Industry Experience on Multi-Network Deployment

ZTE Corporation

Outline

- Overview of Mobile Broadband
- A Practical Multi-Network Sample
  - Multi-Network Layout
  - Outputs of operation
- Future Thoughts
- Conclusions

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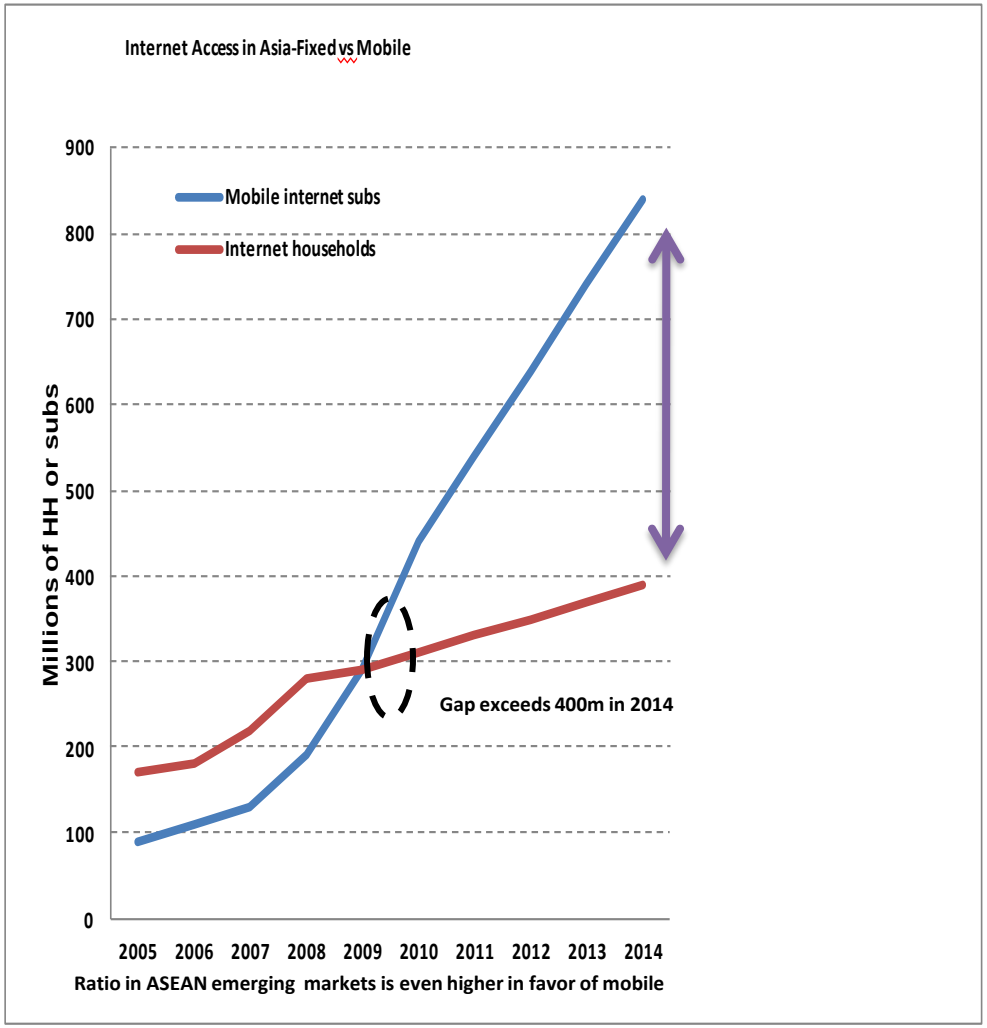
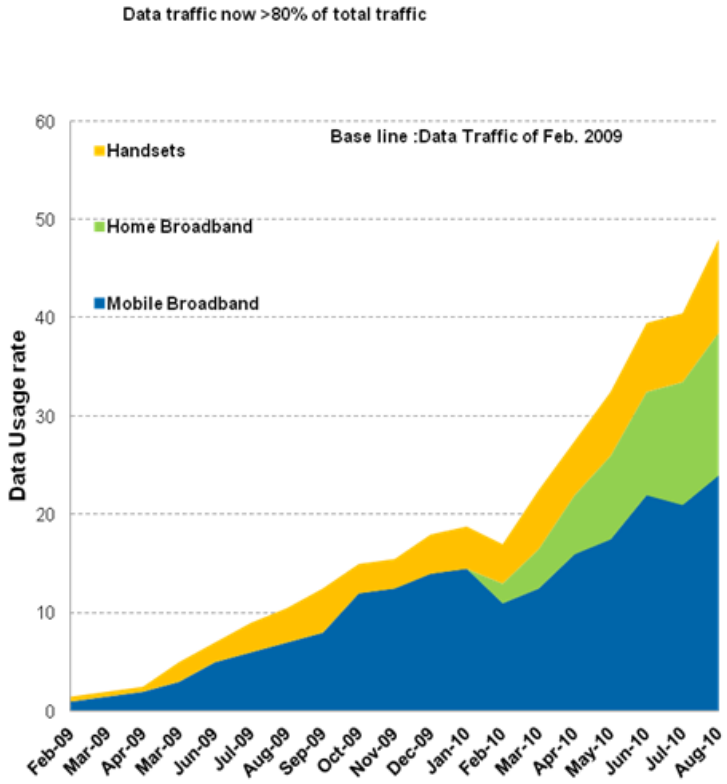
The Future of Internet is Mobile Broadband



Resource: 2010 25th Nov. LTE/DC-HSPA+ Network Launch



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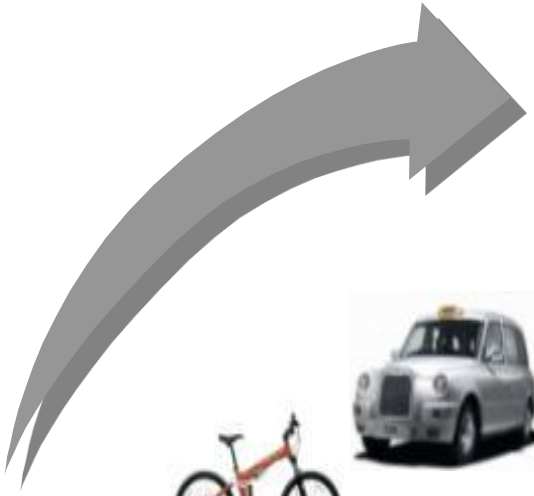
Growing and Diversified Requirements for Mobile Internet



Apply to	Basic mobile Telemetry (machine-to-machine) applications eg. heel tracking	3G video call 3G mobile telemetry application	Mobile broadband for mobile work-force Fixed-line replacement Sophisticated mobile telemetry applications	High –speed mobile broadband supporting multimedia download/upload Mobile POS Mobile IP Messaging(instant broadcast of text + photos/video to a large group of recipients) Real-time imaging/ surveillance HD Mobile TV/video sharing	Mobile-fixed substitution /convergence Interactive, Multi-media applications HD real-time imaging / surveillance Mobile video- conferencing Interactive advertising/TV and any other creative applications you can think of …
Highest downlink speed	**40 kbps**	**384 kbps**	**14 Mbps** **7.2 Mbps** **3.6 Mbps**	**42 Mbps(DC-HSDPA)** **28 Mbps** **21 Mbps**	**100Mbps(LTE)**
Standard	**GPRS (2.5G)**	**WCDMA (3G)**	**HSPA (3.5G)**	**HSPA Evolution (3.75G)**	**LTE (4G)**

Challenges of Mobile Internet

Challenges

- Has a large youth market who demands quality data services
- There is high data throughput for each base station due to high population density
- Fierce competition exists between mobile operators.
- High bandwidth is required for new technologies and services
- Network convergence and evolution are difficult
- A new business model has arisen with smart phone

