

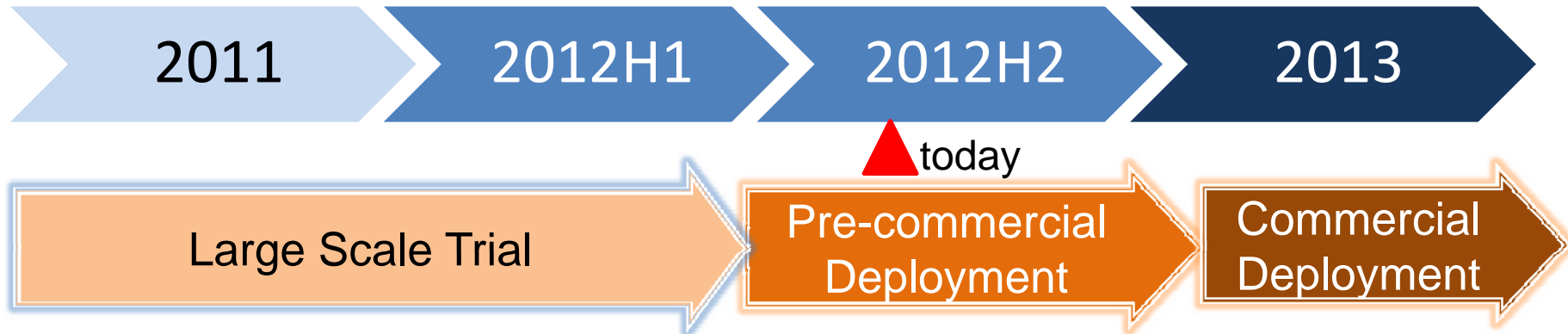
TD-LTE's Requirements on Future Standardization



Outline

- **TD-LTE Deployment in China**
- **Vision for Beyond R12**
- **Challenges and Requirements**
- **Summary**

TD-LTE Trial in China: Overview



- 6 cities, >1000 BS's
- 11 infrastructure and 11 chipset vendors involved
- Verification of technologies, products, networking solutions

- 13 cities, 20k BS's
- Friendly users and services introduced

- Major cities, 200k BS's
- Commercial operation

Spectrum

- 2320MHz~2370MHz (indoor only), 2570MHz~2620MHz, 1880MHz~1915MHz

Large Scale Trial: in 6 Cities, 11+11 Vendors Participating

LST

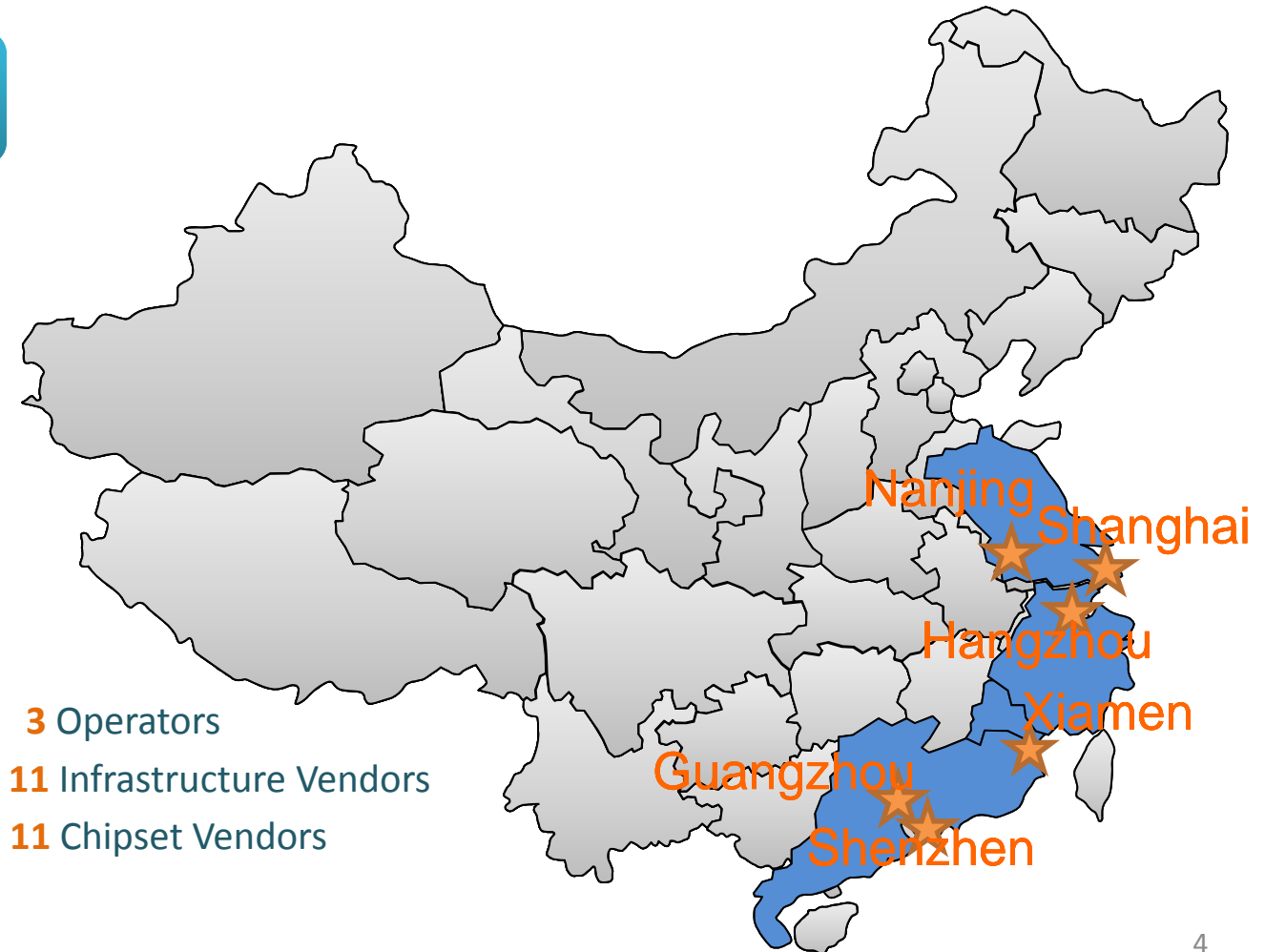
Pre-Com.

Com.

Cities

- Guangzhou, Hangzhou, Nanjing, Shanghai, Shenzhen, Xiamen
- Add up to **83 Million** of population

Participants



- 3 Operators
- 11 Infrastructure Vendors
- 11 Chipset Vendors

Pre-commercial Deployment: Works on networks, terminals and services

LST

Pre-Com.

Com.

Networks

- **Construction:** the network in **13 cities with 20k base stations** will be completed by the end of the year.
- **Cities:** Beijing, Shanghai, Hangzhou, Guangzhou, Shenzhen, Tianjin, Nanjing, Qingdao, Xiamen, Shenyang, Ningbo, Chengdu, Fuzhou
- **Coverage:** **90% urban area will be covered** in Hangzhou / Guangzhou / Shenzhen the 3 major cities.

