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The Impact of Femtocells on Next Generation Mobile Networks



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Overview

- The Femto Forum
- Mobile broadband drivers
- Femtocells
 - Concept
 - Market status
- The case for LTE femtocells
 - Performance
 - Business Case
 - Services
 - Deployment Approaches
- Conclusions



The Femto Forum

- Promoting & enabling femtocells
- Not-for-profit, founded in 2007
- Independent, Inclusive, International

Aims

Ecosystem Development

Market Education

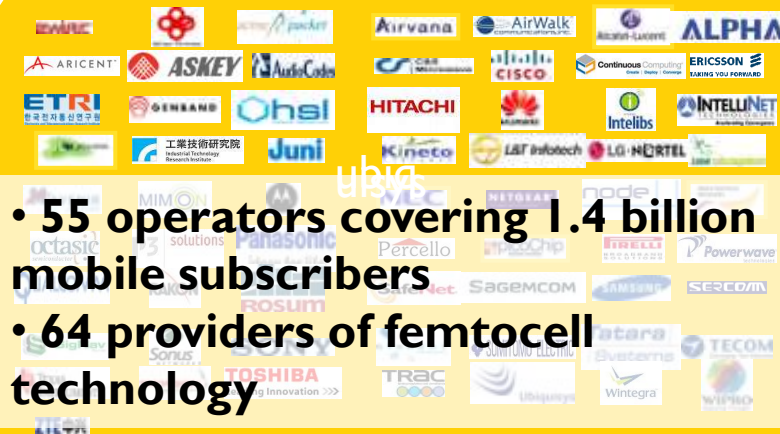
Driving open standards

Partnerships



driving convergence worldwide

Members



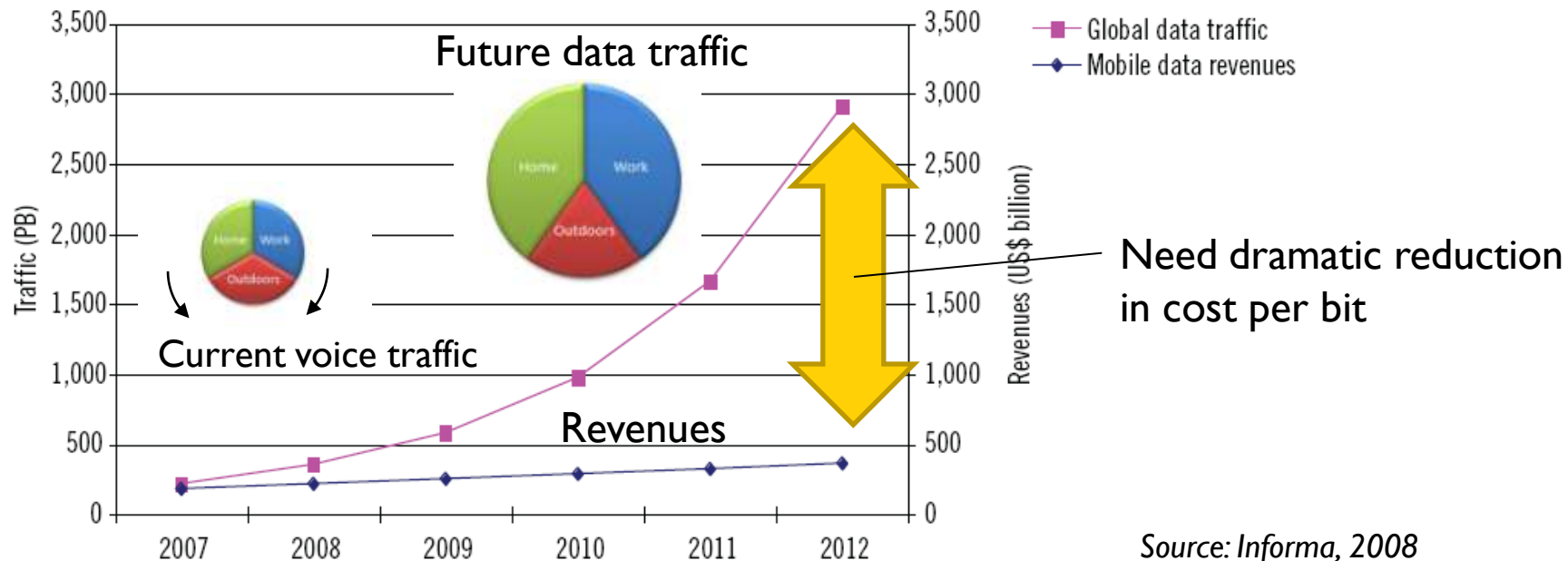
- 55 operators covering 1.4 billion mobile subscribers
- 64 providers of femtocell technology



A compelling and urgent need

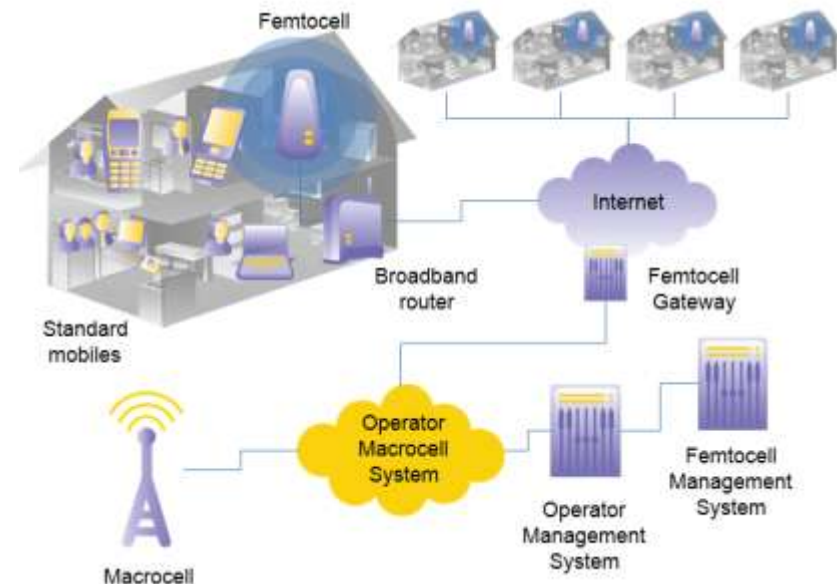
- Substantial growth in mobile broadband data revenues
- But much faster growth in data volumes and changes in traffic patterns
- Must find ways to dramatically reduce cost-per-bit

Figure 1.4: Global mobile data revenues and traffic, 2007-2012



What are femtocells?

