Business Modeling and Funding for TDD Operator

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Task Force	Business Modeling and Funding Task force
Source Contributing members	Huawei, Nokia Siemen Network, Telrad, Green Packet, CMCC, Sprint, 2KTel, AzQTel, On Telecom, Packet One, PT Internux, Planet Computer, Woosh Communication,
Support members	
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Annex A: Document History

Date	Meeting #	Revision Contents	Old	New
2014.1.03		Draft for discussion		1.0
2014.8.22		Draft with presentation		2.0
2015.1.19		Final Draft for Review		3.0

Abstract

To provide information and suggestions for facilitating the efficient utilization and fast deployment of TD-LTE globally, this white paper suggests various business models to encourage funding for deploying commercial TDD networks. To facilitate fast development of TD-LTE global deployment, this report also proposes some recommendations and suggestions for TDD Spectrum holders, WiMAX Operators, standardization organizations, regulators, and Financial Investors,

- The demand for broadband is increasing at an exponent rate around the world causing huge over-demand in fixed broadband in emerging market segments and mobile broadband in high demand urban market segments.

- These under-served demands can be fulfilled cost effectively using wireless broadband networks utilising available TDD spectrum.

- With the maturity of TD-LTE ecosystem and the harmonisation of TDD and FDD LTE, various business models can be adopted to address the different market scenario, competitive landscapes, availability of funding and exit strategies accordingly.

- Depending on the competitive landscape in the certain market, various business models can be adopted to serve the market successfully. As LTE Advanced supports multi-bands aggregation, there is good opportunity for the incumbent operator to partner with TDD Operators to provide higher mobile data capacity and performance. The availability of Dual-SIM, Dual-Radio devices will enable TDD Operators to have an additional avenue to Go-To-Market by offering high performance LTE Broadband to existing subscribers of incumbent Mobile Operators.

- Existing WiMAX Operators can utilise these new business models to transition over to TD-LTE successfully.

Several business models will be highlighted and hopefully can be used as reference for TDD spectrum owners to raise the necessary funding from private investors and financial institutions.

Due to the fast progress in both the industrialization and commercial TDD LTE deployment, the latest information will be captured in the subsequent version.

Version: Draft

Contents

Version: Draft

1 Introduction

Background and Objectives of This Report

GTI was established in 2011 to encourage the adoption of TD-LTE, accelerating the development of the TD-LTE eco-system and the harmonisation of the FDD-LTE and TDD-LTE into a single LTE family for the global deployment of 4G Wireless Network.

Most of the TDD spectrum has being allocated and issued to a variety of green-field operators or smaller service providers for the deployment of Wireless Broadband Access (WBA) Network. Many of these WBA Operators have deployed WiMAX Networks and are interested in transitioning their existing network to TD-LTE technology. As part of the founding objectives, GTI is very keen to assist these TDD spectrum holders in the deployment of TD-LTE Networks.

One of the main challenges for these spectrum holders is to develop a viable business plan and to secure the necessary funding for the TD-LTE network deployment and the commercial launch of the service. This Task Force was set up to compile a Report/White Paper with a clear objective of sharing

Version: Draft

some of the business models that have been adopted successfully by TDD Operators around the world.   It is the hope of this Task Force that some of these business models could be used by other aspiring TDD spectrum holders in seeking necessary funding from potential investors.

 The Report could also be used to encourage the vendors of the eco-system to support these aspiring TDD spectrum holders, the support of the regulators and the funding from the financial investment community.

2.   TDD Spectrum in the World

GTI was set up a separate Task Force to promote TDD spectrum allocation and usage.   The report can be found in the GTI library(www.lte-tdd.org).

It is important to note that a new trend of combining low frequency band FDD spectrum for coverage and higher frequency band TDD spectrum for high capacity zones to achieve a high performance and high efficiency mobile network is being seen with greater frequency within the industry.   With the growing demands for data, operators are now recognizing the value of high band spectrum as an important component of their overall spectrum portfolio.
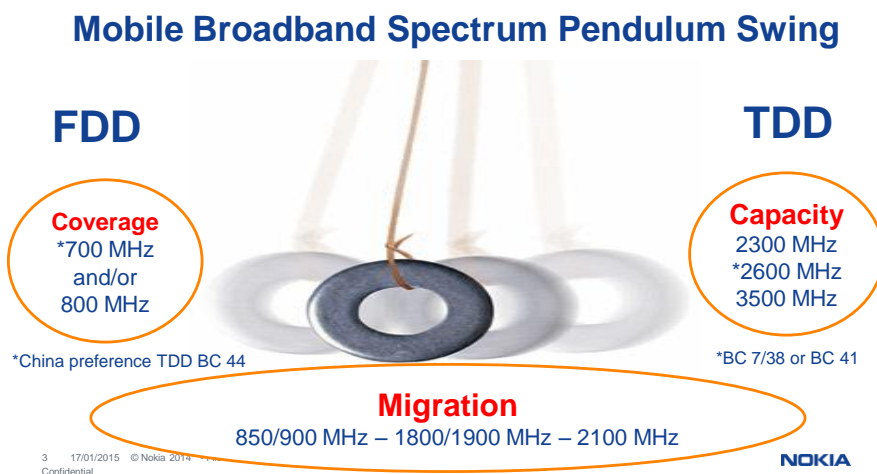
3. Network Solution and Eco-System for TD-LTE

The Network Solution and Eco-System for TD-LTE are maturing and as end November 2014, the number of devices and number of Solution Partners and Infra-Structure providers are as follows:

LTE Multi-mode Multi-band Terminals Have Reached Full Maturity

200+ suppliers have launched 1024+ TD-LTE terminals, including 567+ TD-LTE Smartphones.

TD-LTE Device Type	Quantity	TD-LTE Device Type	Quantity
USB modems	85+	Smart Phones	567+
MiFi/CPE	297+	Mobile Tablets	31

Source: GTI, GSA, TDIA

114 Operators and 95 Partners Joined GTI by Oct. 2014

114 Operators
- Europe — 25
- North America — 16
- South America — 7
- Asia — 51
- Oceania — 4
- Africa — 11

95 Industry Partners
- Test — 17
- Terminal/Chips — 45
- Institute — 3
- Antenna — 1
- Infra — 19
- Solution — 8
- IPX Providers — 1
- Other — 1
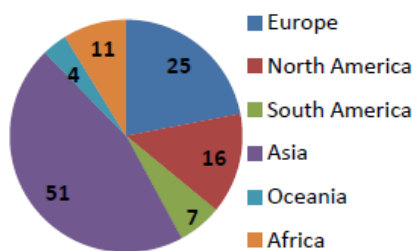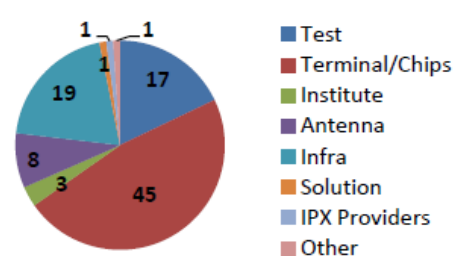
3.1 Available Network Solutions and Devices for TD-LTE(LTE-TDD)

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One of the prominent Solution Partner of GTI is Huawei and has the following offering to the TD-LTE commercial Network.

Huawei SingleRAN LTE TDD is ideal for operators looking to build the fastest LTE networks. End-to-end innovation for a growing and increasingly mature LTE TDD ecosystem has been fueled by numerous commercial launches of LTE TDDnetworks worldwide.