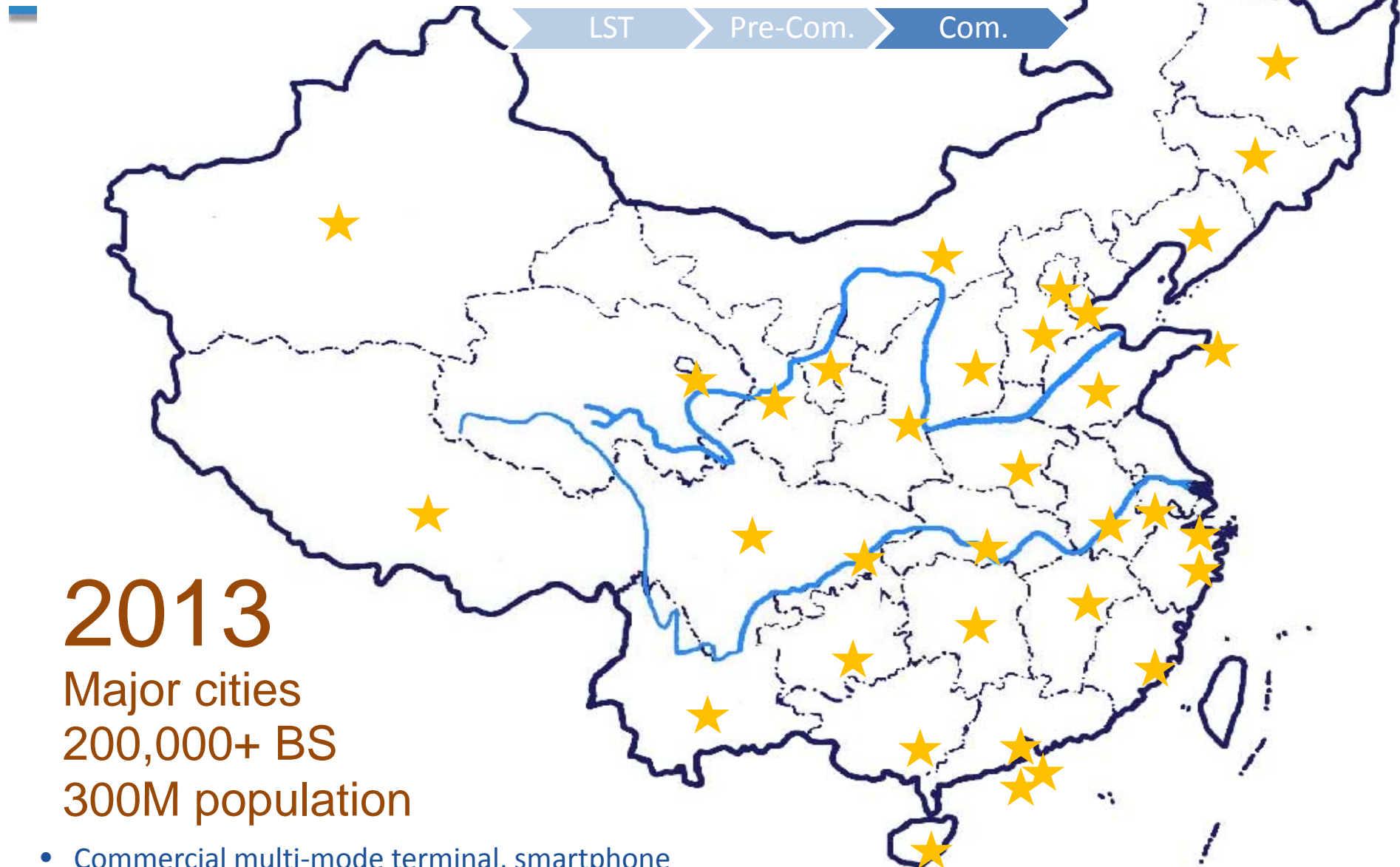
Terminals

- **Types:** Mainly multi-mode data cards, CPEs and MiFi terminals.
- **Volume:** About **30k terminals** will be purchased and distributed to friendly users by the end of this year.

Services

- Mobile internet services.
- SMS on LTE.
- Intra- and inter-national roaming, including **LTE TDD/FDD global roaming**

Commercial Rollout of TD-LTE in China



2013

Major cities

200,000+ BS

300M population

- Commercial multi-mode terminal, smartphone
- Converged LTE TDD/FDD enables global roaming, 40MHz Aggregation with Maximum 220Mbps

