Capacity Building of GNSS Education in China and its enlightenment

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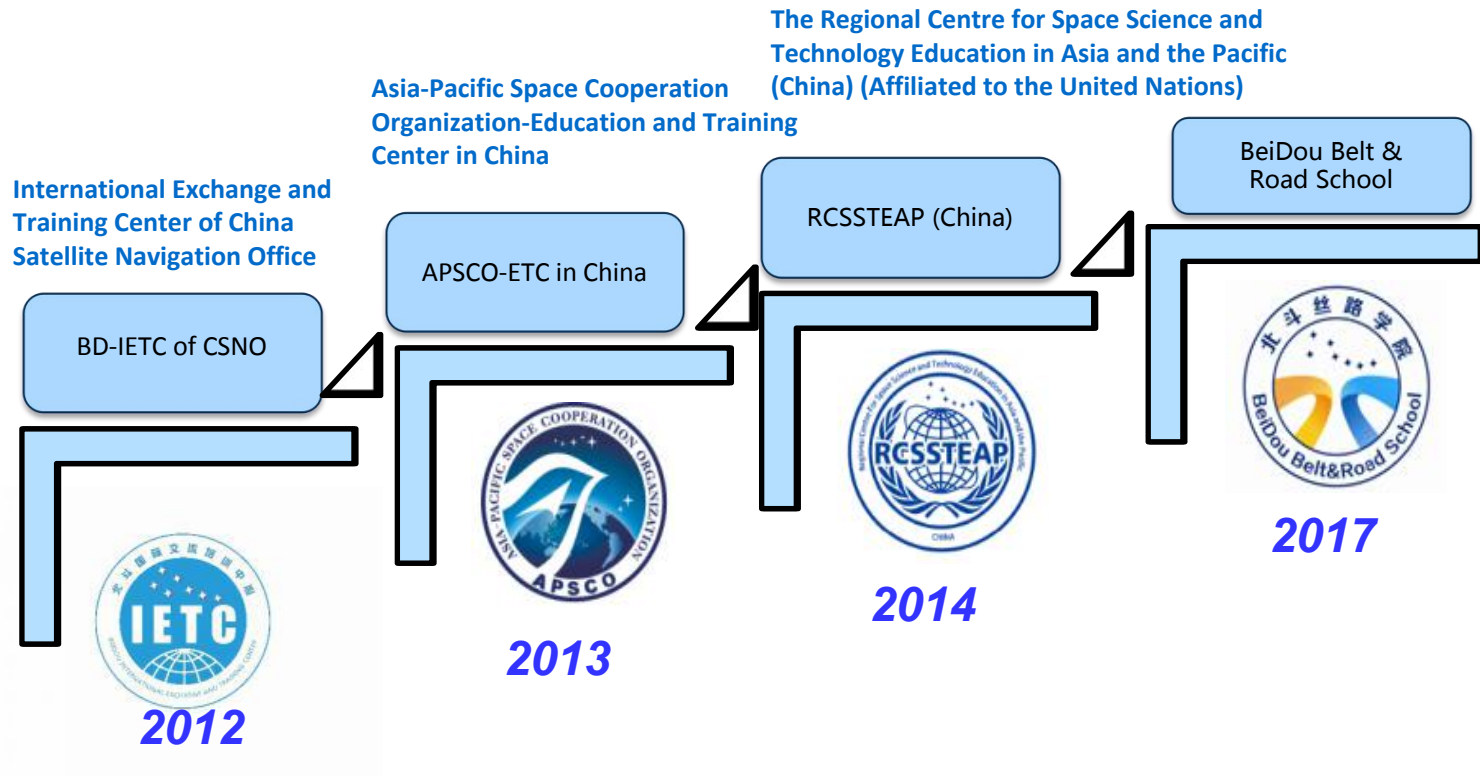
Contents

PART ONE

Degree Program

GNSS Education in China

- Chinese GNSS education and training began in the 1980s. With the large-scale expansion of GPS services in the world

- Construction of BeiDou system stimulated applications together with education and training

- Disciplines, research facilities, talent and industrial chain of BDS/GNSS have been rapidly upgraded and developed in China

