Powering the Future

Albert Lu

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Talking to the Future

Outline

- Smart Convergence – A ZTE's Perspective
- Analog Opportunities for Communication IC Design
- Analog Opportunities for Power IC Design
- Conclusion

ZTE's Product Lines

Terminal	Wireless	Fixed Access	Core Network	Bearer	Cloud-computing & IT	Services	Others
Smart Phone	UMTS/GSM	MSAN	Mobile CN	WDM/OTN	VAS	Maintenance Support Services	Surveillance
Pad	CDMA2000	xPON	Fixed CN	NG-SDH/MSTP	Cloud-computing Infrastructure and Services	Managed Services	Power
Feature Phone	TD-SCDMA	DSL	IMS	PTN	Server	Technical Services	
Data Card	WiMAX	CPE		Routers	Storage	IT Integration Services	
Convergence Terminal	LTE			BRAS	IPTV	Learning Services	
Module/Chips	Microwave			Ethernet Switch	APP store Convergence Service		
	WiFi				OSS/BSS		
	RFID						

- ZTE's products and solutions portfolio is the **most comprehensive** in the industry, and meets the diverse needs of customers
- The company is the leading supplier in the wireless, wired and terminal fields and its **new businesses**, including telecom and Internet services, are growing fast

ZTE Terminals Proliferate, Smartphone Sales Grow

World TOP 4 in 2011 Terminal Shipments

- Handset overall sales grew 50% in 2011, growth rate of smartphone ranked NO.1
- World TOP 4 Terminal Shipments in Q1,2012 (Source: IDC)

2012, Focus on Smart Terminals

- Over 10 years of handset design experience
- Nearly 400 professional design experts
- World TOP 5 Smartphone Shipments in Q2, 2012 (Source: IDC)

Grand lineup

Blade Skate Grand X

ZTE Blade 880 shipment was over 10 million, the best-selling of smartphone in 1,000 RMB-level in China

ZTE Wireless: Innovation for Tier 1 Operators

Steady growth for 2G/3G

No. 1

TDD - Comprehensive competence ranked **No. 1 globally** (Source: F&S)

CDMA - No. 1 for 5 consecutive years in terms of base station shipments

(Source: IDC)

Core Network- lead softswitching technology (Source: Gartner)

TOP 3

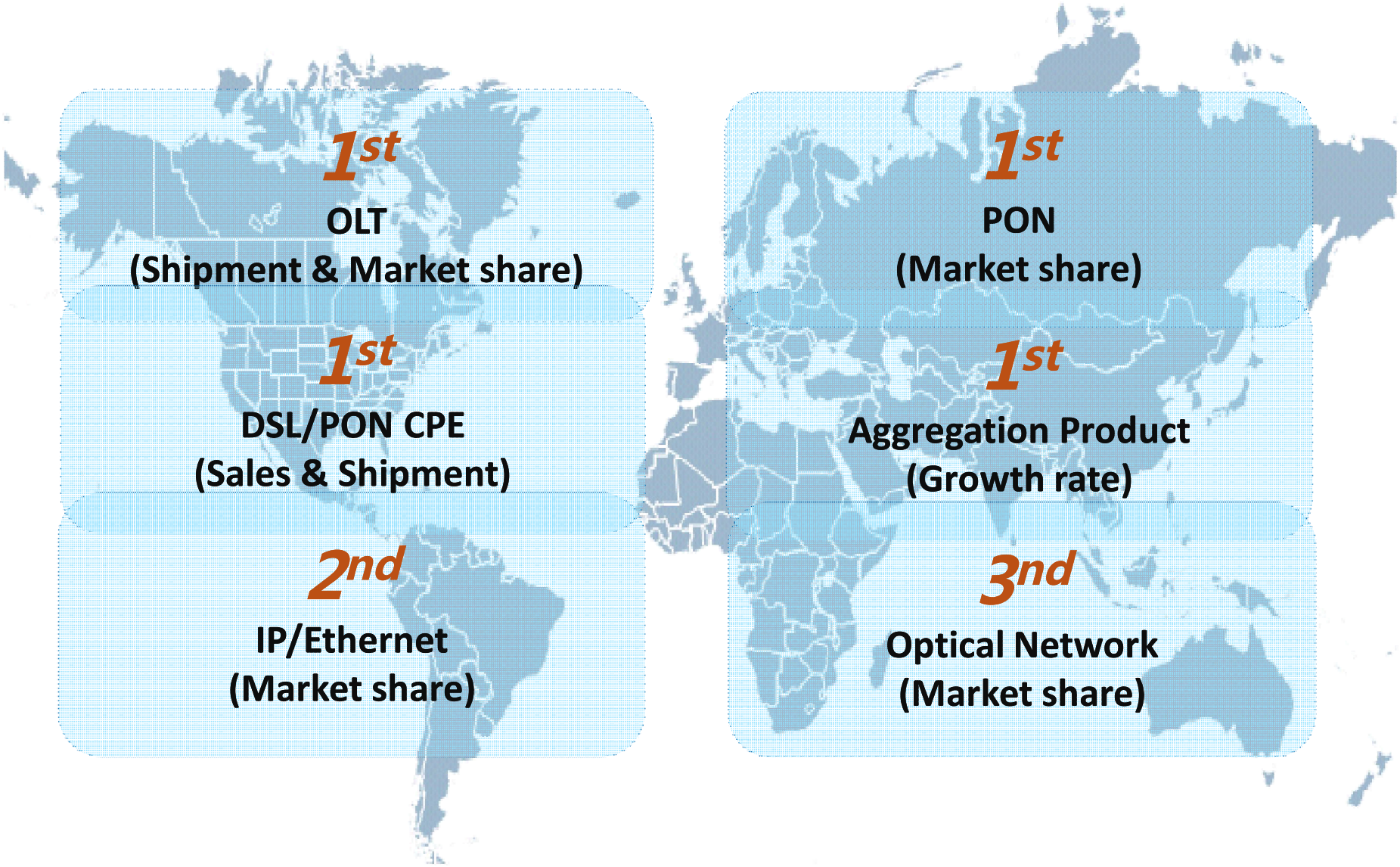
UMTS/LTE – Ranked No.1 in terms of 2T4R shipments (ZTE Research)
GSM –No.1 growth rate in terms of shipments worldwide (ZTE Research)

A Tier-1 vendor for LTE/LTE-A

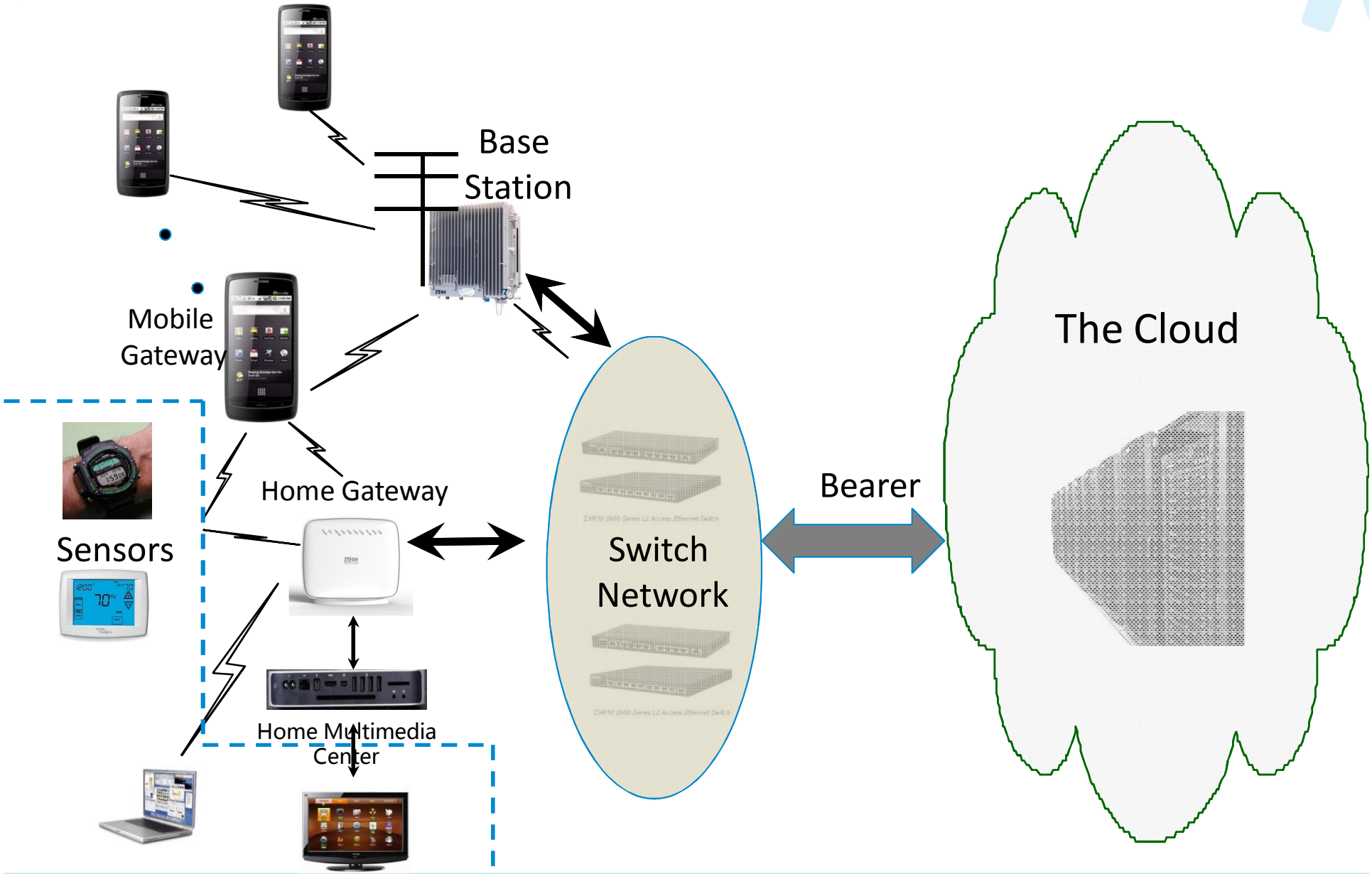
- ***30*** LTE commercial networks globally
- Supplying trial LTE networks to over ***100*** operators worldwide
- ***8*** networks have been commercially launched as of April 2012

