Femtocells - Member Meeting - March 2010

The impact of indoor traffic on the business

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on behalf of the
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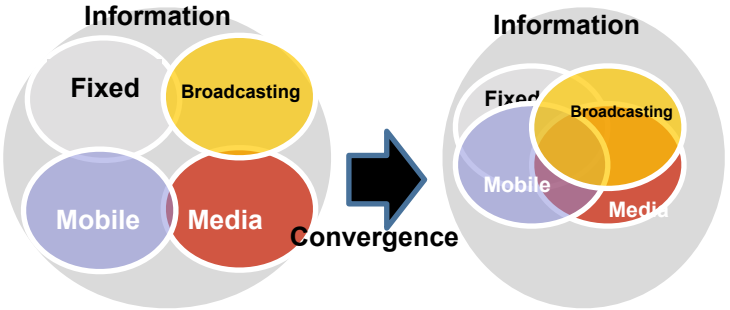
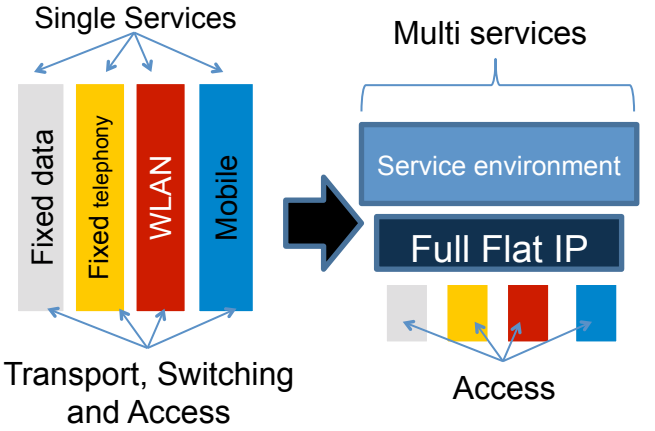
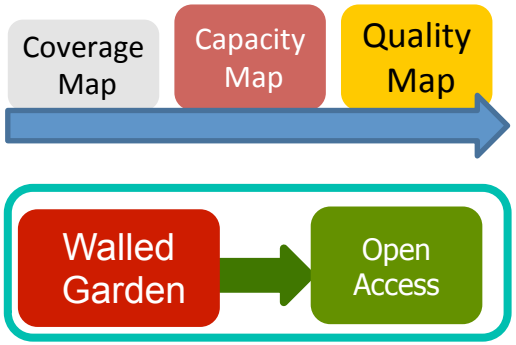
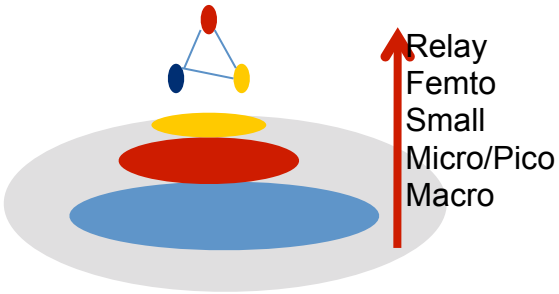
The Requirements Of Changing Industry - Networks

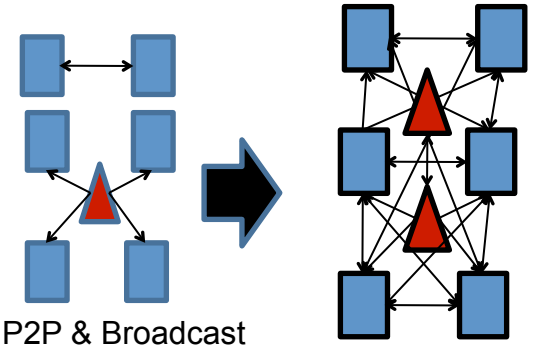
- ✓Blurring boundaries - convergence of telecommunication, information, broadcasting and media and publishing technologies
- ✓Change of vertical NWs for single service to horizontal NWs for multi service
- ✓Hyper connectivity (P2p, M2M)
- ✓New network deployment options
- ✓Walled Garden will change to Open Networks
- ✓High capacity and pipes with intelligent plumbing that could incorporate sophisticated quality control capability
- ✓Self managed and automated networks
- ✓Communication fundamentally delivered through SW on standards / generic HW