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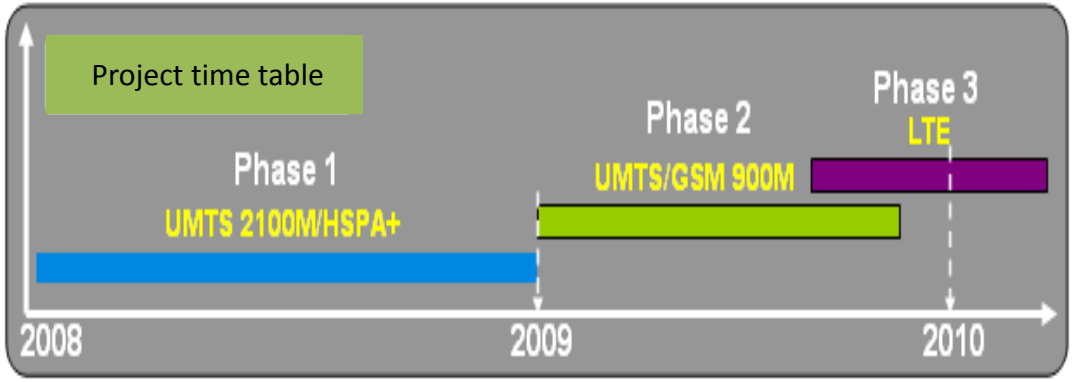
A Practical Network Deployment

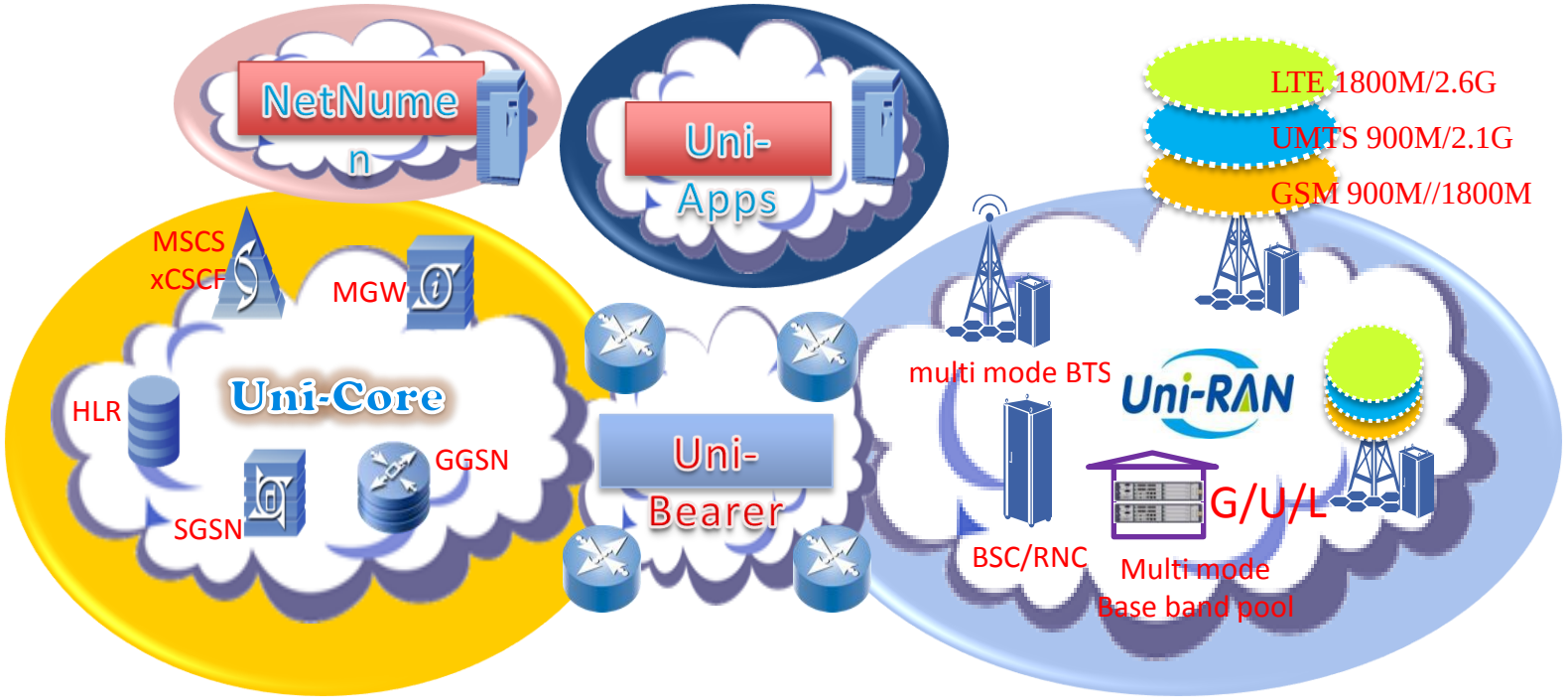
- High Network Speed, Dual band LTE network
- Single network Reduce OPEX
- Ability of evolution, Enhance Competitiveness



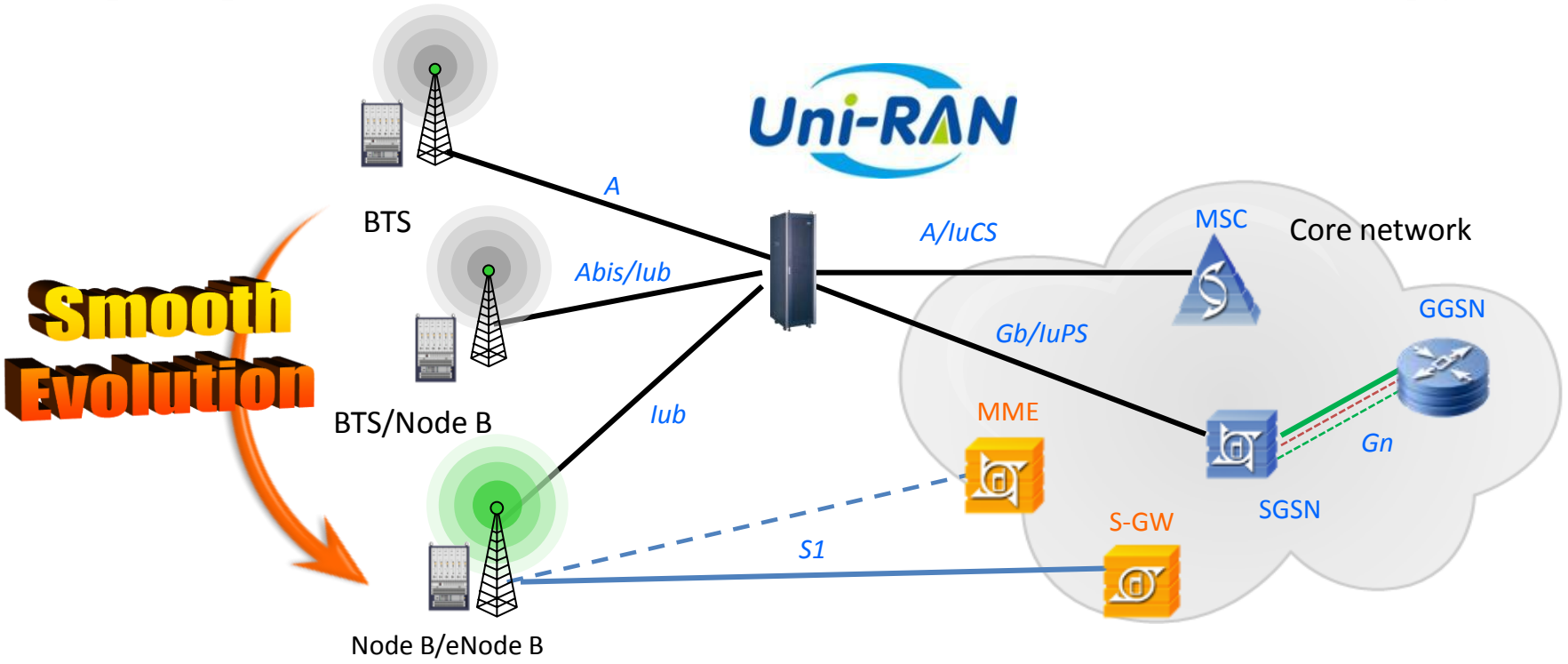
SDR evolution	■ Coexistence of 2G, 3G, and LTE ■ To simplify network structure
Distributed base station	■ Rapid deployment , Sharing of existing network equipment ■ Reduce TCO of network construction
IP e-UTRAN	■ All-IP network ■ Greatly enhance the competitiveness