New LTE Contracts as of April 2012

ZTE Wireline: Creating New Opportunities for Clients



ZTE's Role in Smart Convergence



Key Analog Technology Enablers

- Communication
  - Higher speed; more bandwidth
  - Multimode; multiband
  - Low power
- Power Management
  - More efficient power delivery
  - Less standby power
  - Better battery management
  - Higher power density

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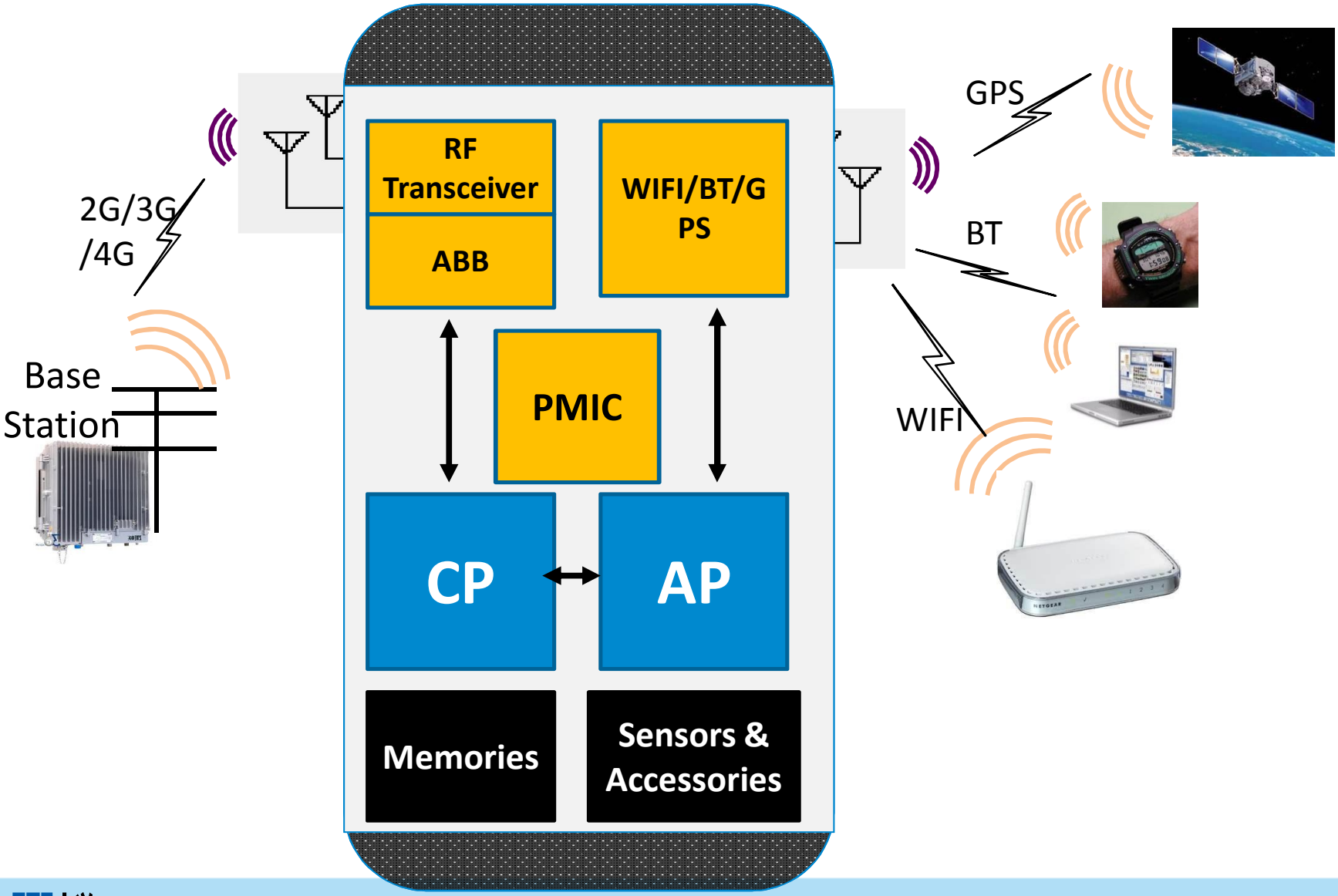
Analog Opportunities in Communication

- RF
  - Cellular Transceiver
  - Transceiver for Connectivity (Wifi/BT/GPS) IC
- AD/DA
  - Analog baseband ADC for 4G cell phone
  - Ultra high speed ADC for 100G network
- Serdes
  - Backplane
  - Optical
  - Inter-chip connect