Products & Solutions

- Ultra-Wideband RRU –Realizes an industry-best 1 Gbps throughput with 4-CA (Carrier Aggregation).

- LampSite – Multi-mode and easy-to-install deep indoor coverage that offers up to 78% fiber resource savings.

- AtomCell – An LTE TDD HetNet solution that easily offloads heavy traffic in hotspots while providing more a comprehensive overall coverage.

- Cloud BB – Helps provide a No-Edge user experience thorough baseband resource coordination and intelligent cell scheduling and allocation.

- MIMO/Beamforming –offers 10 years of expertise deploying innovative multi-antenna technologies for numerous commercial projects.

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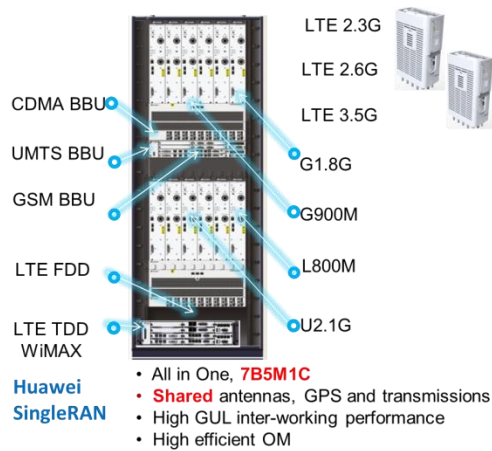
Huawei's SingleRAN make it possible to build once, to have a multi-layer network. SingleRAN platform supports smooth evolution for all modes (GSM, UMTS, WiMAX, TDS, LTE FDD and LTE TDD). It supports up to a 5.0 Gbps data throughput for multiple modes. Moreover, BBU supports 4 modes in the same box, and LTE TDD and FDD using the same hardware.

UMPT supports UMTS, GSM, LTE TDD and FDD at the same time.

UBBP hardware support both LTE TDD and FDD. (2 UBBP cards are needed when LTE TDD and FDD co-exist)

Huawei's SingleEPC provides "atom-level" convergence technology. For the control plane, Huawei provide up to 17 million SAU SGSN/MME convergent

Version: Draft

nodes, which support dynamic resource sharing for multiple modes. For the data plane, Huawei provide up to 600 Gbps throughput with a GGSN/S-GW/P-GW convergent node.

Huawei can boast true end-to-end capabilities in LTE, with businesses ranging from chipsets (via its Balong chipset arm), through devices, to RAN and core network products. Huawei provides a complete lineup of LTE TDD terminals, which boasts several industry firsts. Recently, Huawei announced the world's first Category 6 smartphone-Honor 6 using the new Kirin 920 chip, which is capable of download speeds of up to 300Mbps.
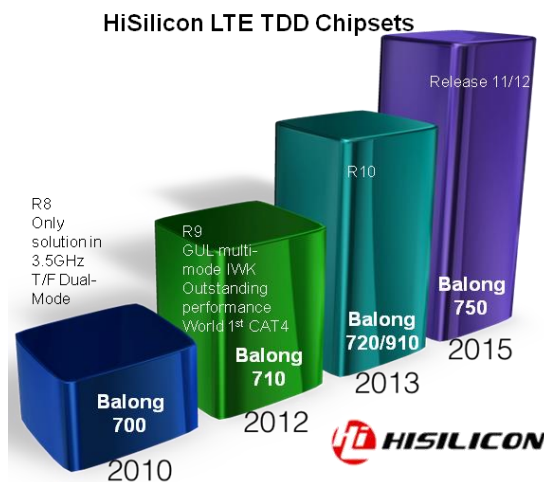

Huawei's SingleSON solution utilizes multiple Huawei products and services like M2000, eCoordinator, SingleRAN BTS and Huawei professional service. The solution provides automated optimization, configuration, maintenance and

coordination of multi-RAT (GSM, UMTS, LTE FDD and TDD) and multi-layer networks.

Huawei's SingleOSS solution realizes co-management for GSM, UMTS, LTE FDD and TDD networks.

Operational efficiency is significantly improved while OPEX and CAPEX are significantly reduced.
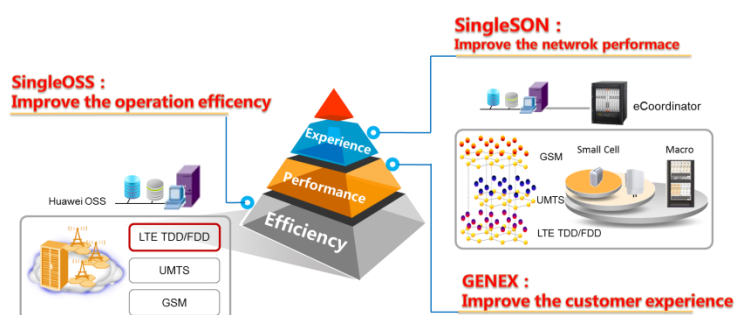
Solution to deploy full Mobile Data and Voice with partnership of existing 3G/2G Operators

Huawei provides SingleRAN solution to cover, including WBB, MBB, also interoperability with other network systems. In particular, Huawei has brought out various innovative WBB solutions.

eWLL (enhanced Wireless Local Loop), Low Cost Solution for Broadband Networ For those small and cost sensitive operators who cannot afford to deploy an EPC in the LTE network due to the high cost of EPC deployment, Huawei

introduces eWLL solution, which helps increase the subscriber quantity and provides the operators with new revenue growth potential.

eWLL, a compact RAN, consists of eNodeBs that are integrated with some EPC functions (EPC-inside). It helps operators deploy a network independent from the EPC and allows CPEs to directly access the LTE network through the eNodeBs in WBB scenarios.

The compact RAN feature provides the following functions:

- Authorization and authentication on the LTE network

- NAS signaling messages, such as messages for network access

- Subscriber registration

- Quality of service (QoS) control, such as imposing an upper limit for available bandwidth for each subscriber

Position of a compact RAN in the radio network
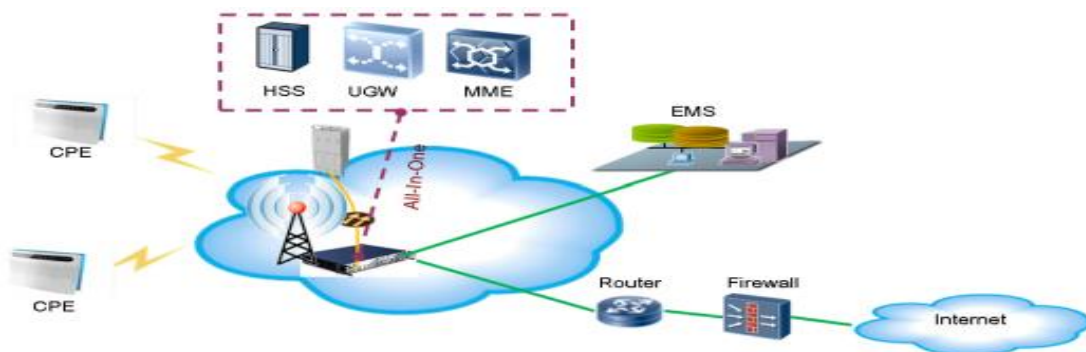
3.2   Solutions for WiMAX to TD-LTE Transition

Huawei's deep WiMAX insights are the result of working with more than 100 operators to deploy WiMAX mobile broadband networks. Looking forward, SingleRAN WiMAX/LTE allows for cost-effective, robust and smooth evolution to LTE amid unprecedented growth in network traffic and industry movement away from voice-only, pure-pipe services to mobile data and on-demand service innovation. SingleRAN WiMAX/LTE includes a comprehensive portfolio of products and solutions that allow for smooth and rapid evolution to a best-in-class LTE network.