Vision for Beyond R12



Socialization



Localization



Cloud



Green



Wireless World



Automatic



High Efficiency



Informatization

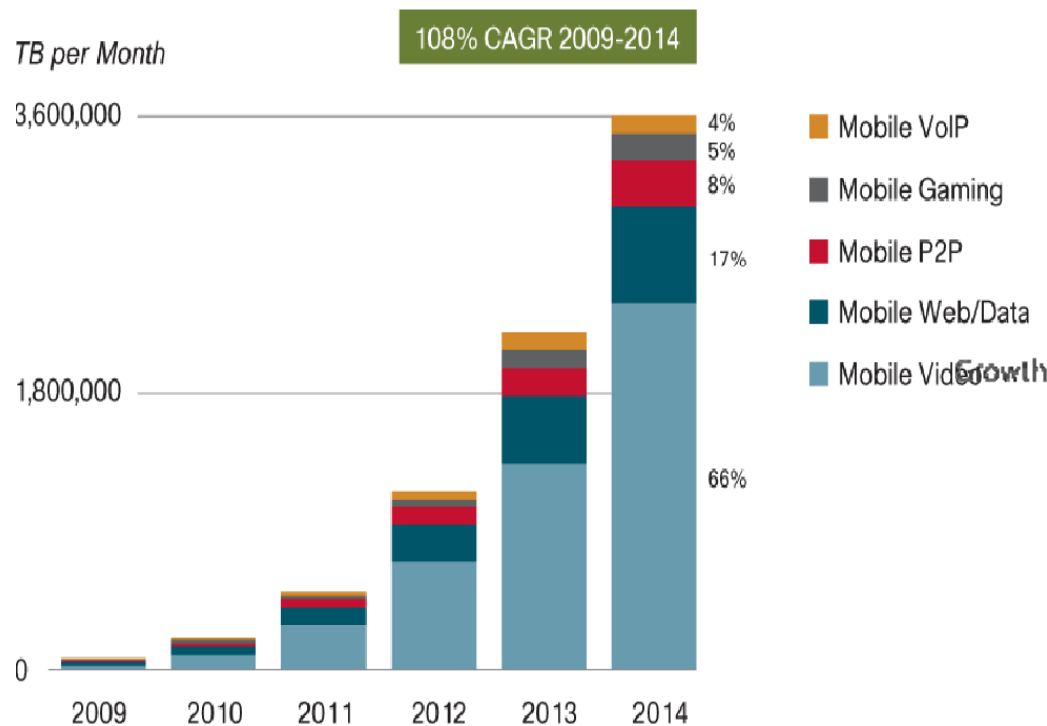
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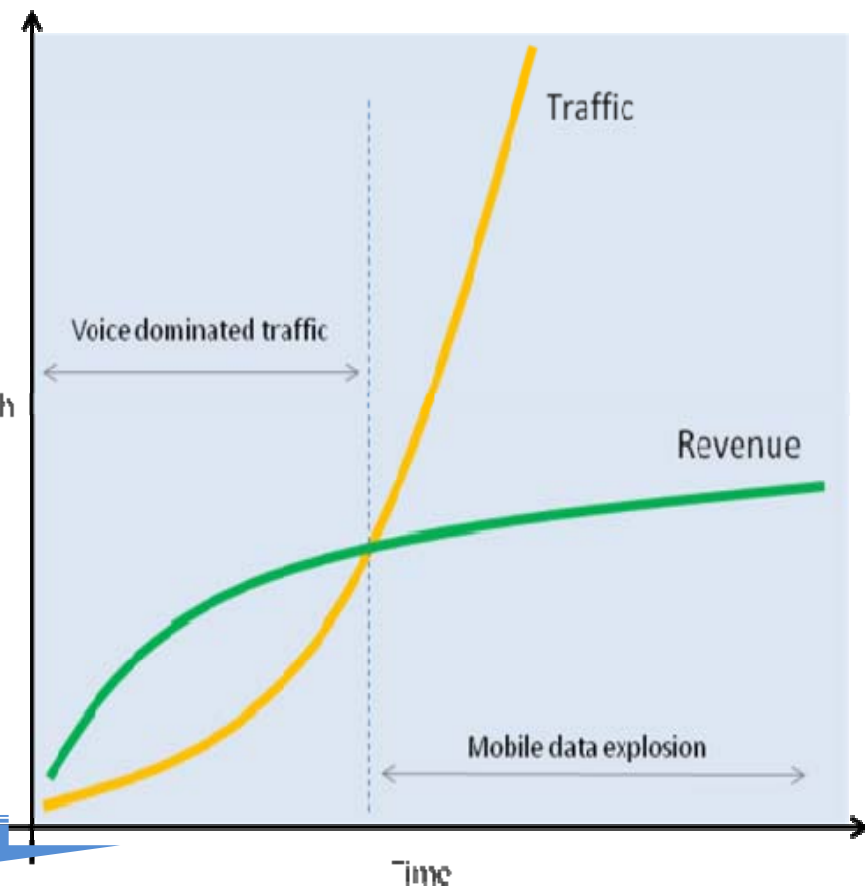
1. Traffic grows explosively but not the revenue

Mobile data traffic will increase 1000 times in 10 years

Profit per bit will continuously decrease in the future years



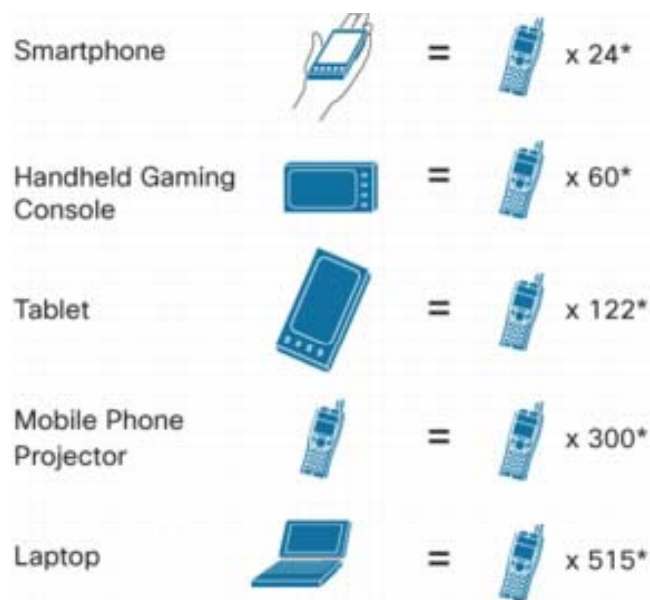
Source: Cisco VNI Mobile, 2010



Extremely low-cost network is expected: deployment and maintenance

2. Traffic distribution appears as unbalanced

- **Imbalance between the terminal type:** in 2010, smart phone's global penetration rate is 13%, while it contribute 78% traffic load from the terminal
- **Geographic imbalance:** in 2009, more than 50% mobile service happened at home/office; while this percentage is 63% in China. Most of the data service happens in low mobility indoor and dense urban



* Monthly basic mobile phone data traffic

Source: Cisco VNI Mobile, 2011

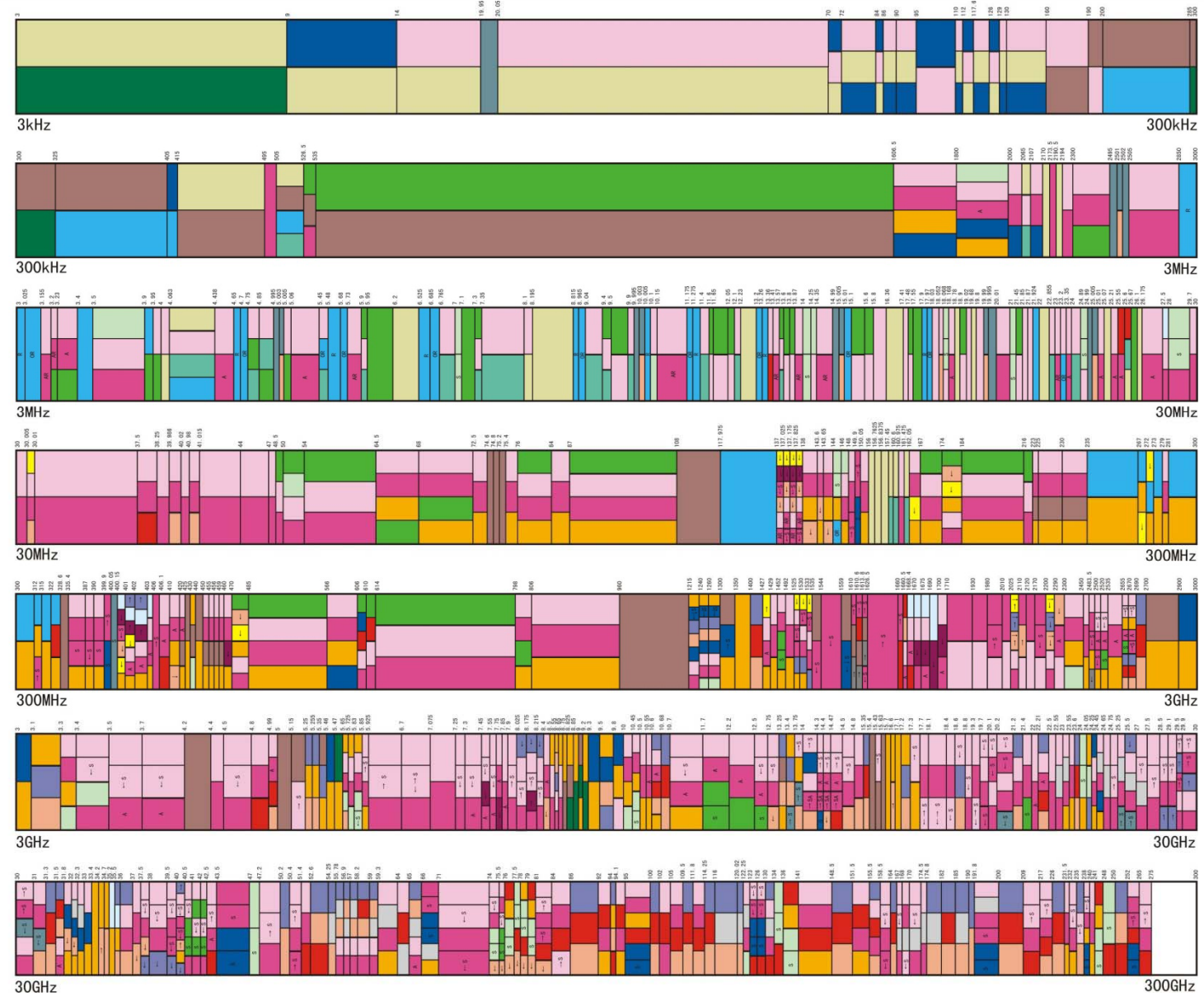
	Home access Internet	Office access Internet	On-road access Internet
USA	37.8%	19.6%	42.6%
UK	45.6%	17.8%	36.6%
Germany	43.4%	15.3%	41.3%
France	33.1%	21.7%	45.2%
Italy	39.6%	21.4%	39.0%
South Africa	48.6%	21.4%	30.0%
Mexico	28.2%	27.6%	44.2%
Brazil	36.7%	24.7%	38.6%
Korea	33.7%	31.7%	34.6%
India	45.9%	30.4%	23.7%
China	30.1%	32.7%	37.2%