- Low-power access points...
 - ...using mature mobile technology
 - ...in licensed spectrum
 - ...generating coverage and capacity
 - ...over internet-grade backhaul
 - ...at low prices
 - ...with full operator management
 - ...self-organising, self-managing



Generic Femto Network Architecture

- Applications include:

- Residential
- Enterprise
- Hot spot
- Metro

Standards for:

- UMTS (*Release 8*)
- LTE (*Release 9*)
- CDMA
- WiMAX

Femto Forum Progress

Overcame barriers to early market adoption

- Achieved harmonisation of architectures for WCDMA
- Interference management study created certainty of capacity and quality enhancements
- Achieved consensus on management protocols
- Delivered business model, demonstrating business case in wide range of situations
- Increased clarity of regulation
- Supported the first femtocell standards

Femto Forum members see eye-to-eye on femtocell architecture

London, UK – 21st May 2008

**...important progress towards harmonizing the integration of femtocells into mobile networks.
...agreed the principles for interoperability...**



Femto Forum Adopts Proven Protocol for Femtocell Management

London, UK – 16th July 2008

Members agreed to implement the Broadband Forum's TR-069 protocol, as the basis for the management protocol for femtocells in 3GPP standards

Femto Forum Market Status Report

- 2009 has been the year of initial launches
- Reflecting the accelerating market, Femto Forum recently launched its market status report
- Available from www.femtoforum.org
- Updated regularly
- Includes:
 - Commercial services
 - Industry ecosystem
 - Market forecasts
 - Standards development
 - Regulatory developments



The Flourishing Femtocell Ecosystem

End to End Solutions



Components & Software



Femto Access Points



Femto Core Network



Others



Product Showcase

Welcome to the Femto Forum's Product Showcase which features the commercially available products of our member organisations.



- Femto Forum Femtocell Product Showcase launched recently
- Features dozens of real products by member companies

Standards Progress



- April 2009: Release 8 provided end-to-end UMTS standard (Home Node-B), with Broadband management data model
- Release 9 provides feature enhancements for UMTS and first end-to-end LTE femtocell (Home e-NodeB) support



- Phase I cdma femtocell standard released Q1 2010
- Phase II features are under consideration now



- Phase I completion Q1 2010
- Phase II to include advanced network features and air interface optimization

- Femto Forum is actively supporting all three activities



Regulation

- Femto Forum regulatory white paper
- Regulators recognising and acting on femtocells
- Risks of hidden hurdles and slow action remain

Regulator	Progress
European Radio Spectrum Committee	Concluded that existing national regulations should support femtocells
Japanese Ministry	Revised regulations in December 08 to be femtocell-friendly
Ofcom (UK)	Proposed changes to spectrum regulation in June 09 “[Femtocell] technology ...has the potential to enable new forms of competition across communications networks: fixed-mobile convergence.”
ITU-R	Recognised description of “Femto Access Node” in August 08
FCC (US)	Chairman stated FCC will encourage use of femtocells in October 2009
MIIT (China)	Director of State Radio Regulatory Committee stated “Femtocell is worth to be adopted, and worth to be promoted greatly”

Committed Commercial Services

8 Operators in 3 Continents

Operators	Offering	Technology	Launch Date
	3G MicroCell	HSDPA	September 2009
	Network Extender	cdma 1xRTT	January 2009
	Home Zone	HSDPA	November 2008
	Airave	cdma 1xRTT	September 2007
	Access Gateway	HSDPA	July 2009
	My Area	HSDPA	November 2009
	IMS based Femtocells	HSDPA	January 2009
	3G Inn	HSDPA	November 2009

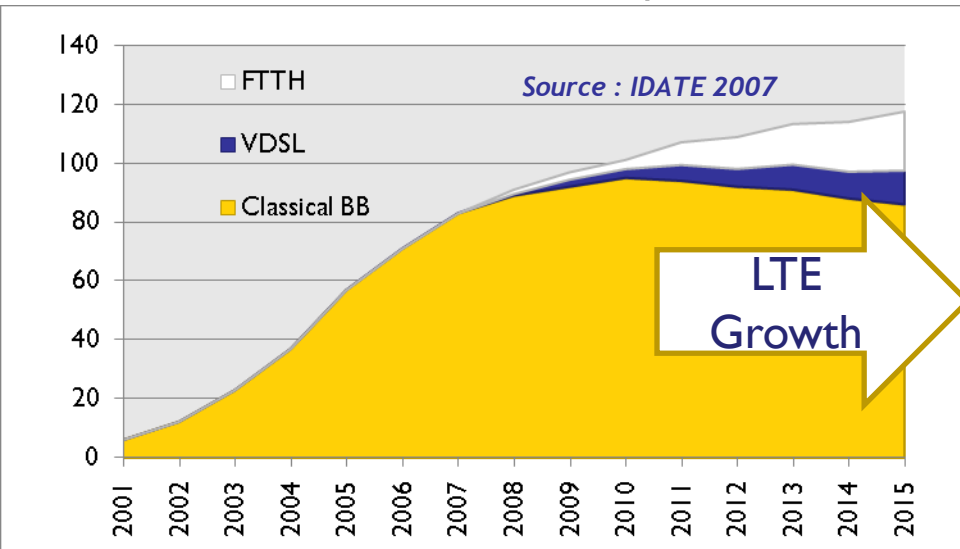
Market Forecasts

- Femtocells to reach addressable market of \$2.4bn, over 18m units shipped, market for systems integration over £360m by 2013 *America's Growth Capital, July 2008*
- WCDMA femtocells market \$2.2 billion by 2012. 30% of 3G networks will deploy femtocells by 2010, rising to 80% by 2012 *Rethink Research, April 2008*
- Global equipment revenues growth CAGR of 126 % from 2008 to \$4.9 billion, integrated home gateway shipments exceed 23 million units in 2012 in 2012 *Forward Concepts March 2008*
- Femtocells deployed by end of 2013 to exceed 40 million, 22 million units added in 2013, offloading up to 8 per cent of total mobile traffic *Informa, September 2008*
- 39.97 million femtocells deployed by end 2014, serving 132 million subscribers *ABI research, Oct 2009*
- Sales of FMC network element equipment and femtocell equipment grow at healthy rate through downturn, to \$8 billion worldwide by 2013 and worldwide growth 160% CAGR from 2008 to 2013 *Infonetics March 2009*
- Femtocell based 3G service revenue \$9bn per annum by 2014 *Juniper Research, June 2009*

