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Wi-Fi in Heterogeneous Networks (HetNets)

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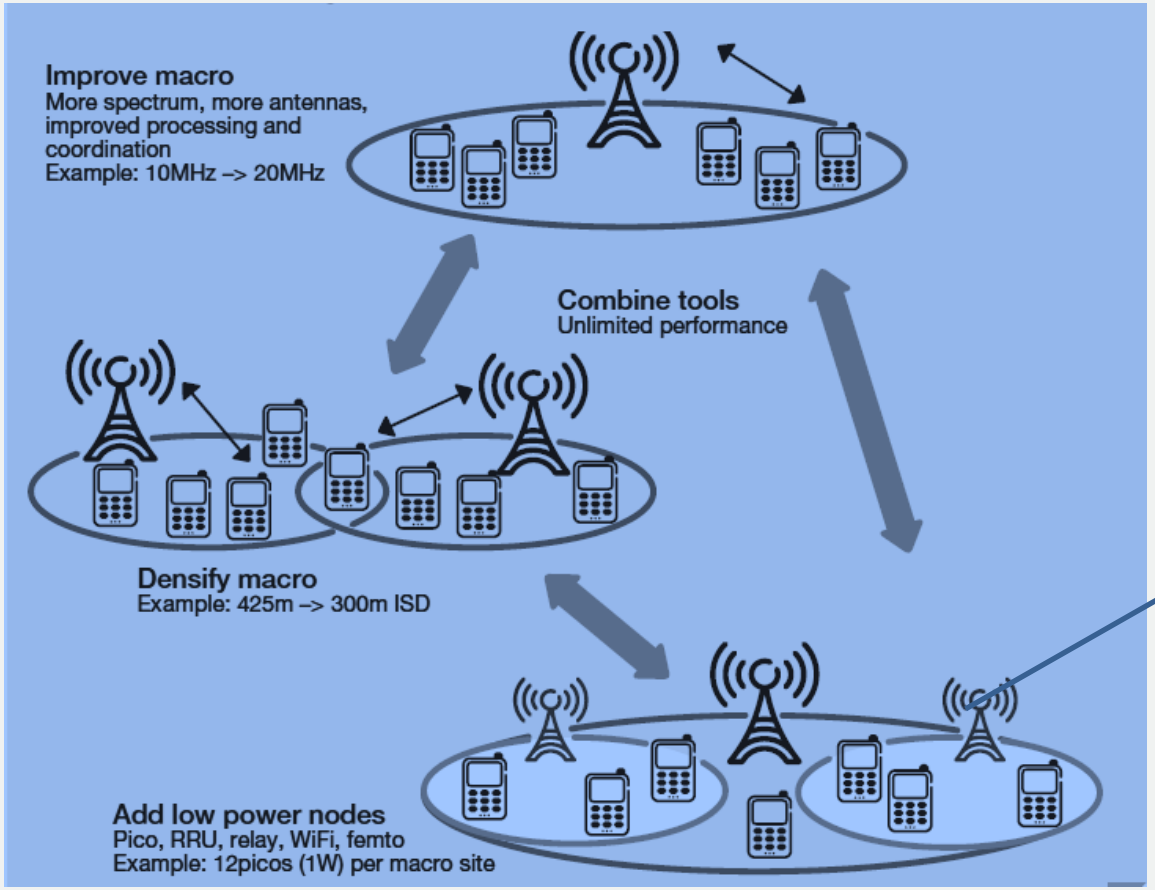
Outline

Technology and demand-side factors are driving small cell infrastructure deployments in cellular networks

- Mobile demand side trends
- Issues for Mobile Network Operators (MNO)
- Heterogeneous Networks (HetNets) and Wi-Fi
- Global and Australian developments
- Potential for Wi-Fi in HetNets in Australia

Macro cell mobile network evolution

Macro cell networks are evolving to small cell Heterogeneous Networks or HetNets'



