



WI-FI IN HETEROGENEOUS NETWORKS

COMMSDAY SUMMIT, SYDNEY



INDEX

- Introduction
- Wi-fi In Heterogeneous Networks
- Summary

INTRODUCTION

HETNETS | Wi-Fi in Heterogeneous Networks

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'

- 1 Enhance macro cells with higher capacity and data rate (e.g. LTE deployment)



- 2 Increase density of the macro network through sectorisation, cell splitting or building new sites



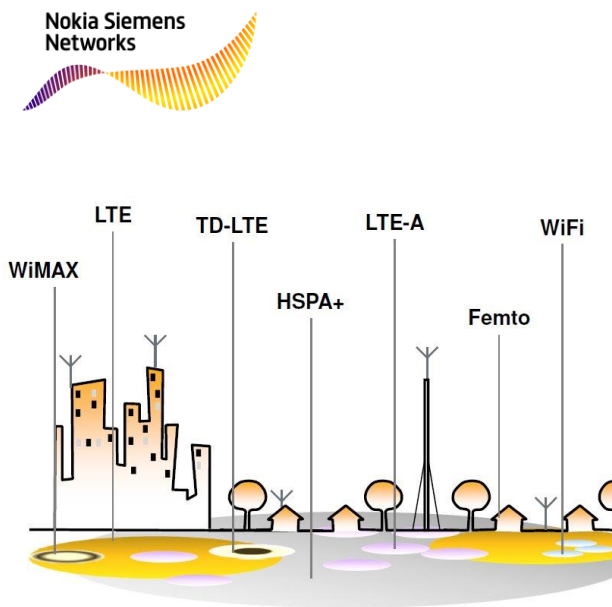
- 3 Small cells to service high capacity demand or hard to get at areas



A mix of WiFi and
LTE small cell sites

Wi-Fi Part of the HetNet

ALL MAJOR VENDORS OFFER
WI-FI SOLUTIONS FOR
CELLULAR NETWORKS



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© Nokia Siemens Networks

Nils Kleemann, Vietnam Symposium, 18 Nov'10

Via: 3g4g.blogspot.com




Example: Heterogeneous Networks
Nokia Siemens Network

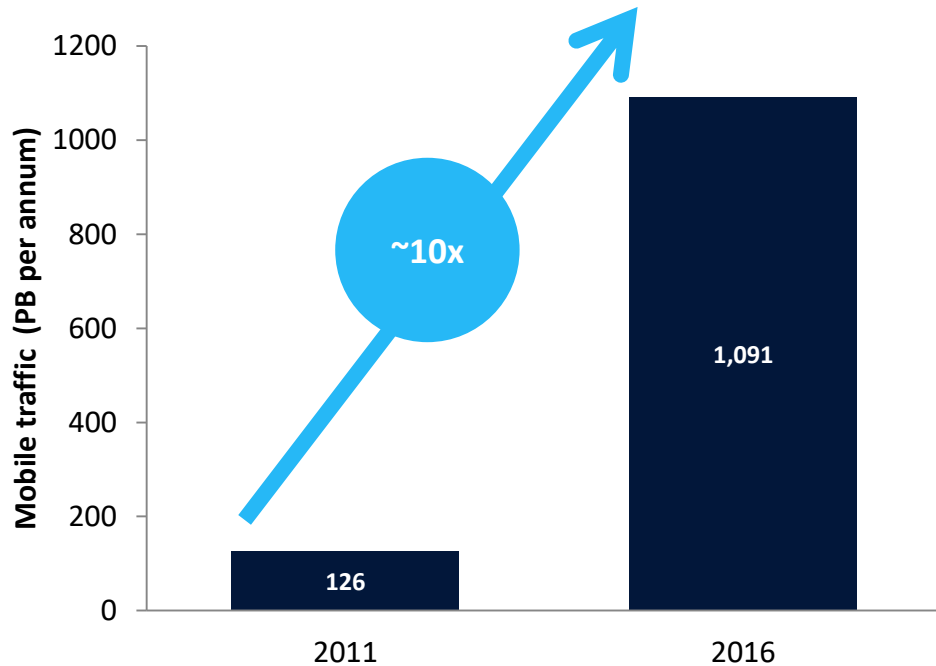


Example: Heterogeneous Networks
Ericsson

Mobile Traffic Growth

MOBILE TRAFFIC GROWTH
FORECAST TO INCREASE X10 OVER THE NEXT 5 YEARS
DRIVEN BY INCREASE IN SMART MOBILE DEVICES AND DATA CONSUMPTION