- GNSS Education and training is mainly provided by three parties:
  - ✓ Universities are mainly responsible for degree education and training activities.
    - More than 30 universities have relevant postgraduate teaching and training.
  - ✓ Research institutes focus on training activities that related to technological innovation.
  - ✓ Enterprises' training activities mainly rely on related products and market activities
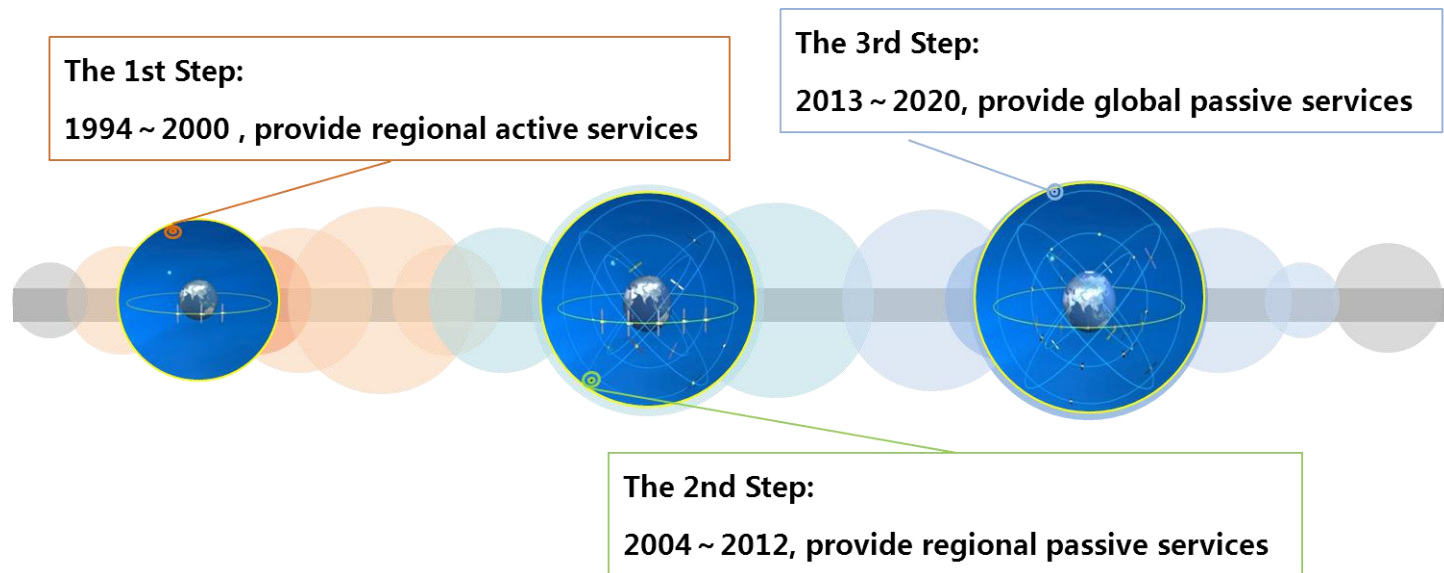
Example : GNSS Education in Beihang University

International Exchange and Training Center of China Satellite Navigation Office

BD-IETC of CSNO

Asia-Pacific Space Cooperation Organization-Education and Training Center in China

APSCO-ETC in China

The Regional Centre for Space Science and Technology Education in Asia and the Pacific (China) (Affiliated to the United Nations)

RCSSTEAP (China)

BeiDou Belt & Road School

2012

2013

2014

2017

GNSS Education Platforms

BeiDou System Development Plan

The BeiDou System has been developing in line with the "three-step" and the thinking of" from regional to global, and from active to passive", and forms a development path as region-highlighted, world-oriented, with its own features.
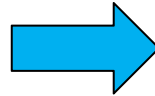
The 1st Step:

1994 ~ 2000 , provide regional active services

The 3rd Step:

2013 ~ 2020, provide global passive services

The 2nd Step:

2004 ~ 2012, provide regional passive services

PNT1m Emerged business in China

1994~

Car navigation

2012~

Pedestrian navigation

Indoor navigation

LBS

GNSS：Global Navigation Satellite System
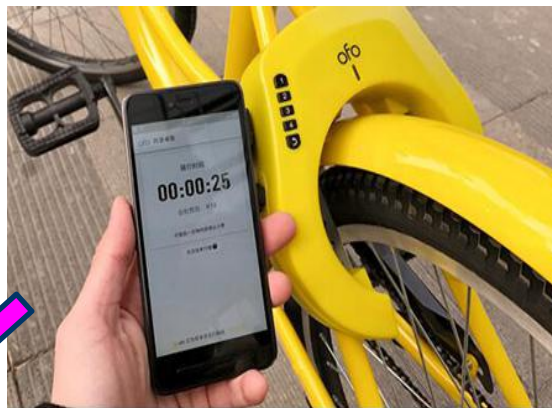PNT: Positioning, Navigation, Timing

Industry Chain

室内定位系统　四大卫星定位导航系统

广域增强系统

PNT1m Provider

位置云计算

Information Provider

eMap

Content provider

Terminals

移动社会网络

facebook

twitter

foursquare

Service provider

applications

Courtesy Shichuang

•Information management

•Control
•Management of tractors

•Internet+
•Big data

NRTK

GNSS

SBAS

WAAS/EGNOS/MSAS

Telematics

NTRIP

IRON 1

Section/ VR Control

ISO 11783/J1939

UA35

Hydraulic Valve

Video

010C   Net20

Radio Base

UHF 410-470 MHz
UHF 223-235 MHz

MC1/MC2

RTCM/ROX
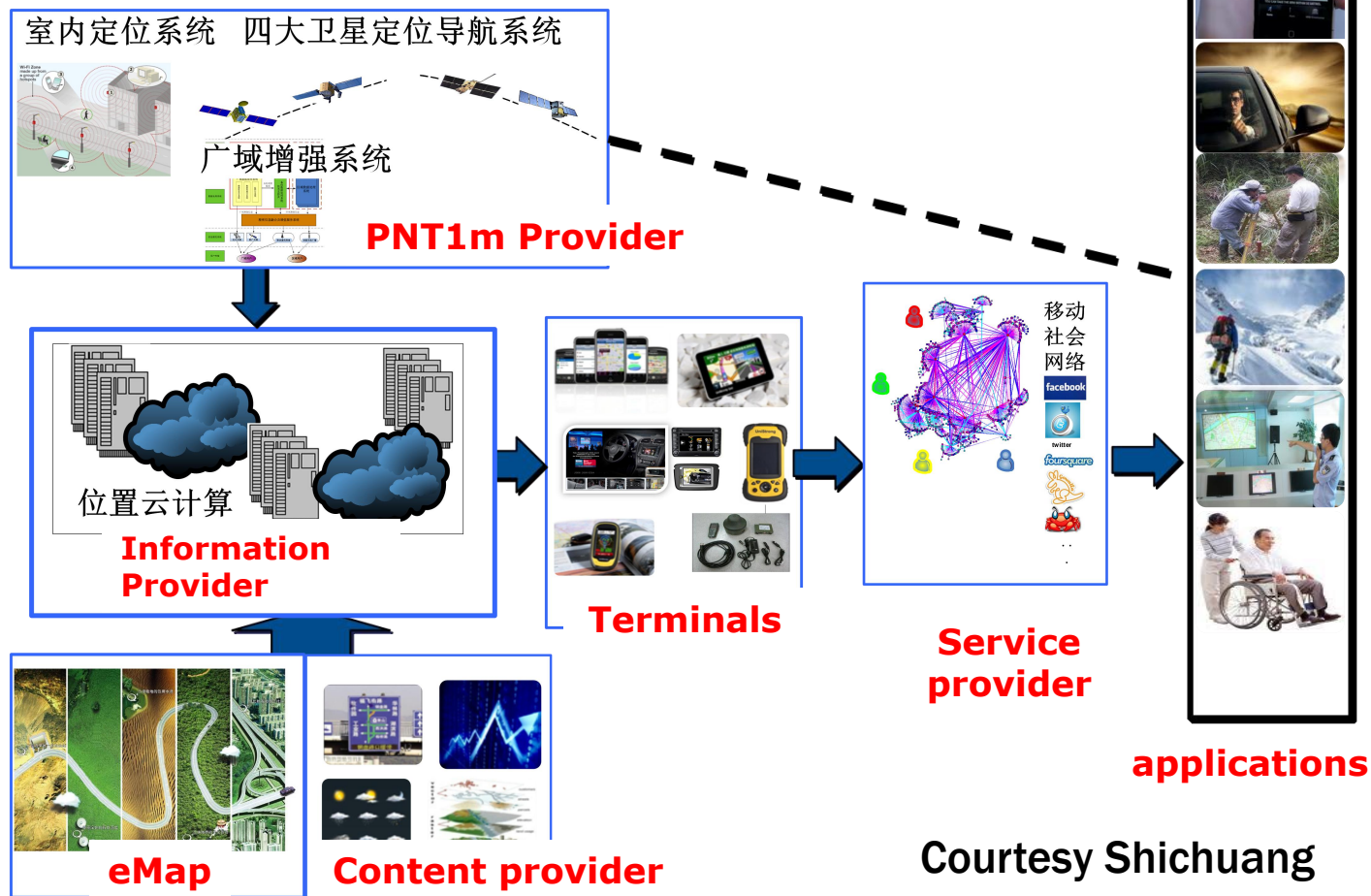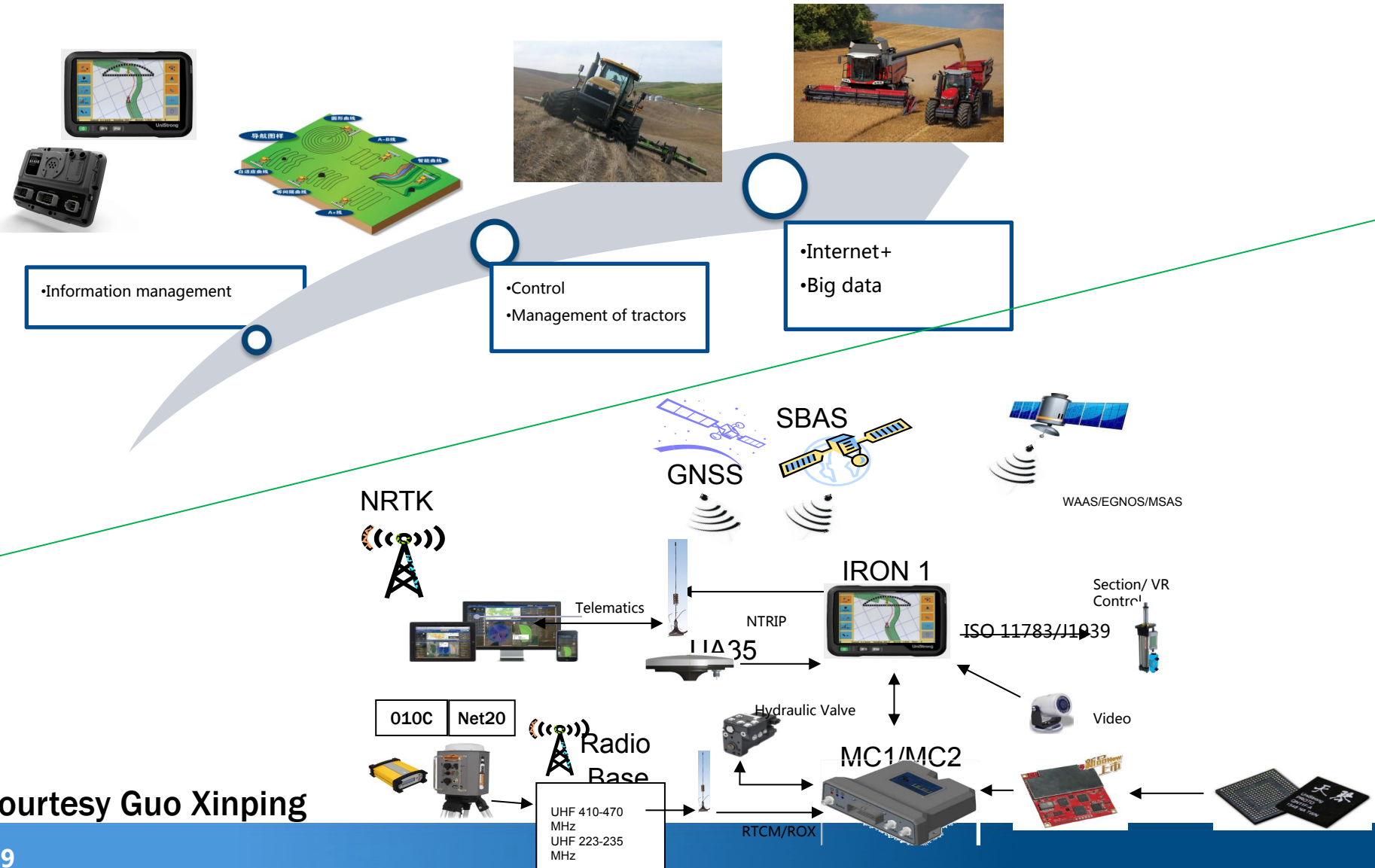
Courtesy Guo Xinping

