Femtocells - Building the Quality Network for Mobile Operations - Oct 2010

From coverage to quality: building the future network

represented by:
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on behalf of the
Center for Wireless Innovation Norway
CWI Norway (http://cwin.no)

Outline

- Network capacity requirements
  - need for doubling the capacity of the mobile network
  - including customer equipment
- The core network challenge
  - indoor coverage for
- Analysis and experience
  - current models are not sufficient for Beyond3G
  - the academic offer for a Norwegian project

Diverged Traffic & Revenue Growth

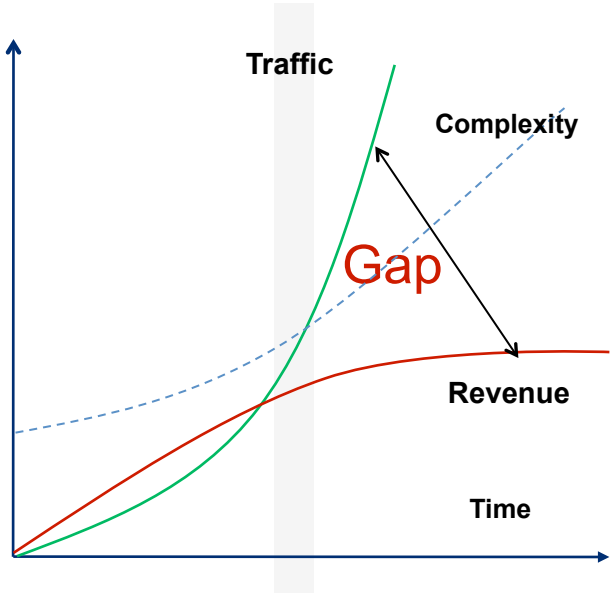
- ✓ **From Kilo (10^3) bytes to Tera (10^{12}) and Zeta (10^{21}) bytes**

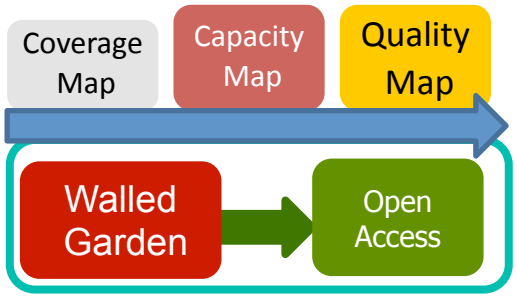
- ✓ Global ubiquitous Internet-based solution with hyper Connectivity
- ✓ Hundred-fold increase in network flow brought by mass terminals and mass digital content, and the thousand-fold, increase in traffic flow on mobile networks

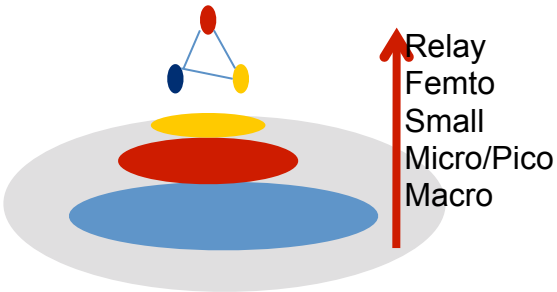
- ✓ Users are spending more time on the phone & internet
- ✓ Average household spending on communication falls
- ✓ Consumer pay less while getting better value -> they pay ~30% less than 5 years ago

- ✓ Significant growth in traffic while slow in revenue
- ✓ User experience at risk

- ✓ What do we do with a surging traffic
  - Limit/control it?
  - Turn it to revenue?
  - Bring the cost of it down?