A mix of WiFi and LTE small cell sites

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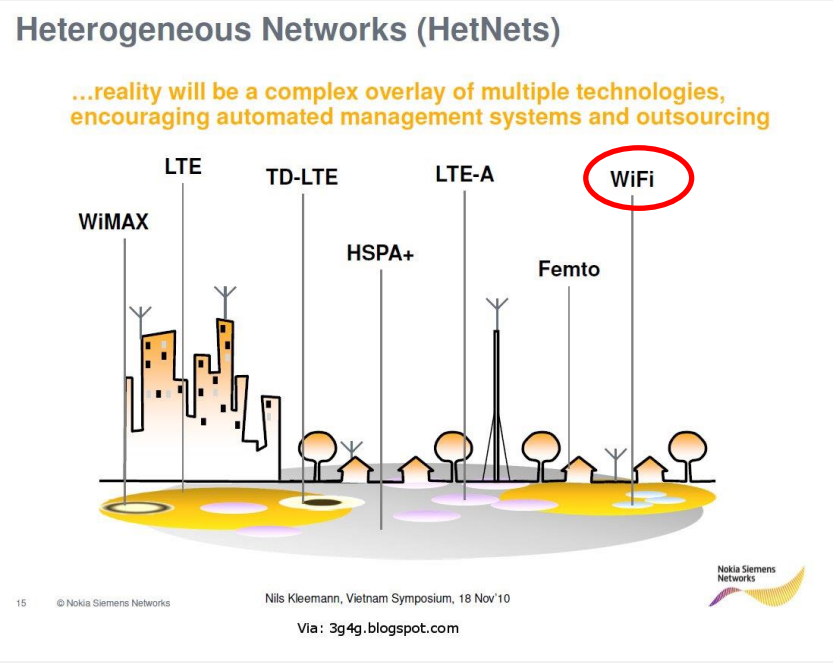
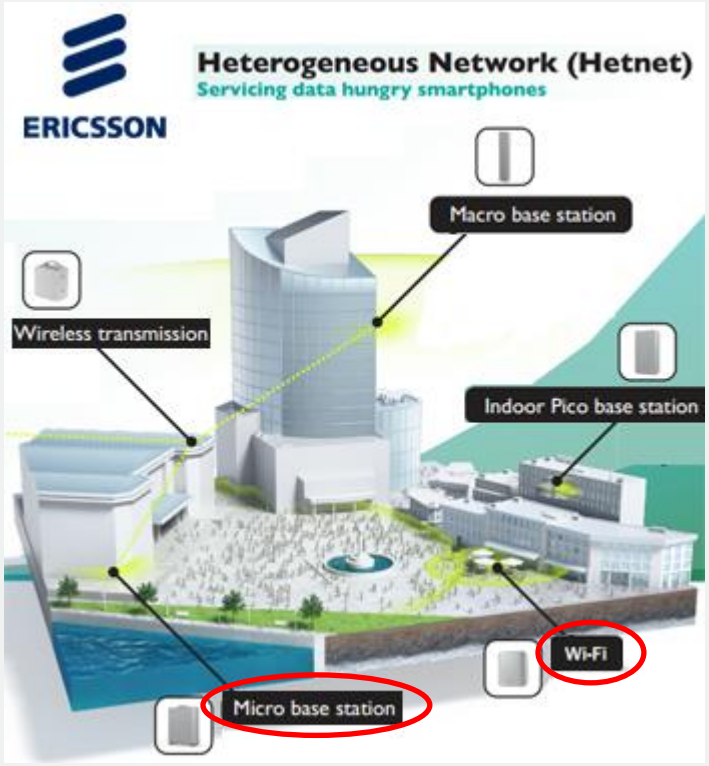
Wi-Fi part of the HetNet

All major vendors offer Wi-Fi solutions for cellular networks

Nokia Siemens Network



Ericsson



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Mobile traffic growth

Forecast to increase x10 over the next 5 years driven by increase in smart mobile devices and data consumption

2011			2016
Smartphone			
~9 million units	=		= ~20 million units
141 MB per month	=		= 2.3 GB per month
Tablet			
~1.5 million units	=		= ~11 million units
469 MB per month	=		= 5.5 GB per month
Laptop/dongle			
3 million units	=		= ~5+ million units
1.9 GB per month	=		= 8.5 GB per month