3. Spectrum has been fragmented and used up

中华人民共和国
无线电频率划分图

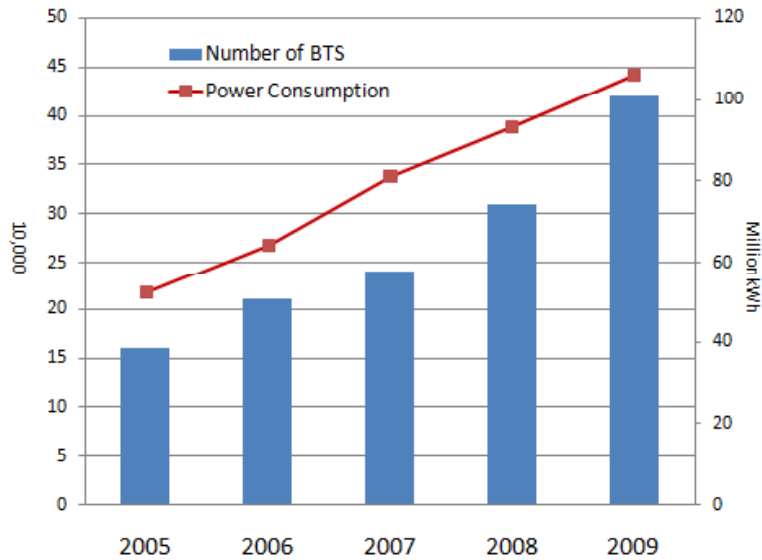
THE PEOPLE'S REPUBLIC OF CHINA
FREQUENCY ALLOCATIONS
THE RADIO SPECTRUM

- 气象业务 METEOROLOGICAL AIDS
- 无线电授时 RADIOLOGATION
- 海上业务 MARITIME MOBILE
- 航空业务 AIR MOBILE
- 航空移动 RADIO AERONAUTICAL MOBILE
- 无线电天文 RADIO ASTRONOMY
- 无线电探测 RADIO DETECTION
- 无线电导航 RADIO NAVIGATION
- 业余无线电业务 AMATEUR
- 气象卫星 METEOROLOGICAL SATELLITE
- 水文卫星 HYDRO SATELLITE
- 卫星 SATELLITE
- 航空移动业务 EXCEPT AERO MOBILE
- 航空业务 AERONAUTICAL RADIO NAVIGATION
- 广播 BROADCASTING
- 陆地 MOBILE
- 陆地 FIXED
- 航空移动 RADIO AERONAUTICAL MOBILE
- 空间研究 SPACE RESEARCH
- 空间操作 SPACE OPERATION
- 标准频率和时间信号 STANDARD FREQUENCY AND TIME SIGNAL
- 早期空间无线电卫星 EARLY EXPERIMENTAL SATELLITE
- 无线电导航卫星 RADIO NAVIGATION SATELLITE
- 航空移动业务 EXCEPT AERO MOBILE (S)
- 无线电寻呼业务 EXCEPT AERO MOBILE (S)
- 业余无线电业务 AMATEUR (A)
- 业余无线电业务 AMATEUR (SA)
- 业余无线电业务 AMATEUR (S)
- 业余无线电业务 AMATEUR (Y)