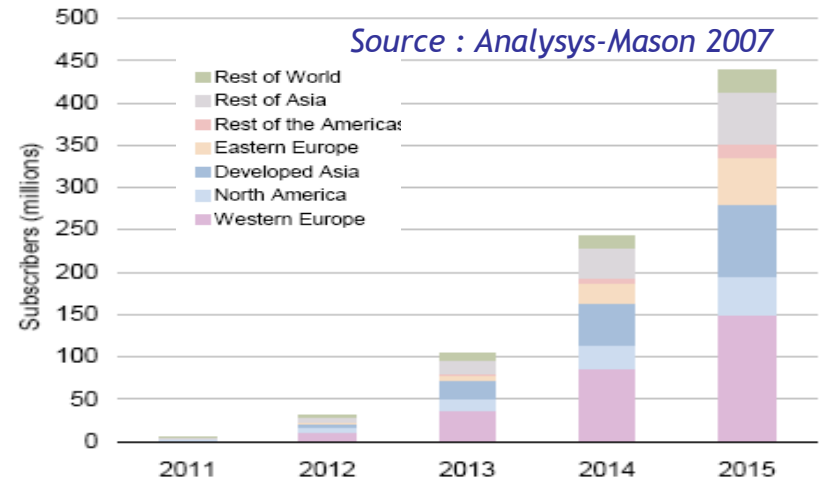
Backhaul Availability & Bit Rates Growing Rapidly

- In all regions, progressive evolution to higher rates is predicted, with major growth in the period for LTE introduction
- This will differentially favour early adopters of LTE
- Air interface rates exceeding backhaul rates are important to deliver responsive user experience
- Increasing proportions of traffic expected on home LAN, not involving backhaul