Products & Solutions

- Dual-Mode RRU – Support simultaneous coexistence of WiMAX and LTE TDD spectrum bands.

- Multi-Antenna Technologies – Provide 15% to 20% capacity increases for commercially deployed network with adaptive MIMO and Beamforming.

Huawei SingleRAN WiMAX/LTE TDD Solution
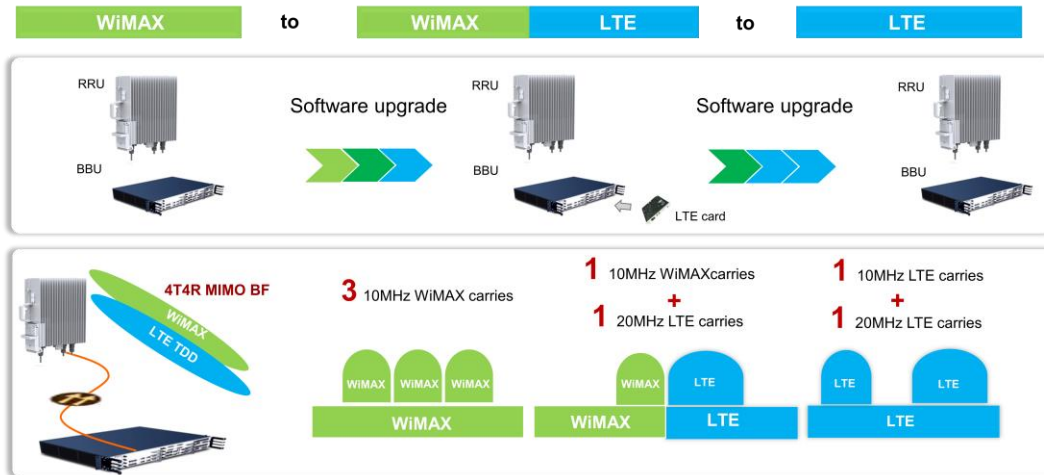
Generally, the evolutionary path from WiMAX to TD-LTE will involve two phases: the first will see the two networks coexist, and then complete sole TD-LTE network. In order to ignore coexistence interference between WiMAX and TD-LTE, GPS clocks and UL and DL subframe ratios should be synchronized respectively. In this case, the guard bandwidth does not need to be reserved. The GPS clocks can be automatically synchronized, but the synchronization of UL and DL subframe ratios need to be coordinated and mapped between the WiMAX BS and LTE TDD eNodeB in terms of subframe ratios and special LTE subframe configuration.

Table Subframe synchronization solution for the WiMAX BS and LTE TDD eNodeB

WiMAX DL/UL Subframe Configuration	LTE TDD DL/UL Configuration and Special Subframe Configuration	WiMAX Performance	LTE TDD Performance
35:12	3:1 and 9:3:2	No impact on the WiMAX network	LTE DwPTS length is changed to 9 os, about 2% DL capacity loss (compared with special subframe configuration 7: 10:2:2).
32:15 (31:15)	3:1 and 3:9:2	No impact on the WiMAX network	LTE DwPTS length is changed to 3 os, about 13% DL capacity loss (compared with special subframe configuration 7: 10:2:2).
29:18	2:2 and 10:2:2	The last two symbols of WiMAX DL need to be removed, about 9% DL capacity loss.	No impact on the LTE network

There are other vendors offering similar solutions and it is no longer a technical challenge to deploy TD-LTE co-exist with LTE FDD and WiMAX.

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Another prominent Solution Partner of GTI is Telrad and has proven solution to assist WiMAX Operators to transition to TD-LTE.   The following slides below highlights their approach in achieving this transition in a real
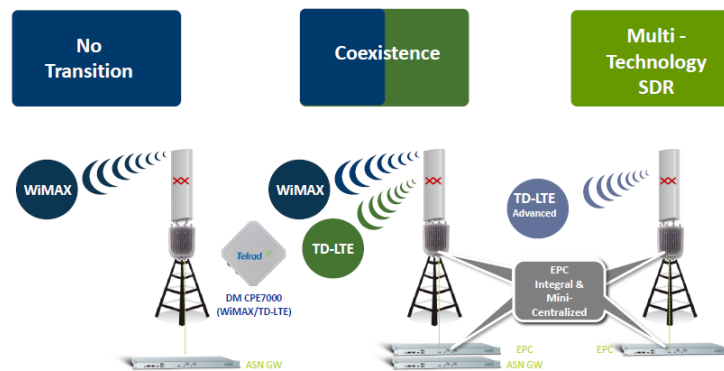
environment   .
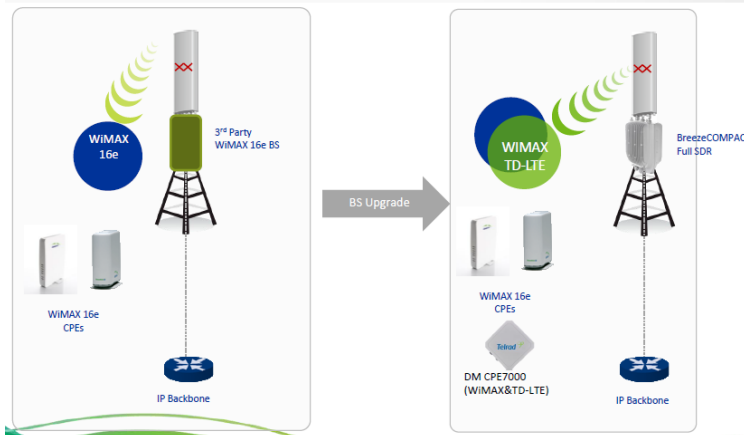
There are other Solution Partners of GTI that provide multi-mode and

multi-bands devices. Green Packet Bhd has the following devices that assist

WiMAX Operators in the transition over to TD-LTE on a orderly manner.

P1 Single Device from Green Packet to Service TD-LTE & WiMAX

Value-added software option designed for the networks with TD-LTE and WiMAX coexistence or migration.

- **Wideband to Address more WiMAX Frequencies**
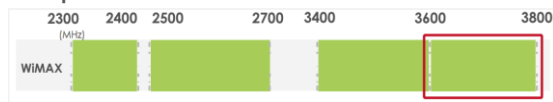
3.6GHz~3.8GHz is available to complement service coverage.

- **Auto-Switch between TD-LTE and WiMAX**

CPE can be configured to automatically switch between TD-LTE and WiMAX networks based on preferred RAT.