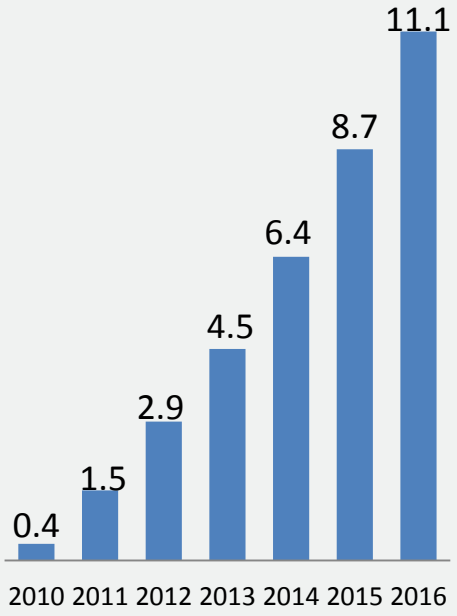
Total Network data traffic 2011 = 126 PB pa
Total Network data traffic 2016 = 1100 PB pa

Source: Various and GQI Research

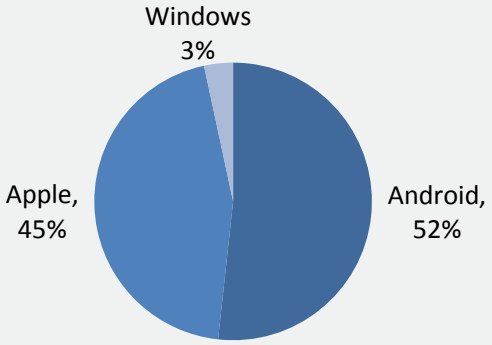
Australian smart phone market

There will be 3 million Wi-Fi only devices in 2013

Tablets in Australia (M)



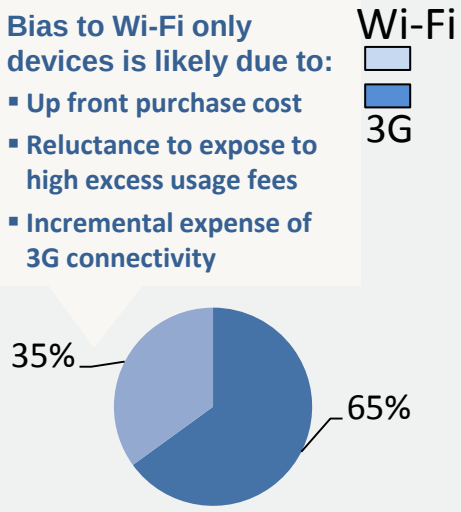
Tablet uptake by OS



Mix of WiFi and 3G

Bias to Wi-Fi only devices is likely due to:

- **Up front purchase cost**
- **Reluctance to expose to high excess usage fees**
- **Incremental expense of 3G connectivity**