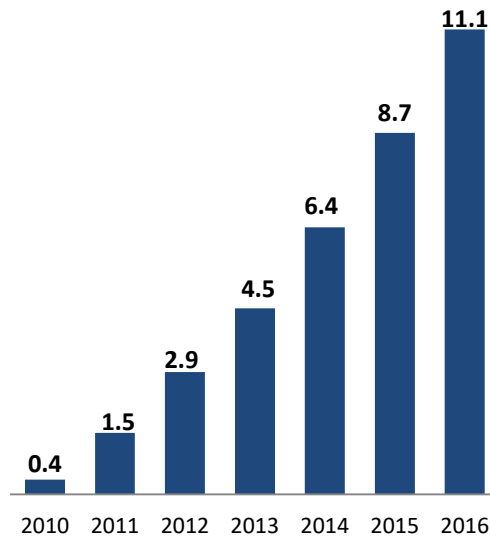
| 2011 | | SMARTPHONE | 2016 |
|--------------------------------------------|--|-------------------------------------------------------------------------------------|-------------------------------------------|
| ~9 million units = 141 MB per month = | |  | = ~20 million units = 2.3 GB per month |
| | | TABLET | |
| ~1.5 million units = 469 MB per month = | |  | = ~11 million units = 5.5 GB per month |
| | | LAPTOP/DONGLE | |
| 3 million units = 1.9 GB per month = | |  | = ~5+ million units = 8.5 GB per month |



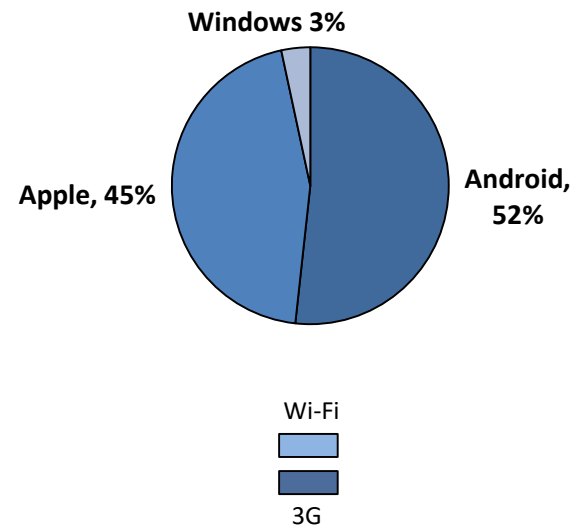
Australian Smart Phone Market

THERE WILL BE 3 MILLION WI-FI ONLY DEVICES IN 2013

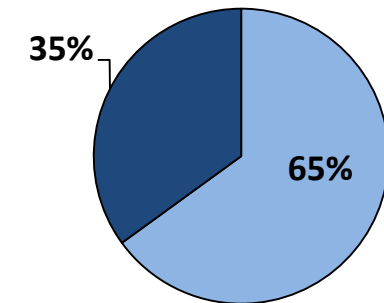
TABLETS IN AUSTRALIA (M)