Broadband Connections in Europe

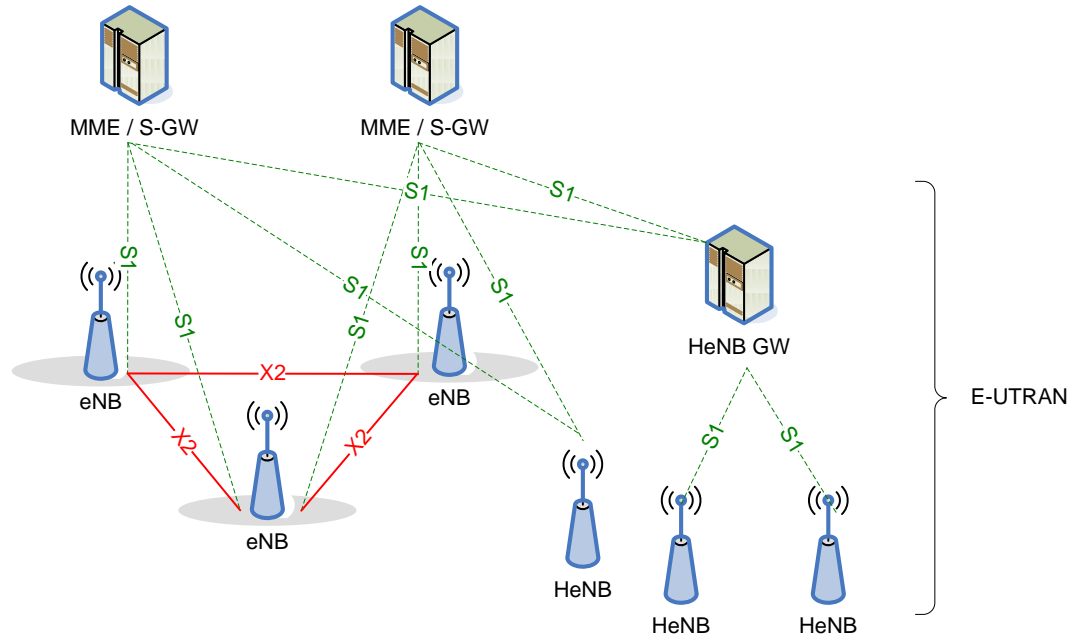


LTE Subscribers

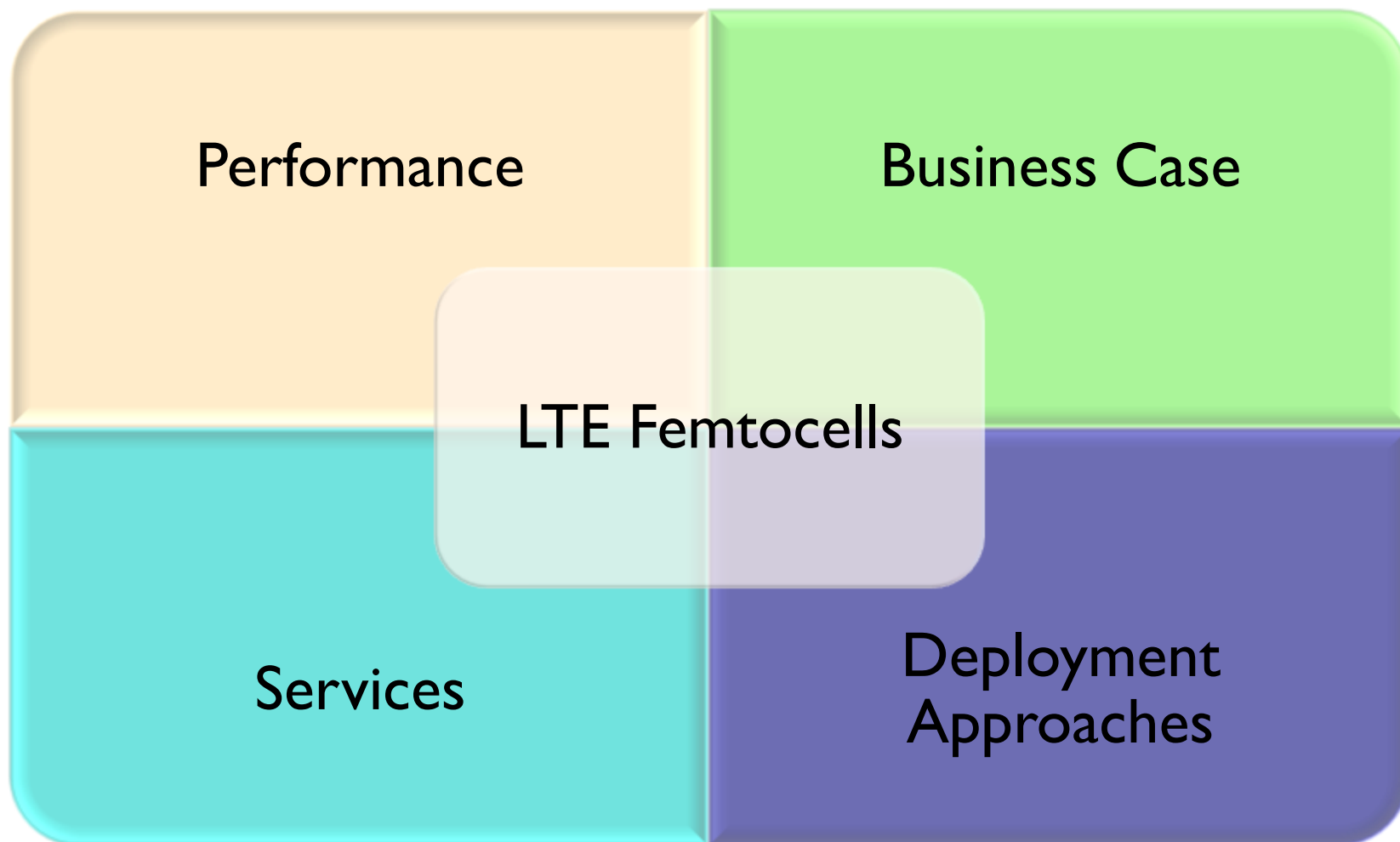


Architecture

- Femto/ HeNB fits well with flat Enhanced Packet Core architecture
- HeNB Gateway is optional and transparent, delivering concentration and scalability without sacrificing architectural simplicity
- Reuses standardized open management approach
- Femtocells form an essential element in the heterogeneous network ‘toolkit’ for LTE operators (no more one-size-fits-all approach)



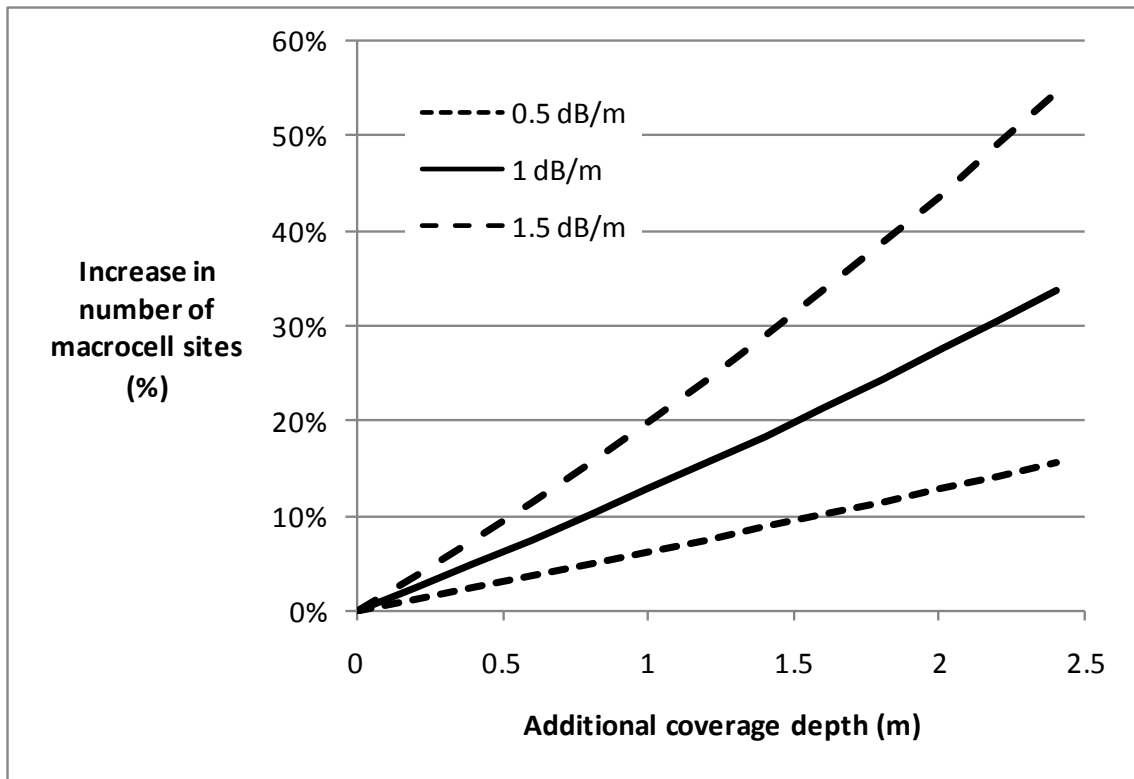
The Case for LTE Femtocells



Coverage: Outside in?