Unified Radio Access Technology Simplifies Network Structure

- Unified core realizes open, convergent, and flat packet based core
- Unified bearer promotes IP centric bearer network
- Unified application ensures the convergence of applications
- Unified network management facilitates fault isolation, fault coordination, and performance management



Highlights of Unified Radio Access Technology



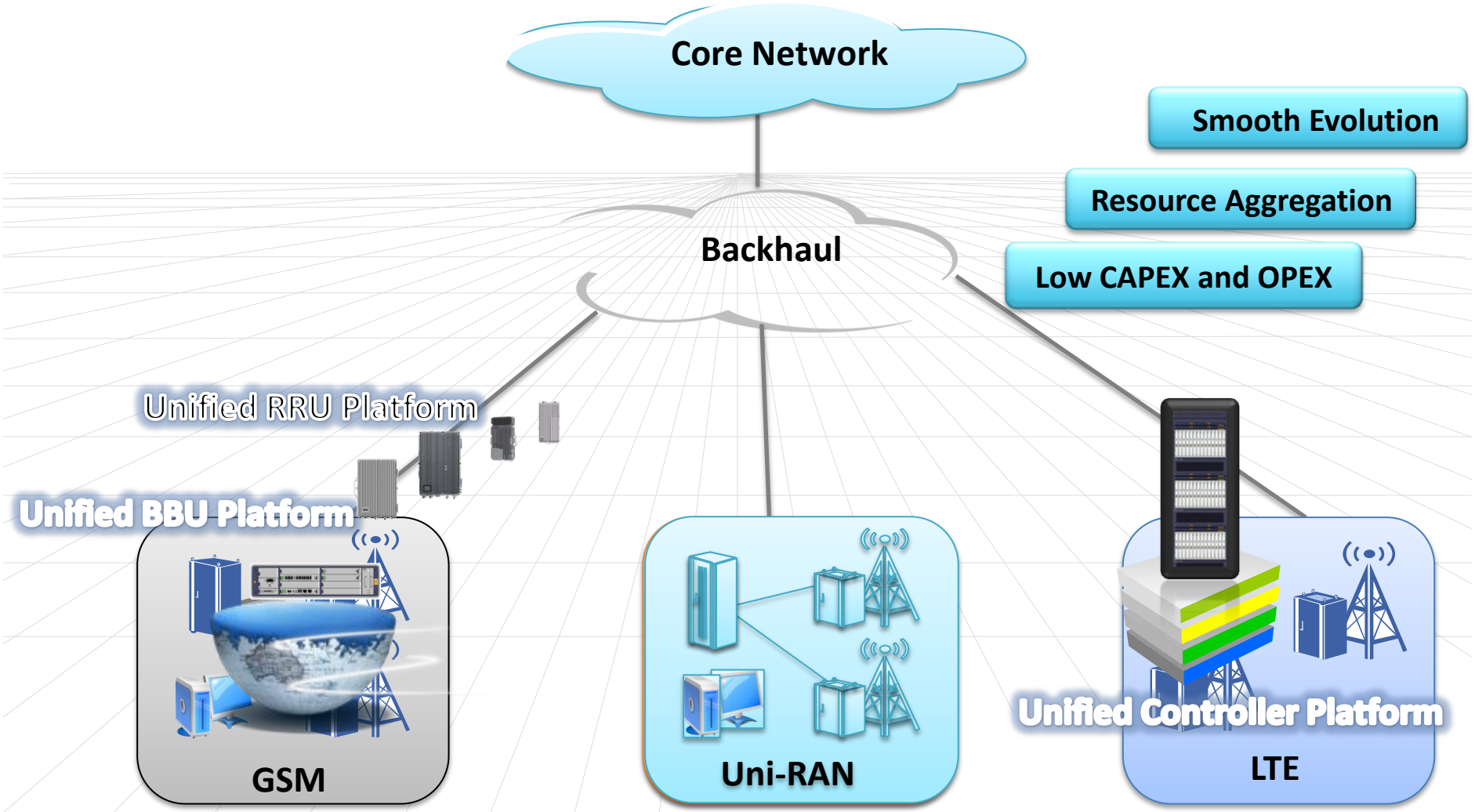
Features

- Only one Cabinet in E-UTRAN – eNode B
- Scalable spectrum bandwidth configuration
- High capacity LTE BP board