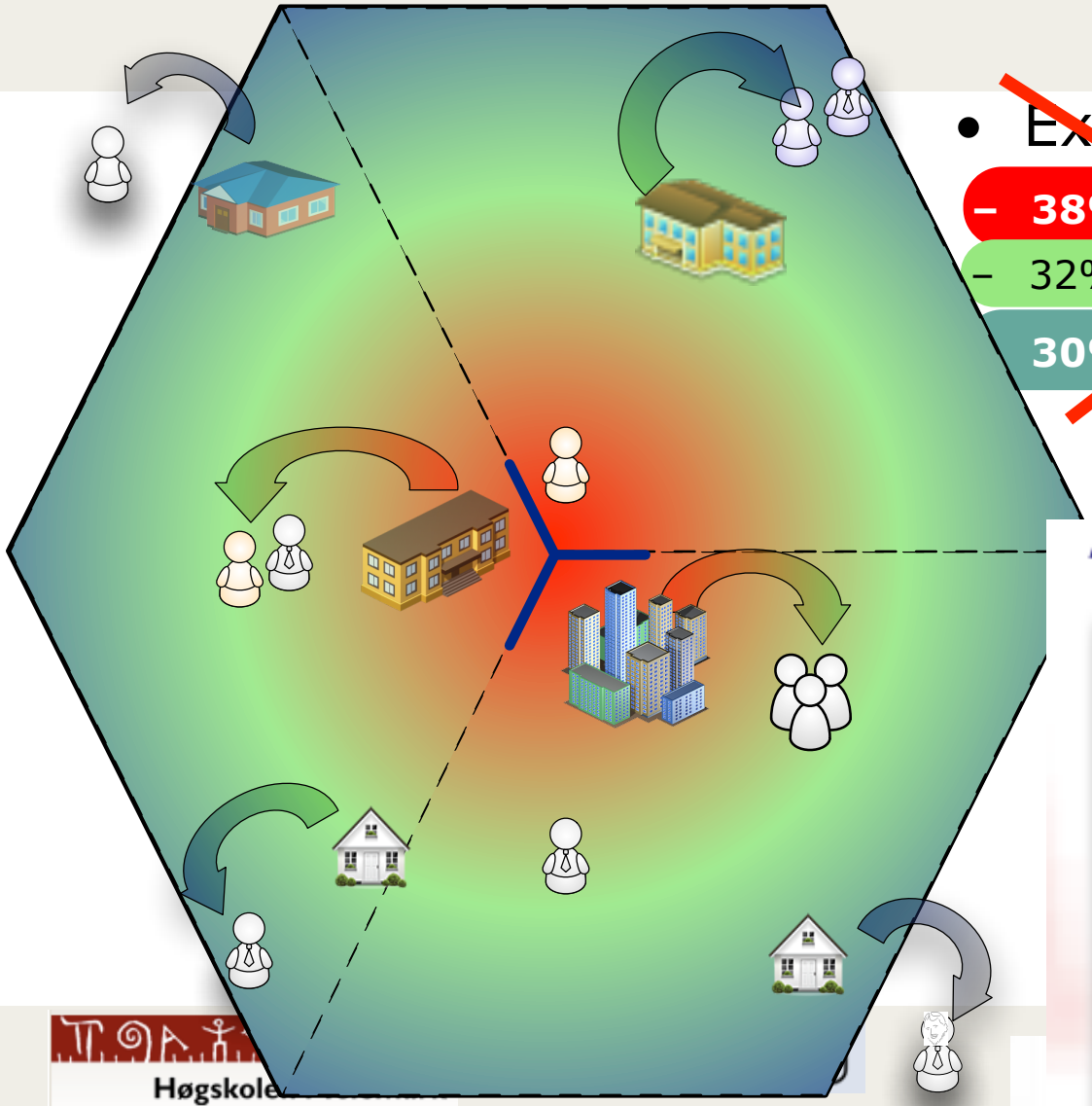




Next generation networks will grow in technical complexity

[source: Sharam G Niri, 2010]

