

# 3G Mobile Cost Modelling Summary



For Vodafone New Zealand

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**PUBLIC VERSION**

# Introduction



- We have been working with VFNZ to develop understanding of the likely costs that a new 3G mobile entrant would face in NZ.
- We have developed a cost model for 3G entry based on data about VFNZ's actual 3G network, and conversations with VFNZ network engineers.
  - Not a proper bottom-up or top-down cost model, but a reasonable proxy.
- The model estimates required capital and operating expenditure and calculates total annual costs for different entry scenarios.

# Summary of the Model



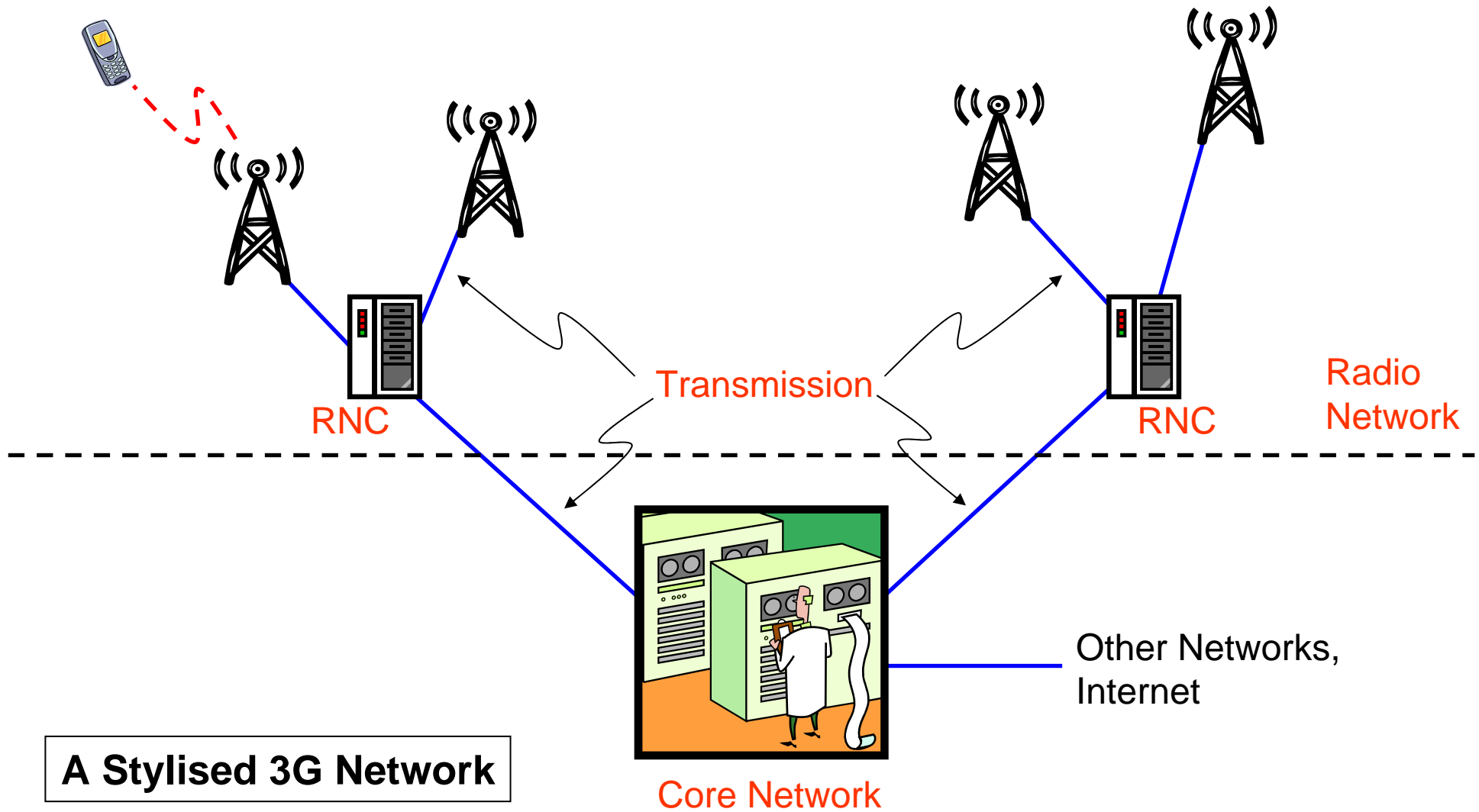
- 3G entrant is assumed to build in some or all of the 5 main cities (Auckland, Wellington, Christchurch, Hamilton, Dunedin) and have access to roaming elsewhere within VFNZ's current 2G coverage area.

