

Competition or Partnership between Wireless Access Network Operators: A Game Theoretic Approach

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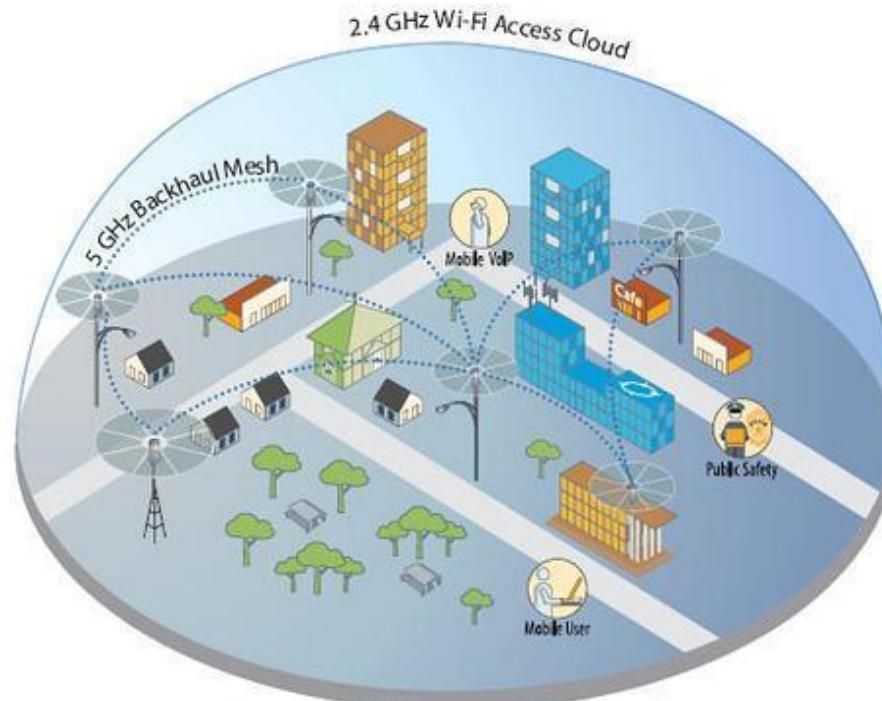
■ Content

- Introduction
- WiFi model
- 3G femtocell model
- Competition modeling
 - PPP or independent?
 - Real situation?
- Conclusions

■ Introduction

Rollout of a wireless network in a city environment

- Role of municipality
 - PPP or independent rollout
- Competition with other operators
 - Price setting game



■ Introduction

- General adoption of service
- Division of total market between players
 - Based on price setting