One RAT at a time

Device External Interface

P1

Built-in 6dBi Antenna

LED

SIM Card

RJ-11 VoIP Port

2*RJ-45 Ethernet Port

USB Port

Power

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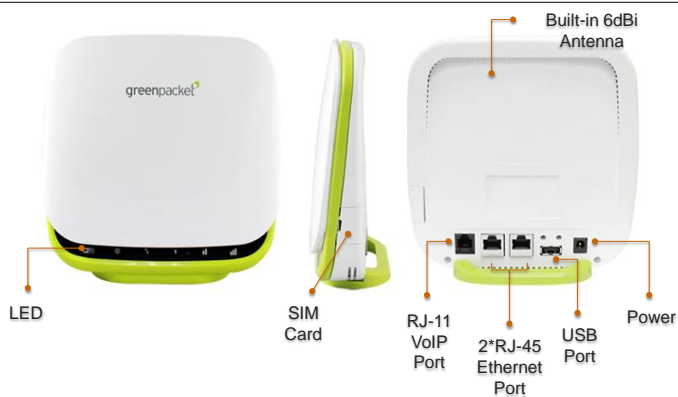
4. The Various Competitive Landscapes and Business Strategies

The usage and demand of wireless broadband are different in different markets. The usage pattern and demand in most of the urban centres are generally very high. The users in urban centres in most countries in the world are well exposed to the ever present social media which normally have rich media content including streaming video. Most of these rich media are consumed using high end smart-phones, PCs and tablets and have caused congestions in the wireless networks.

4.1 Emerging market with pent-up broadband demand

The demand of broadband will continue to grow around the world. In developing countries where there is a lack of fixed infra-structure, there is a pent-up demand of good broadband connectivity. TD-LTE can be a viable technology and a more cost effective approach to fulfil this pent-up demand for good quality broadband connectivity.

In most of these countries, the existing fixed infra-structure is focused in urban centres while most of their rural and in some cases, even sub-urban

regions do not have sufficient fixed infra-structure to provide the necessary broadband connectivity. Hence, wireless broadband can play an important role in these areas by providing a more cost effective solution.

Some of these markets do have some limited 2G/3G wireless broadband connectivity but is normally not adequate to serve the pent-up demand. Most of the developing countries fall under this scenario and TD LTE can play a major role in serving these pent-up demands.

4.2   Markets with 3G/2G players but with increasing demand of wireless broadband and lack of 4G deployment

In some markets, the incumbent had already deployed 2G for reasonably good nation-wide coverage and reasonable 3G coverage in urban centres but have yet to have any 4G deployment.   In this market, there is still an opportunity for TD LTE to be deployed to provide wireless broadband in sub-urban areas and to provide superior performance and capacity in urban centres.

  Some examples of these type of markets can be found in Indonesia, Laos, India and Azerbaijan.

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4.3.1 Markets with Strong 4G/3G players

In most advanced developing and developed market, the incumbent mobile operators will have good nation-wide coverage on 2G, good 3G coverage in most urban centres and also reasonable 4G coverage in high demand zones in urban centres.

In these markets, a big percentage of the incumbent mobile operators do not own the fixed line infra-structure and their mobile network is designed to give priority to mobile voice services. Some of these operators do not have sufficient frequency spectrum to deliver the capacity and speed performance that the customers are expecting.

With these short-comings, there are opportunities for a TDD spectrum owner that has sufficient frequency spectrum to deploy a suitable TD LTE network to fill these demand gaps particularly in dense urban and suburban areas.

5 The Various Business Models

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To cater for the various competitive market landscapes, different business models can be implemented.   The prime objective is to execute a business model that can successfully generate sufficient cash-flow for the operation after deploying the TD LTE network.

As demand for wireless broadband continue to grow in the next few years, the TD LTE operator will be in a stronger position to establish an   alliance and partnership with an incumbent operator. There is also potential to merge with the incumbent operator or to launch service as a new operator entrant focusing on significant regions within the country.

5.1   Business Models for market with pent-up broadband demand.

When a market has pent-up demand for Broadband connectivity and there is a shortage of network infra-structure, the TDD Spectrum Owner can deploy TD-LTE network adopting a "Build and Bill" business model. This business model enable the TD LTE Operator to build each Base Station in the under-served area and start selling fixed-wireless broadband services within the newly build coverage area of that Base

Station. This approach had been adopted by many WiMAX/TD LTE Operators in many emerging economies where there is in-sufficient broadband infra-structure.

Some examples of these are deployed in the rural and sub-urban centres around Sao Paolo of Brazil by On Telecom and in Vianteinne, Laos by Planet Computer.

The following few presentation slide highlights the key business strategy and business model of On Telecom in Brazil :
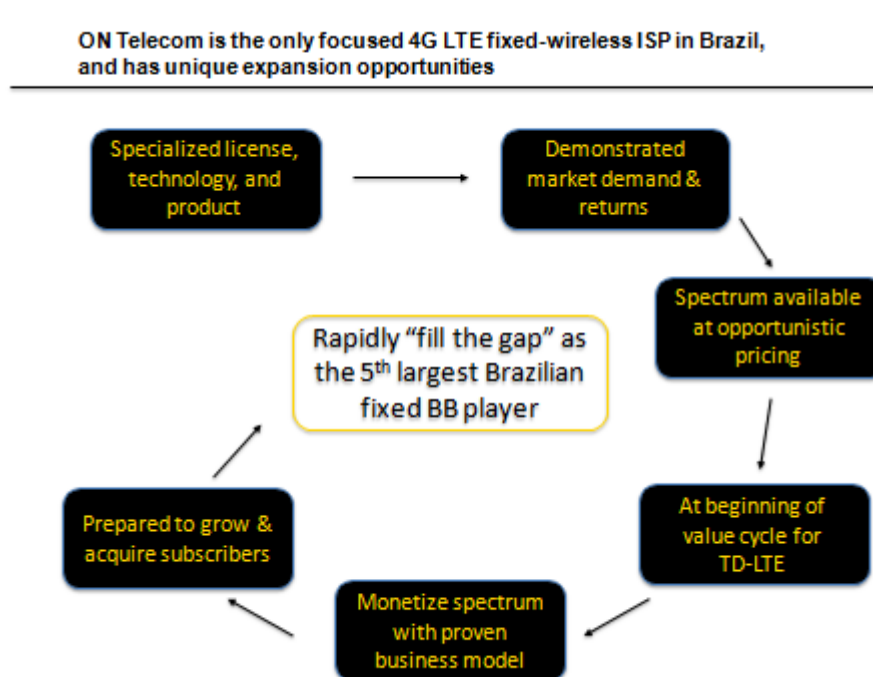
ON's business model proposes to solve this divide through the repurposing of cutting edge mobile networks…

ON Telecom has repurposed the most advanced data-focused cellular technology, TD-LTE, and rethought the design of cellular networks with the objective of providing subscribers stable high-speed broadband access within their homes

The ON Network | | Traditional Wire-Based Network

Internet

Cable / DSL Infrastructure

In both networks, a subscriber connects in-home devices (laptops, tablets, etc.) wirelessly to a modem broadcasting WiFi within the home
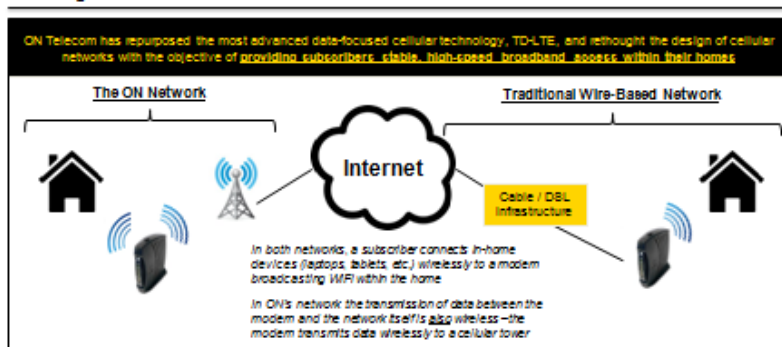
In ON's network the transmission of data between the modem and the network itself is also wireless – the modem transmits data wirelessly to a cellular tower