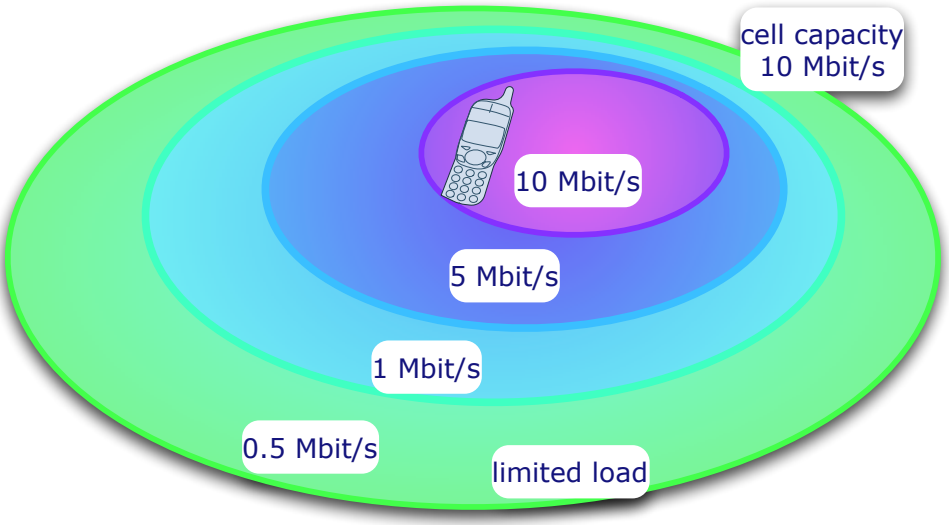


Cost reduction is a very critical aspect of the future networks. Telecom seems to be the only sector delivering price decrease

[source: Sharam G Niri, 2010] (adapted)

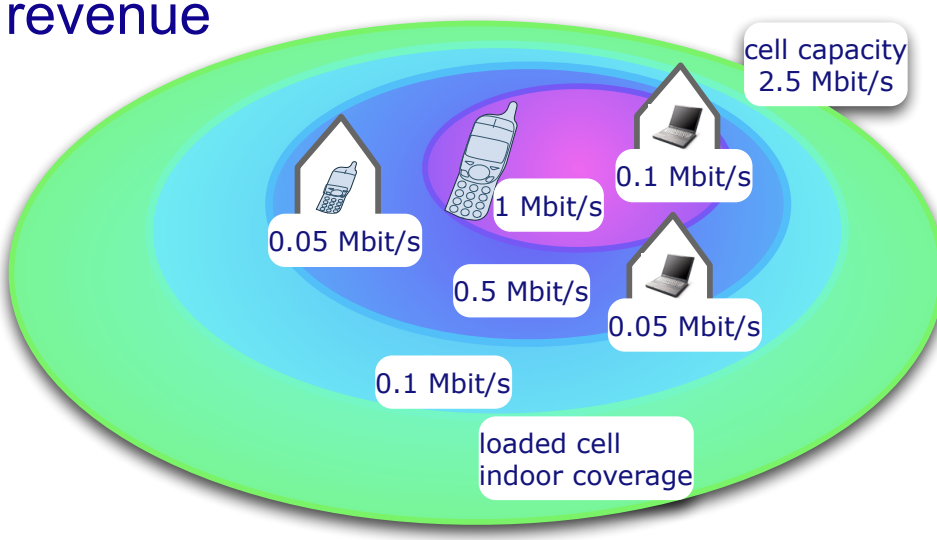
5G access - business considerations

- The radio dilemma
  - outdoor to indoor



"coverage cell"