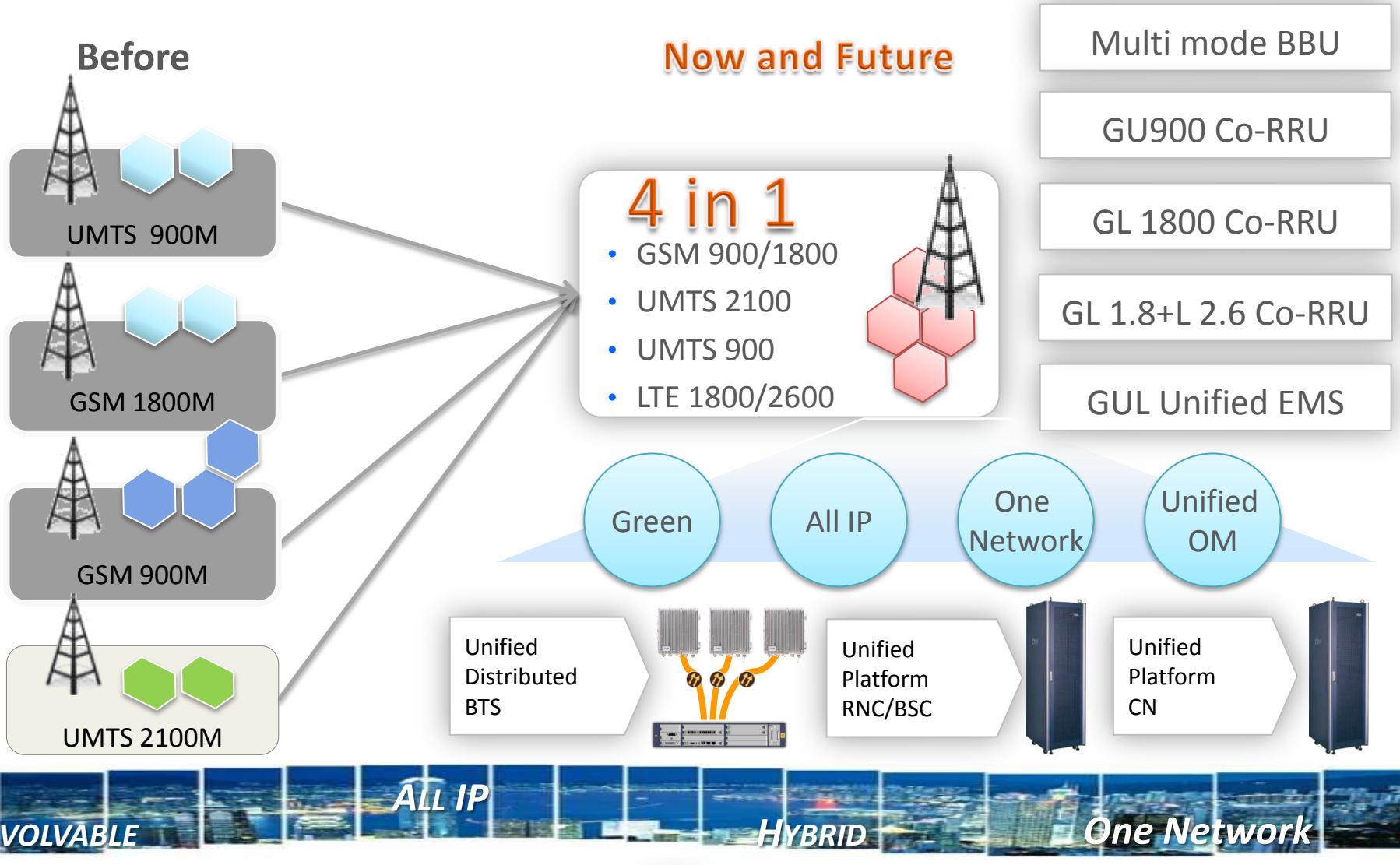
Benefits

- Flexible expansion and evolution
- Higher spectrum efficiency
- High peak rate, Lower latency

Unified Radio Access – “ALL IN ONE”



Modernized Network by Unified Radio Access



Flexible Rollout with SDR Distributed BTS

BBU & RRU indoor

BBU&RRU indoor

1. BBU&RRU installed on a standing pole
2. RRU installed on the wall
3. BBU installed in 19 inch rack
4. RRU installed on a standing pole

FLEXIBLE INSTALLATION

BBU&RRU outdoor

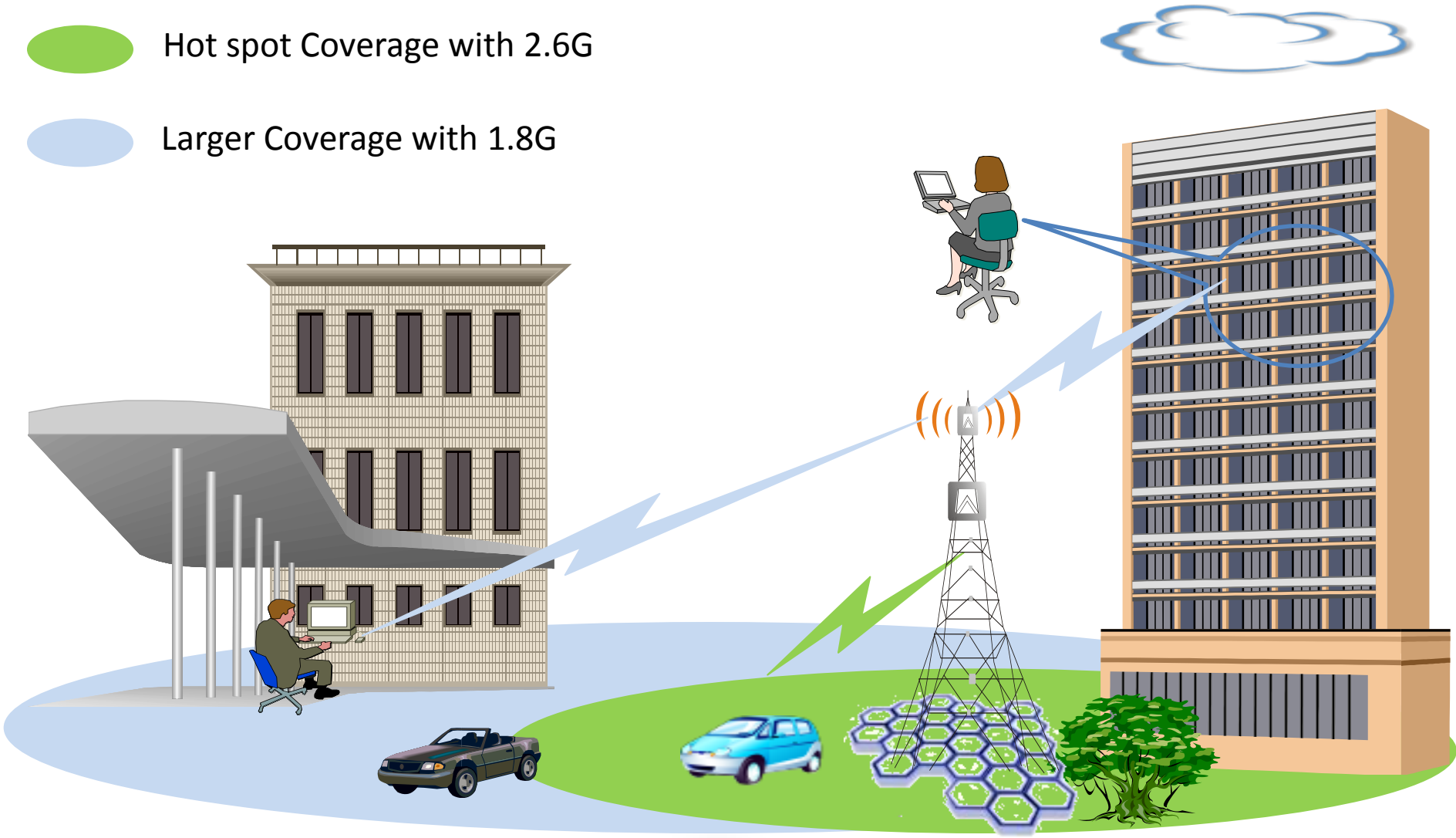
5. BBU installed in the cabinet
6. RRU installed on ANT pole
7. RRU installed on the wall
8. RRU installed on a standing pole

BBU & RRU outdoor

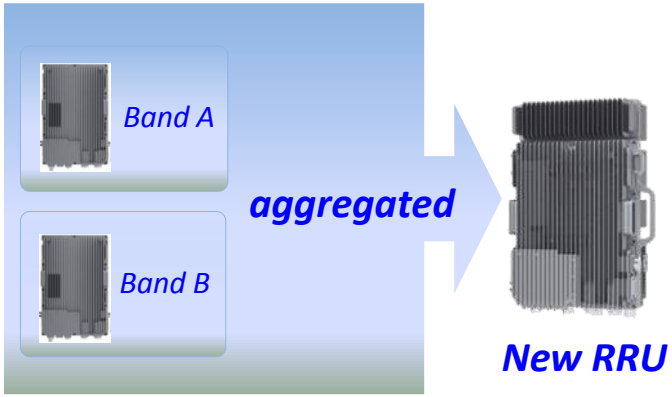
1.8/2.6G Dual-Band LTE Network Coverage

Hot spot Coverage with 2.6G

Larger Coverage with 1.8G



Innovative Dual-band, Dual-mode Radio Unit



- LTE-A supportive RRU
- Dual-band, Dual-mode RRU
- Inter- band carrier aggregation is supported