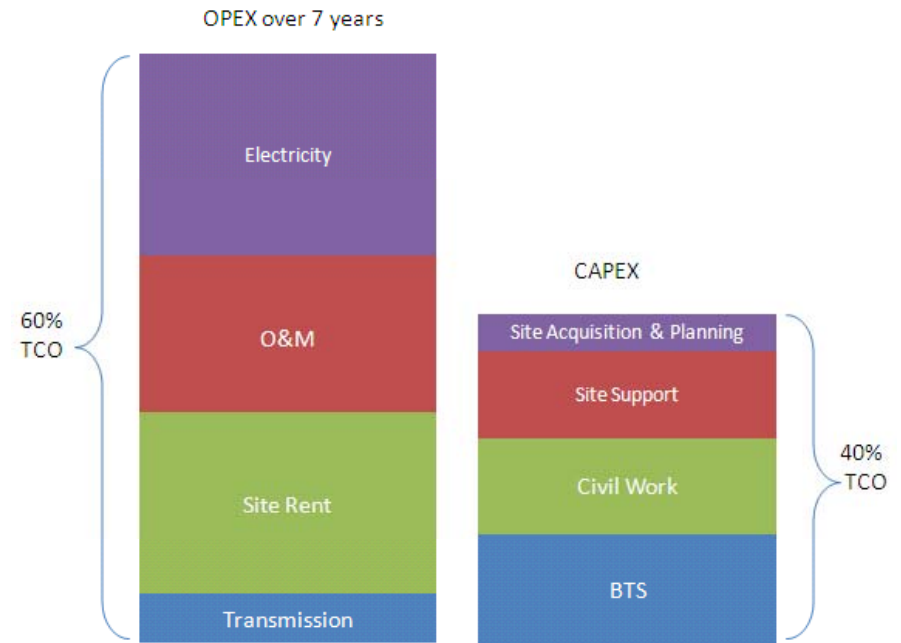


4. Power consumption plays an important role in OPEX

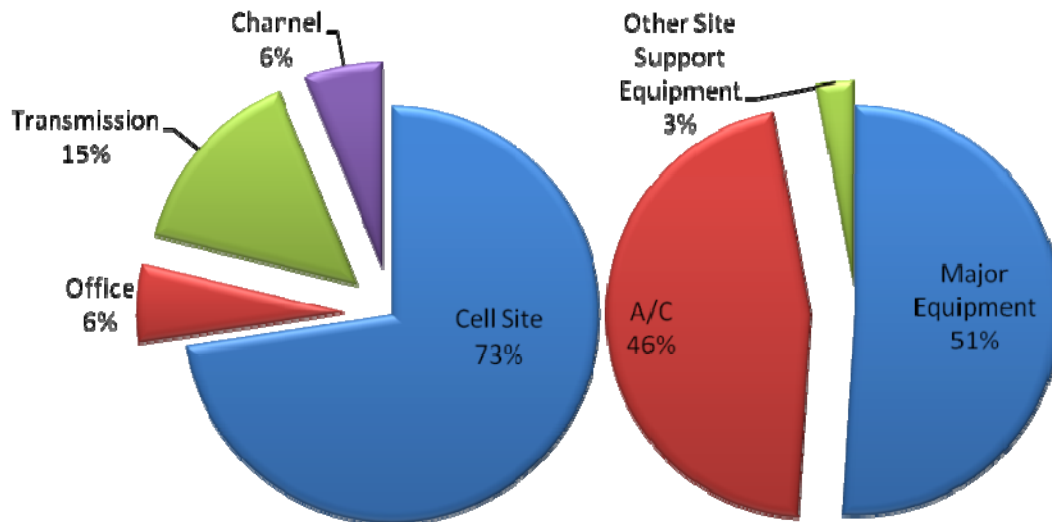
Surging power consumption



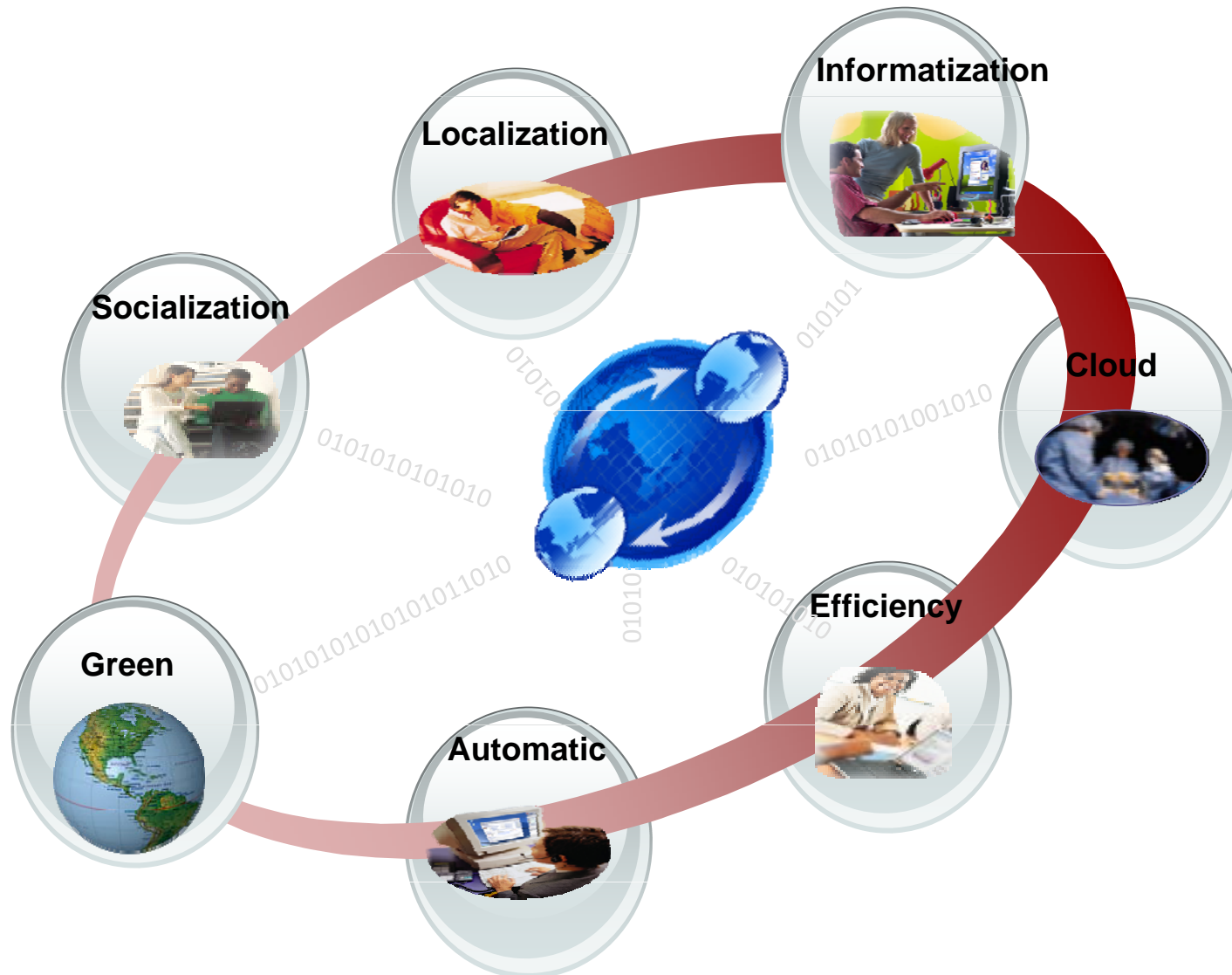
High CAPEX/OPEX of RAN result from BS equipment room



The majority of power consumption from RAN



Requirements for Beyond R12



Socialization

- Direct communication between devices
 - Autonomous device discovery
 - Lower power consumption
 - Overhead reduction
- Flexible mesh network



Live video Radio music

A screenshot of a mobile application interface showing "Live video" and "Radio music" options. The "Live video" section features a "RALLY CAR EXPERIENCE!" advertisement with a "PLAY NOW" button. The "Radio music" section shows a mobile phone with signal waves.