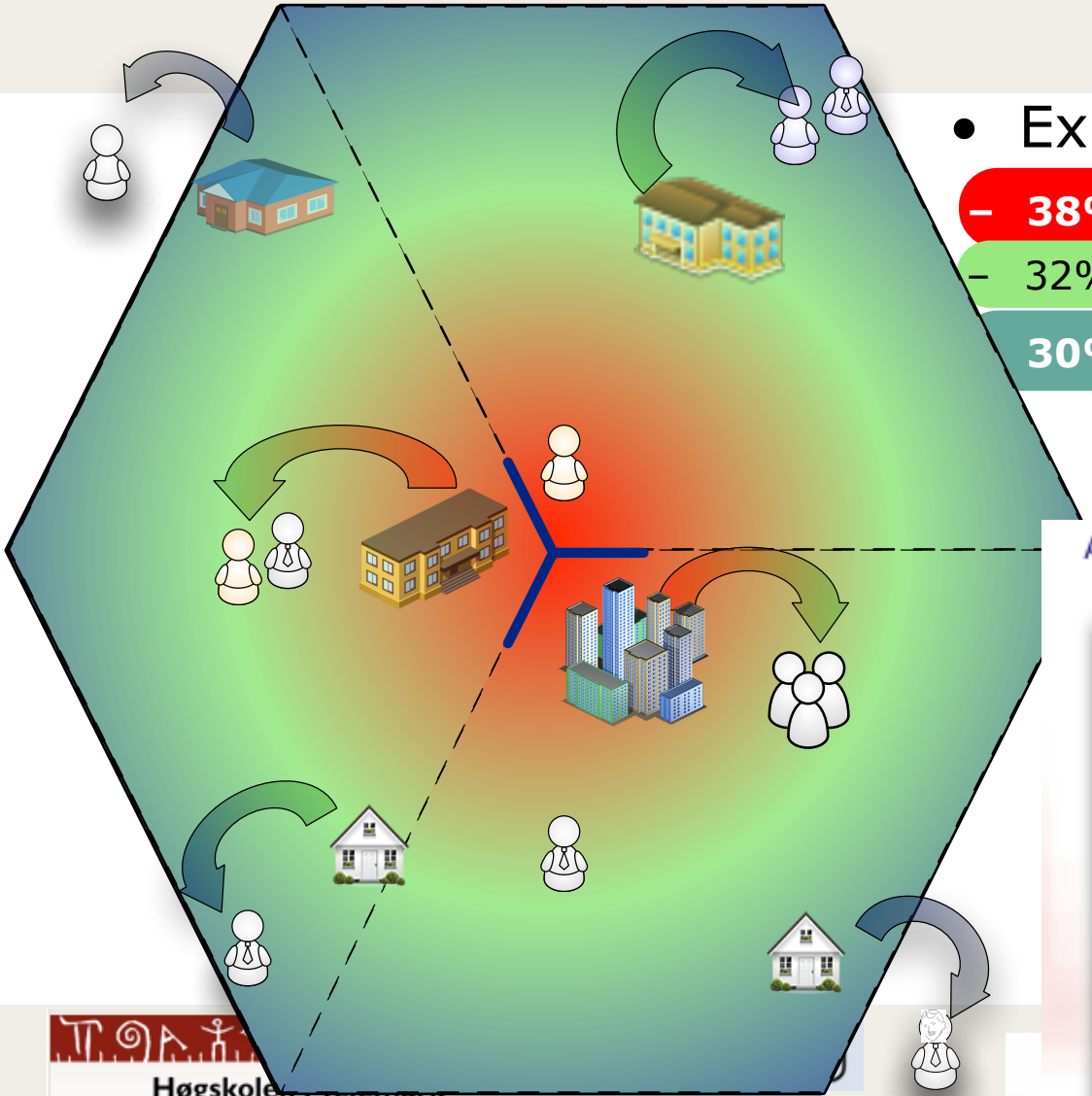
- The business dilemma
  - 5G access is expensive (range)
  - changing access means loosing revenue