It Makes Network more Simple and Efficient

Two band Two frequency in one New RRU

67% Conventional RRU Saved

Less Installation Space

OPEX & CAPEX Reduction

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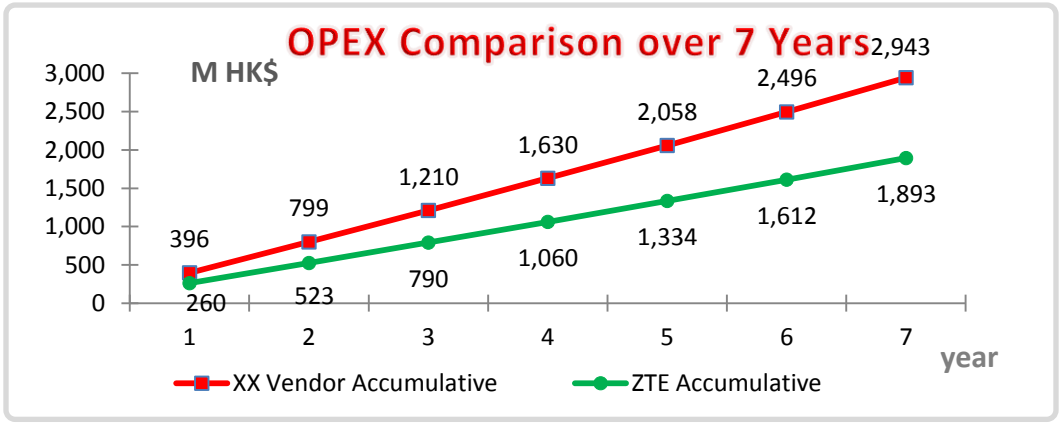
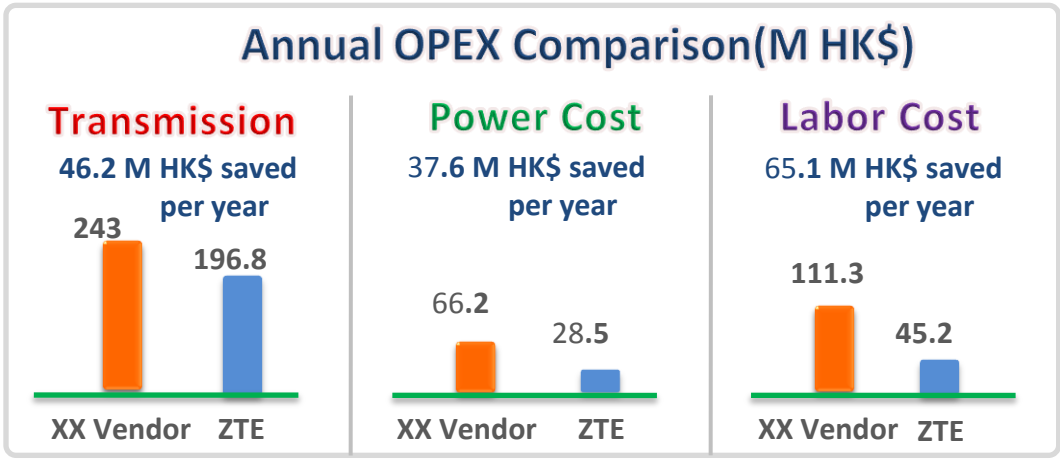
Performance of Practice: Continuous Saving on OPEX

Item Index	Before	After
Network	G/U separated	GU unified
Swap	1,500	1,500
New	---	550
BTS Rack	5,050	2,050
Transmission	TDM	IP
E1	8,100	0
FE	0	2,050
Average Power Consumption	4280 W	1845 W





A simple network with a reduction of 1,050 million HK$ on 7-years accumulative OPEX, average 150 million HK$ for each year, 35.7% OPEX saved.

UMTS Field Test by E-Zone

- On July, 2010, journalists of E-Zone, a large PC magazine, tested and compared iPhone 4 voice and upload/download speed of the four networks in all districts