Source: Various and GQI Research

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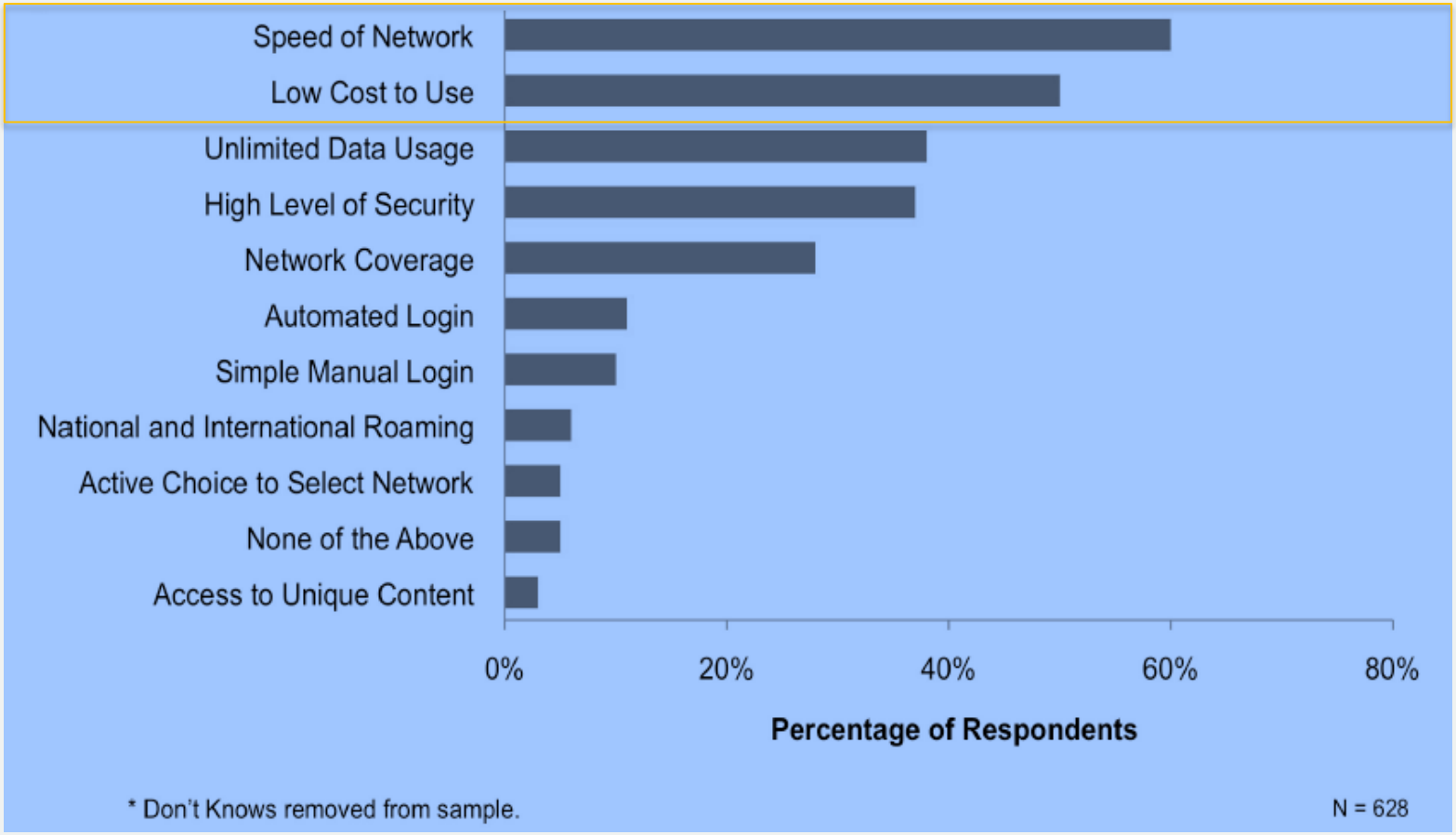
What do customers want from Wi-Fi