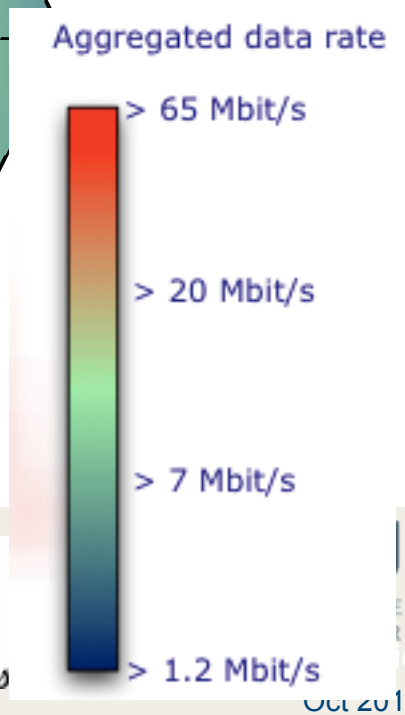
"70-80% indoor usage"

[drawings: Jørgen Grinnes, Telenor, 2010]

Real network usage



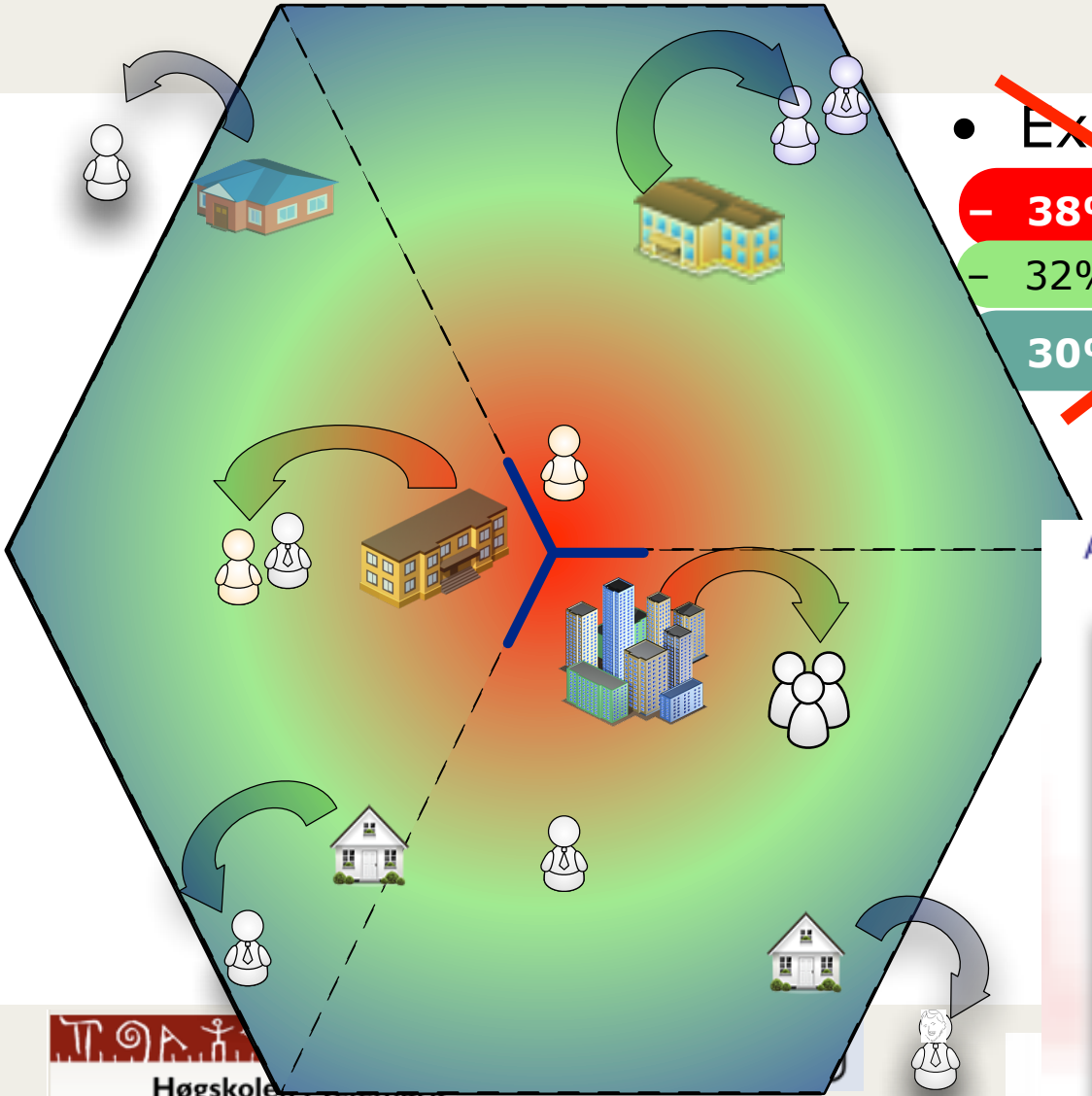
- Expectation [Motorola 2009]
  - **38% of users > 20 Mbit/s**
  - 32% of users 7...20 Mbit/s
  - **30% of users 1.2...7 Mbit/s**



