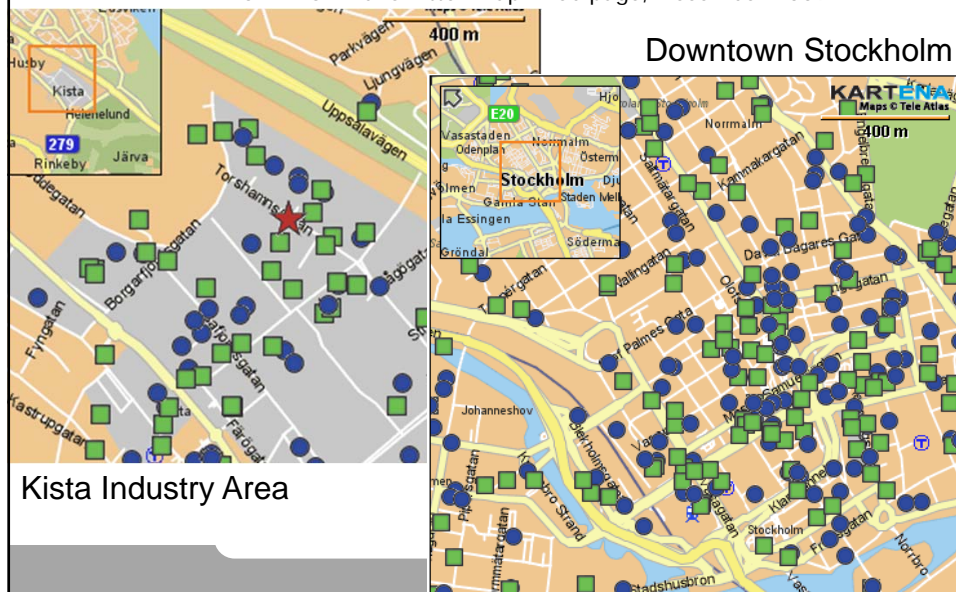
Capacity, cost and cost structure



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Base station site location in urban areas

from PTS "Transmitter map" web page, December 2009



Examples of Base station densities (Urban areas in Sweden)



<i>Name and type of area</i>	<i>Total density of sites</i>	<i>Typical densities for operators</i>
Residential area in Uppsala	~6 per km ²	1-3 per km ²
Residential area Akalla	~14 per km ²	3-5 per km ²
Central part of Uppsala	~20 per km ²	3-8 per km ²
Industry area Kista	~50 per km ²	7-20 per km ²
Central part of Stockholm	~130 per km ²	20-40 per km ²

Compare network sharing year 2000 and year 2010



- 2000
 - Many new base station sites were needed
 - Radio capacity relatively expensive
 - Capacity demand was relatively low
 - No shortage of spectrum
- 2010
 - Many base station sites exist
 - Cost of radio capacity has decrease dramatically
 - Capacity demand is increasing
 - Amount of spectrum is important