Customers want access to a high performance Wi-Fi network at low cost

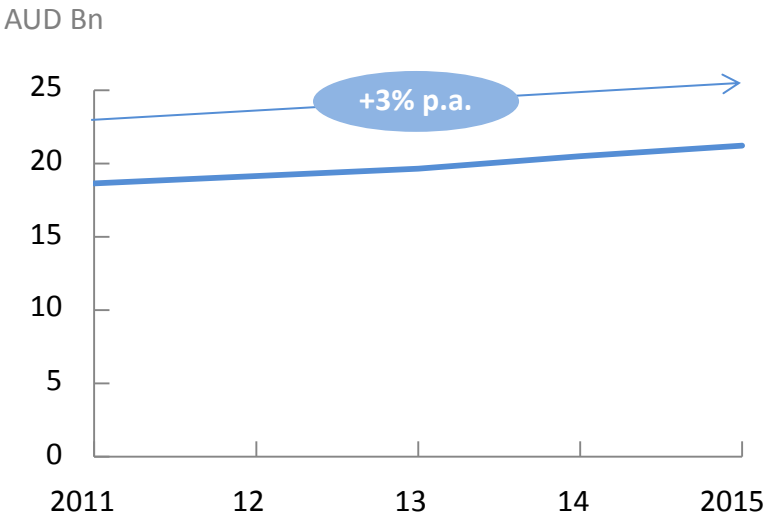


Source: Cisco 'What do consumer want from Wi-Fi?' 2012

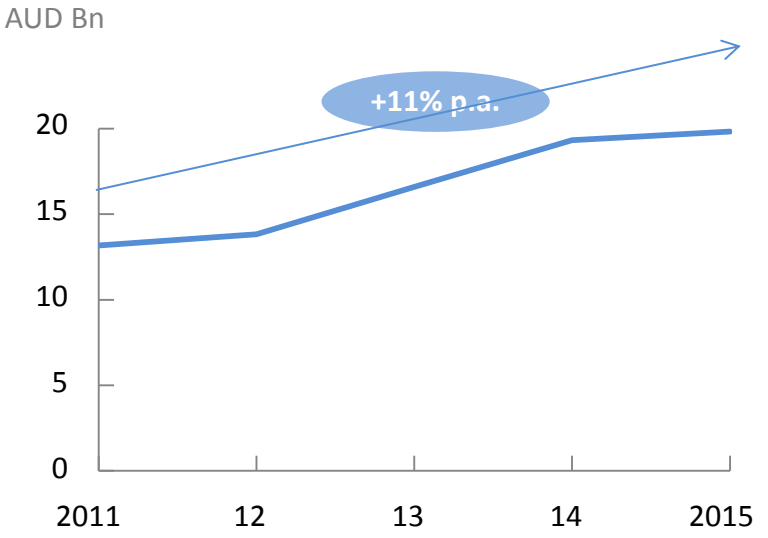
Capex is a major issue for MNOs

Australian MNOs are facing significant CAPEX challenges when revenue growth is flat lining

Industry revenues



Industry invested capital incl. spectrum



Source: Cisco VNI, GQI Consulting analysis

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Capacity Issues for MNOs

Macro cellular networks have reached maturity and HetNets will be increasingly seen as the answer to smaller area converge and capacity requirements

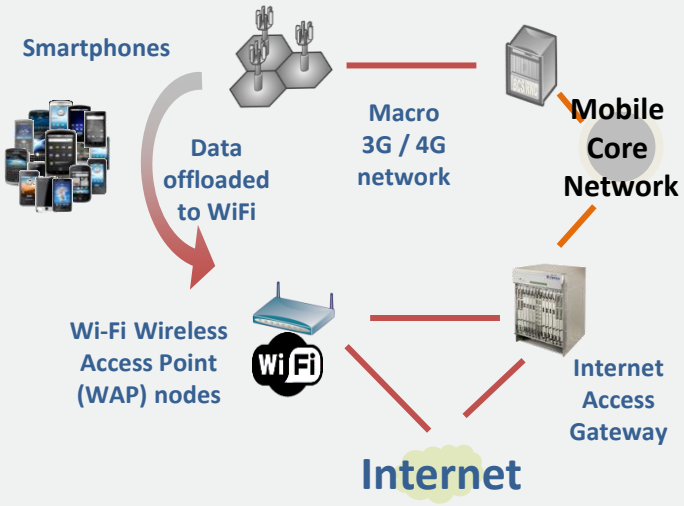
- Macro cellular networks have reached maturity and MNO in many countries are reaching maximum price /performance benefit for this type of infrastructure.
- MNO will be looking to avoid high Capex macro cell expansions in high peak traffic/hot spot locations
- Data-off load to small cells is a practical option adopted by major MNO to address capacity issues.
- MNO globally are planning large scale small cell infrastructure solutions

Source: Analysys Mason article March 2013

Wi-Fi in cellular networks

Today and Tomorrow

- **Roaming on to Wi-Fi by smartphones/tablets is available today**



  - Smartphone detects availability of local Wi-Fi Access node, which has a universal “SSID” for that carrier’s WAP’s nationwide
  - Once set up is established (one time), Smartphone auto logs on to WAP and sends/receives all data via Wi-Fi automatically
  - When Wi-Fi signal is lost, data auto resumes on Macro; if Wi-Fi is picked up again, it continues on

- **in the future roaming with Wi-Fi on Smartphones/tablets will be more seamless**
  - Data and Voice will be offloaded to Wi-Fi (as voice increasingly becomes data on 4G (IMS VoIP)
  - Smarter roaming and even more graceful handoff strategies being developed by Wi-Fi standards bodies ”Wi-Fi Alliance”, and “Wireless Broadband Alliance (WBA)” to maintain continuous connectivity Wi-Fi-to-macro and macro-to Wi-Fi
  - A developing “ Hotspot 2.0 standard” aims to eliminate the manual steps a mobile subscriber goes through to get on a Wi-Fi network so it becomes like any other mobile roaming process.