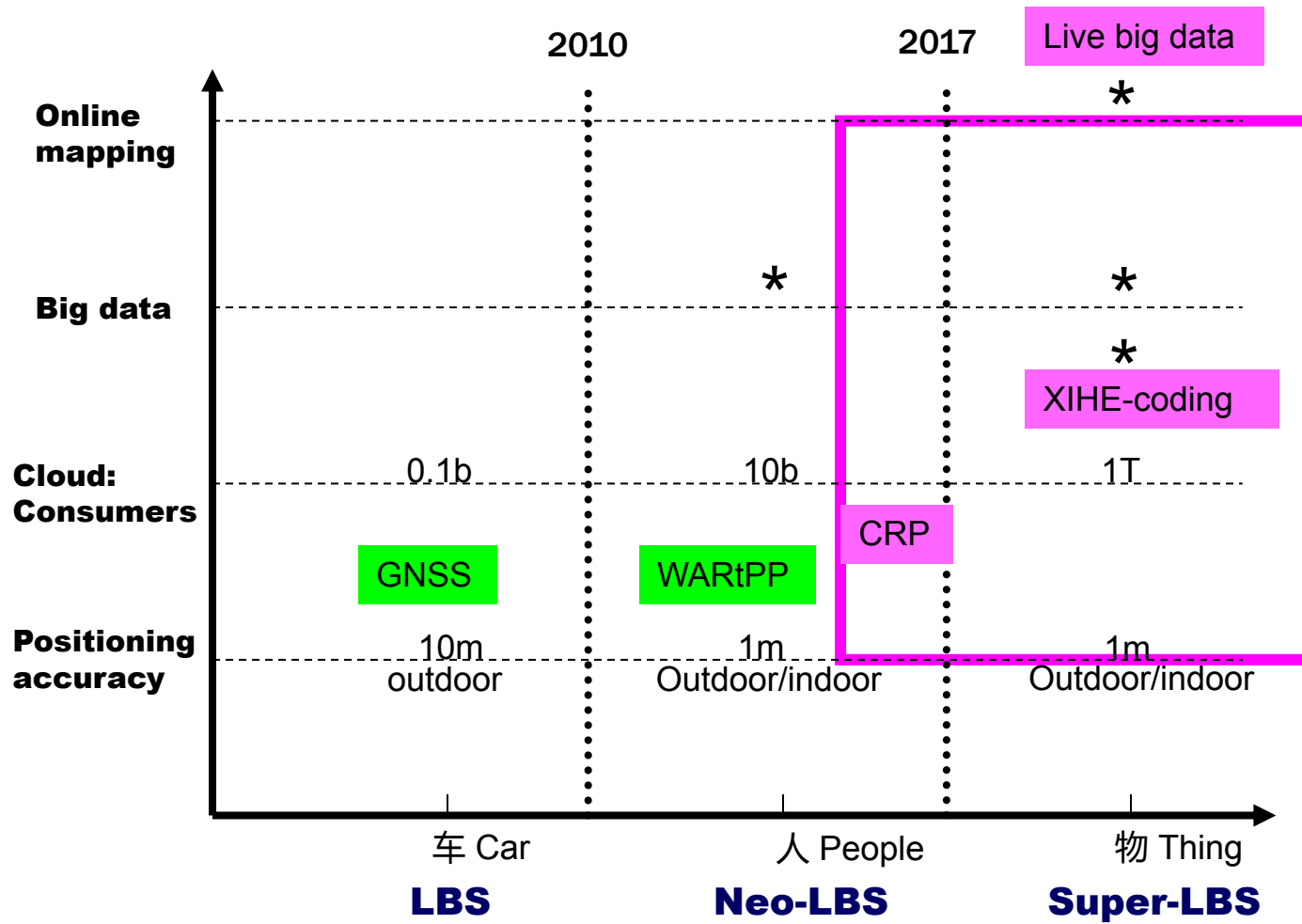# Sharing bicycles

More than 3M in big city like Beijing, Wuhan, etc

Location-based service/Location service

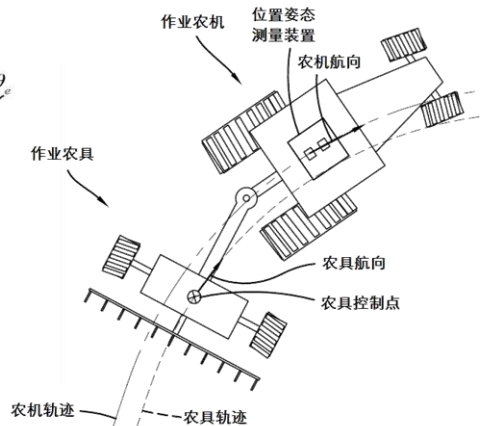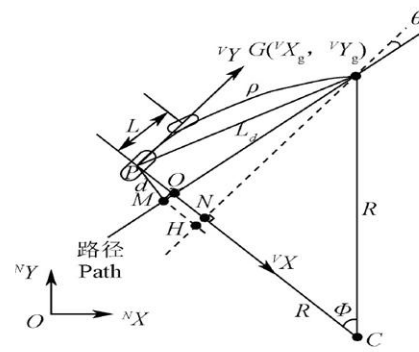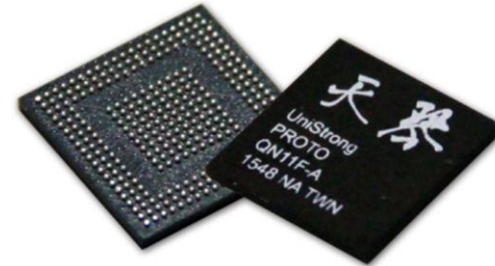# Algorithm and Chipset - MPNT
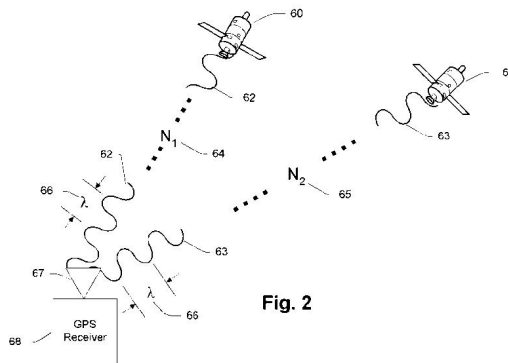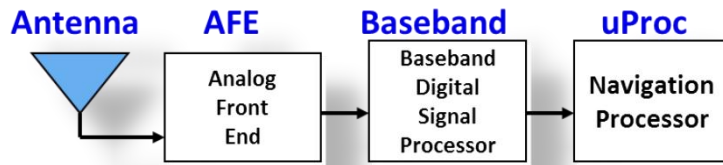
Maybe "terminal=chipset" then

Courtesy Guo Xinping

Degree Program in Beihang

- Beihang University has initiated the Master program on Space Technology Applications (MASTA) since 2006
- Improved together with evolution of BDS/GNSS applications in china

■**Global Navigation Satellite Systems**
■**Remote Sensing and GIS**
■**Satellite Communications**
■**Micro-satellite Technology**
■**Space Law and Policy**

The program are designed for improving space education of developing countries.