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- Capital costs are annualised over 10 years.

# Summary of the Model



# Summary of the Model



- Key inputs:
  - Entrant's coverage choice (which cities).
  - Per-minute roaming rate (average of 1-leg and 2-leg calls).
  - Colocatable sites and rentals.
  - Entrant's customer numbers and traffic.
  - Impact of entry on per-customer revenues (ARPU).
- Main model outputs:
  - Estimated total capital expenditure for years 1 – 5.
  - Annualised capital and operating expenses for years 1 – 5.
  - Market share required to cover annual costs in each year.

# Radio Network Costs



- Radio network costs comprise costs associated with cellsites and Radio Network Controllers
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  - Site numbers expand over time.
- Modelled entrant's cellsite numbers:

Cellsites					
	Year 1	Year 2	Year 3	Year 4	Year 5
Auckland	205	324	404	404	404
Wellington	72	103	138	138	138
Christchurch	41	50	50	50	50
Dunedin	4	9	9	9	9
Hamilton	9	22	22	22	22
<b>Total</b>	<b>331</b>	<b>508</b>	<b>623</b>	<b>623</b>	<b>623</b>

# Radio Network Costs



- **Cellsite** capital cost estimates (with colocation):

## Cellsite Capital Costs (\$m)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Auckland	35.6	20.7	13.9	0.0	0.0	70.1
Wellington	13.2	5.7	6.4	0.0	0.0	25.3
Christchurch	7.0	1.5	0.0	0.0	0.0	8.5
Dunedin	0.7	0.9	0.0	0.0	0.0	1.6
Hamilton	1.7	2.4	0.0	0.0	0.0	4.2
<b>Total</b>	<b>58.2</b>	<b>31.2</b>	<b>20.3</b>	<b>0.0</b>	<b>0.0</b>	<b>109.7</b>

Average capital cost per cellsite (with colocation): \$176,000

Total cellsite capital cost without colocation: \$156.4m

# Baseline Scenarios



- Entrant builds:
  - (1): Auckland & Wellington only
  - (2): All five cities
- Low IT costs (\$20m capital cost).
- Non-network non-IT capital costs are 25% of total.
- Entrant's volumes:

	Year 1	Year 2	Year 3	Year 4	Year 5	
Minutes per customer per annum	1050	1050	1050	1050	1050	
Market size (mil customers)	3.80	3.88	3.95	4.03	4.11	(2% p.a. growth)
Entrant's market share (customers)	3%	6%	9%	12%	15%	

# Baseline Scenario: Cost Results



- Scenario 1: Build coverage in Auckland & Wellington only.
  - Total capital cost over 5 years: \$237m.
  - Total cost over 5 years @ 20cpm average roaming rate: \$1,183m.
- Scenario 2: Build coverage in all five cities.
  - Total capital cost over 5 years: \$260m.
  - Total cost over 5 years @ 20cpm average roaming rate: \$1,184m.
- Similar total costs in both scenarios over 5 years: At 20cpm, the roaming costs saved by expanding coverage to the three other cities roughly equals the costs of building coverage there.

# Baseline Scenario: Cost Results



- Annual **total** costs (\$m) at different roaming rates:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Auckland + Wellington						
15 cpm	128	182	233	276	320	1,139
20 cpm	131	188	242	287	335	1,183
25 cpm	134	194	251	299	350	1,228
30 cpm	138	200	259	311	365	1,273
All Five Cities						
15 cpm	133	186	236	276	318	1,149
20 cpm	135	191	243	285	330	1,184
25 cpm	138	196	249	294	342	1,219
30 cpm	140	200	256	304	354	1,254

# Baseline Scenario: Cost Results



- The roaming rate affects an entrant's total costs and most importantly their incentive to build coverage.
- Illustration: Year 5 total costs (\$m):

	AKL + WLN	All Five	Difference
15 cpm	320	318	-2
30 cpm	365	354	-11
<b>Difference</b>	<b>45</b>	<b>36</b>	

Cost difference between 15 cpm and 30 cpm is not very large relative to total costs

Higher roaming rate means a bigger cost reduction with coverage expansion, and a stronger incentive to build coverage.