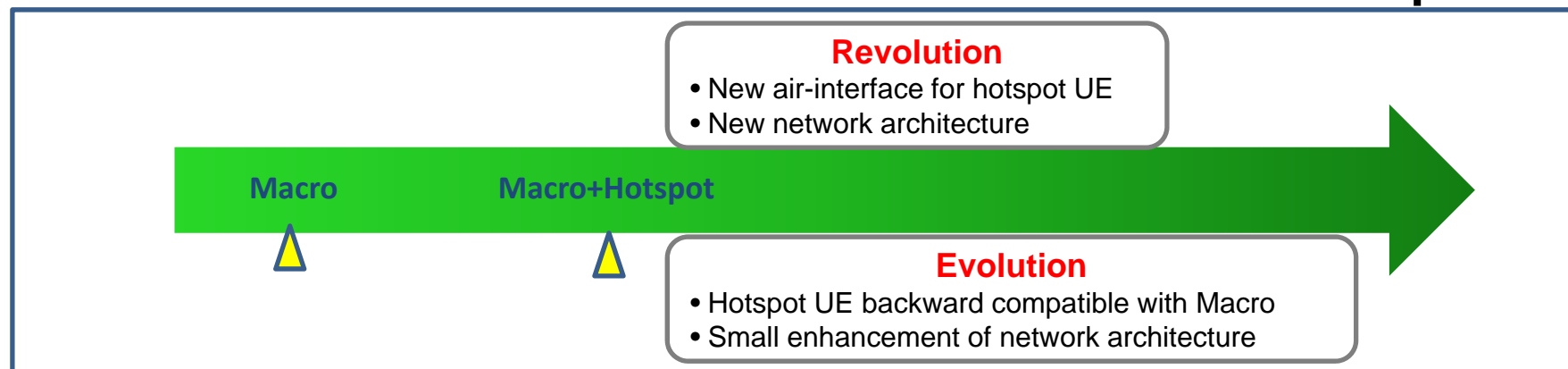
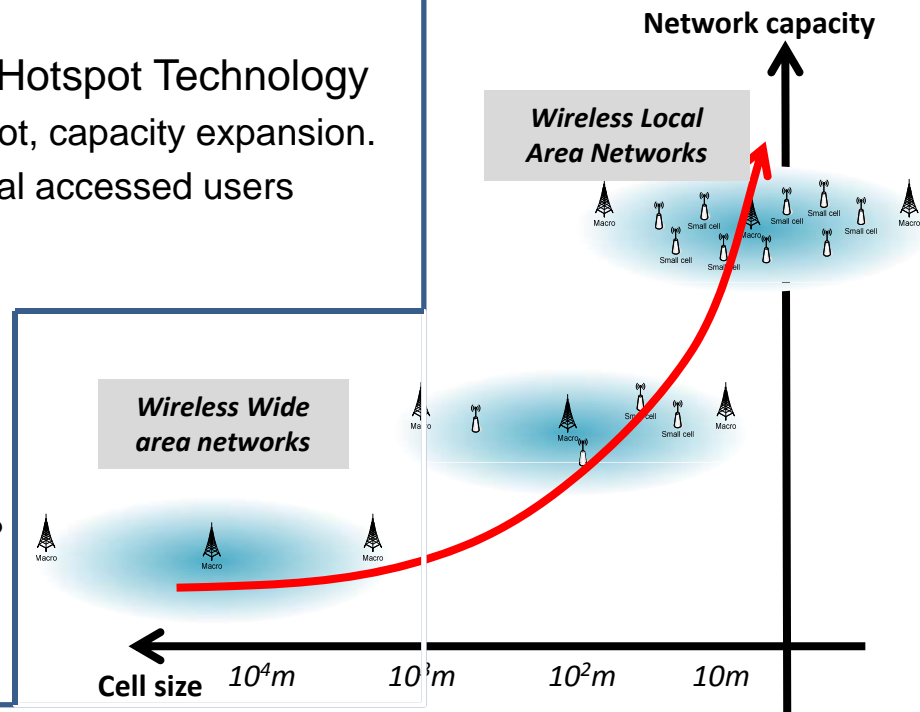
Mobile paper Traffic condition Emergency message

Three icons representing different services: "Mobile paper" (a stack of papers), "Traffic condition" (a navigation device showing a map), and "Emergency message" (a hand pointing to a screen with a warning icon).

- Media broadcast service
 - Colorful traffic provision
 - Capacity improvement

Localization

- The Macro Technology extended to Hotspot Technology
 - Extend network capacity, e.g., hotspot, capacity expansion.
 - Provide high user experience for local accessed users
- Localization growing path for Macro technology
 - “*Evolution Path*”
 - “*Revolution Path*”
- Potential impact
 - New spectrum usage, e.g., 3.5GHz?
 - New network architecture for small cells?