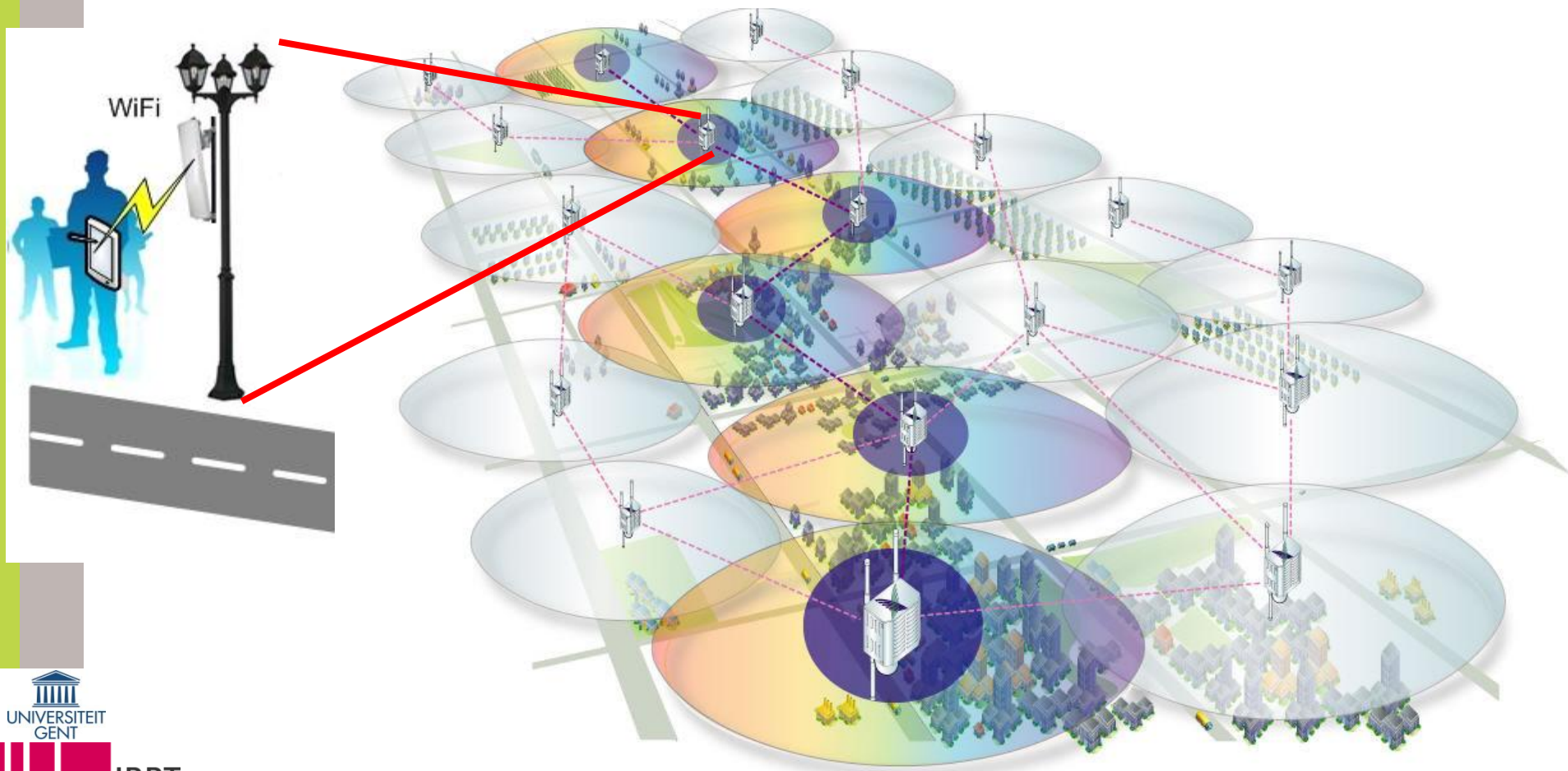
Introduction

- Business Case in Ghent City center
 - 14 km²
 - 100.000 inhabitants
 - 45.000 students
 - 7.000 businesses
 - 400.000 tourists a year



WiFi model

- Installing WiFi access points on lampposts, buildings,...
- Creating a city-wide WiFi mesh network



WiFi model

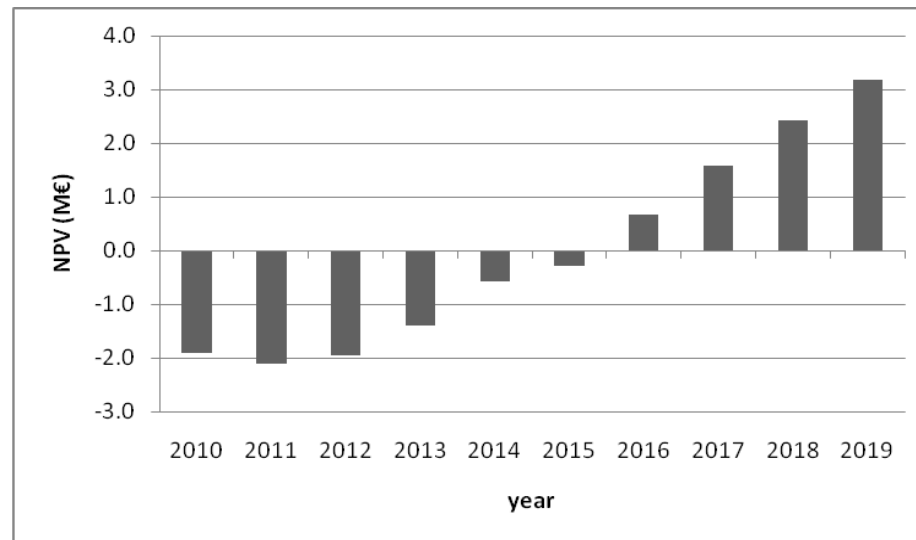
Standalone business case evaluation

- Sites modeling
 - Power gains and losses
 - Margins
 - Path loss
- CapEx and OpEx modeling
- Revenues
 - Based on adoption model
 - Four different subscription possibilities