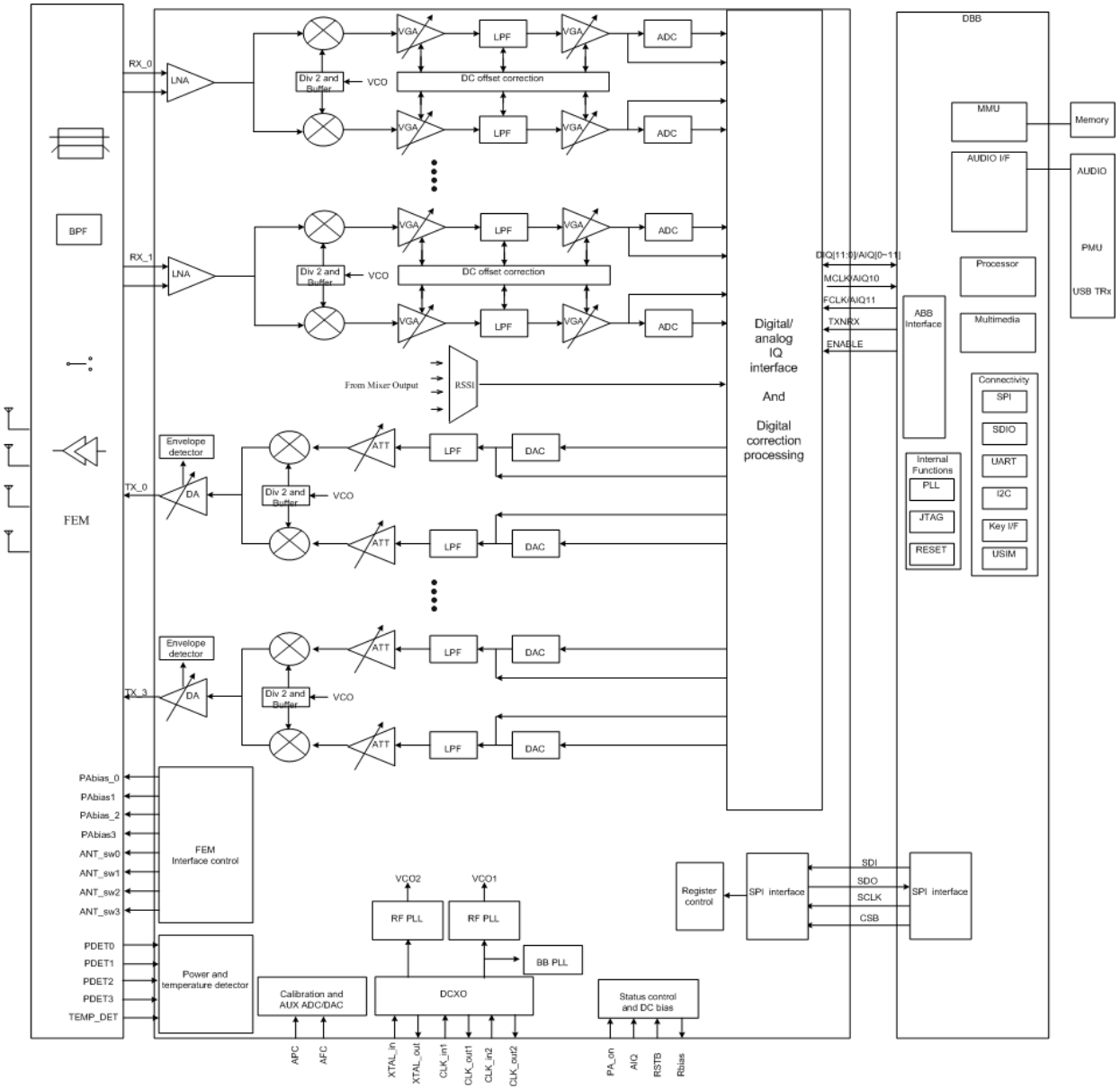
Communications Around a Smartphone



Cellular RF Transceiver

- Cellular RF Transceiver
  - Multimode
    - 2G: GSM, GPRS, EDGE
    - 3G: UMTS(WCDMA/HSPA/HSPA+), CDMA2000, TD-SCDMA
    - 4G and beyond: TDD-LTE, FDD-LTE, LTE Advanced
  - Multiband
  - MIMO
  - Carrier Aggregation
  - Saw-less

Cellular RF Transceiver

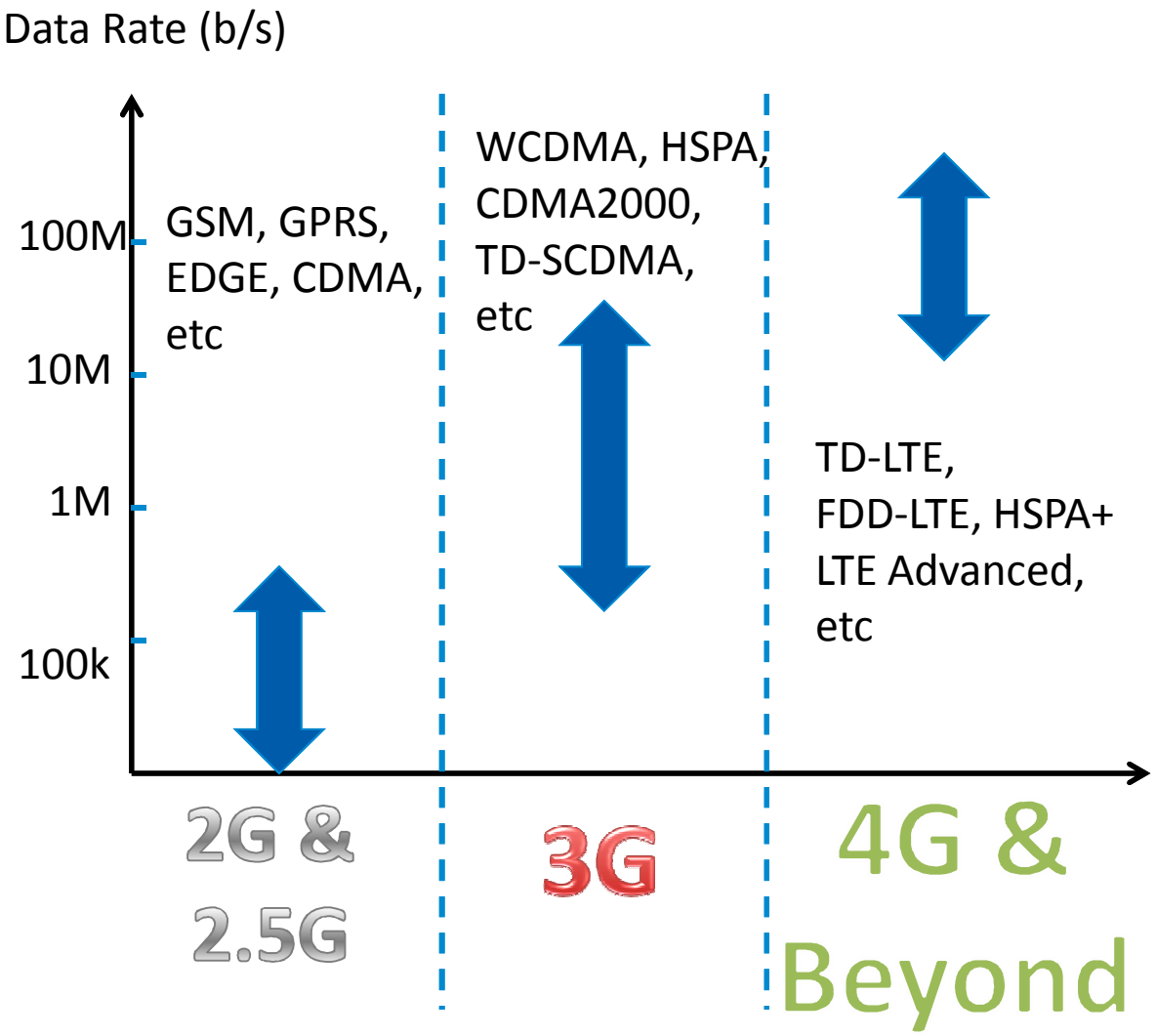


Cellular RF Transceiver

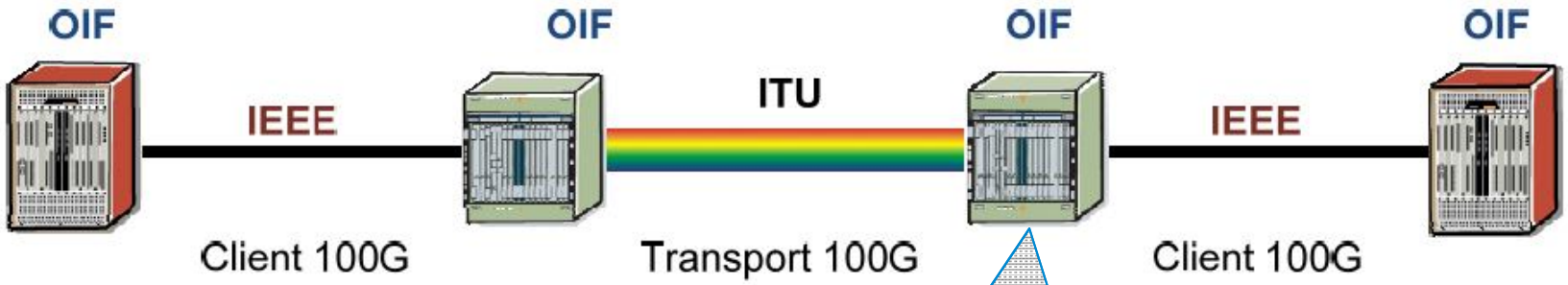
- Major design challenges
  - Integration of 2G into 3G/4G
  - Reconfigurable, easy-to-share channels
  - High channel bandwidth (up to 100Mhz)
  - Carrier frequency spreading from 600Mhz to 2.6Ghz
  - Saw-less
  - Spur Control