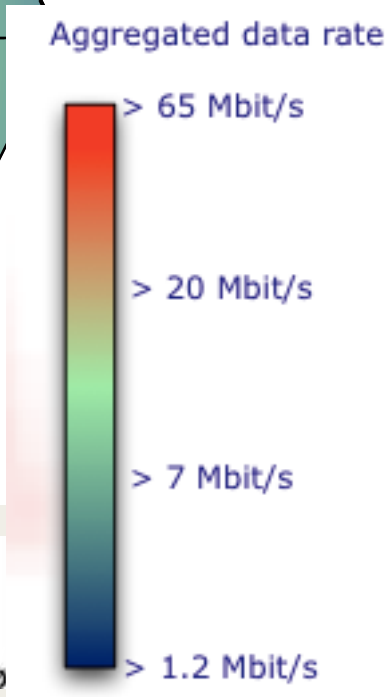
Real network usage



- 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

The Impact of Indoor usage based on LTE simulations

- LTE network simulator - 7 cells
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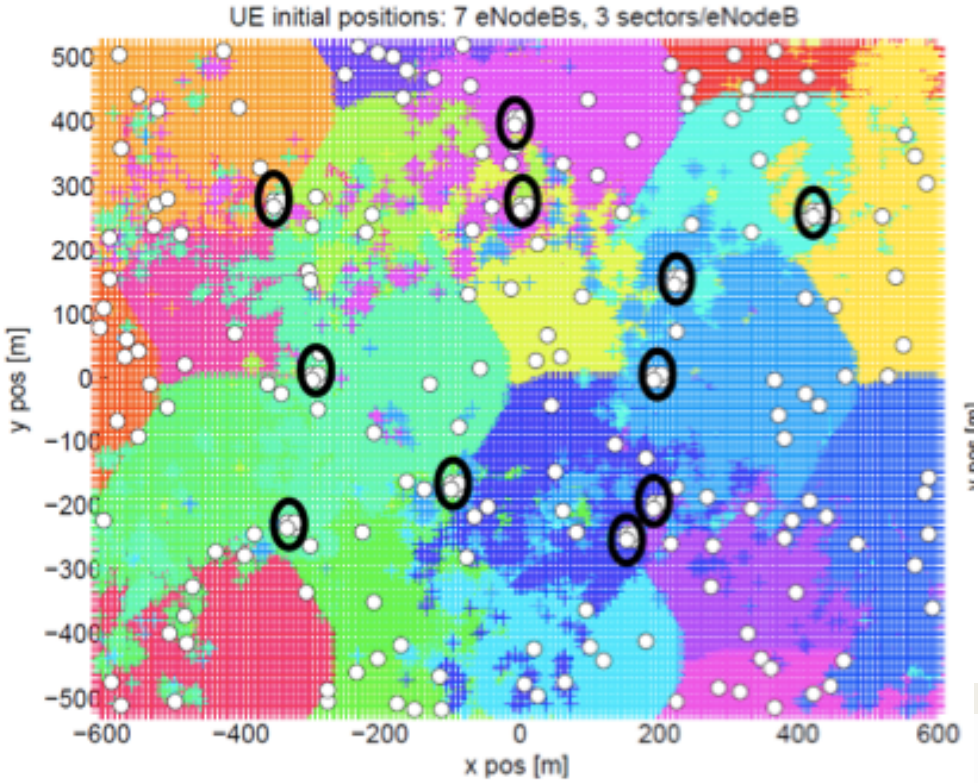


Figure 5: Users distribution for 20% indoor users

Table2: LTE Simulation Parameters

Parameter	Value
Frequency	2.0 GHz
Receiver noise figure	9 dB [2], [4]
System Bandwidth	10MHz
Thermal noise density	-174 dBm/Hz
Lognormal Shadowing	10dB
Inter eNodeB distance	500m
UE Power	23dBm
Macroscopic pathloss	128.1 + 37.6 log10(R) [5]
Average number of UEs per sector	10
eNodeB TX Power	46 dBm [2], [4]
Indoor Penetration Loss	20dB
UE speed	5 km/h
BS antenna gain	15 dBi [4]
Traffic type	Full Buffer Traffic
Cell Layout	Hexagonal grid, 3sectors/eNodeB