70% indoor users means 30% ed

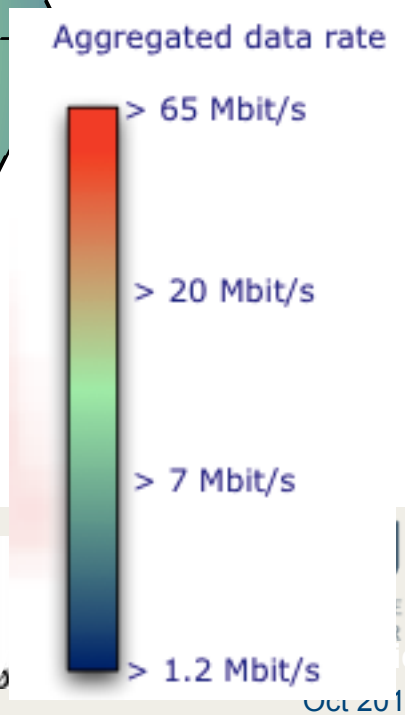
ed users

Real network usage



- Expectation [Motorola 2009] | Reality
  - 38% of users > 20 Mbit/s | 16%
  - 32% of users 7...20 Mbit/s | 17%
  - 30% of users 1.2...7 Mbit/s | 32%
  - | 35%

- no femto
- indoor usage



70% indoor users means 30% ed... ...ed users

Open issues and
Suggestion for Project

- Realistic values for
  - usage pattern for LTE (>90% indoor?)
  - current models are not sufficient for Beyond3G
  - core network capacity reduction due to indoor usage