TABLET UPTAKE BY OS



MIX OF WIFI AND 3G

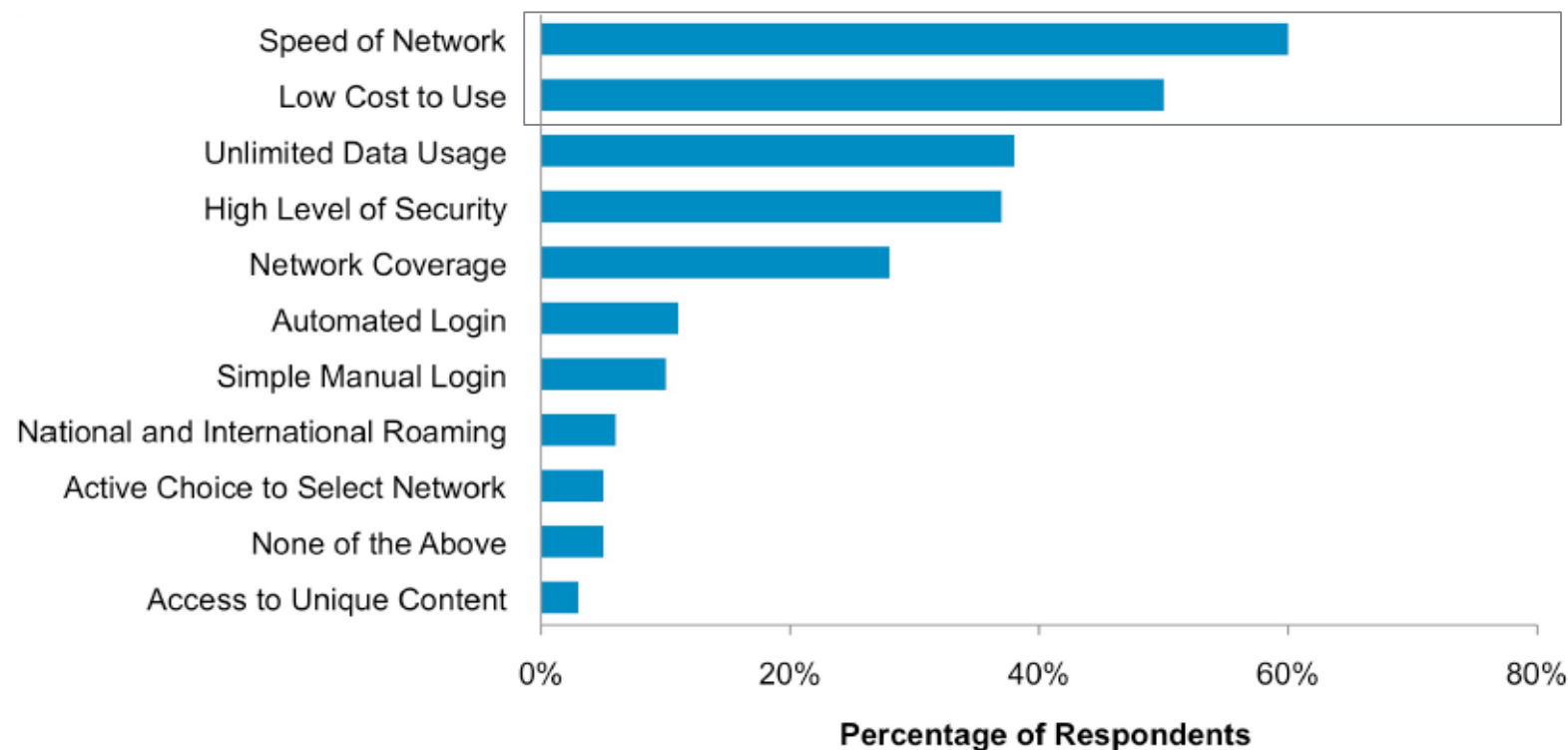


Bias to Wi-Fi only devices is likely due to:

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

What do customers want from Wi-Fi?