1. ON's product combines the speeds of traditional wireline infrastructure (cable or DSL), the ease of no installation, and the convenience of in / out of home portability with substantial capital savings due to the use of a targeted tower-based network
   - In home devices (laptops, tablets) require no modification to connect to the WiFi broadcasted by an ON CPE (modem)

2. Furthermore, ON's speed and stability is greater than those of traditional mobile / cellular operators employing similar 4G technologies (and resulting capex lower), because the ON network has been designed with specific consideration of the needs of a data-based Internet subscriber (as opposed to consideration of the needs of a cellphone-based mobile subscriber)
   - ON's tower deployment (non-contiguous cells) and spectrum configuration (asymmetric balance of uplink / downlink) are ideal for data usage – but would not be ideal for fully mobile usage

… Result in a competitively differentiated product…

The mix of high capacity with mobility, low cost of coverage, and no installation positions ON's product to compete aggressively in secondary and tertiary cities of Brazil characterized by lower income per capita, lower density, and low existing broadband penetration

	Cost x dist efficiency of backhaul network	Efficient Coverage Cost (Access Nework)	Product capacity	Mobility	Installation
LTE Fixed Wireless	Very high	Superior	High	High	None
DSL	Low	Moderate	Moderate	Low	Required
Cable (HFC)	Moderate/ Low	Moderate / Poor	High	Low	Required
Fiber	Moderate/ Low	Poor	Superior	Low	Required
LTE Mobile	Very high	Moderate	Moderate	Superior	None

Version: Draft

With existing TD-LTE concession covering the interior of the State of São Paulo (ex. City of SP metro area)…

ON's existing license concession covers one of the wealthiest regions of Brazil
*Average GDP / capita of R\$28K per annum (+46% wealthier than Brazilian average)*

9.9MM pops

3.0MM households

133 cities (Footprint excludes Sao Paulo City)

83.4% of pops in classes A, B, or C (vs. 57.8% avg. in Brazil)

Includes 7 cities with higher GDP per capita than Sao Paulo city

ON's concession covers ~8% of Brazil's total GDP
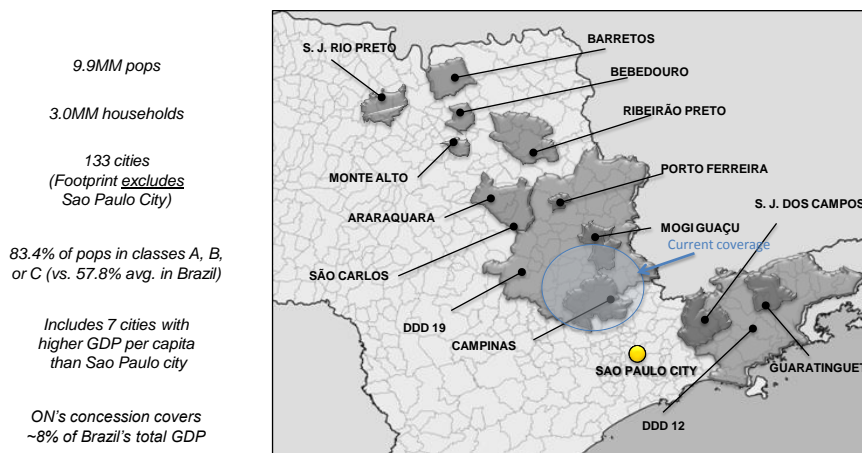
On Telecom had successfully secure necessary funding to deploy TD LTE Network. Their current plan is to deploy approximately 300 Base Stations and are targeting 70,000 fixed wireless broadband subscribers by the end of 2014. On Telecom is planning to expand to other regions of Brazil and has a goal to become the fifth largest Fixed Broadband Service Provider in Brazil using TD LTE technology.

In Laos, the internet infra-structure is inadequate to serve the fast growing demand of good, reliable broadband connectivity. Planet Computer who has an existingdeployed WiMAX network plans to deploy TD LTE in selected urban centres to provide Fixed and Nomadic Broadband service.

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Planet Computer currently has 11 Base Stations deployed in Viantienne and once funding is secured, it plans to deploy TD LTE in 4 other urban centres. Below is the summary presentation from Planet Computer Co., in Laos.
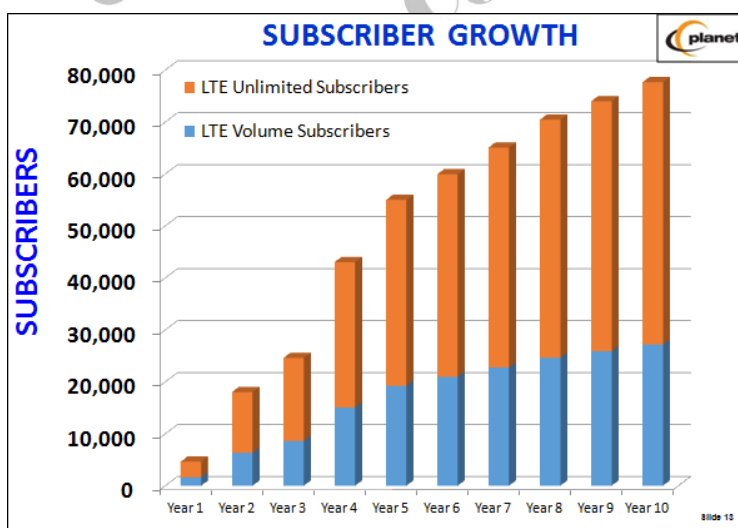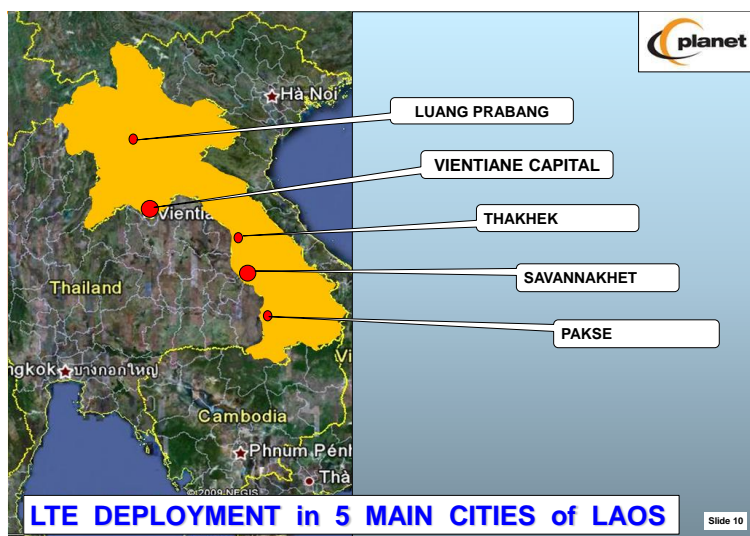
5.2 Business Models for market with existing 2G/3G players

In markets that already have reasonably good 2G and 3G coverage, the business strategy will need to be more aggressive and on a larger scale. The business strategy will need to look at offering unique value propositions that the consumers need.