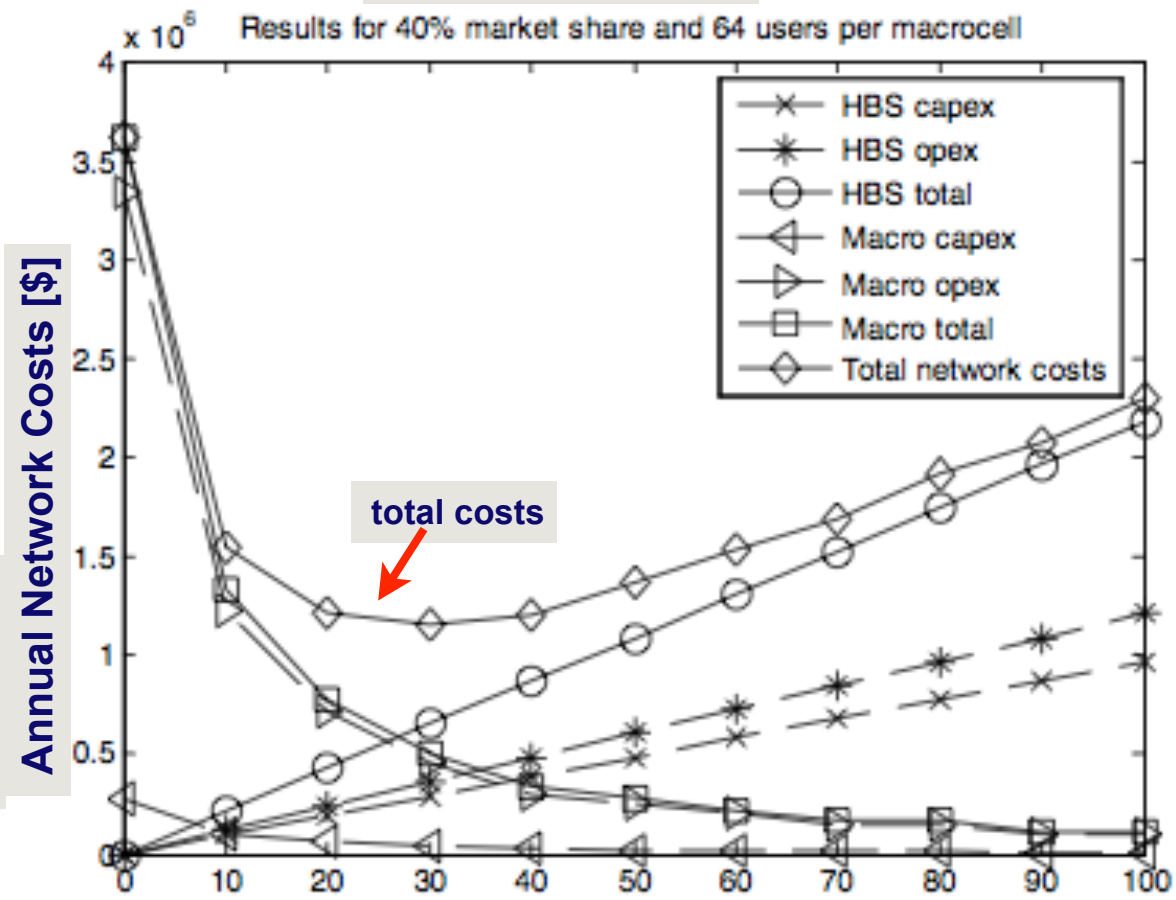
- The business perspective for femtocells
  - Single operator cells versus multi-operator cells
  - Regulation, frequency, interference
  - User-managed femtocells

- Academia can support
  - stress-testing the outdoor network
  - Outdoor-indoor
  - Femtocell coverage and interference

Femtocell equipment:
Rate of return on capital 5%
Term of loan 15 years
CapEx cost of one home BS - 350 $
Core network packet router CapEx per BS - 77$
Maintenance cost as a fraction of CapEx 12%/year

Business perspective of Femtocells

40% market share



percentage of customers with home-BS

OpEx and CapEx calculations based on "free provisioning" of home base stations

[source: H. Claussen, 2007]