Analog Baseband ADC

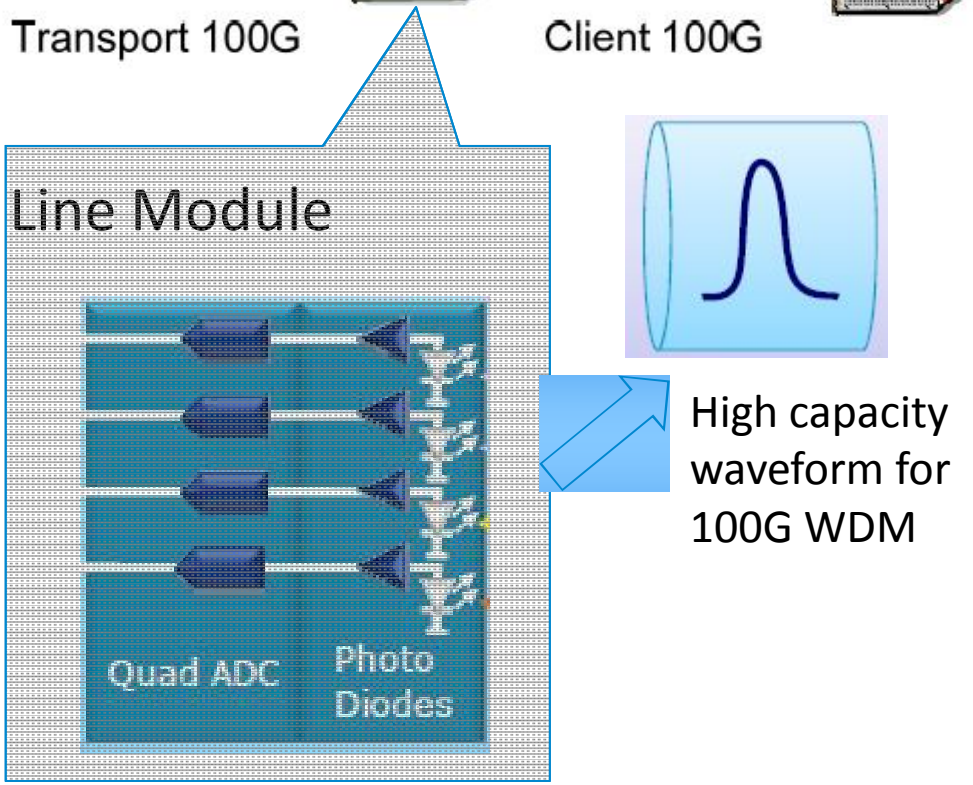
- Higher data speed requires higher bandwidth (20Mhz or more)
- Better spectral efficiency requires better resolution (12bits or more)
- Low power
- Continuous DS or pipeline



ADC for 100G Network

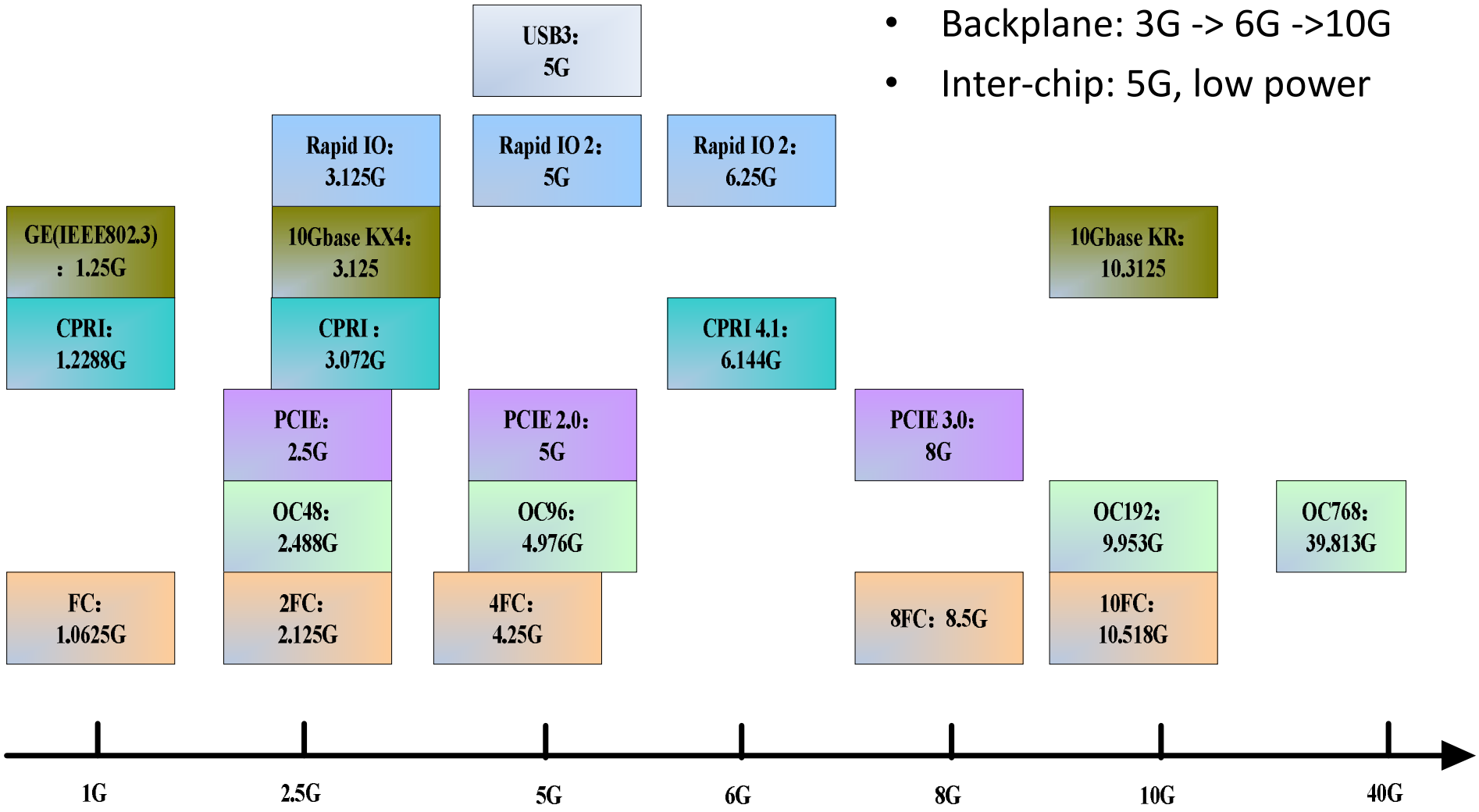


- Sampling rate: 50Gs/s or more
- Resolution 8bit (~6bit ENOB)
- Bandwidth: 15Ghz or more
- SAR or Pipeline
- 65nm or below



Serdes

- Optical : 10G -> 20G
- Backplane: 3G -> 6G ->10G
- Inter-chip: 5G, low power



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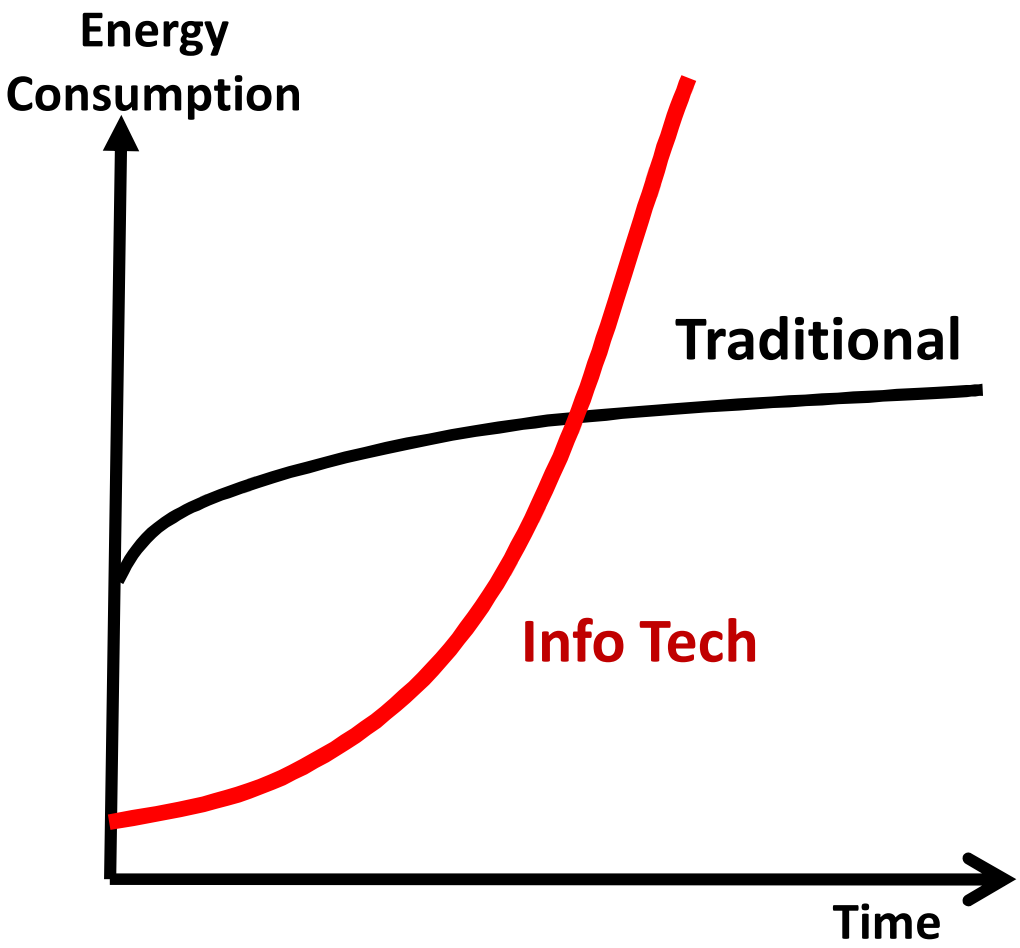
Analog Opportunities in Power Design