Simulation results

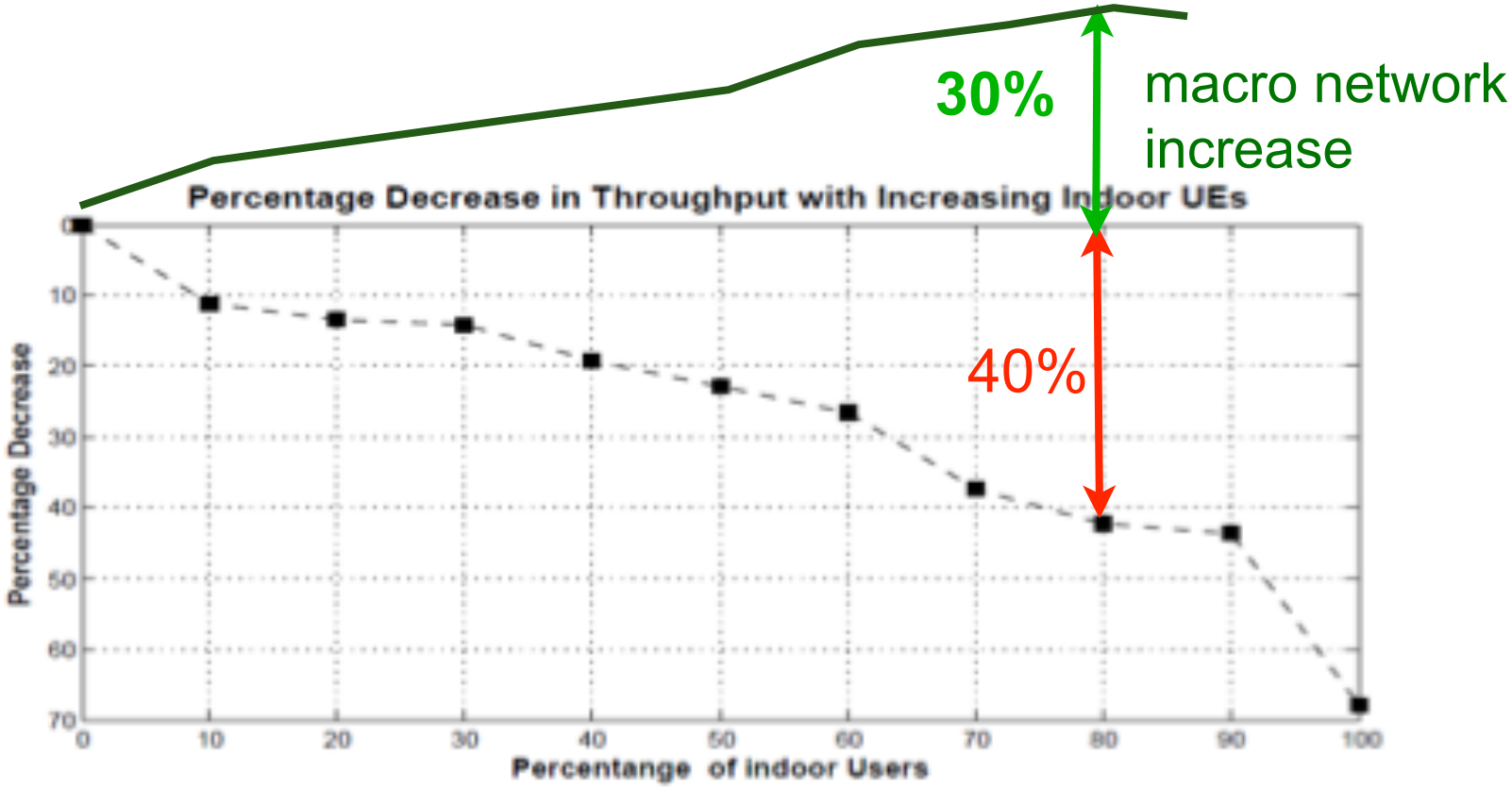
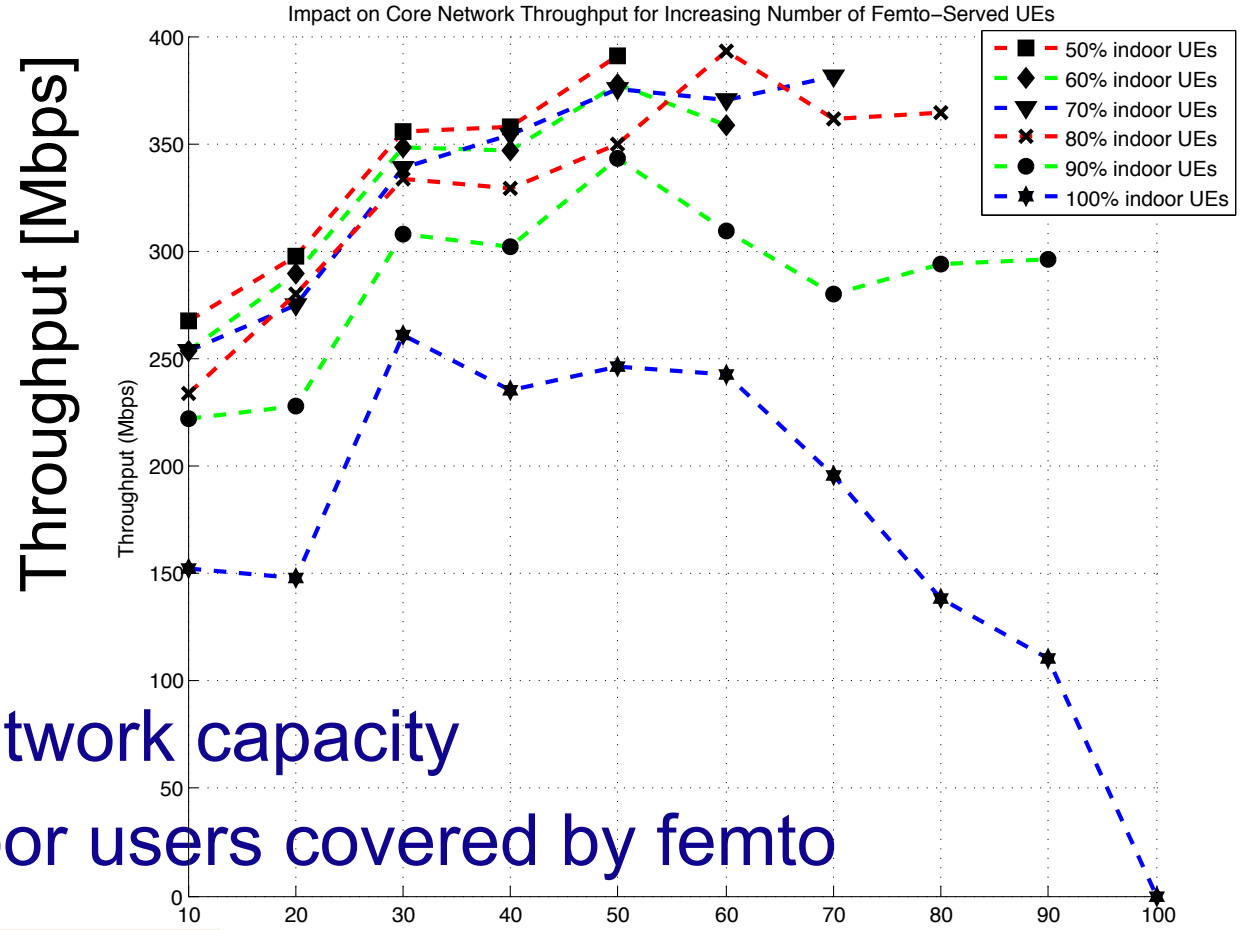


Figure 7: Decreasing Throughput by increasing percentage of Indoor users

Details of simulation



- Makro network capacity
- % of indoor users covered by femto

% of indoor users covered by Femto

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