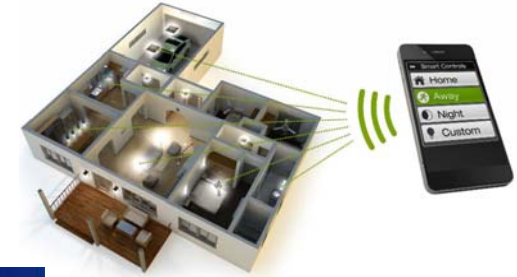
Informatization



Intelligent Elevator



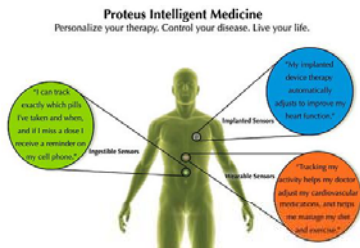
Monitoring



Smart home



Ubiquitous Access for Internet of Things



Medical



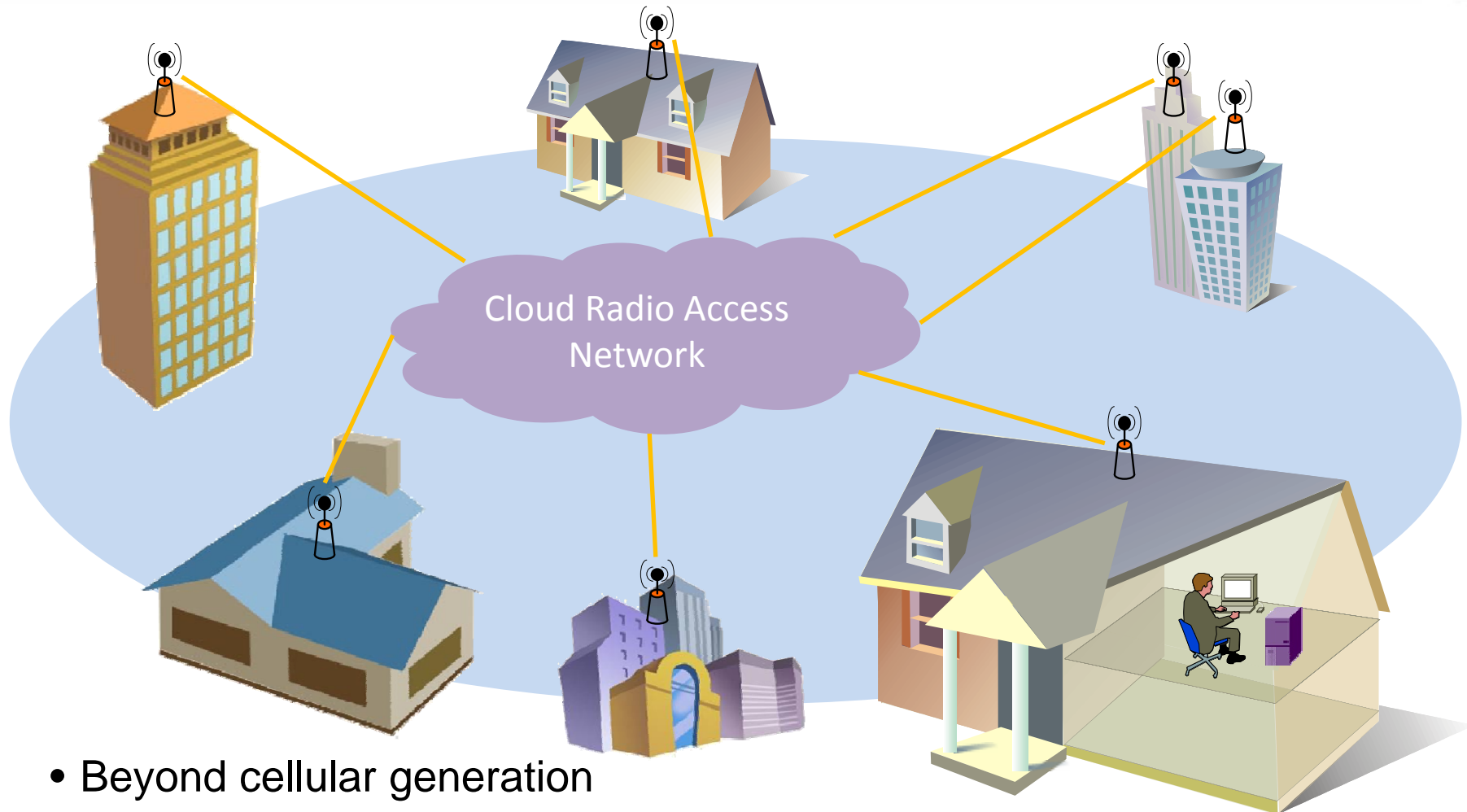
Smart Grid



Intelligent traffic



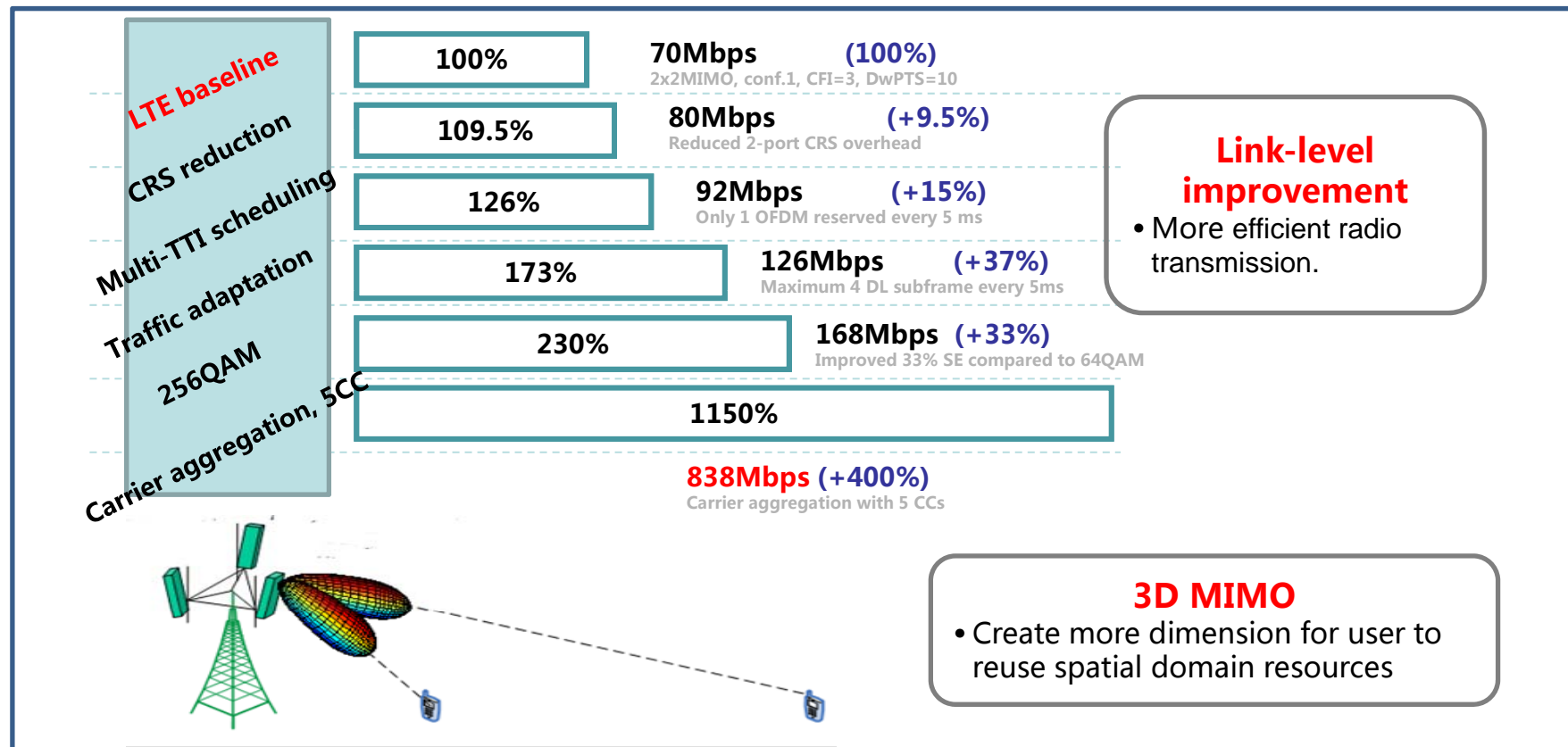
Agriculture



- Beyond cellular generation
 - On-off small cells /APs
 - C/U decoupling
 - UL/DL decoupling