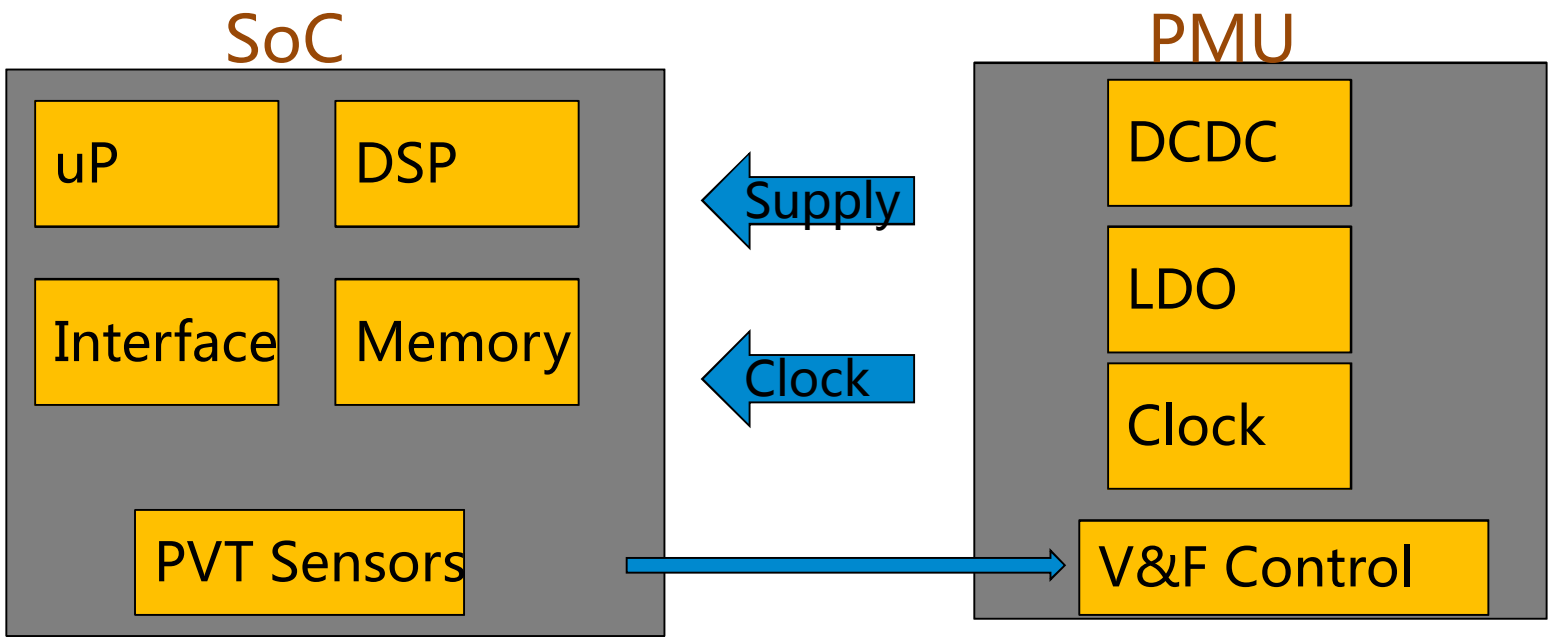
- Information technology helps to increase the energy efficiency in the traditional world
- Content (information) creation, delivery and consumption all require energy
- No limit in sight for content creation
- Data generation currently outpaces the efficiency improvement for data processing



Analog Opportunities in Power Design

- Terminal
  - Power management
  - Charging/Battery management
  - LED backlight, flash
- System
  - AC/DC
  - DC/DC

Power management Concept



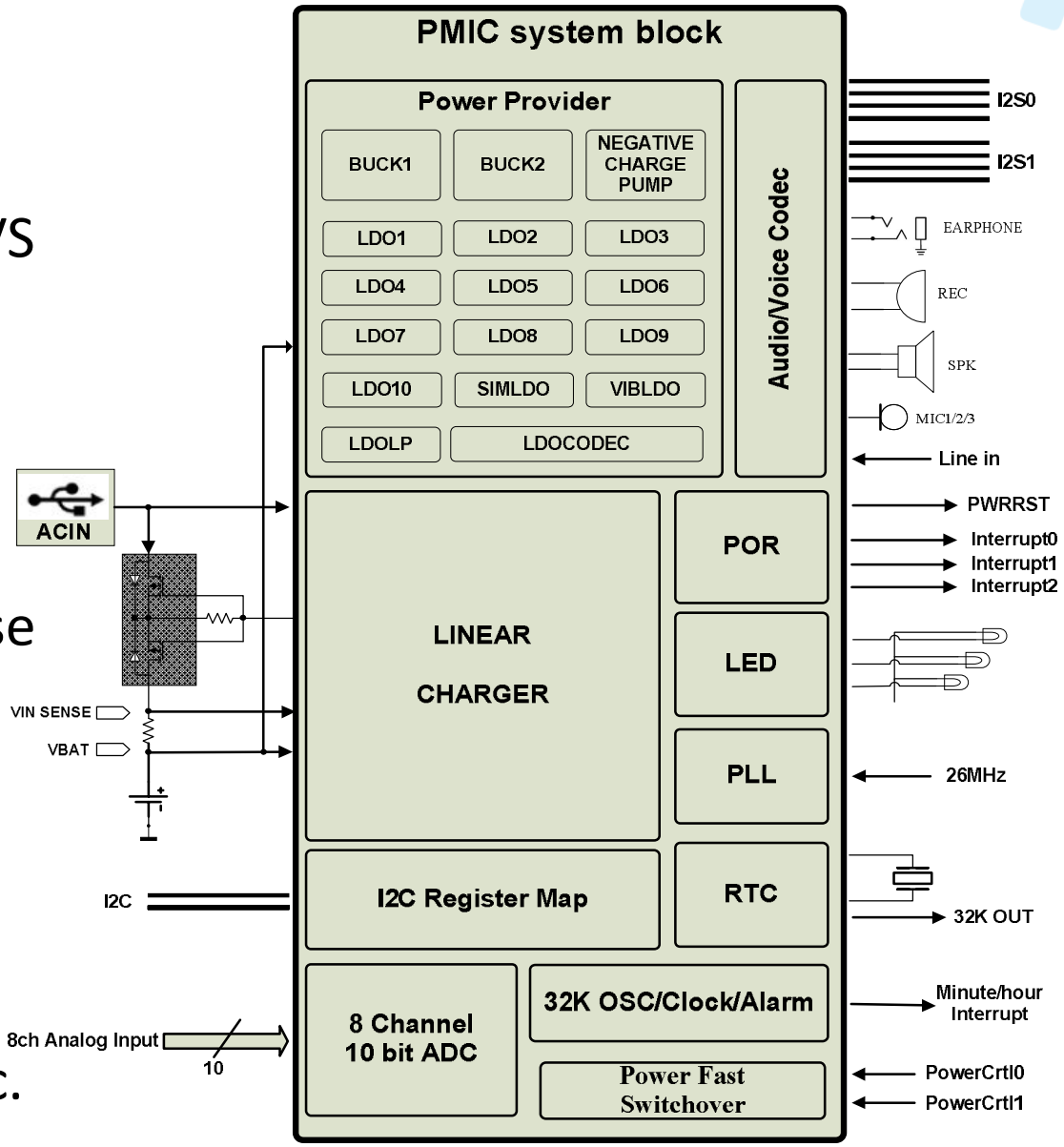
- Adaptive Voltage and Frequency Control
  - PVT sensors sense the working condition and feed the engine to find the optimum supply and clock
  - PMU adjust the supply and clock accordingly