# Business Case Analysis



- We have also used the cost model to estimate the market share the entrant would need to break even.
- We assume a pre-entry ARPU of \$560 per customer per annum.
  - Post-entry ARPU may decline (everything else equal).
- We calculate the market share and customers required to break even in year 5, depending on:
  - Entrant's coverage build
  - Roaming rate
  - Effect of entry on ARPU

# Updated Business Case Results



- Results: Break-even market share in year 5.

Auckland + Wellington Only		Roaming rate (cpm)			
		15	20	25	30
ARPU change	0%	12%	14%	16%	18%
	5%	14%	16%	18%	21%
	10%	16%	18%	21%	25%
	15%	19%	22%	26%	31%
	20%	22%	26%	32%	39%
	25%	27%	33%	40%	48%

All Five Cities		Roaming rate (cpm)			
		15	20	25	30
ARPU change	0%	12%	13%	15%	16%
	5%	14%	15%	17%	18%
	10%	16%	17%	19%	22%
	15%	18%	20%	23%	26%
	20%	21%	24%	27%	32%
	25%	26%	29%	34%	39%

Market size: 4.1m customers

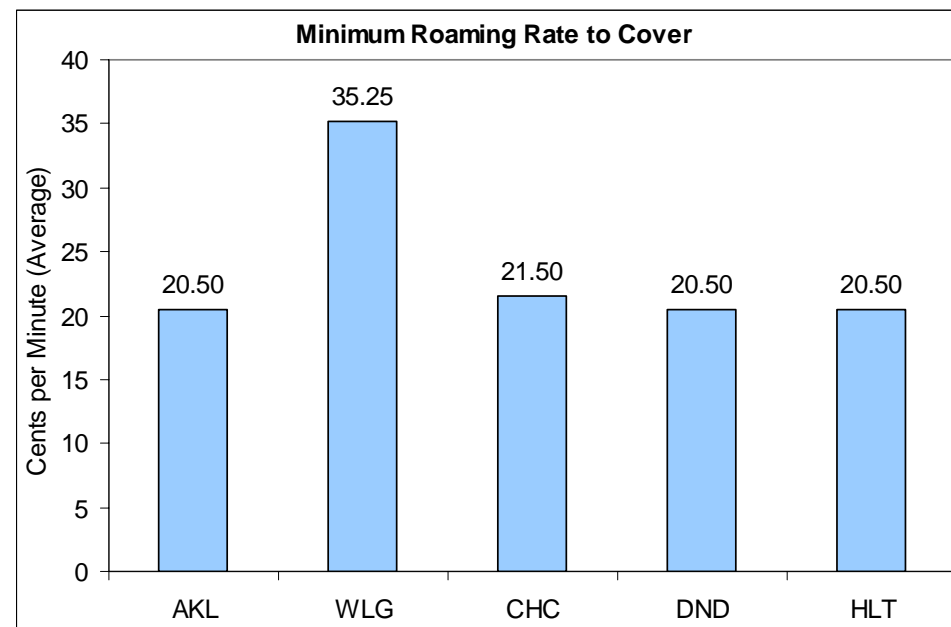
# CS First Boston Analysis



- CSFB carried out a similar (financial) analysis of the effects of an Auckland + Wellington build for Telstra in July 2005.
- They estimated \$200m capital costs excluding customer acquisition costs.
  - We estimate \$178m assuming low IT costs.
- Based on an ARPU of \$600 p.a., they found break-even could be achieved after 4 years with a market share of about 15.5%.
  - If entry causes no ARPU change, we estimate 5 years and between 12% and 18% depending on the roaming rate.