As an example of this business modelis from PT Internux of Indonesia where they use TD LTE technology to give superior performance and capacity to fixed, nomadic and mobile broadband users in Jakarta and the surrounding areas.   Under the brand Bolt, their differentiation is in offering good coverage and very high performance at reason price as the incumbent operators in Jakarta does not have LTE spectrum and have in-sufficient frequency spectrum for 3G.
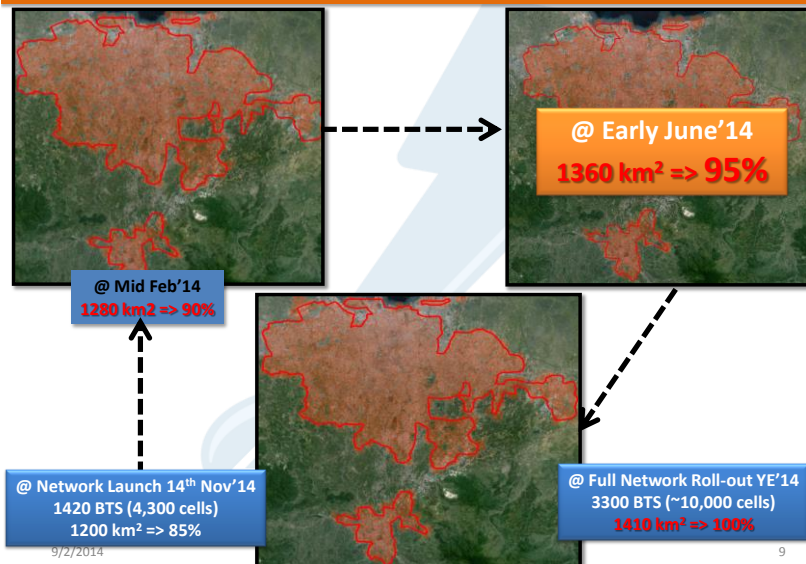
There is a potential 18 to 30 months of market opportunity for PT Internux to aggressively deploy the TD LTE network and grab a significant wireless broadband market share.   The few slides below summarise their business model.   Thus far, PT Internux have successfully signed up more than 500,000 subscribers within 9 months after launch of their service.

Once they have sufficient coverage, they also plan to launch Dual SIM Dual Radio smart phone and allowing them to sell to users who want to keep their existing mobile number.

Bolt Super4G: Plan and Execution

LAUNCHED THE 1st LTE NETWORK IN INDONESIA

WiMAX to LTE Network Upgrade	Launch 1st LTE MBB Service	MVNO VOICE and 3G offload	Future Expansion
• Convert **940 WiMAX BTS to LTE (full swap**)	• Introduce the 1st Post-Paid & Pre-Paid LTE Data Services	• Implement **MVNO type model with local Telco partner(s)**	• Coverage play
• Launched **with 1420 sites**	• Device: USB Dongle, **Mobile Wifi**, Home Modem	indosat XL 3	• Content play
• Implement **Higher Capacity MPLS core & new Mobile Core (EPC)**	• **Extensive marketing campaign** & aggressive recruitment of distributors/resellers	• Mid'14: Launch LTE Data + **Voice Services** with first Smartphone	• Voice play
• Upgrade Billing Support System to **full carrier-grade**		• Introduce new Device: and focus on bundling	• Device play
• **Target > 3,000 sites** for ultimate roll-out in 18 months	• **Target to acquire 500,000 new subscribers** in the 3 Month period from launching	• Develop Mobile Content services	• Wi-Fi play

Bolt Super4G: Network Coverage

@ Mid Feb'14
1280 km2 => 90%

@ Early June'14
1360 km² => **95%**

@ Network Launch 14th Nov'14
1420 BTS (4,300 cells)
1200 km² => 85%

@ Full Network Roll-out YE'14
3300 BTS (~10,000 cells)
1410 km² => 100%

9/2/2014   9

Bolt Super4G: Product Launch

Uniqueness of offer
- Focus on **MiFi** (to date 94% of take-up)
- **US$30** starter pack includes:
  - **MiFi Device** (US$20 for USB)
  - **8GB preloaded Quota** (30 days)
- Price leading Top-ups: from **US$2.5** for 2GB… US$20 for 30GB

PAKET INTERNET	MASA AKTIF KUOTA	HARGA (TERMASUK PPN)
2 GB	30 Hari	Rp. 25.000
4 GB	30 Hari	Rp. 45,000
10 GB	30 Hari	Rp. 100,000
20 GB	60 Hari	Rp. 150,000
30 GB	60 Hari	Rp. 200,000

Version: Draft

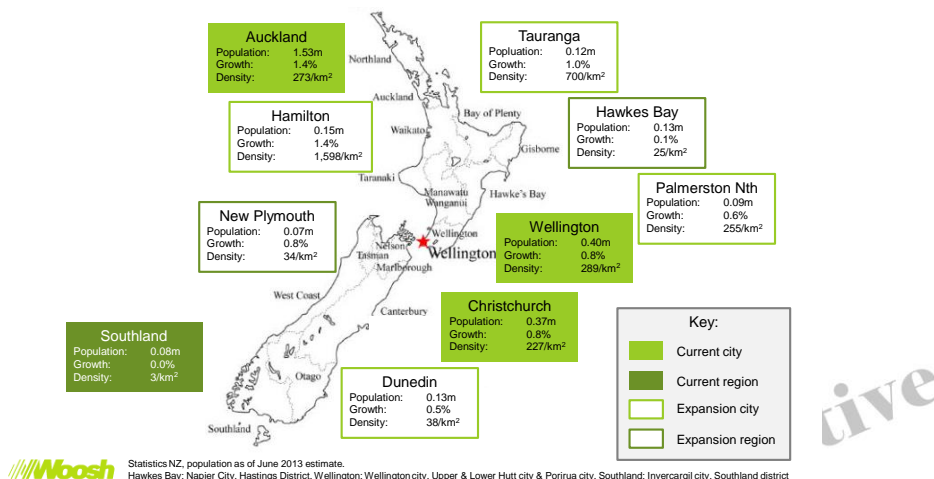**Bolt Super4G**: Introducing Dual-SIM LTE Smartphones
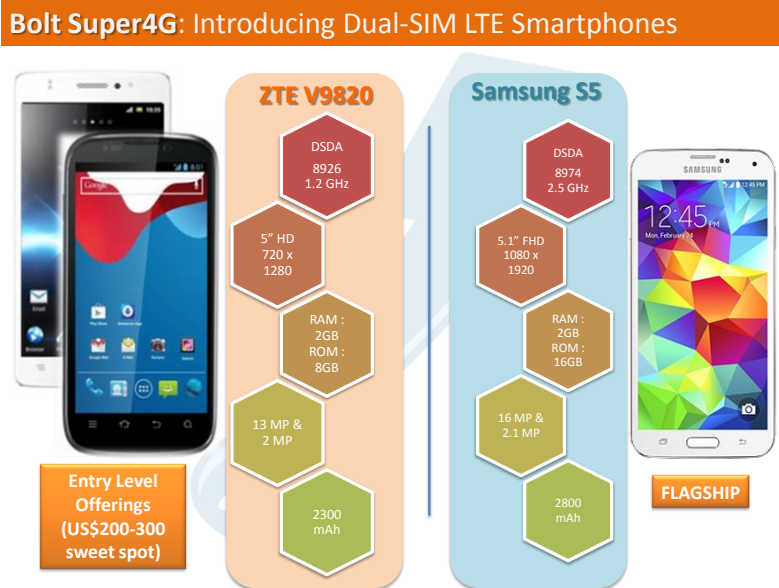
Another interesting market model is in New Zealand where the fixed line market is regulated with a very high subscription fee and the incumbent mobile operators are protecting their high ARPU(Average Revenue Per User). Hence, the TDD spectrum owner, Woosh Wireless that has more than 70MHz TDD spectrum intends to deploy TD LTE to provide a fixed and nomadic broadband service with an attractive price-point and performance.