PMIC for Mobile Handsets

- DCDC
  - 2~6 bucks: 1A~3A, DVS
  - 1boost: LED backlight driver
- LDO
  - 10~20 channels
  - Low noise requirement on RF supplies
- Charger
  - Linear charger for sub 1A charging current
  - Switching charger for 1A~2A charging current
- Housekeeping
  - POR, RTC, etc.
- Others
  - Audio Codec
  - USB Phy
  - Touch screen control

PMIC for Mobile Handsets

- Feature Phone PMIC
  - 2 Buck DCDC with DVS
  - 12 LDO
  - Integrated Charger
  - Integrated Audio Codec and PA
  - 10bit General Purpose ADC
  - Power on/down sequence control
  - Real Time Clock
  - I2C Interface
  - LED, Motor Drive, etc.



PMIC for Mobile Handsets

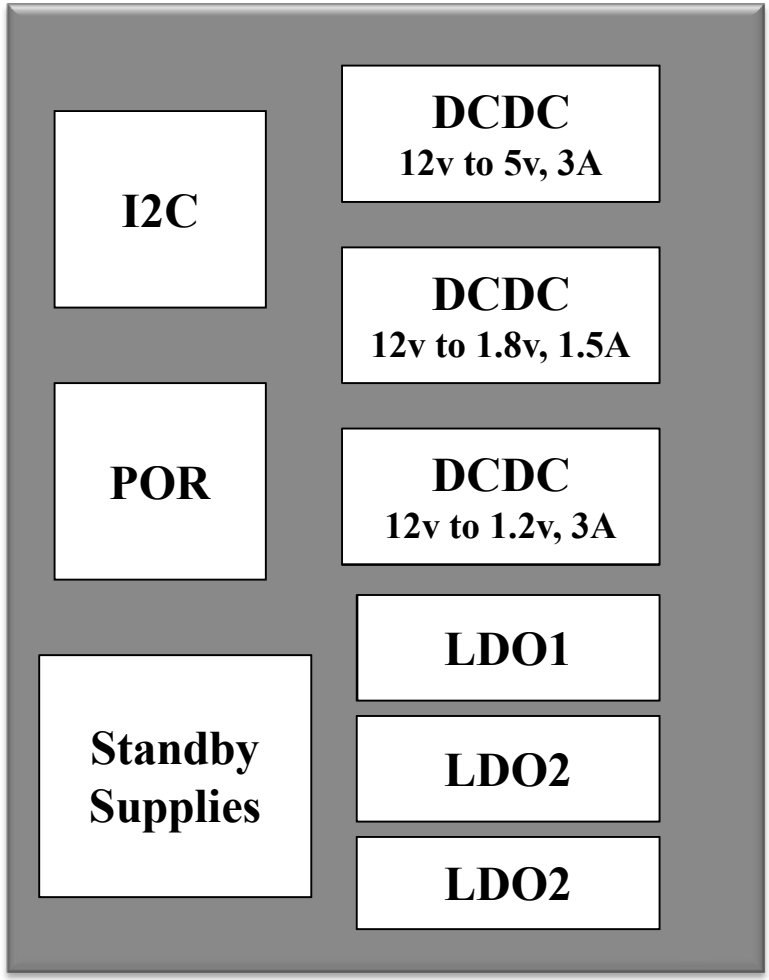
- Design Challenges
  - DCDC:
    - efficiency (both high and low load), standby power,
    - output adjustment resolution and response time
    - Cross interference
  - LDO: low noise, low standby power
  - Overall efficiency and heat management
  - Low cost

PMIC for Set-top box

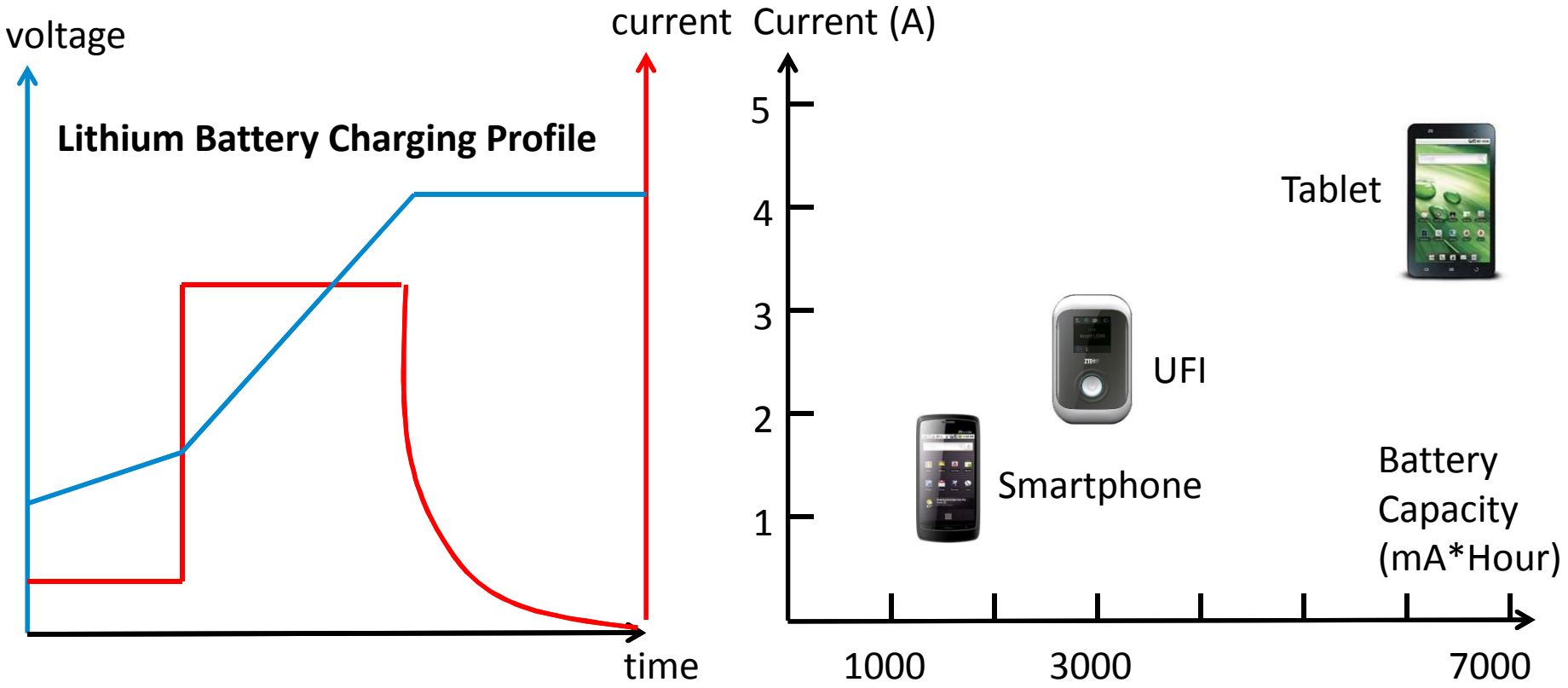
- DCDC buck
  - 12v to 1.2v/below (Core), DVS, 3A
  - 12v to 5v (accessories), 3A
  - 12v to 1.8v/1.5v (DDR), 1.5A
- LDO
  - 5V to 3.3v/2.5v/1.8v, hundreds of mA
- Power on/down sequence control
- Digital interface
- High efficiency, low standby power
- Low cost

PMIC for Set-top box

- Design challenges
  - DCDC efficiency
  - Heat management
  - Efficient standby supplies (Energy Star)
  - Low cost