Business perspective of Femtocell

CELL PHONES / VOIP

June 30, 2010 8:30 AM

Operators Ready to Open up Femtocells, Says Ubiquisys

By Mikael Ricknäs, IDG News

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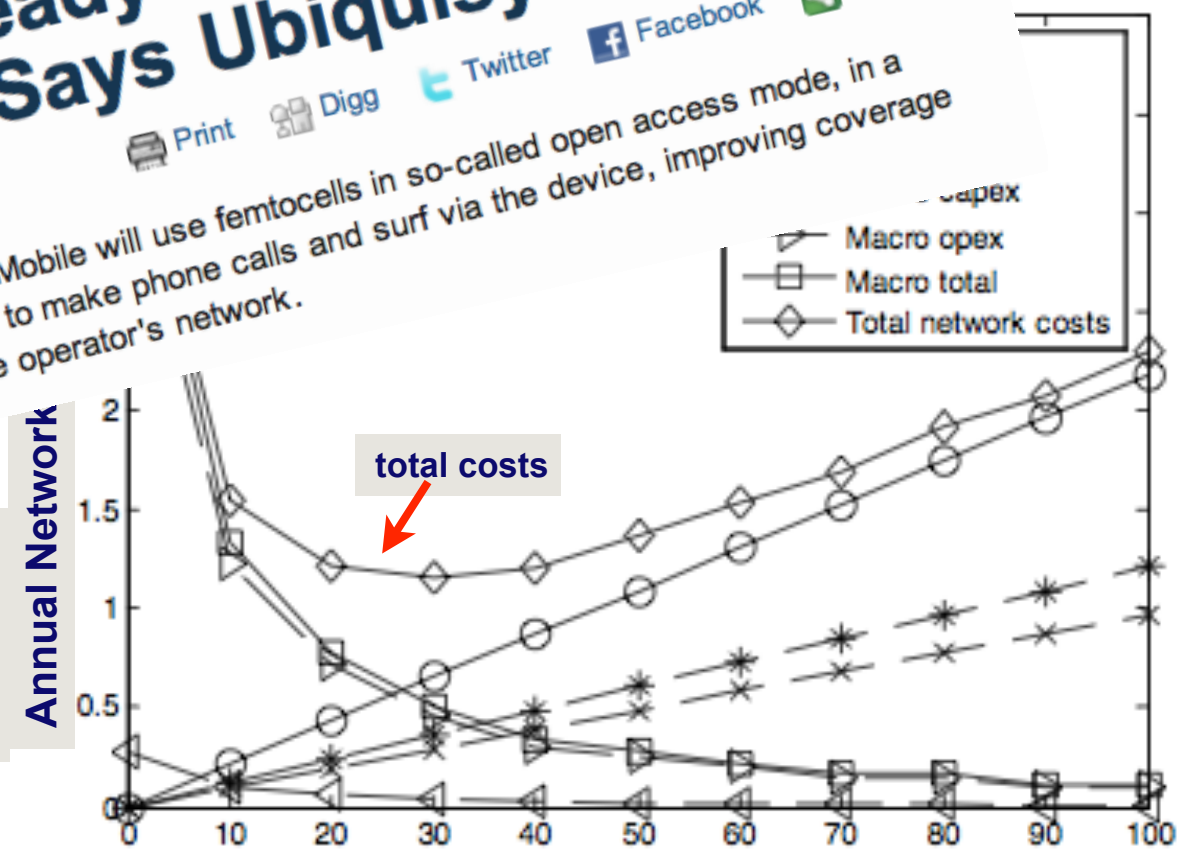
Japanese operator SoftBank Mobile will use femtocells in so-called open access mode, in a move to allow all subscribers to make phone calls and surf via the device, improving coverage and offloading traffic from the operator's network.



OpEx and CapEx calculations based on "free provisioning" of home base stations

[source: H. Claussen, 2007]

Total network cost reduction more

Conclusions

- 70-80% of indoor 3G from users

	expectation	reality
>20 Mbit/s	38 %	16 %
7-20 Mbit/s	32 %	17 %
1.2-7 Mbit/s	30 %	32 %

-35%

- Open issues
  - usage pattern for LTE (>90%?)
  - Reduction of network load through femtocells
  - user experience "where is my operator"
- Suggestion for national project

Thanks to

My colleagues at UNIK

- **Mohammad Mushfiqur Rahman Chowdhury** for 5G discussions and calculations
  - see tutorial ICWMC 2010 for whole picture
- **Arlindo Bengui André** for LTE work

My colleagues at CWI

- **Frank Reichert** for comments on 5G

Our cooperation partners at CTIF (Aalborg University)

- **Ramjee Prasad** for initiating the “discussion”

Our industrial partners

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- **Linda Firveld** from MobileMonday for femtocell industrialisation
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- and many, many more....

more info: "Collaborative Radio for 5G Mobile and Wireless Communications, ICWMC 2010 tutorial, Valencia, Sep 2010