Cellular and Wi-Fi around the world

Global operators use a mix of macro and Wi-Fi cells

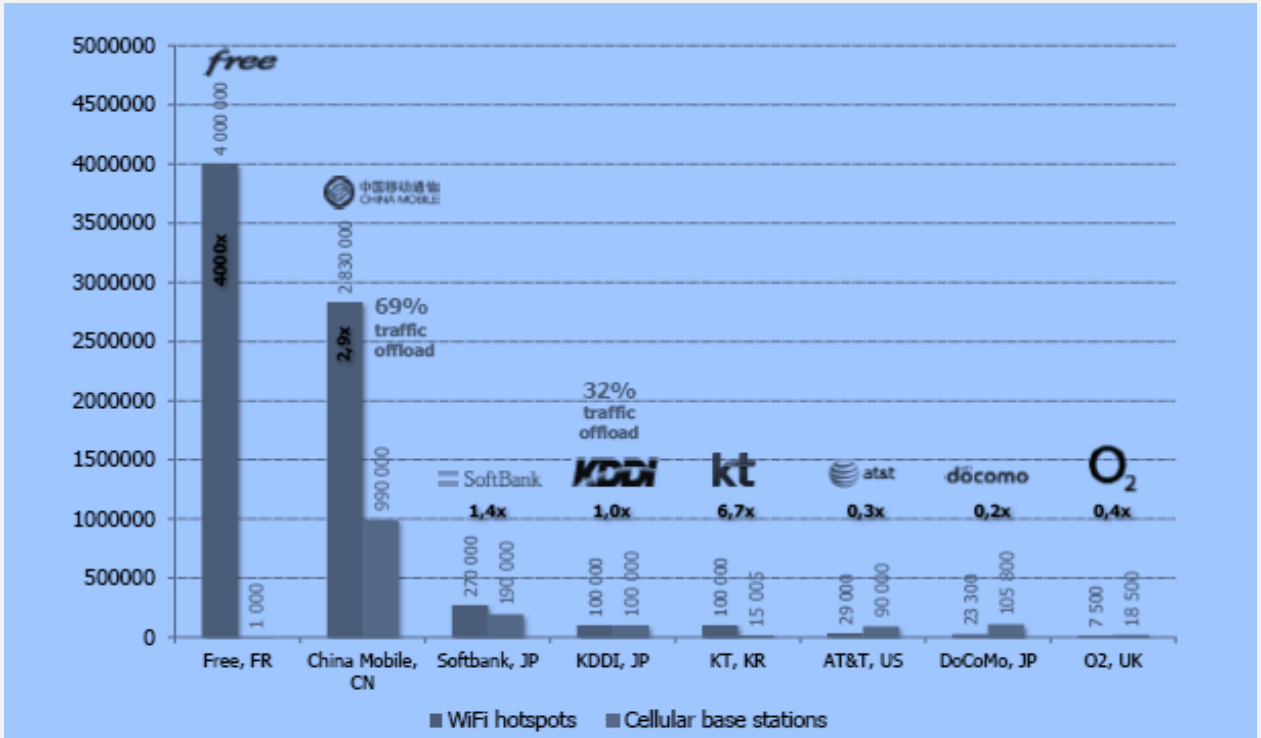


Figure 1. Number of WiFi hotspots and cellular base stations for a number of reporting mobile operators globally

Source: Tefficient http://www.tefficient.com/

Case for data off load to Wi-Fi

Wi-Fi small cell infrastructure can enhance capacity and coverage

- Smart phones and tablets all have Wi-Fi
- Wi-Fi is a mature and relatively low cost technology which has the potential to build cost effective capacity to alleviated macr cell network congestion
- Wi-Fi technology typically provides higher line speeds than 3G and even LTE and is constantly developing e.g. 802.11ac standard which promises Gigabit data rates.
- 3GPP and Wi-Fi standards are converging though initiatives from the Wi-Fi Alliance and Wireless Broadband Alliance.
- Vendors already offer Wi-Fi solutions which integrate into macro cellular networks