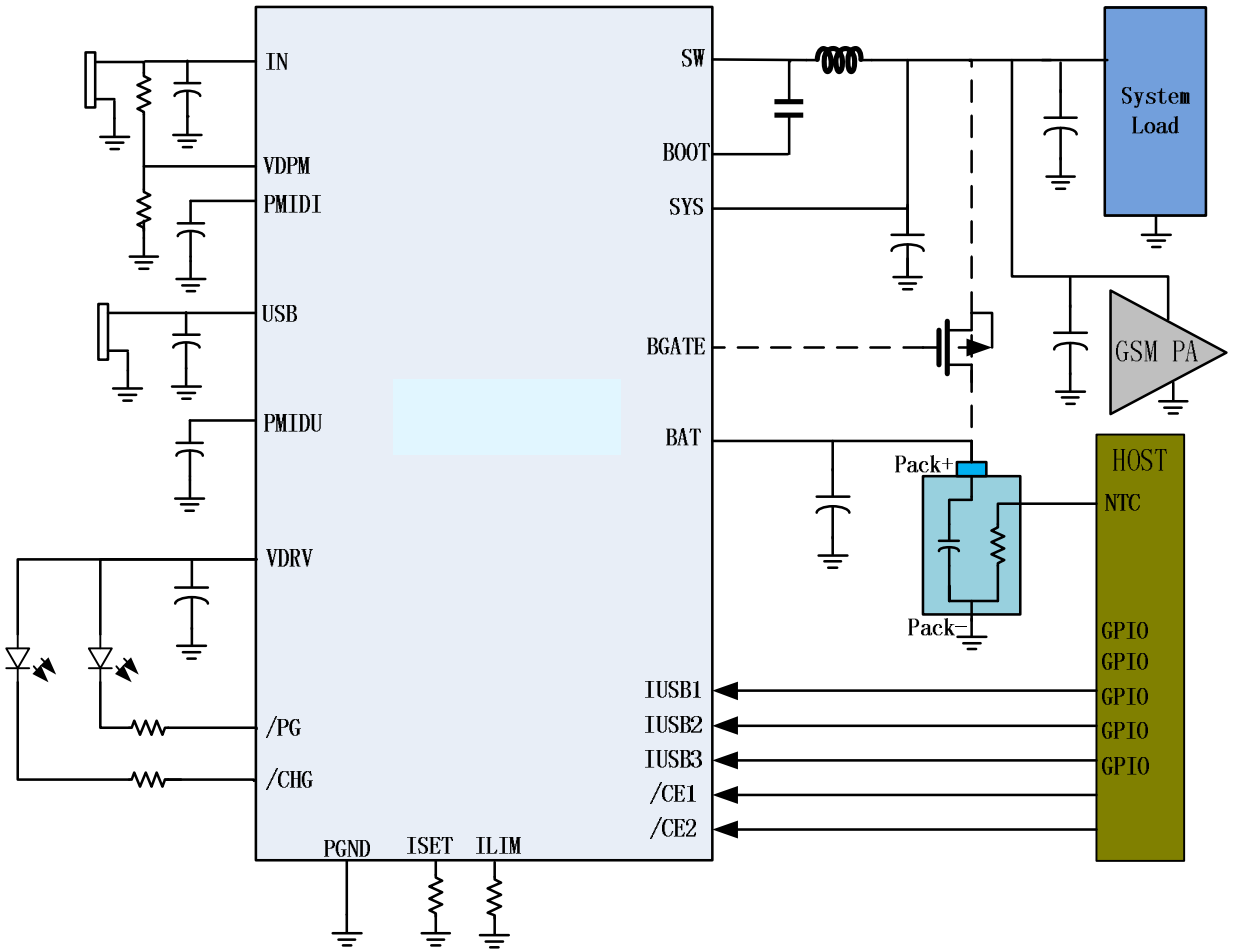
Switching Charger



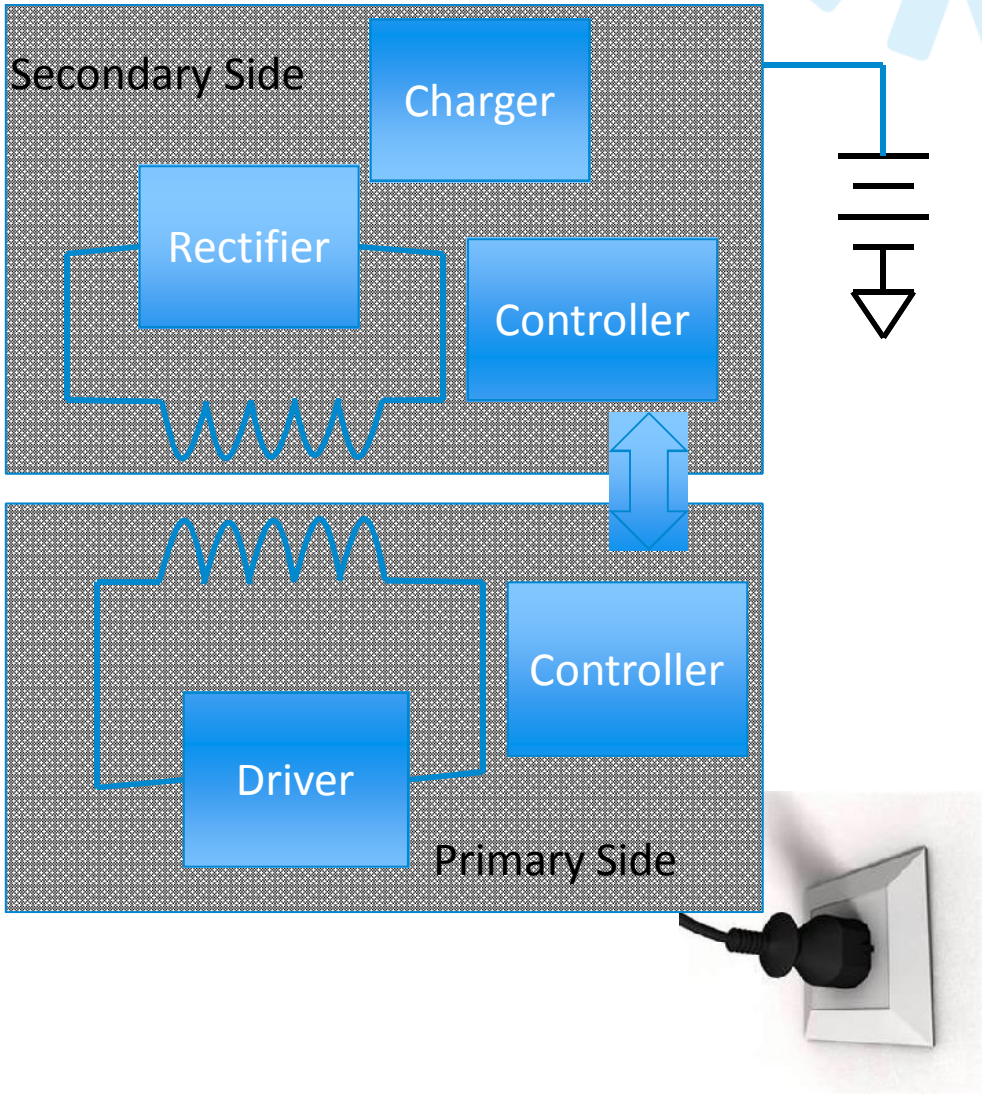
4 Hours

Switching Charger

- Design Challenges
  - Loop stability under various charging conditions
  - Efficiency and heat management
  - Fast charging