Once they have built up sufficient coverage, the TD LTE operator could also consider using Dual SIM Dual Radio devices to enter the Mobile Broadband market segment. The presentation slides below provide some insight into their business strategy.

New Zealand Market Demographics

Auckland
Population: 1.53m
Growth: 1.4%
Density: 273/km²

Tauranga
Population: 0.12m
Growth: 1.0%
Density: 700/km²

Hamilton
Population: 0.15m
Growth: 1.4%
Density: 1,598/km²

Hawkes Bay
Population: 0.13m
Growth: 0.1%
Density: 25/km²

Palmerston Nth
Population: 0.09m
Growth: 0.6%
Density: 255/km²

New Plymouth
Population: 0.07m
Growth: 0.8%
Density: 34/km²

Wellington
Population: 0.40m
Growth: 0.8%
Density: 289/km²

Christchurch
Population: 0.37m
Growth: 0.8%
Density: 227/km²

Southland
Population: 0.08m
Growth: 0.0%
Density: 3/km²

Dunedin
Population: 0.13m
Growth: 0.5%
Density: 38/km²

Key:
- Current city
- Current region
- Expansion city
- Expansion region

//Woosh Statistics NZ, population as of June 2013 estimate.
Hawkes Bay: Napier City, Hastings District. Wellington: Wellington city, Upper & Lower Hutt city & Porirua city. Southland: Invercargil city, Southland district

New Zealand Regulated Fixed Broadband Infra-Structure

Where and when is UFB being delivered?
UFB fibre will be delivered to the door of schools, health premises, businesses and homes, reaching 75% of New Zealanders in 33 towns and cities around New Zealand by 2019.

These places have been selected because they are the country's largest population centres according to Statistics New Zealand projections for 2021. The boundaries for UFB coverage relate to areas agreed under contract with CFH's partners, so while they are close to those of local territorial authorities, they do not always overlap exactly.

As a general rule, UFB is being built in the most densely populated parts of metropolitan areas. Click on the key below to see the deployment plans of our partners around New Zealand.

Wholesale prices are regulated and these wholesale players are not allowed to compete in the retail market.

//Woosh Statistics NZ, population as of June 2013 estimate.
Hawkes Bay: Napier City, Hastings District. Wellington: Wellington city, Upper & Lower Hutt city & Porirua city. Southland: Invercargil city, Southland district

Version: Draft

NZ Market Products & Pricing

15

Competitor Leading Prices	ADSL	VDSL	Fibre	High Speed Wireless
Vodafone	$75 / 30GB	$85/ 80 GB	$95 / 80 GB	
Telecom	$75 /40GB	$85 / 40GB	$85 / 40 GB	
Slingshot	$69 / 40GB	$84 / 40GB	$69/40 GB	
Orcon	$75 / 30GB	$95 / 80GB	$75 / 30 GB	
Woosh	$75 / Uncapped			$60-70 / 60GB

Woosh 4G: A Fixed Line Substitute

$10	$20	$30	$40	$50	$60	$70	$80	$90	$100 +

Woosh 4G Fixed Line Substitution

Fixed Line Market Prices
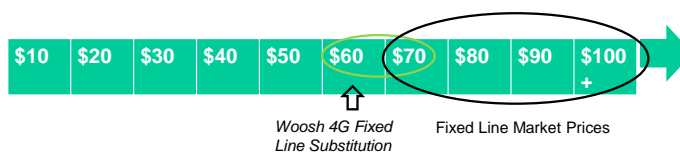
All competitor services listed include a phone line. ADSL regulated wholesale cost $45, Lowest Fibre regulated wholesale Cost $ 37.50, VDSL non regulated wholesale cost $50. Average NZ broadband speed for 2013 was 5.1Mbs. www.Akamai.com

Another example is in Azerbaijan, where the TDD spectrum holder had deployed WiMAX to provide fixed and nomadic broadband and is now planning to deploy TD LTE to improve its service offering. With superior spectrum assets, Sazz plans to differentiate its service by offering superior capacity and performance at reasonable price.
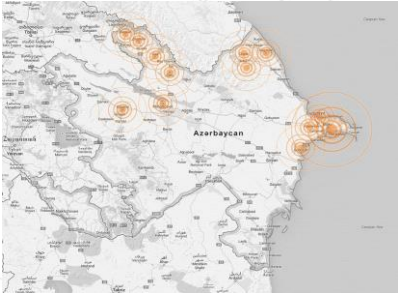
In this growing market where the incumbent has not aggressively deployed 4G services, there is still a market window for Sazz to gain sufficient market share and become a profitable operation. The presentation slides below highlights some of its main business positioning in this resource rich country :
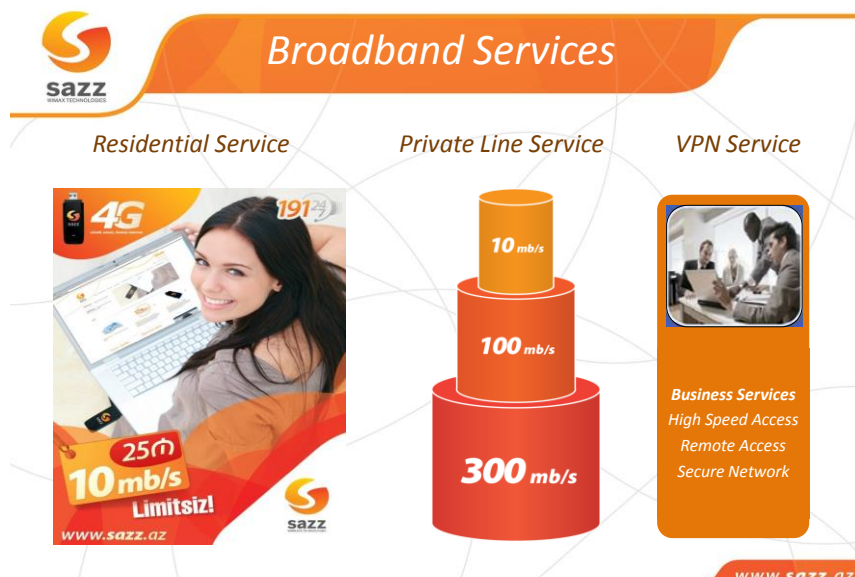
Sazz Story

Azerbaijan

Background
- *Sazz 4G network commercial launch in March 2011*

Network Coverage
- *Metropolitan Baku*
- *Absheron Peninsula – Xirdalan & Sumgayit*
- *Regional Cities*

Subscribers & Services
- *Over 80,000 in gross subscriber sales*

Frequency allocation
- *142 Mhz in 3.5 – 3.6 Gigahertz Range*
- *Nationwide License*

www.**sazz**.az

Utilize Multi-type Devices to serve different customers

Indoor CPE	Outdoor CPE	Mobile WiFi
• B593s-42	• B222s-42	• E5776s-420
• Indoor CPE with WiFi	• Outdoor CPE	• Multi mode
• 4FE+2POTS+1USB		• Available Time: 2013Q2
• Available Time: Oct 2011		

WiFi User

LTE TDD syste

WiFi link

Indoor CPE with WiFi can supply **LTE & WiFi** services for **family & enterprise.**

Outdoor CPE can supply **high gain** signal and bring user **good experience.**

Mobile WiFi Router can attract **all WiFi devices** and turn them to LTE subscribers.