CUSTOMERS WANT ACCESS TO A HIGH PERFORMANCE
WI-FI NETWORK AT LOW COST

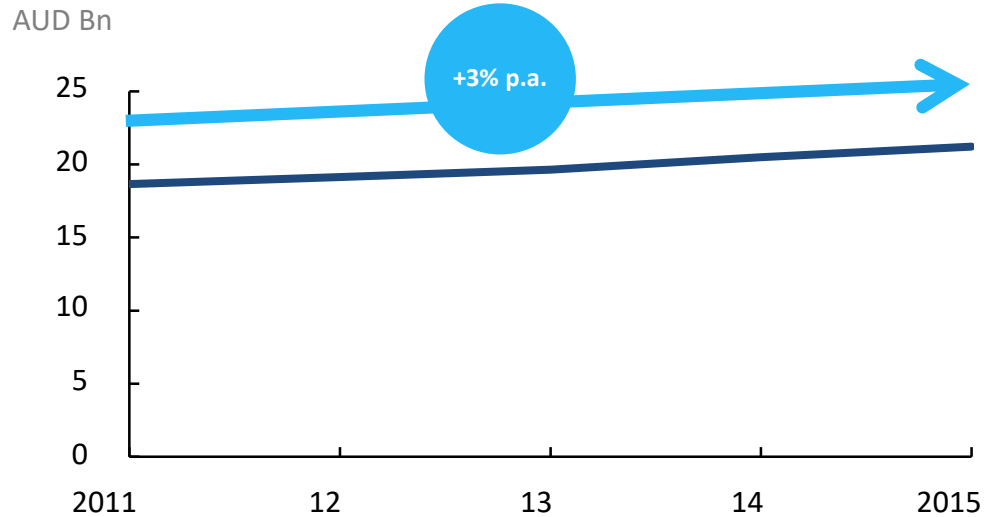


Source: Cisco 'What do consumer want from Wi-Fi?' 2012

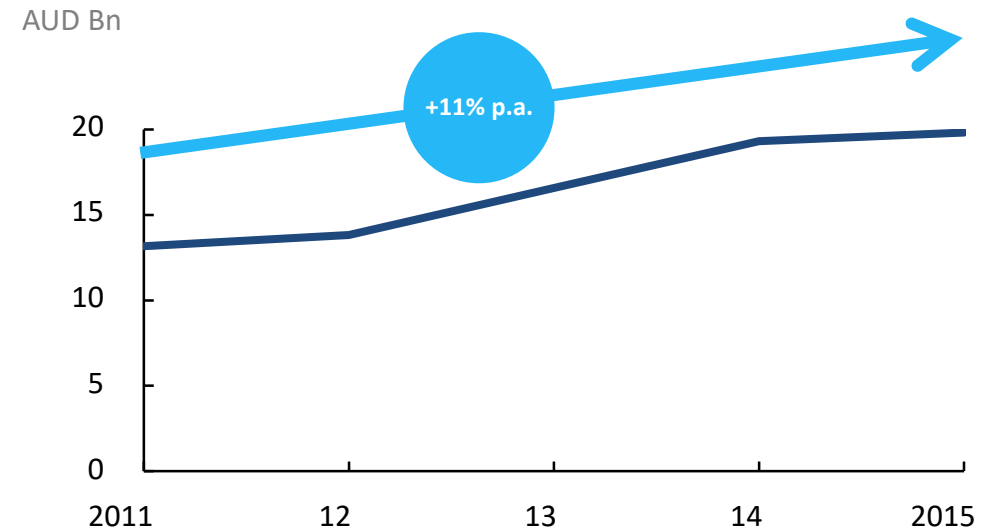
Capex is a major issue for MNOs

AUSTRALIAN MNOS ARE FACING SIGNIFICANT CAPEX CHALLENGES WHEN REVENUE GROWTH IS FLAT LINING

INDUSTRY REVENUES



INDUSTRY INVESTED CAPITAL INCL. SPECTRUM



Capacity issues for MNOs