# Optimal Coverage Analysis

- One of the key results is that the entrant's optimal (cost-minimising) coverage choice depends on the roaming rate.
  - The lower the roaming rate, the weaker the entrant's incentive to expand coverage.
- We can use the model to find the cost minimising coverage choice for a given roaming rate, under the baseline scenario:



# Optimal Coverage Analysis

- These results suggest that a cost-minimising entrant may have a weak incentive to build any coverage if the average roaming rate is below about 20 – 21 cents per minute.
  - Also suggests that regulating roaming rates too low runs a significant risk of deterring facilities-based entry.
- Traffic is relatively expensive to obtain in Wellington, thus a higher roaming rate is required to give incentives for an entrant to build coverage there.
  - Though, an entrant may choose to cover Wellington for ‘strategic’ reasons rather than cost minimisation.

# Pricing Principles for Roaming



- The roaming rate affects an entrant's decision to enter *and* the amount of facilities that it builds if it does enter, which makes pricing even more important than usual.
- There is difficulty using cost-based pricing in standard form.
  - Decreasing average cost creates a circularity problem: Traffic affects the cost-based roaming charge, but the roaming charge affects the traffic quantity.
- Retail-minus must also be applied with caution, as the appropriate 'minus' depends on the average cost in the area where the entrant roams, but the entrant's coverage choice depends on the roaming rate.
- To give incentives to build coverage, higher roaming rates are preferred to lower rates.
- A time-varying roaming rate may be the best solution.

# Appendix: Modelling Details



- The following slides give more details about the structure of the model and the assumptions that we have made.

# Structure of the Model: Roaming Costs



- The entrant incurs roaming costs in proportion to the fraction of its traffic that falls outside its geographic coverage area.
- Entrant's geographic traffic distribution is based on actual VFNZ traffic patterns.
- Total roaming charges are calculated using a constant average per-minute roaming rate.
  - In reality, there will be 'one-leg' and 'two-leg' roamed calls.
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# Structure of the Model: Traffic Distribution



- Distribution of entrant's traffic is based on VFNZ 2G traffic distribution for 2005
  - Adjusted for quality of VFNZ 3G coverage versus 2G.
  - Assumed 'in-footprint' roaming onto 2G is available.
  - Modelled over time as a function of the entrant's number of cellsites.
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# Structure of the Model: Colocation Costs



- Based on advice from VFNZ engineers about the feasibility and costs of colocation, we assume that 40% of the entrant's sites are colocated.
  - Of these, half require some additional capital cost to support colocation.
- Colocation allows the entrant to save capital and operating costs on some sites, but requires it to pay a colocation rental.
- Example: A typical outdoor monopole site:
  - Colocation saves \$276,000 capital costs
    - Total capital cost: \$376,000
    - Radio equipment: \$100,000
  - Operating cost saving is \$8,250 p.a.
  - Colocation rental: \$17,940 p.a.
    - 13% of half of \$276,000

# Structure of the Model: Transmission & Core Costs



- Transmission:
  - Transmission is bought and rented depending on the situation.
  - Major driver of costs is number of cellsites connected, and geographic dispersion.
- Core:
  - Core network costs are either fixed, or driven by customer numbers.
  - Redundancy is required in the core.
  - Estimated first year core network capital cost: \$47.8m.

# Structure of the Model: IT, Spectrum & Overhead Costs



- IT costs:
  - Cost and sophistication of an entrant's IT system will depend on the requirements of its business strategy.
  - Cost model includes three choices for entrant's IT capital costs: Low (\$20m), Med (\$70m) and High (\$120m) with 30% operating costs per annum.
- Spectrum costs:
  - Annualised cost based on 20 year license and VFNZ spectrum expenditures: \$1.6m.
- 'Overhead' capital:
  - Incorporates all other non-network non-IT capital costs and related operating costs.
  - We have treated brand development costs (customer acquisition) as a capital cost.
  - Estimates based on actual VFNZ accounting data.