Increase in macrocell sites required for deeper coverage

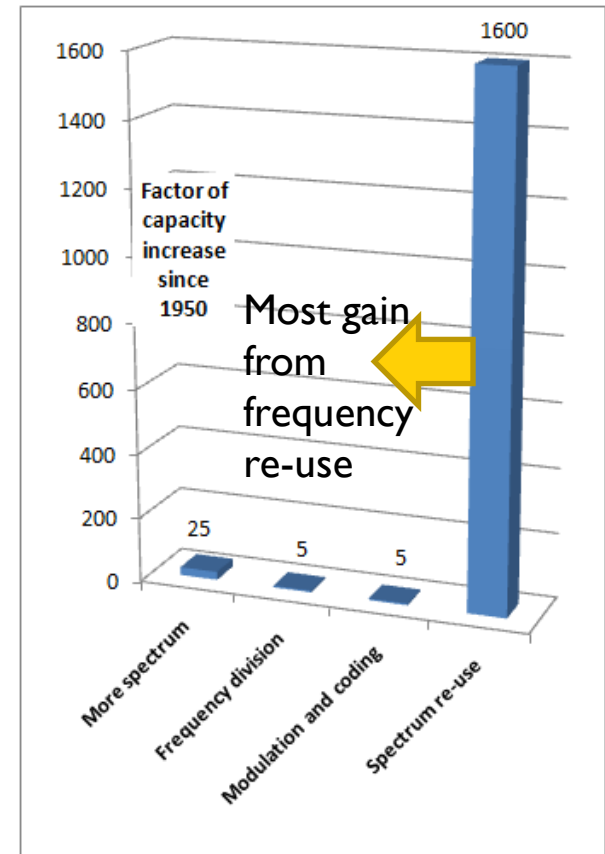
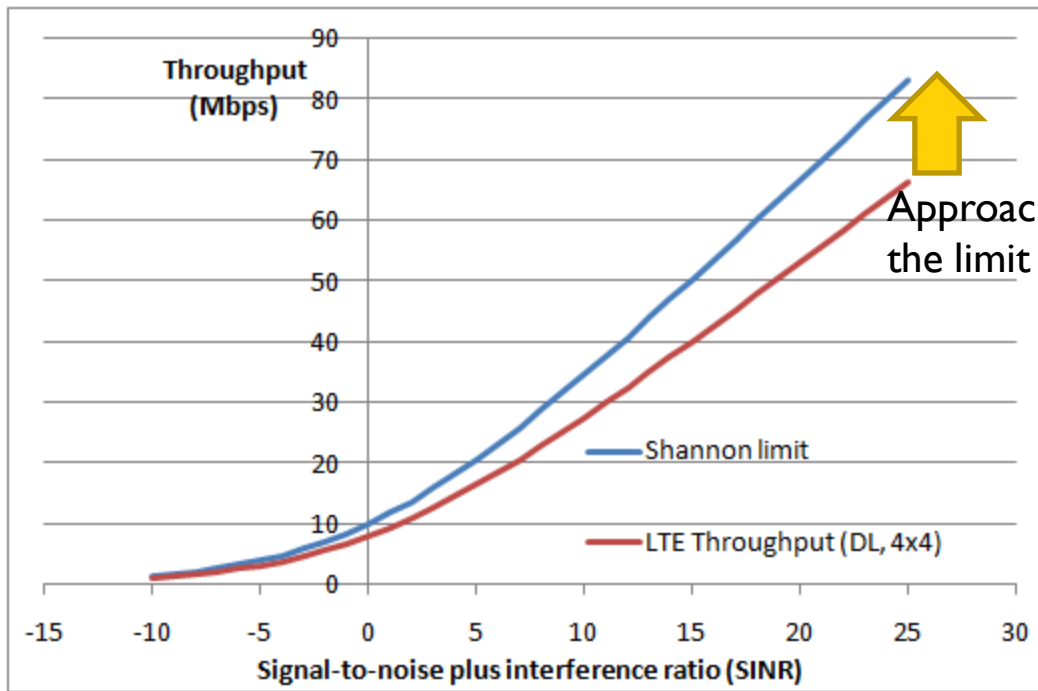
- Meeting the traffic demand from the outside inwards:
 - Macrocell site numbers need to increase very rapidly to provide indoor coverage for high-rate services
 - Domestic coverage is currently 'incidental', not planned
- Very costly: approx €308M for 1 metre extra coverage depth into building



Assumes 5,000 initial sites, €225k NPV per site, 1 dB/m internal penetration loss

Capacity – Reaching Limits?

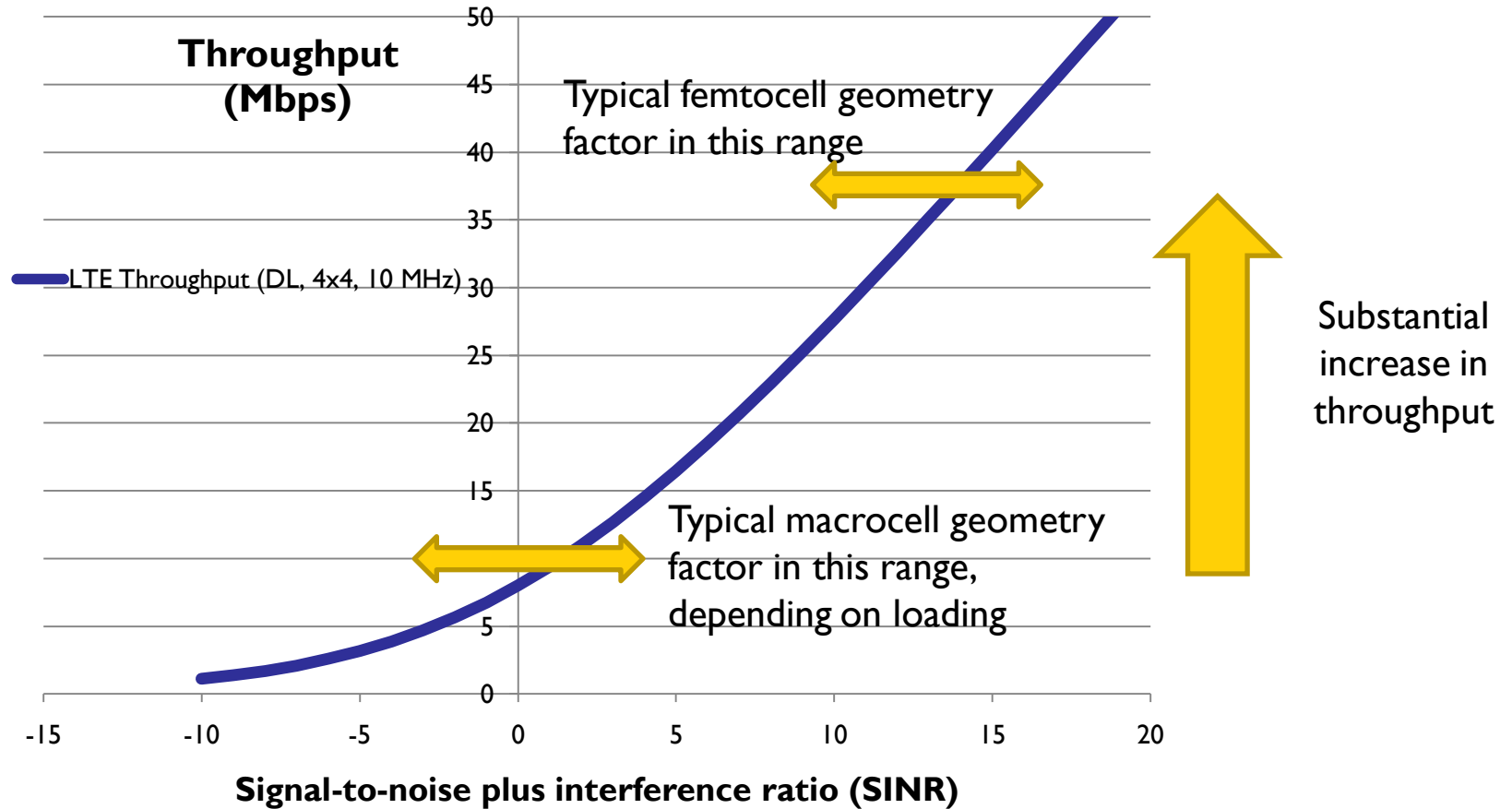
- Next-generation system performance is close to the Shannon boundry
- Cooper’s Law suggests that increasing the number of cells has always been the main means of adding capacity