Browser speed comparison on hk.yahoo.com page

YouTube video clip

LTE Driving Test and Demo in Different Districts

Demo 1

Demo 2

Demo 3

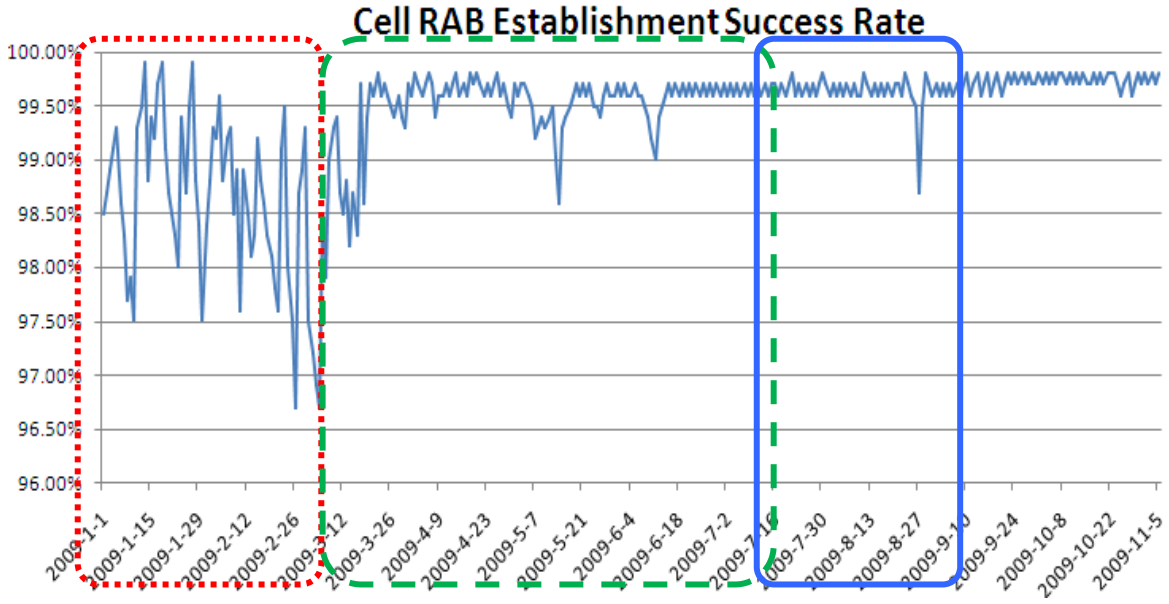
Demo 4

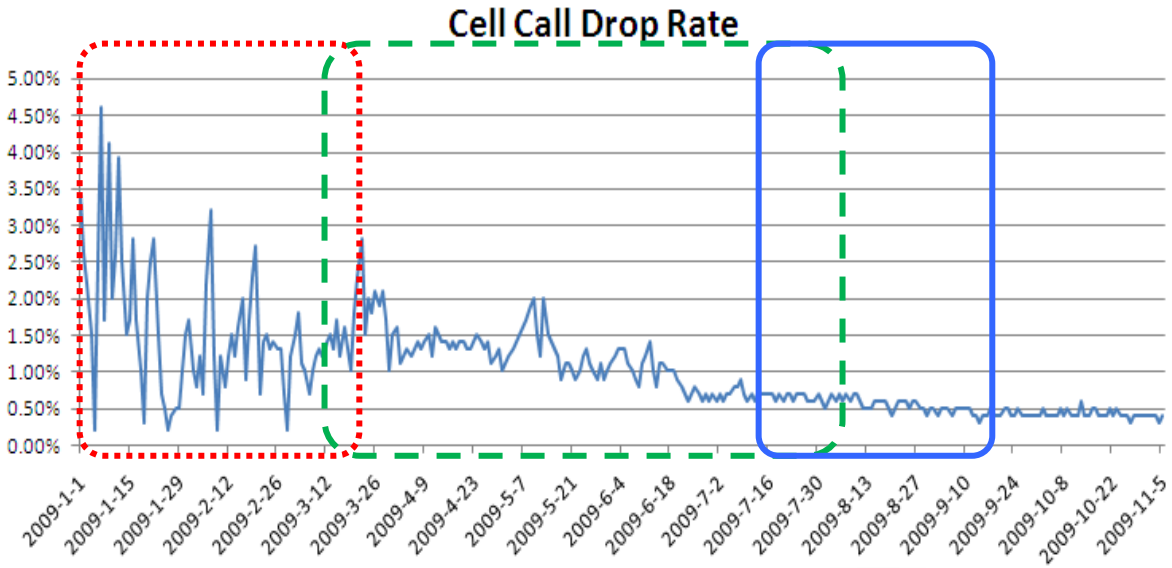
Network Performance

Previous network

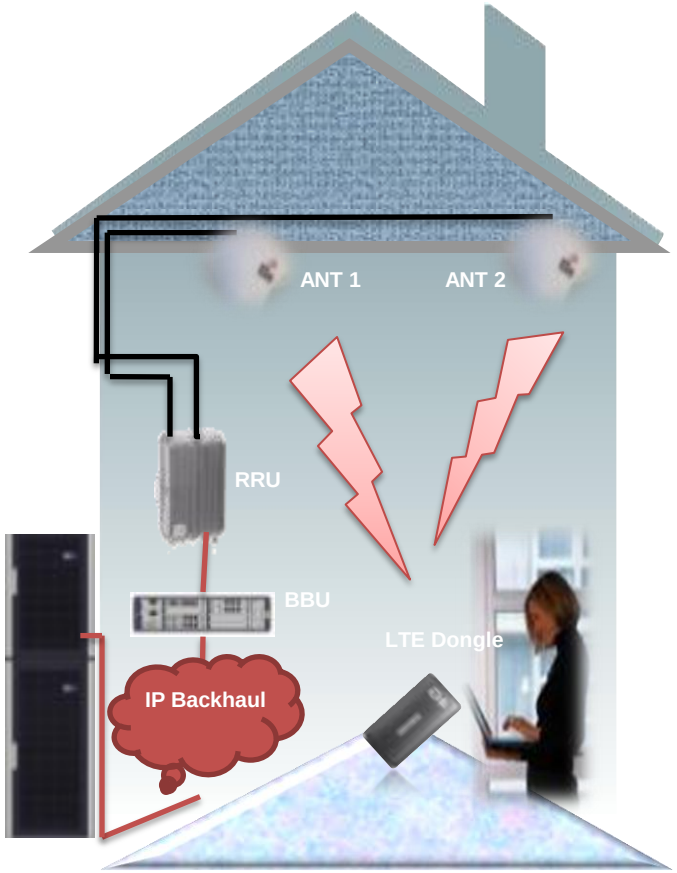
Network in optimization procedure

Network after migration





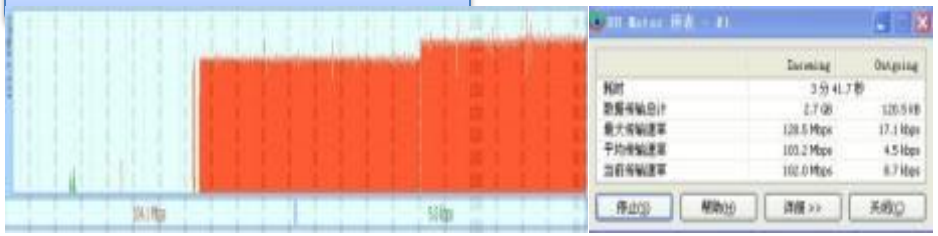
Single UE Throughput Test



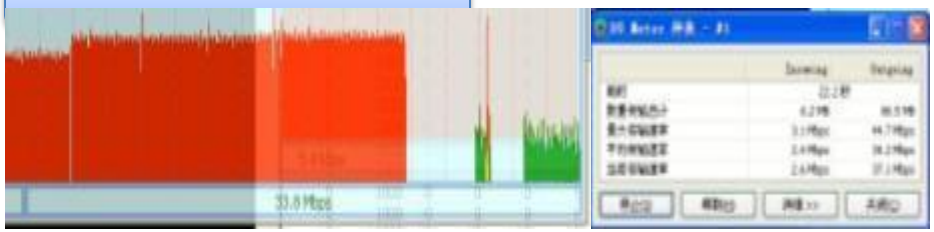
Test Environment

Environment	Bandwidth	Terminal (categy 3)	Average DL Throughput	Average UL Throughput
Lab	15M	Smart Phone	103.2Mbps	34.2Mbps