# Structure of the Model: Interconnection & Other Opex

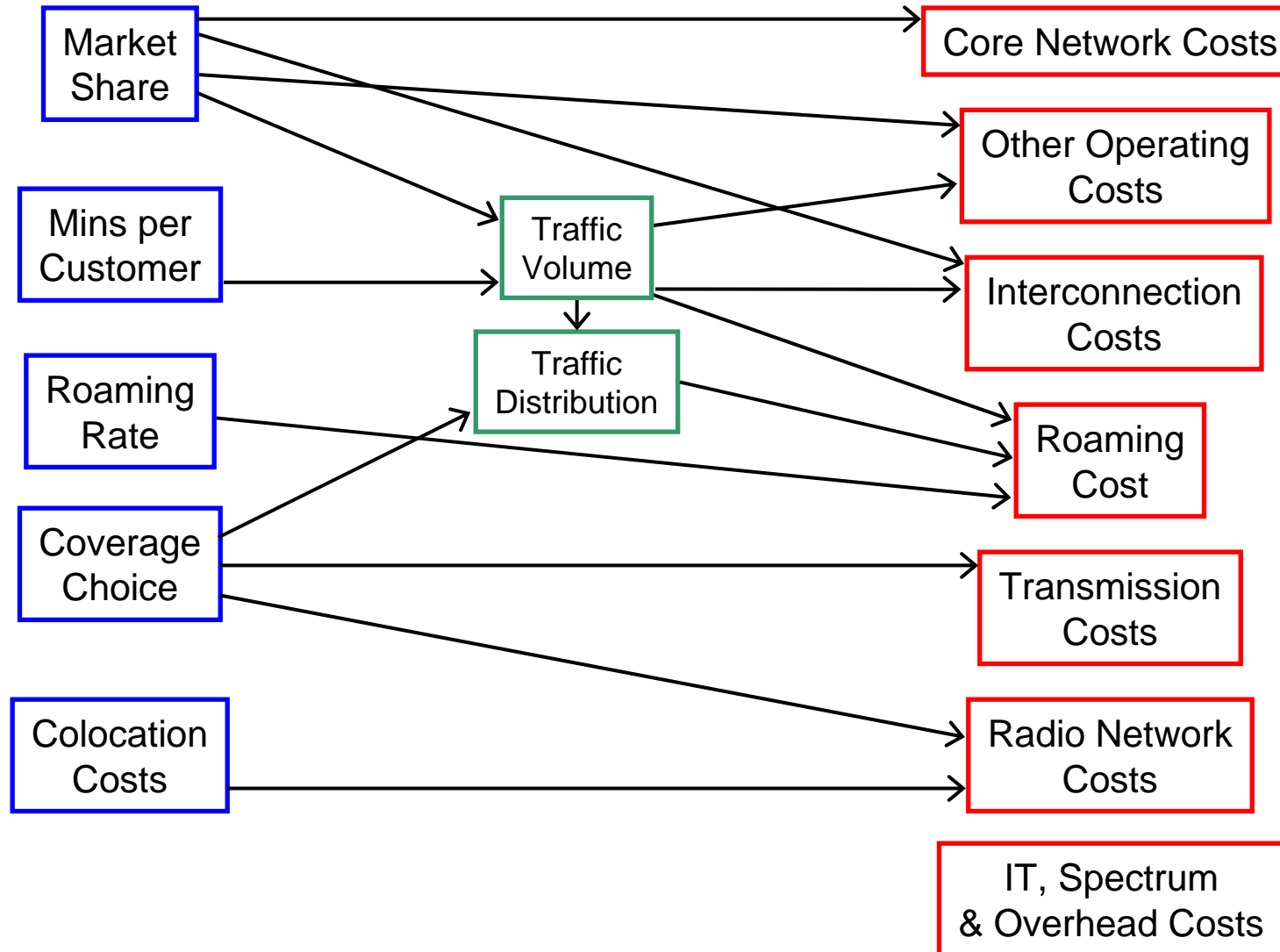


- Interconnection:
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- Other operating costs:
  - There are a number of other operating expenses not directly associated with the cost categories already defined:
    - Content
    - Prepaid commissions
    - Customer retention
    - Customer commissions
  - We estimated these based on VFNZ accounting data.

# Structure of the Model: Summary



# Structure of the Model: Capital Cost Drivers

- Modelled capital cost drivers:

Component	Driver(s)
Cellsites	Coverage
RNCs	No. of cellsites
Transmission	Coverage, No. of cellsites
Core	Fixed, No. of customers, Redundancy
Spectrum	Fixed
Information Technology	Fixed
Overhead	Fixed %