WiFi model

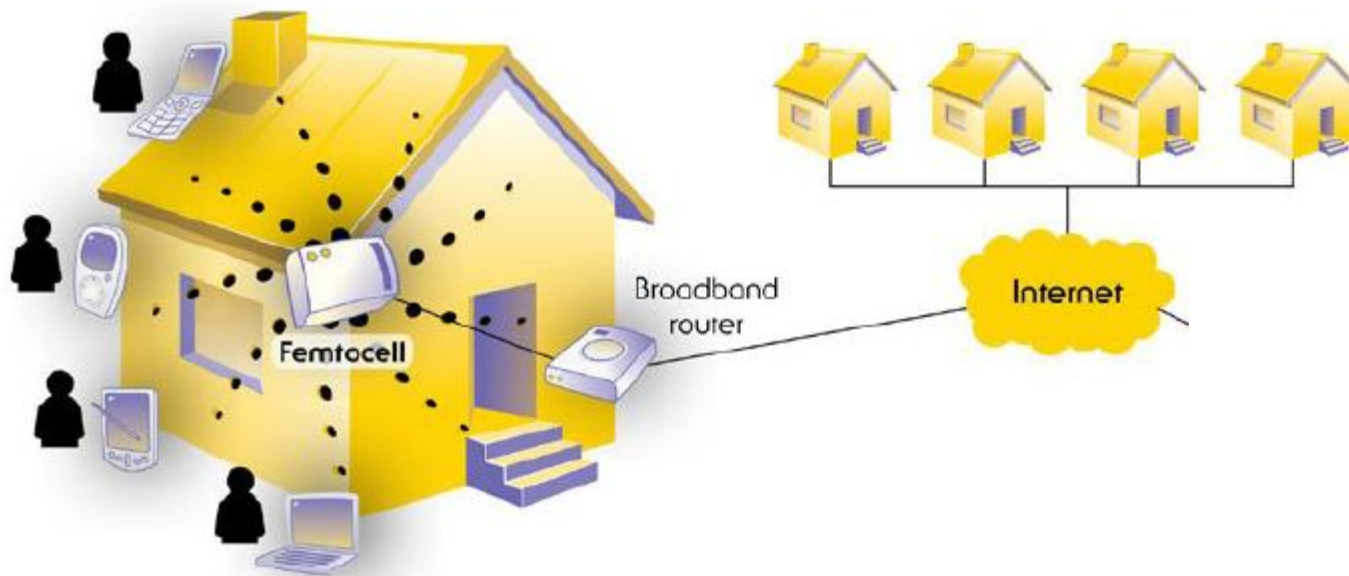
Positive business case

- NPV \approx €3.2 million
- 7 year payback period



3G femtocell model

- Installation of 3G femtocell on customer premises
- Operated by a Mobile Virtual Network Operator (MVNO)



■ 3G femtocell model

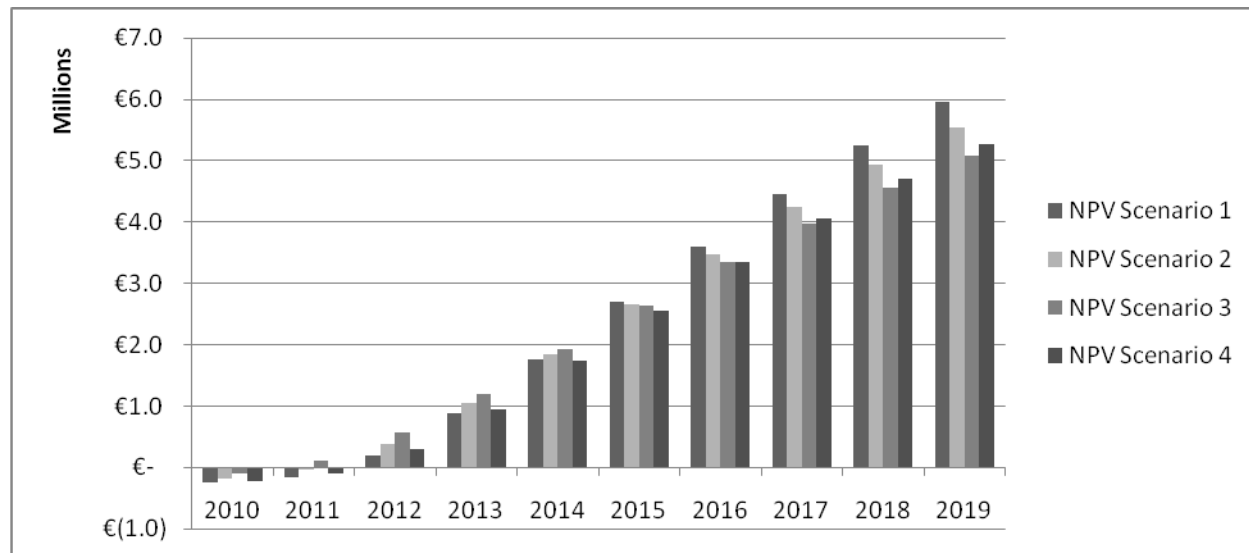
Standalone business case evaluation

- CapEx and OpEx modeling
- Revenues
 - Based on adoption model
 - Four different subsidization scenarios

3G femtocell model

Positive business case

- NPV \approx €6.0 million in 100% subsidization scenario
- Payback period = 2 years