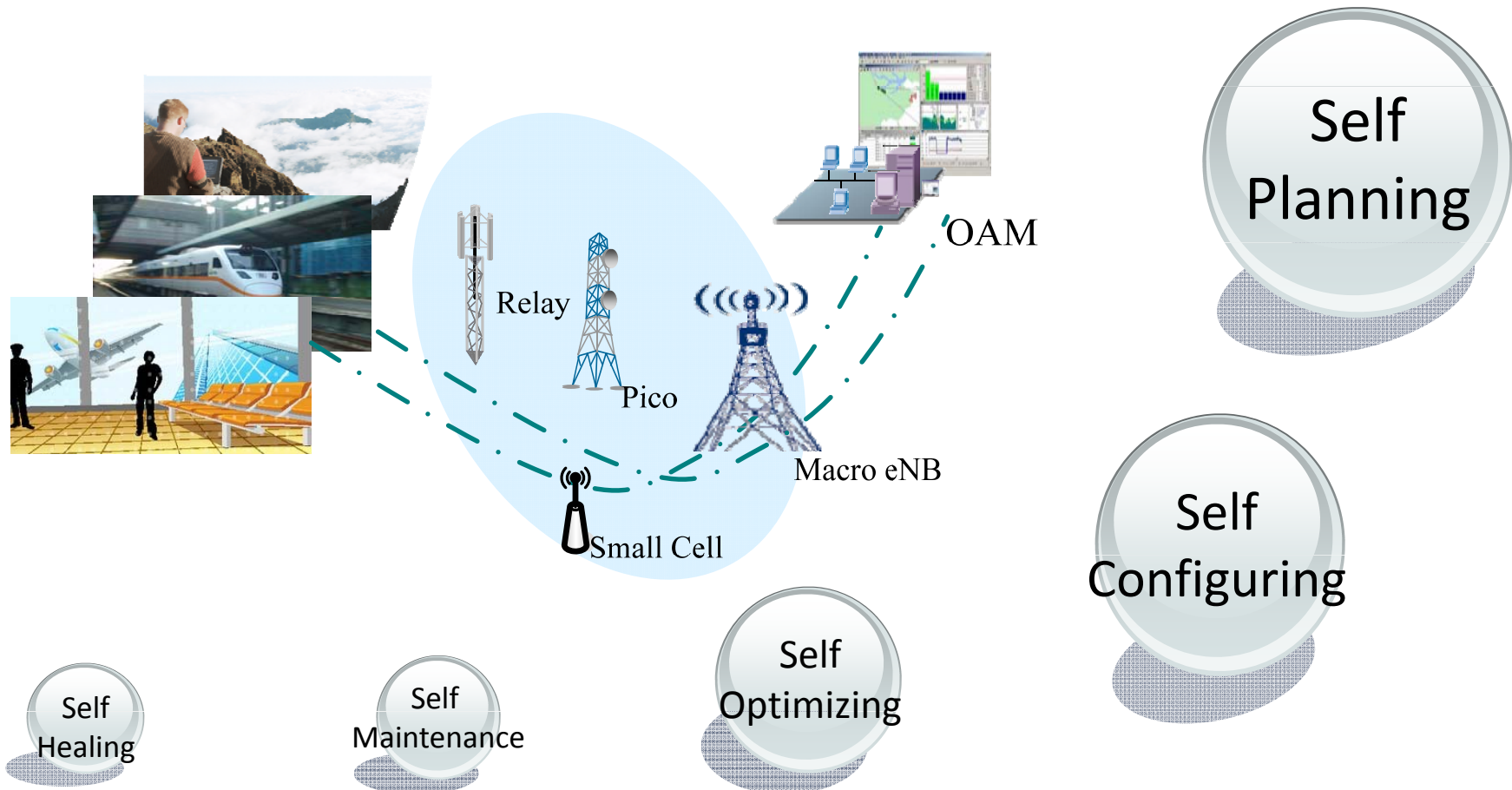
High Efficiency

- Make full use of available spectrum
 - TDD & FDD synchronized & harmonized
- Technical evolution
 - Time-domain improvement - spectrum efficiency of radio transmission would be improved
 - Spatial-domain improvement - Network level improvement, e.g., spatial reuse by 3D MIMO.
 - Frequency-domain improvement - Aggregate of more carriers.
- Technical revolution



Automatic

Fully SON for easy deployed, smart maintenance, and low cost network

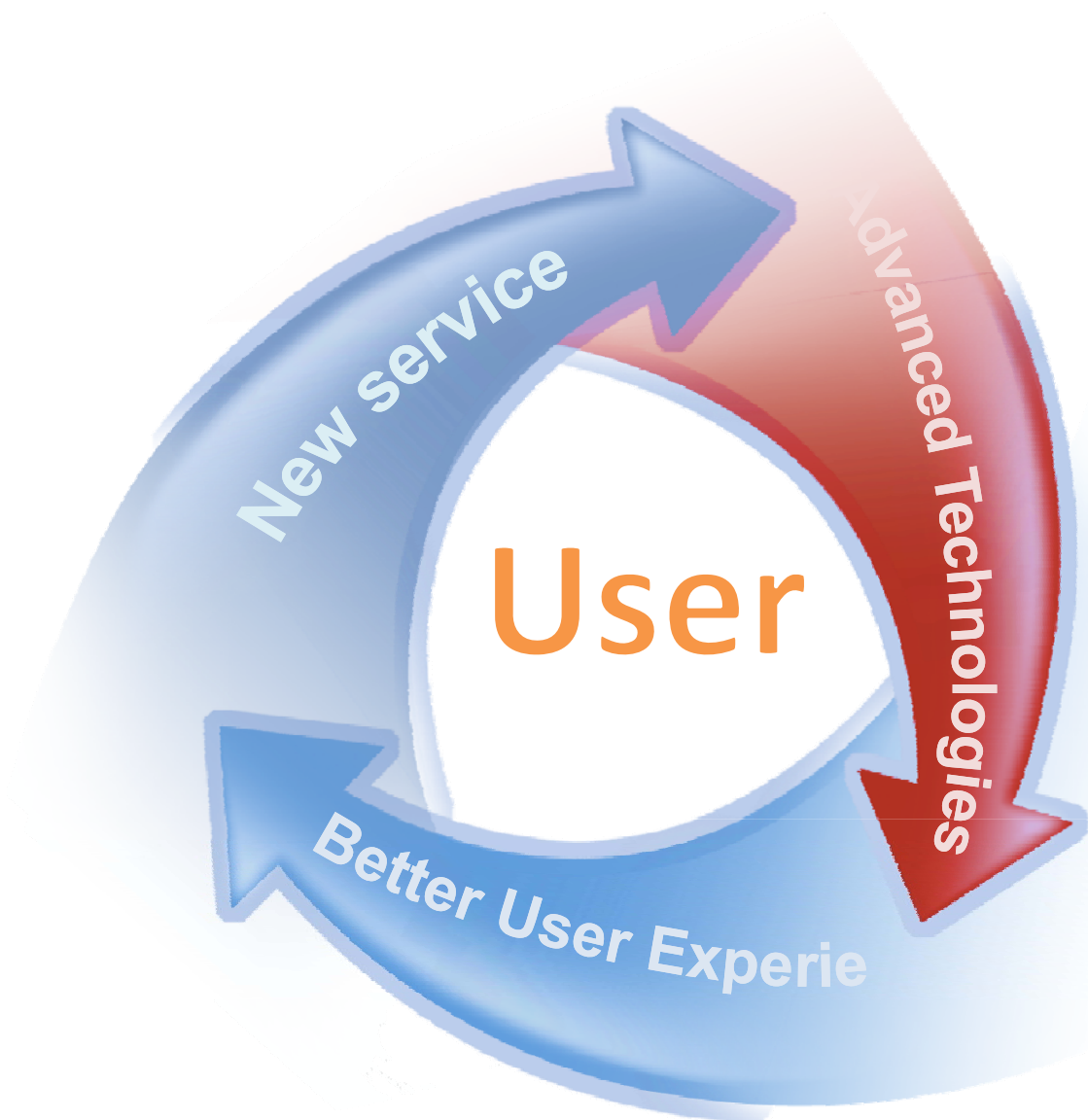


User centralized, Power-efficient, OPEX-reducing network

- Ultra low power consumption with guaranteed experience
- Smart power saving for Radio Access Network
- Magnificent power efficiency in the network infrastructure
- Intelligent options for reducing operators' OPEX



Summary



Thank you