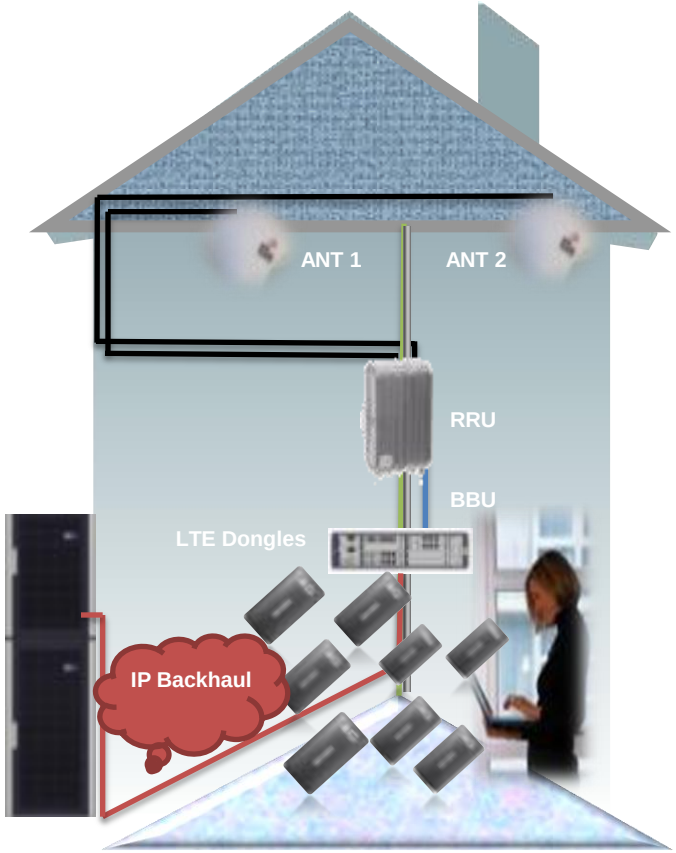
Downlink Throughput Test Result



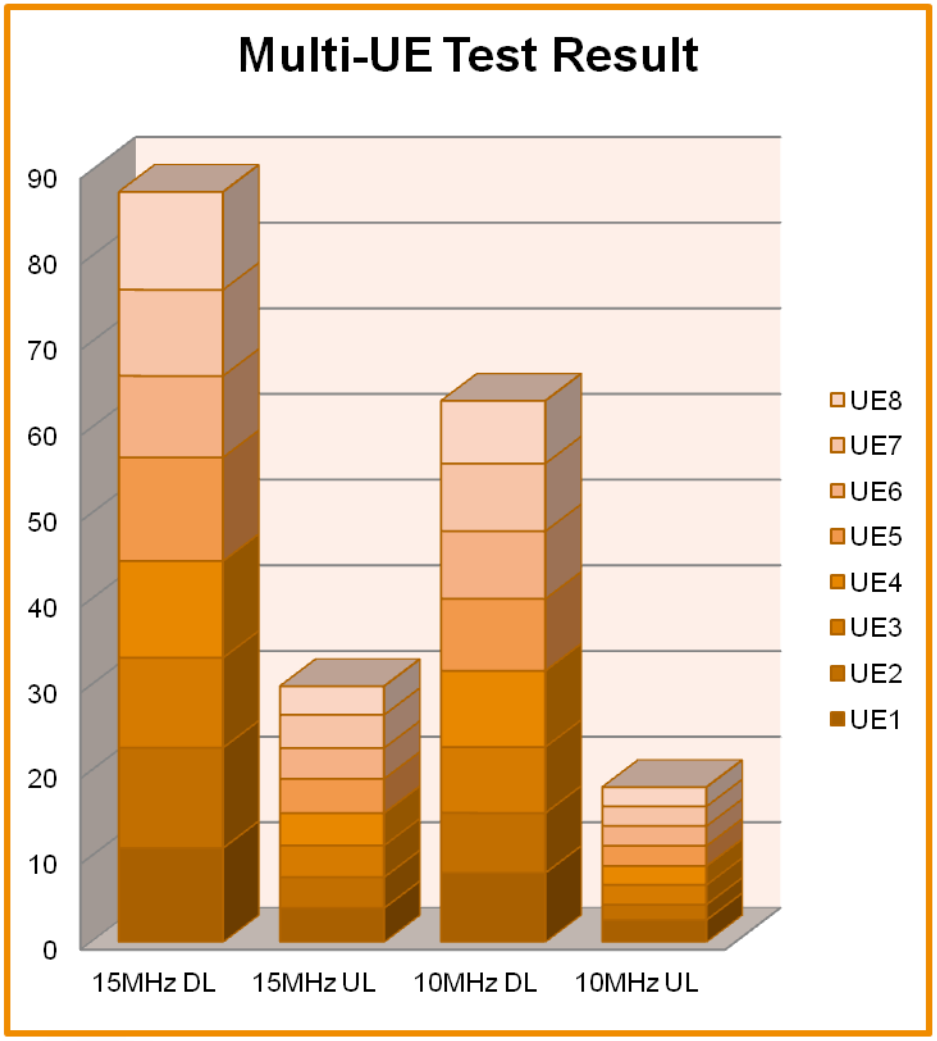
Uplink Throughput Test Result



Multi-UEs Throughput Test



Test Environment



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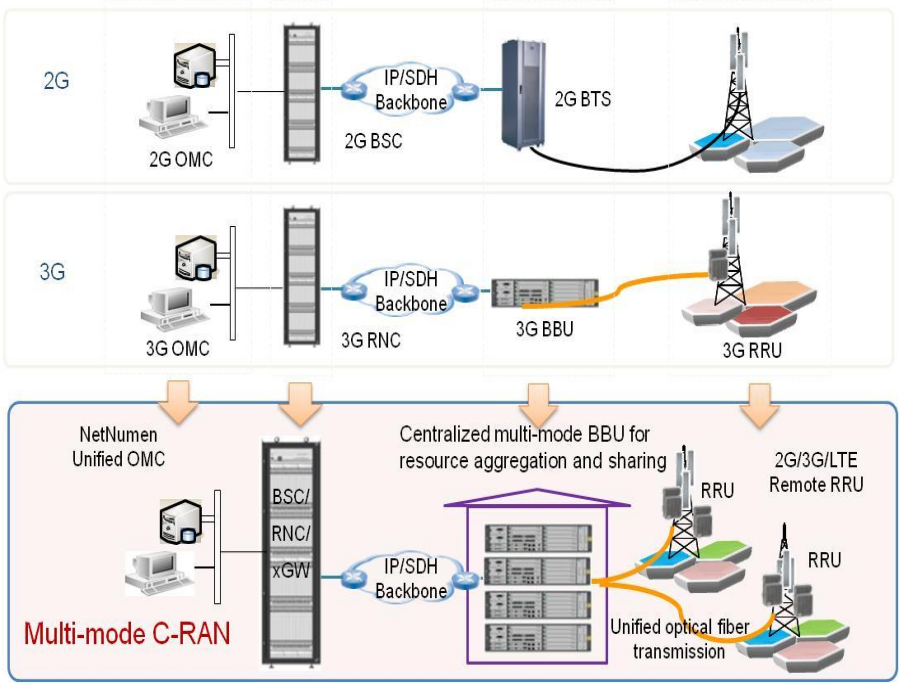
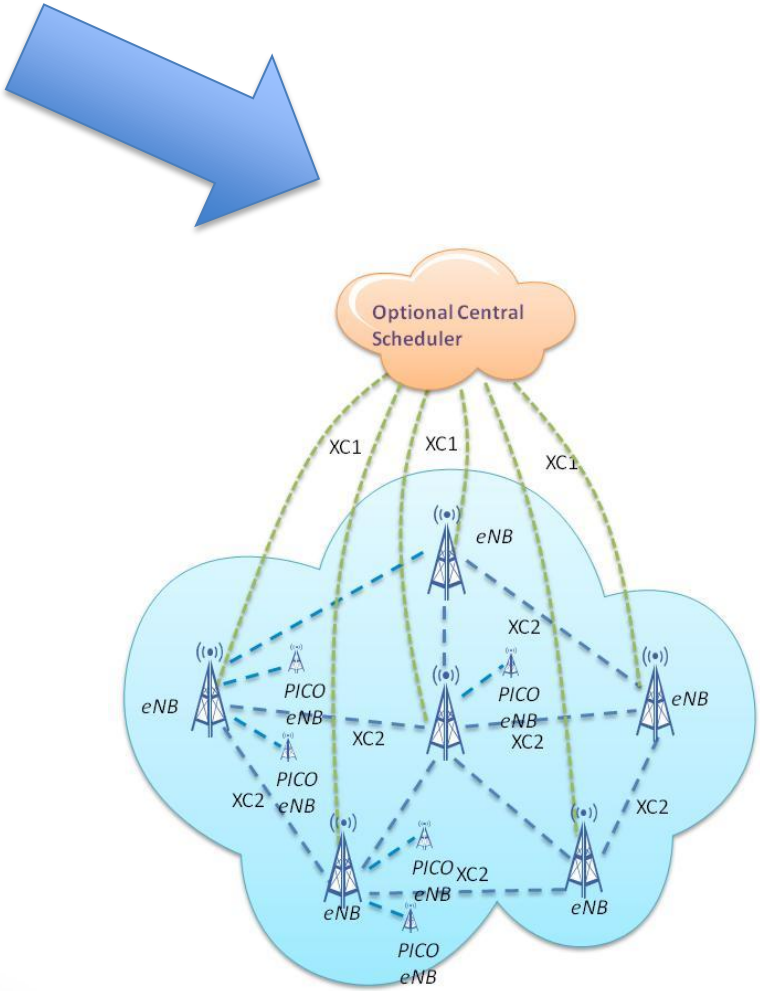
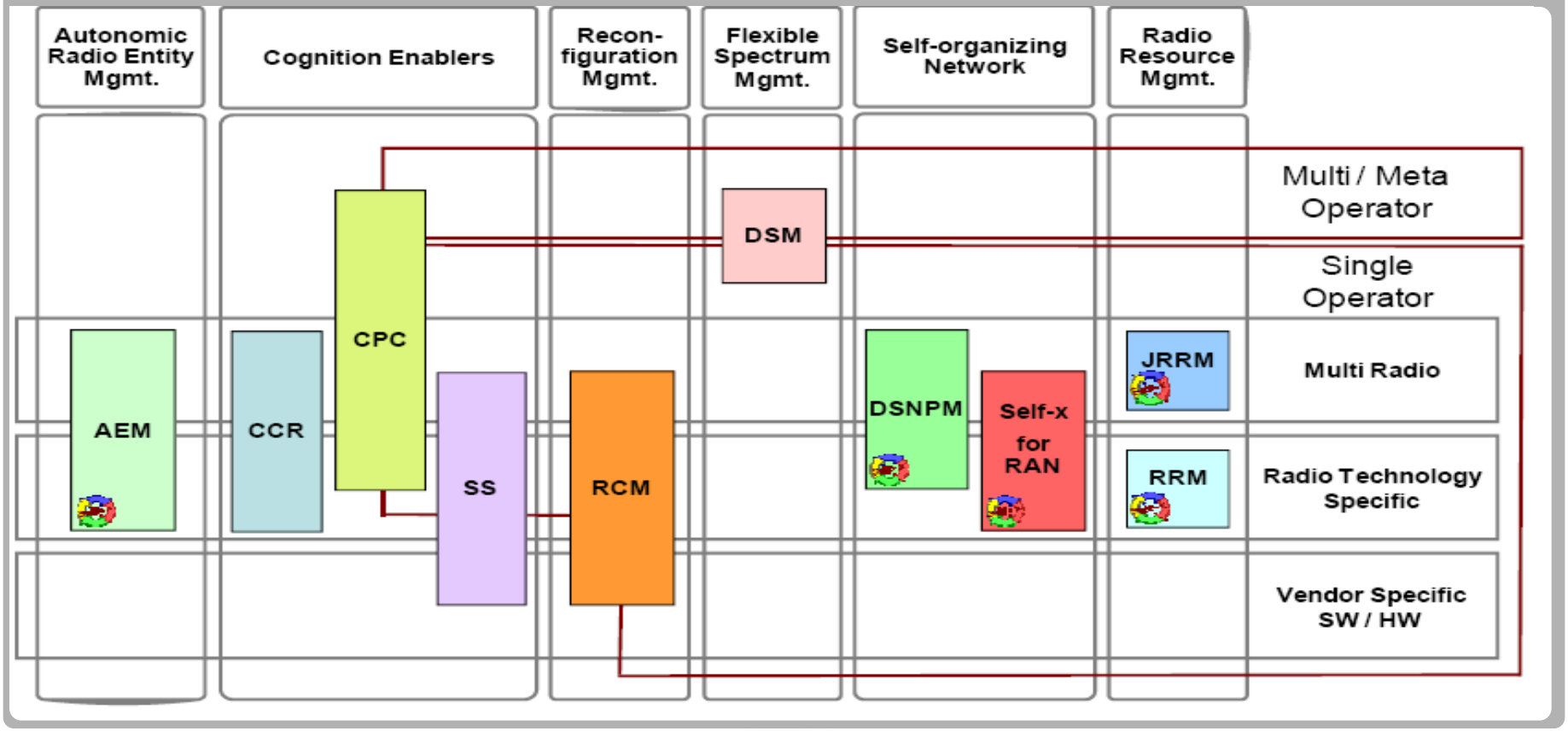
Cloud RAN Architecture will Greatly Help Multi-Network Deployment