■ Competition modeling

Two different questions:

- Strategic choice by municipality
 - PPP or independent rollout
- Subsidization scenario by MVNO

Game theoretic approach

- Strategic form
- Nash Equilibrium

Game Theory

- Two or more players compete for some good, e.g.:
 - The customer
- Every player chooses from different strategies, e.g.:
 - Rollout speed & area
 - Price setting → influences adoption rate
- Payoff-matrix created with the outcomes of the strategies
 - Net present value (NPV)
 - Adoption

	A1	A2	A3
B1	1, 0	1, 2	0, 1
B2	0, 1	1, 2	2, 1

- Nash-Equilibrium:
 - No player will gain by unilaterally changing its strategy

■ PPP or independent

- Three players
 - Municipality
 - Commercial WiFi player
 - MVNO
- Strategies
 - Mun.: Partnership or independent rollout
 - Comm. WiFi: Price setting
 - MVNO: subsidization
- Include indirect revenues for municipality

PPP or independent

		Municipality					
		enabler			independent		
Commercial Wifi	3G				14		
14	Scenario 1	0.49	1.92	-0.28	-2.51	-0.53	-0.39
	Scenario 2	0.32	1.79	0.26	-2.72	-0.82	-0.51
	Scenario 3	0.18	1.67	0.59	-3.09	-1.09	-0.03
	Scenario 4	0.35	1.81	0.13	-2.68	-0.77	-0.49
15	Scenario 1	0.49	1.96	0.01	-2.29	-0.27	-0.39
	Scenario 2	0.32	1.82	0.43	-2.57	-0.56	-0.49
	Scenario 3	0.18	1.69	0.77	-2.94	-0.86	0.12
	Scenario 4	0.35	1.84	0.31	-2.52	-0.51	-0.47

■ PPP or independent

Conclusions:

- NE: (14, PPP, 0%)
- Municipality and commercial player choose for PPP
- MVNO picks no subsidization scenario
 - Contrast with monopoly situation

■ Competitive setting

Extra MVNOs offering 3G femtocell service

- PPP in competitive market
- Impact on competition?
- Extra players capture market share
- Reduction of low payoff for commercial WiFi

Competitive setting

		Player 1: 3G					
Commercial Wifi	PLAYER 2: 3G	Scenario 2			Scenario 3		
14	Scenario 1	0.38	0.54	-0.18	0.18	0.91	-0.48
	Scenario 2	0.11	0.34	0.34	-0.10	0.65	0.07
	Scenario 3	-0.10	0.07	0.65	-0.32	0.42	0.42
	Scenario 4	0.14	0.39	0.20	-0.06	0.69	-0.05
15	Scenario 1	0.30	0.63	-0.04	0.14	0.98	-0.34
	Scenario 2	0.07	0.39	0.39	-0.12	0.73	0.19
	Scenario 3	-0.12	0.19	0.73	-0.38	0.51	0.51
	Scenario 4	0.11	0.43	0.27	-0.08	0.77	0.06

■ Competitive setting

- MVNOs choose for no subsidization
- Negative payoff for commercial WiFi player
- Solutions?
 - Postponing rollout -> cost reduction
 - Capturing market share via price reductions
 - Price wars?

Price wars

Price reduction

		Player 1: 3G					
Commercial Wifi	PLAYER 2: 3G	Scenario 2			Scenario 3		
10	Scenario 1	1.02	0.48	-0.39	0.72	0.88	-0.39
	Scenario 2	0.71	0.22	0.22	0.46	0.62	-0.09
	Scenario 3	0.46	-0.09	0.62	0.21	0.35	0.35
	Scenario 4	0.76	0.27	0.08	0.52	0.65	-0.21
11	Scenario 1	0.85	0.50	-0.33	0.60	0.89	-0.39
	Scenario 2	0.59	0.26	0.26	0.34	0.62	-0.05
	Scenario 3	0.34	-0.05	0.62	0.11	0.37	0.37
	Scenario 4	0.64	0.31	0.12	0.39	0.66	-0.17

Conclusions

- Partnership offers benefits for WiFi players
- Price game results in other subsidization scenario
- Price wars to capture extra market share
- To infinity?

References

1. Van Ooteghem, J., Lannoo, B., Casier, K., Verbrugge, S., Tanghe, E., Joseph, W., et al. (2009). Municipalities as a driver for wireless broadband access. *Wireless personal communications*, 49(3), 391.
2. Lannoo, B., Tahon, M., Van Ooteghem, J., Pareit, D., Casier, K., Verbrugge, S., et al. (2009). *Game-theoretic evaluation of competing wireless access networks for offering mobile internet. Paper presented at the CRNI, Brussels, 20/11/2009*



Questions ?

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