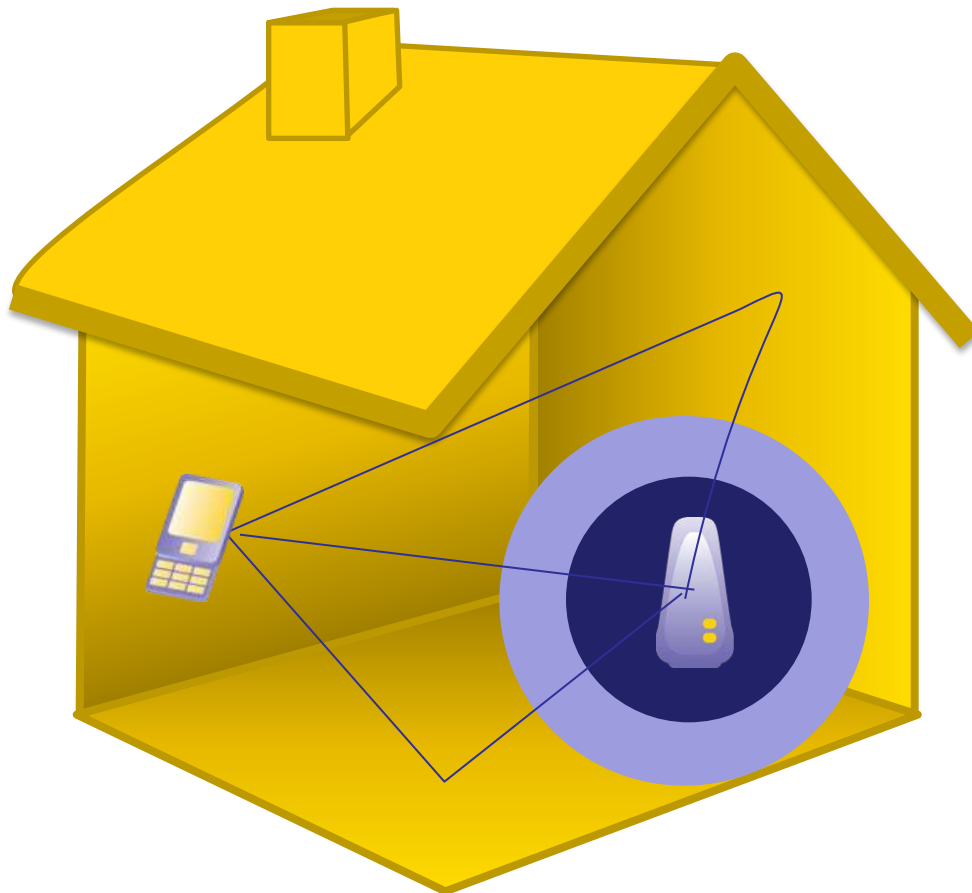
- Need *more cells* and *tighter interference control* to continue to increase capacity

Higher Rates from Lower Interference

- High SINR and low contention deliver near-peak rate performance throughout coverage area



LTE in femtocell environments



- Propagation environment:
 - Home provides site shielding from macrocell
 - Rich angular multipath and high SINR, maximising gains available from MIMO
 - Delivers high geometry factor (own : other cell interference)
- Allows LTE to work at its highest modulation rates and spectral efficiency, delivering great service to a large number of high-usage customers

Femtocells Enabling Customer Propositions



Great home coverage

Femtozone call tariffs for all

Fast data, high call quality

Unlimited data services

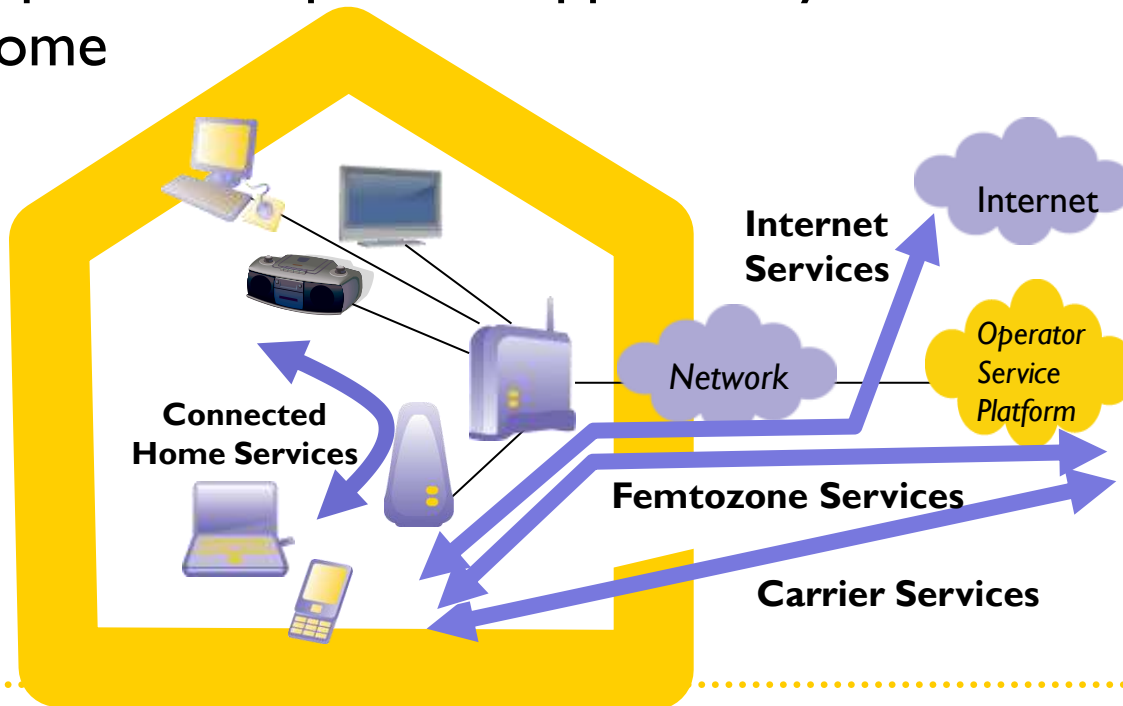
Compelling new femtozone services



With full operator management, in existing spectrum, at reduced cost-per-bit

Enabling Next-Generation Services

- Femtocell acts as a portal to in-home services and automation
- High-bandwidth connected-home services
- Femtocells deliver *presence, context & location*
- A powerful operator opportunity for mobile presence in the home