More Effective Cooperation among Multi-Network

1. Columns: organization in six pillars, encompassing algorithms, cooperation protocols (enablers), enforcement capabilities
2. Rows: Specific vendor specific or radio technologies, heterogeneous networks, single or multiple operators



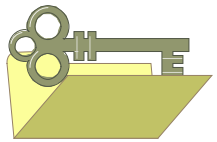
Cognitive Radio System

- According to Report ITU-R SM.2152:

"Definitions of software-defined radio (SDR) and cognitive radio system (CRS)"

The concept of CRS defined as following:

"A radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained."



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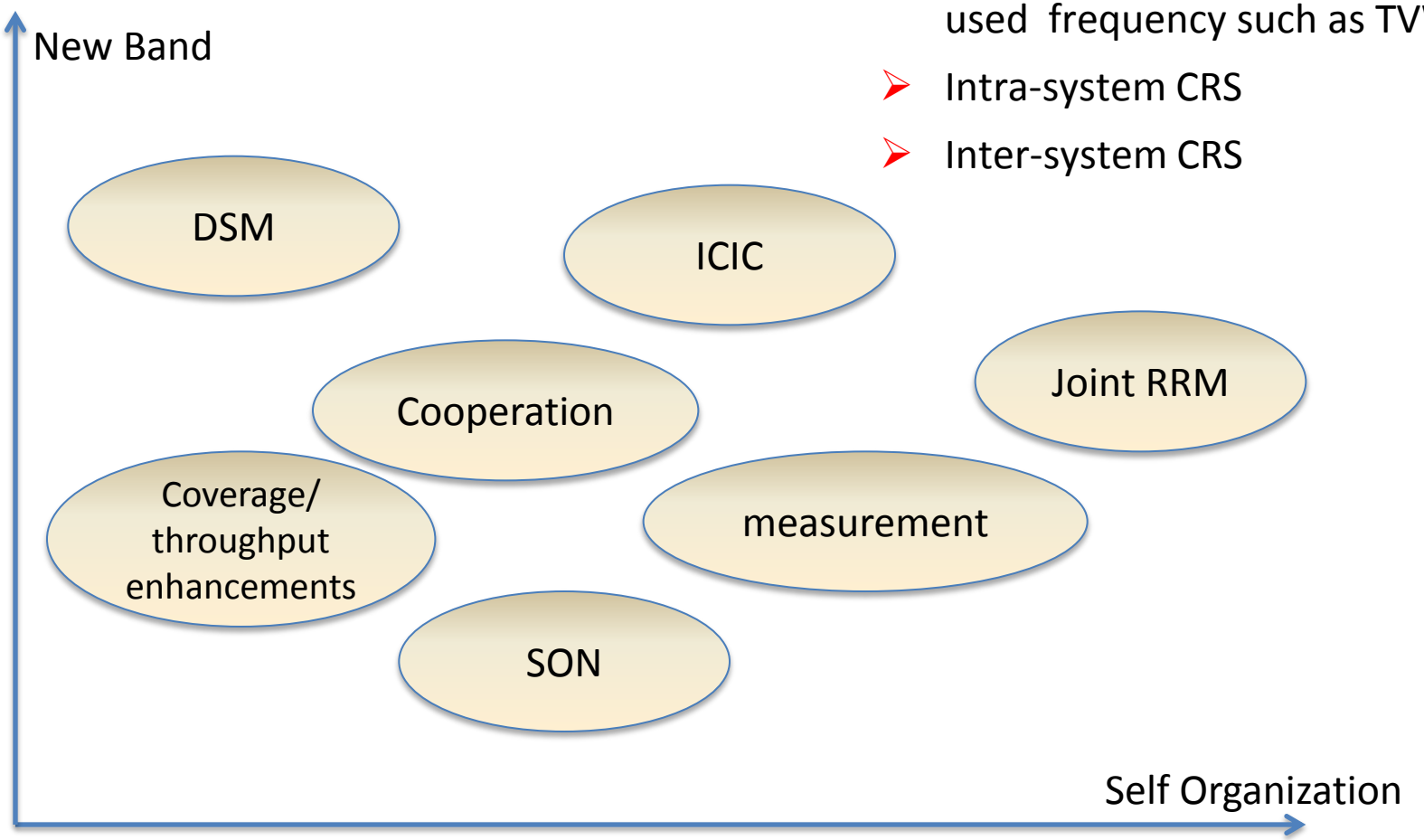
Cognitive Radio System(cont.)

- Intra-operator
- CRS could utilize inefficiency used frequency such as TVWS
- Intra-system CRS
- Inter-system CRS



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Conclusions

- Software Defined Radio is essential to Multi-Network deployment
- Unified core and network management facilitates the deployment
- Further enhancement and optimization on common radio resource management need to be improved continuously
- Mobile broadband keeps challenging existing mobile access technology
- More industrial work and efforts are needed

Bringing you Closer

Thanks!