Data Off-Load forecasts

26% of mobile data traffic in 2017 will be off loaded - CISCO

Source; Cisco and Comms Day article February 2013, Exabyte's = x10-18th

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Comparison of Wi-Fi/ 3G/LTE

Wi-Fi has short range but provides higher speeds than 3G

Key Parameters	802.11n Wi-Fi	3G (HSPA+)	LTE
Theoretical Peak download data rates Mbps	300 Mbps	84 Mbps	300 Mbps
Typical user rates (Carrier grade Wi-Fi)	20 to 30 Mbps	10 to 20 Mbps	30 t 50 Mbps
Typical Spectrum available	Up to 600 MHz	5 to 10 Mhz	10 to 20 MHz
Spectrum bands	2.4 and 5 GHz	Many options	Many options
Typical Cell range	50 to 100m	5 Km	5 Km

Cost Comparisons

Wi-Fi Capex is about 10% of the cost of the data part of a macro cell

Cost item	Macro cell cost Data only*	Wi-Fi (Per AP)
Infrastructure cost	$25,000	$2,000
Transmission	$20,000	$3,000
Installation and setup cost	$13,000	$1,000
Capex including install	$58,000	$6,000
Asset life	7	3
Depreciation pa	$9,619	$2,000
Opex pa	$2,500	$2,000
Backhaul pa	$1,200	$800
Site leasing pa	$3,000	$1,800
Total Yearly Cost	$16,319	$6,600

* Assumes 20% of macro cell capex is for data. GQI Consulting analysis

Summary of case for Wi-Fi

Wi-Fi has many benefits but there are issues for MNOs'

- Wi-Fi Advantages
  - Free unlicensed spectrum
  - Well known and widely available in smart phones, PCs and tablets
  - Low cost
  - High line speeds, 802.11ac 500Mbps to 1Gbps
  - Better indoor coverage
  - Ease of installation
  - Integrated cellular solutions becoming available: Hotspot 2.0, standards include IEEE.802.11u, 802.11ac, 3GPP release 6 and 8
- Issues with Wi-Fi
  - Unlicensed spectrum
  - How to get access to the 1,000s of locations in small high density areas
  - Availability of backhaul
  - How to guarantee end to end customer experience and security
  - Difficult to monetise hence uncertain payback
  - Mix of technologies adds operational complexity

Wi-Fi networks in Australia

Public access Wi-Fi is under developed

- Wi-Fi is widely adopted by residential and business consumers
- Carrier grade public Wi-Fi access is very limited (Telstra closed its public Wi-Fi hotspot service about a year ago)
- Deployment of carrier grade Wi-Fi for data off-load is non existent but we understand that Australian MNOs' are investigating this option
- Availability of Wi-Fi access services at Hotspots is expected to be used as a differentiator to provide fixed and mobile smart phone/tablet access for customers outside their home or business
- Over 60% of tablets sold in Australia don't have SIM's = 3 million devices in 2013 that provide a potential new market for Wi-Fi access

Monetising Wi-Fi

New revenue streams or optimise network costs, while delivering on Customer Experience

- Potential new revenue streams
  - Wi-Fi services direct to consumers e.g. subscription service for Wi-Fi only devices
  - Value added services e.g. location based advertising
  - International roaming data off load e.g. services for international travellers and wholesale access for international carriers
- Potential for macro cell cost optimisation opportunities
  - Mobile data offload e.g. offloading mobile data traffic to Wi-Fi reduces macro cell congestion in small areas thus reducing need for Capex
  - Black spot infill e.g. Wi-Fi AP's used to fill coverage in hard to reach locations
  - Serve special high traffic locations e.g. Wi-Fi in very high peak traffic locations such as sporting venues

Summary

Time is ripe for the expanded use of Wi-Fi in Australia

- Business opportunity for carrier grade national Wi-Fi network:
  - Built by the MNOs'
  - White label shared Wi-Fi service for MNO's and ISPs for data off load and to services SIM less smart phones outside the home or business
- How to monetise this Wi-Fi network will require keen entrepreneurial skills
- A national Wi-Fi network could require up to 10,000 APs
- Finding the locations to mount the 1,000s of Wi-Fi APs required and get backhaul connected to them will be critical

Thank you

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