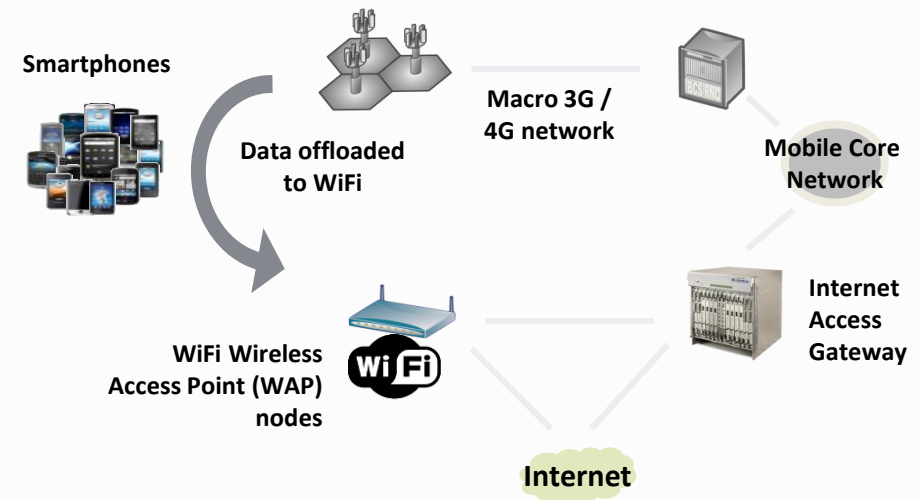
Macro cellular networks have reached maturity and HetNets will be increasingly seen as the answer to smaller area converge and capacity requirements

- 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.

Wi-Fi in cellular networks

TODAY AND TOMORROW

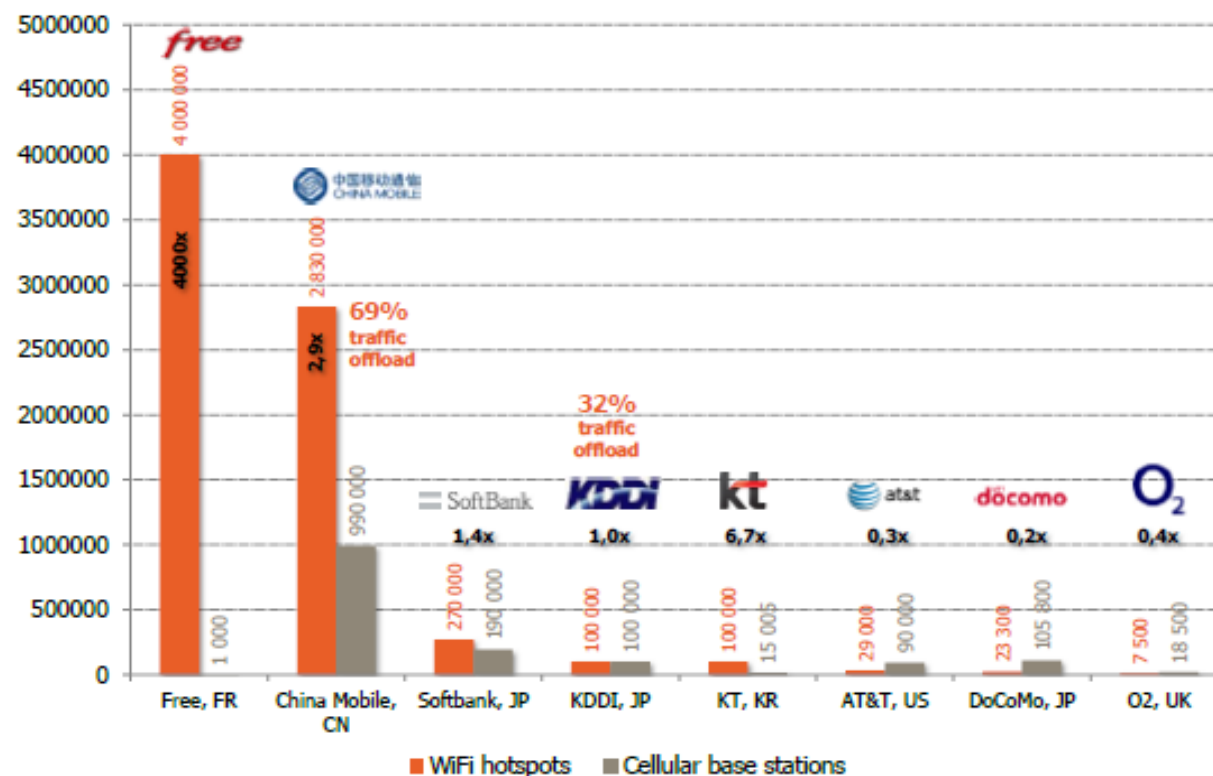
ROAMING ON TO WI-FI BY SMARTPHONES/TABLETS IS AVAILABLE TODAY



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.