Business Case

Revenue impact

- New revenue streams from value-added services
- Location-specific tariffs without leakage
- Family contracts

Time-to-market

- Rapid deployment of LTE
- Rapid provisioning of new services

Cost savings

- Optimised macro roll-out
- Operational savings – especially power, backhaul, site rental
- Churn reduction – contract extension

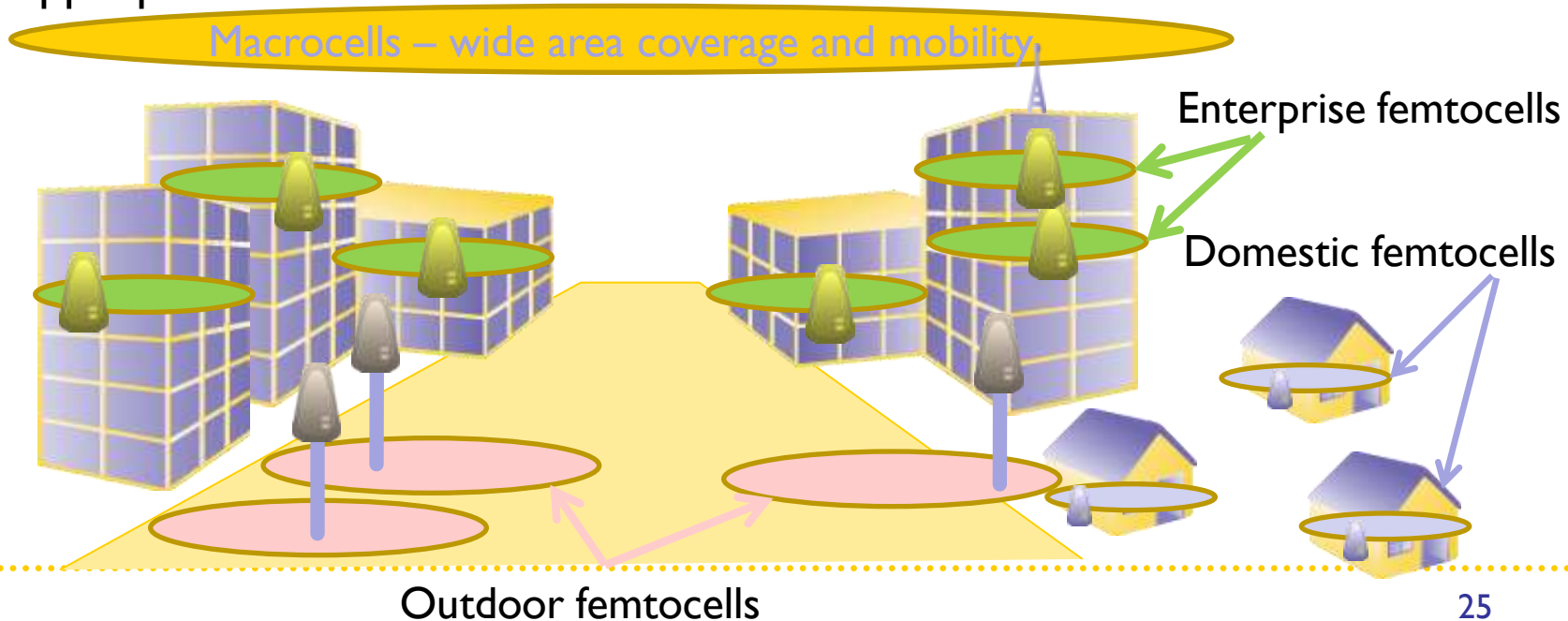
Substantial value to be created, challenging preconceptions of cellular economics

Self-organizing Networks

- Self-organizing network capability is crucial to meet the economics of mobile broadband demand growth with realistic revenue growth
- Femtocells deliver SON capabilities with 3G today:
 - Open interfaces
 - Standardized management protocol
 - No need for site-specific radio planning or optimization – but always within operator-set limits and with full control in extreme situations
- Enables delivery of many more cells in the network without increasing operational overhead

'Greater' Femtocells

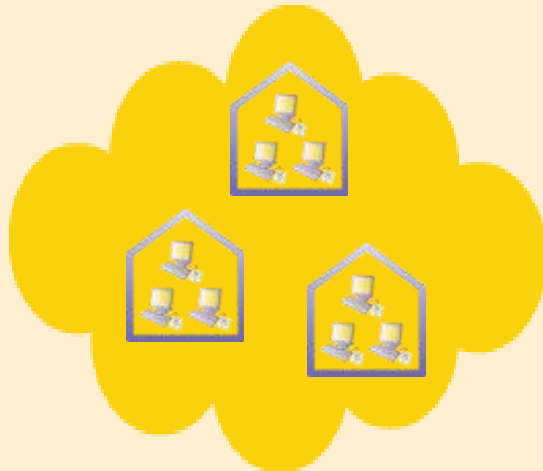
- Not only for the home!
- Femtocell economies of scale deliver cost-effective deployments in offices and in high-traffic or low coverage locations
- Femtos in the enterprise and metrozone
- Scope for cost-effective access to rural and developing markets via appropriate backhaul solutions