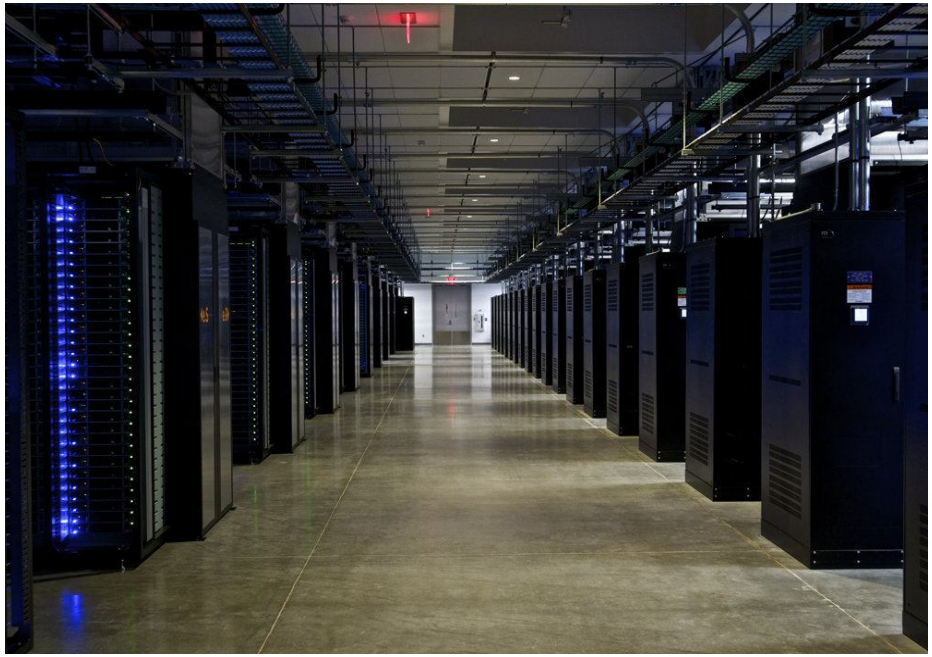


Wireless charging

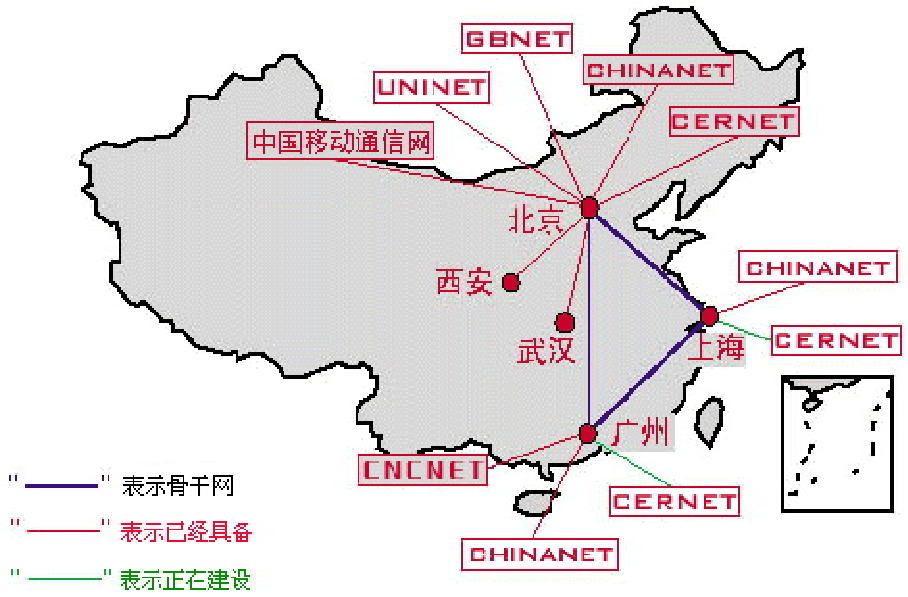


- WPC Standard: Qi
- ~100khz
- Pros: convenience
- Cons: efficiency, charging current, convenience

Powering the Data Center



China Mobil Data Centers

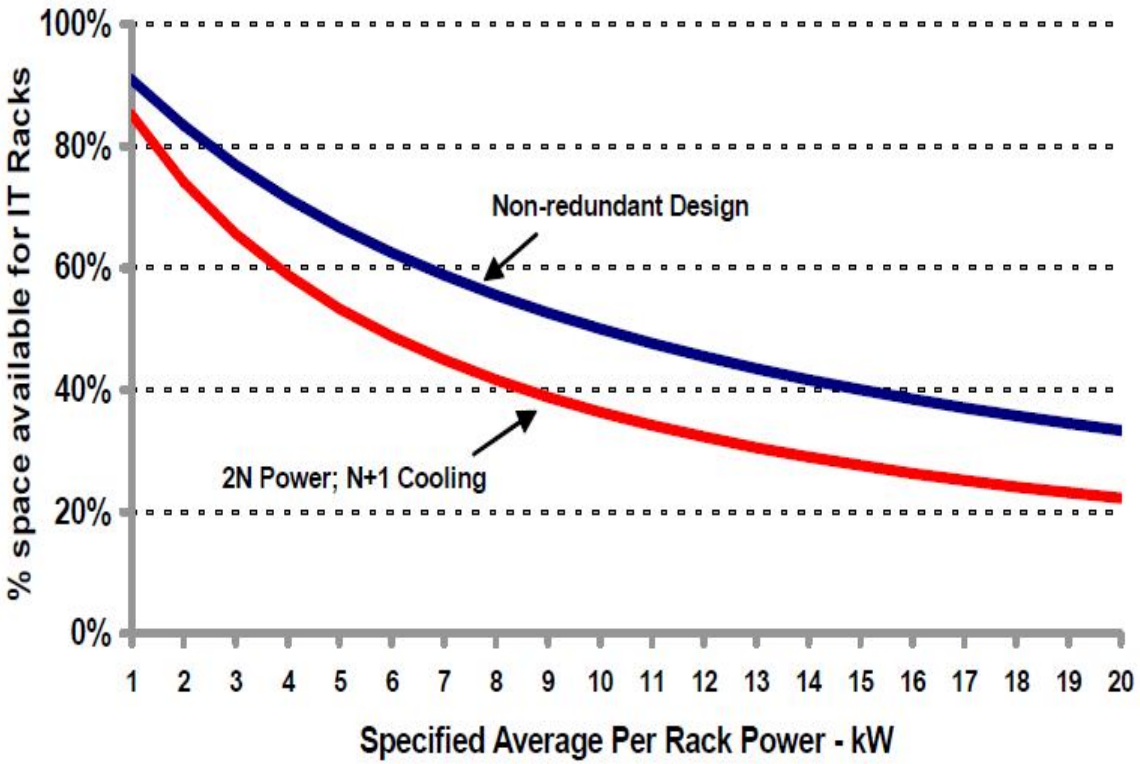


- Smart convergence drives the growth of data centers
- Densely clustered servers require huge amount of power (1~20kw/rack)
- A typical power plant (coal or hydraulic) outputs ~100MW

Powering the Data Center

- For every W delivered to the IT equipment, equal amount of wattage is required for the air conditioning
- Low power design for processor and other data processing unit
- Size does matter for the power delivering modules
- Efficiency is important for heat and cost concerns
- Need components to work under higher temperature

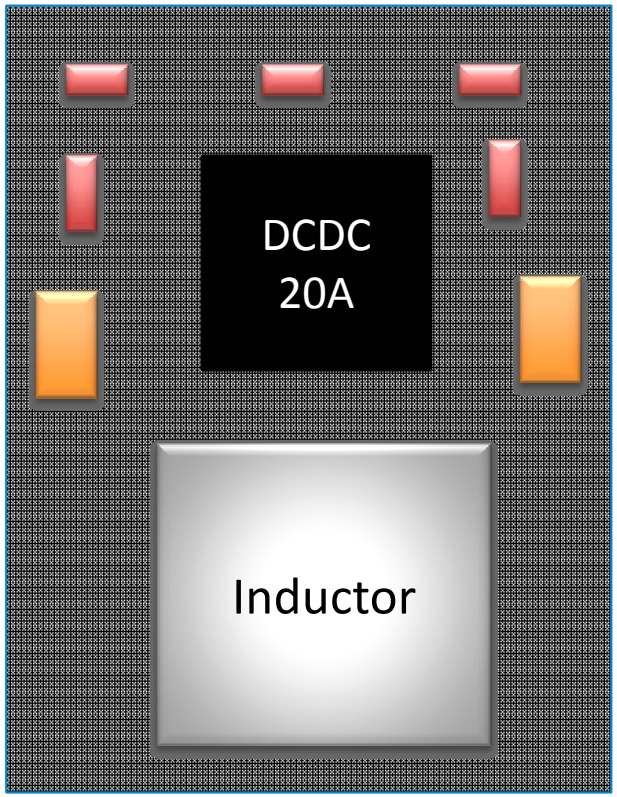
***Figure 1** – Effect of average rack density specification on the fraction of available space for IT racks*



Source: "Guidelines for Specification of Data Center Power Density", APC Whitepaper #120

High Current DCDC Power Module

- Monolithic integration of DCDC controller and driver
- High efficiency and low thermal resistance
- Small form factor of inductors, capacitors, etc.
- High reliability



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Conclusions

- Exciting analog opportunities from smart convergence , especially in communication and power
- Challenges to be met by design innovations as well as the advancement in processing technologies
- ZTE has been and will continue to be one of the most prominent players

Bringing you Closer

Thank you