5.3   Business Models for market wi th existing 2G/3G/4G players

In markets where the incumbent mobile operators have already deployed good nation wide coverage with 2G, good 3G coverage in urban centres and some 4G networks, the TDD spectrum holder could either address a niche market or region, or need to secure sufficient funding to compete directly with the incumbent operators.

An example of such business model is by Packet One Network (P1) in Malaysia that had previously raised more than US$100m from Intel Capital and SK Telecom.   Their intention was to capture a significant market share of the Wireless Broadband market using WiMAX and then transition into TD LTE with nation-wide coverage.

When P1 started, the LTE spectrum was not allocated to any of the incumbent operators. Hence, P1 aggressively deployed WiMAX network to start building up market share and when the 4G LTE spectrum was allocated to the incumbent operators, P1 managed to secure the incumbent fixed line operator to take up the controlling share holder position and will be deploying TD LTE on a nation-wide basis.   Their planis   to phase out WiMAX to compete aggressively with the other incumbent mobile operators.

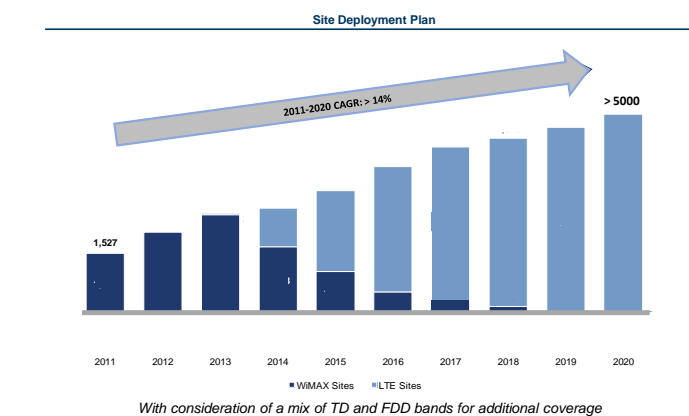The following presentation slides outline P1 main business strategy in the Malaysian market.
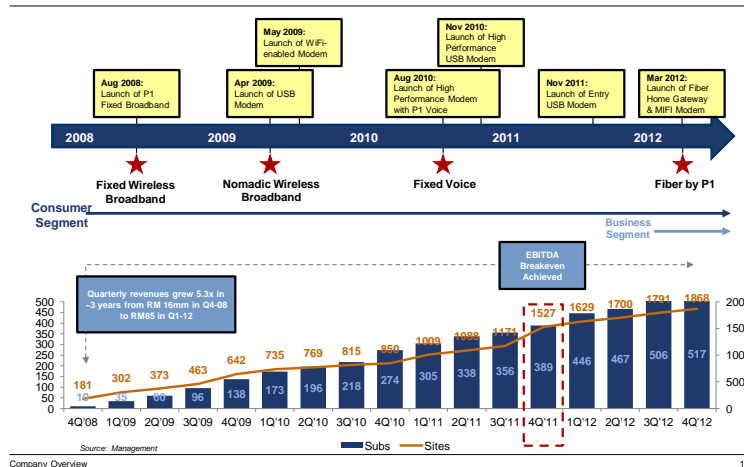
Another Operator, 2K Telecom in Romania decided to adopt a different approach. Even though the Romania market has mature 2G/3G/4G incumbent operators, 2K Telecom decided to deploy TD LTE to provide a superior service and also plan to become an MVNO to gain rural coverage and focus on data centric services.

The following presentation slides highlight the current competitive landscape and allocated spectrum in Romania and the intended business plan of 2K Telecom.

Version: Draft

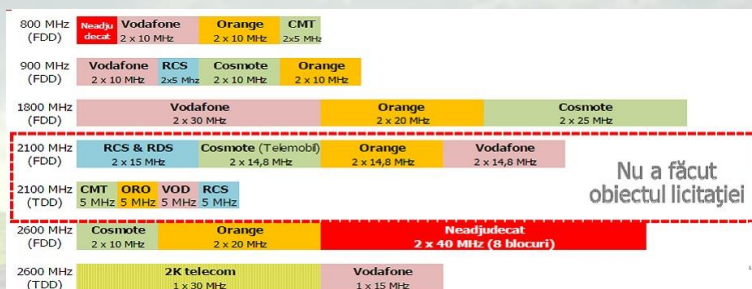## 2.5 MARKET ENVIRONMENT – COMPETITION

Mobile customers (thousands)
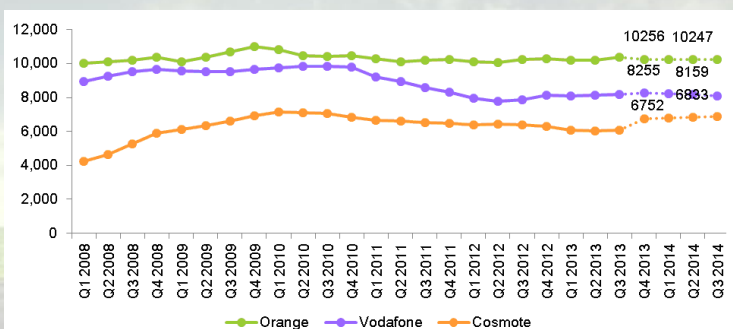
www.2ktelecom.ro

3.1 SPECTRUM – CURRENT STATUS

- 2K Telecom holds 30 MHz of the 2.6 GHz (band 38) and 28 MHz of the 3.5 GHz spectrum (band 42).

Red bars: not allocated. Status after the auction of October 2012.

www.2ktelecom.ro

Version: Draft

5.1 THE LTE PROJECT

- -

- 2100 planned eNode-Bs;

- 10 M pops coverage - all urban areas;

- Rest of country: 10 M rural: covered by full-MVNO w/ local op.; dual IMSI;

- Detailed business plan available;

- Scalable business plan;

- Funding requirements: approx. 110 M US$; 20% of necessary – existing shareholders' contribution;

- 10 M needed from partners as equity injection plus 20 M as a shareholders' loan, for a negotiable stake.

www.2ktelecom.ro

6 Concluding Remarks

This report attempts to illustrate the many values of TDD Spectrum and how it can be used as a supplement to FDD Spectrum or by itself to provide wireless broadband capacity to address the ever increasing data demand. Different business models can be used to address the various market conditions successfully.

The intrinsic values of these TDD spectrums will continue to increase, driven by the ever increasing demand for wireless broadband. The best approach in many markets is to combine the lower FDD spectrum for coverage and penetration with the higher TDD spectrum for speed and capacity.

With the maturity of TD-LTE industry and eco-system and the convergence of LTE TDD and LTE FDD, it is an opportune time for financial investors to invest in these TDD Operations while valuation for TDD spectrum is still attractive.