New Deployment Approaches

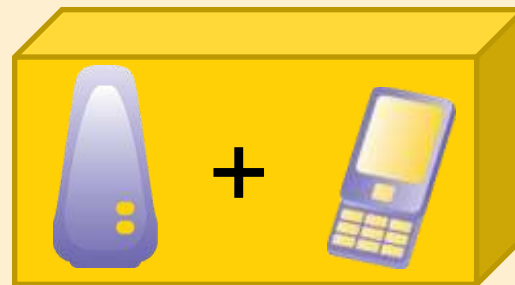
Femto-centric LTE Introduction

- Build femto first



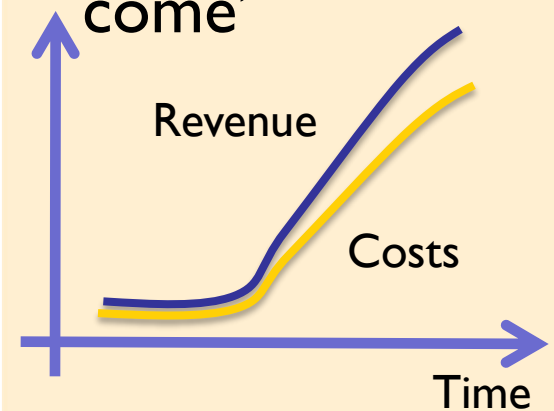
LTE femto quick-start package

- Provide LTE user device and femto to early adopters

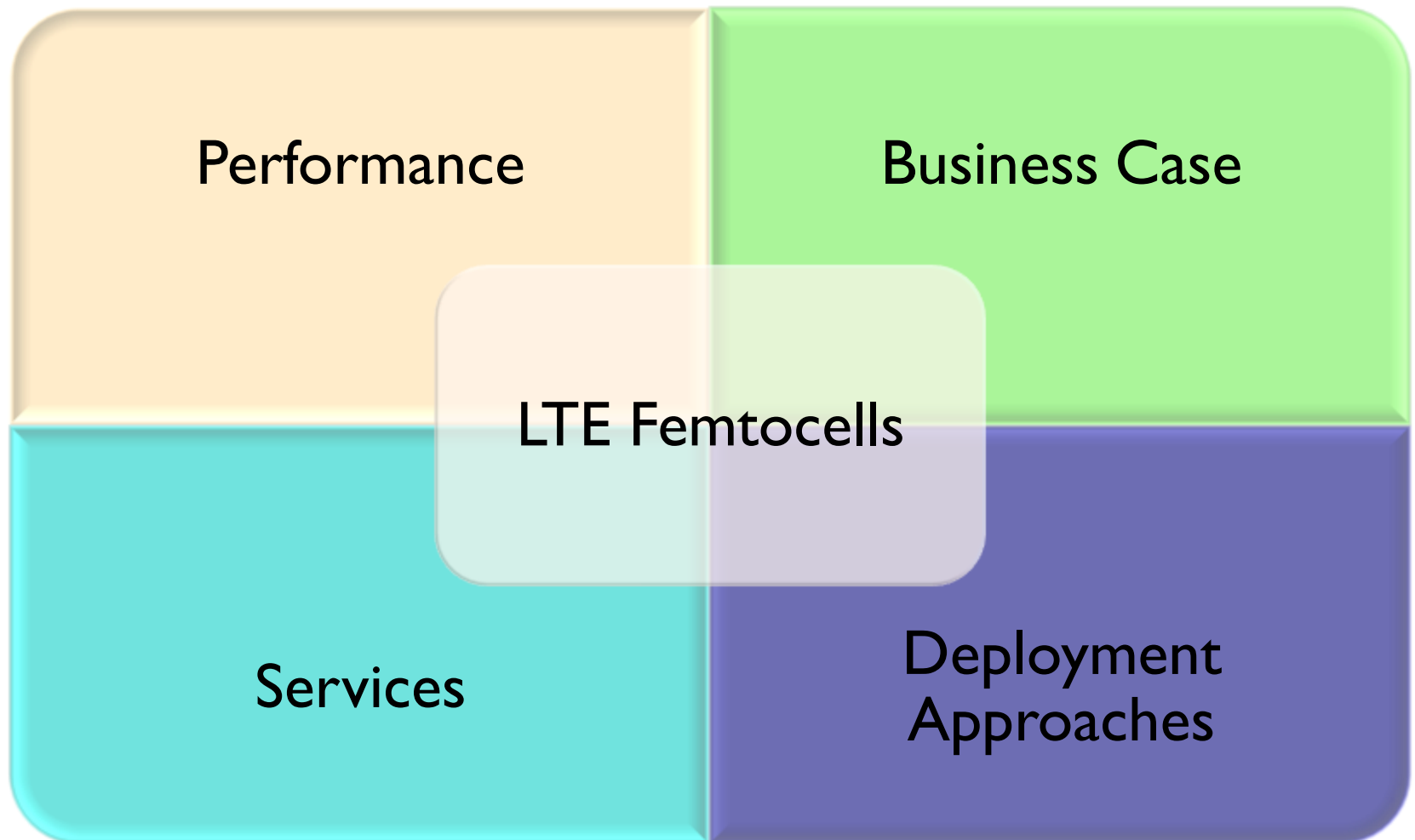


Matches costs to revenues

- Avoids 'build it and they will come'



Summary: LTE Femtocells



Conclusions

- There is a compelling case for LTE femtocells
- Femtocells have a key role in LTE services:
 - Speeds-up launch and deployment
 - Enables services that encourage adoption
 - Delivers superior performance where needed
- A key launch pad for new services: builds demand beyond the home and supports a business case for wider roll-out
- Enabling factors addressed via co-operation in standards bodies (3GPP, 3GPP2) and the Femto Forum

Femtocells enable *optimized LTE networks*

Forthcoming Events and Information



Femtocells World Summit
& Femtocell Industry Awards
London, 22nd-24th June 2010



China Femtocell Symposium, Beijing
7th – 8th September 2010



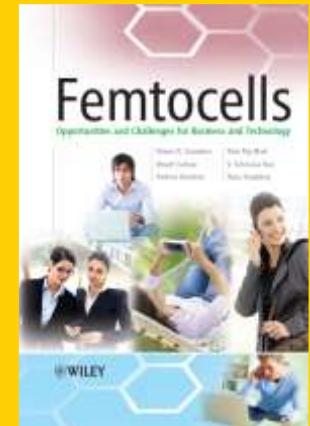
Femto Forum Plenary, San Francisco 28 September –
October 1st 2010



Femtocells Americas, Miami December 13-14

Further Info:

www.femtoforum.org



www.femtocellbook.com



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Thank you!



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