Cellular and Wi-Fi around the world

GLOBAL OPERATORS USE A MIX OF MACRO AND WI-FI CELLS



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

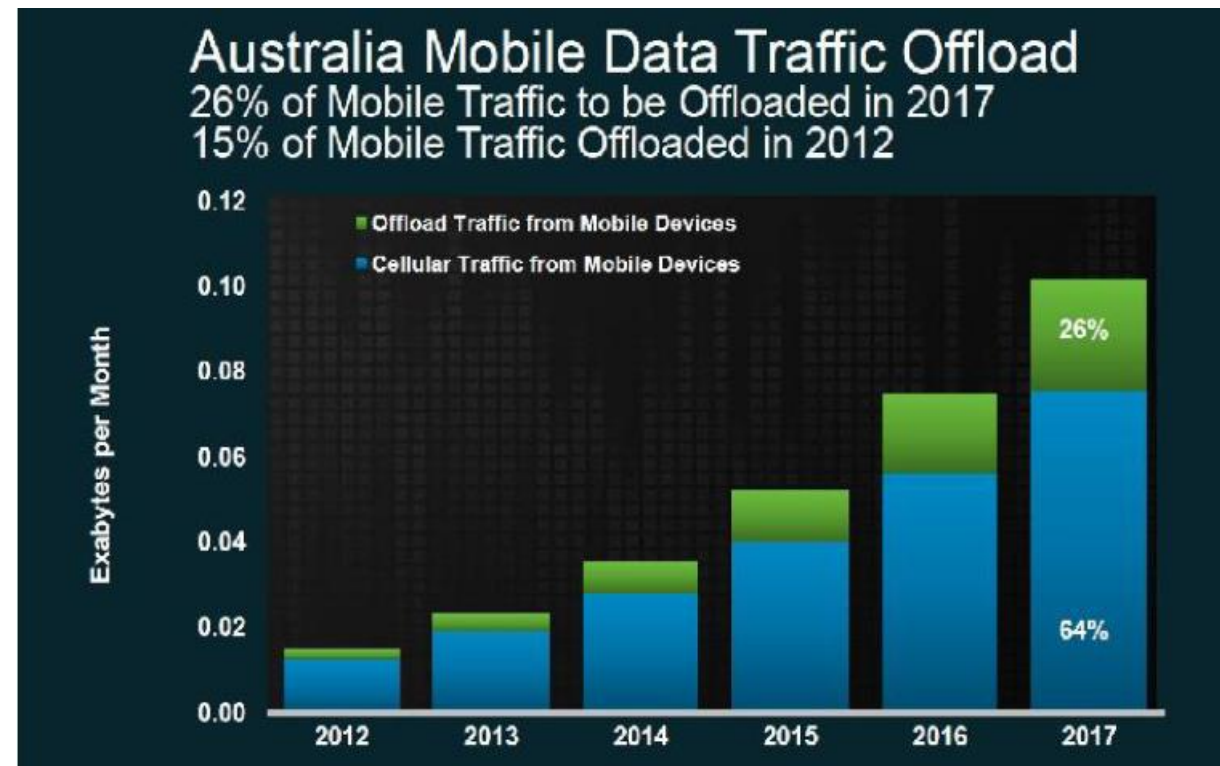
Case for data off load to Wi-Fi

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 alleviate macro 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 through 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

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 | 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 |

Summary of Case for Wi-Fi

Wi-Fi has many benefits however 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 WI-FI IN HETEROGENEOUS NETWORKS

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 MNOs and ISPs for data offload and to service 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



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