RS&GIS

GNSS

Micro-Satellite Technology

SATCOM

Space Law and Policy

Degree Program

Study period is divided into two phases

Phase Ⅰ: Course Study (9 months at Beihang University) (Leading to Course Completion Certificate of)			
Formulation of an Individual Training Plan	Module I Common Platform Courses	Module II • Major courses • Academic Lectures • Professional Visits	Module III Team Pilot Project or Practical Courses

Phase Ⅱ: Thesis Research (12 months in China or home country) (Leading to Master's Degree in Engineering)			
Literature Survey and Thesis Proposal	Midterm Assessment	Academic Activities	Thesis Defense

- **Tailor-made Curriculum**
- **Teaching Language: English**

Degree Program

9-month Course List

No.	Item	Class Hrs	Credits	Remark
Module Ⅰ Platform Courses				
PC1-1	Probability and Statistics in Engineering	48	3	Select at least 3 compulsory credits
PC1-2	Theory of Matrix	48	3	
PC1-3	Numerical Analysis	48	3	
PC2-1	Matlab Programming	32	2	Compulsory/ Optional
PC3-1	Space Environment, Orbit and Spacecraft Systems	48	3	Compulsory
PC3-2	Introduction to Space Technology Applications	18	1	Compulsory
PC3-3	International Cooperation in the Peaceful Uses of Outer Space	16	1	Compulsory/ Optional
PC3-4	Introduction on Space Life Science and Astrobiology	18	1	Compulsory/ Optional
PC4-1	Introduction to China and Chinese Language	54	3	Compulsory
Module Ⅱ Major Courses				
MC3-1	GNSS Reference System	18	1	Compulsory
MC3-2	Principle of GNSS	32	2	Compulsory
MC3-3	GNSS Receiver Principles and Design	32	2	Compulsory
MC3-4	GNSS/INS Integration Navigation	32	2	Compulsory
MC3-5	GNSS Applications	18	1	Compulsory
MC3-6	Satellite Navigation Data Processing	32	2	Compulsory
MC3-7	GNSS Experiment	18	1	Compulsory
MC3-8	GNSS New Technologies	18	1	Compulsory
Module Ⅲ Team Pilot Projects				
PPC	Team Pilot Project	12 Weeks	8	Compulsory

GNSS Education in Beihang University

GNSS Textbook & training Materials
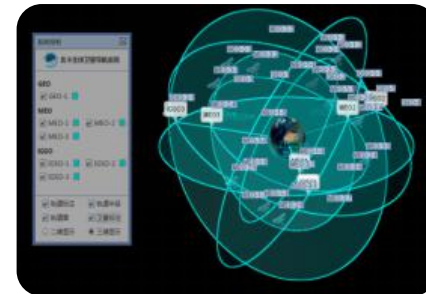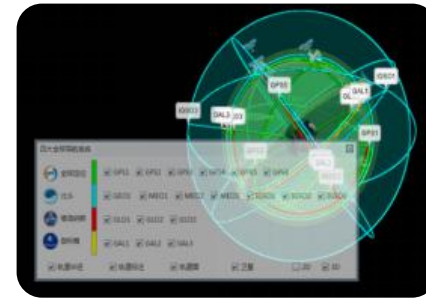
imported BDS

GNSS Education at Beihang University

BDS Exhibition Hall

Smart Classroom

Experiment equipment

Courseware/Tools

Experimental teaching conditions

Mr. Yang Yuanxi
Academician of Chinese Academy of Sciences

Mr. Han Chunhao
Beijing Satellite Navigation Centre

Mr. Jing Guifei
Deputy Director of NRSCC

Mr. Wang Jinnian
China RSGeoinformatics Co., Ltd.

Mr. Zhuang Fengyuan
Beihang University

Mr. He Linshu
Beihang University

Mr. Yang Dongkai
Beihang University

Mr. Weng Jingnong
Beihang University

Mr. Wu Falin
Beihang University

Mr. Jin Tian
Beihang University

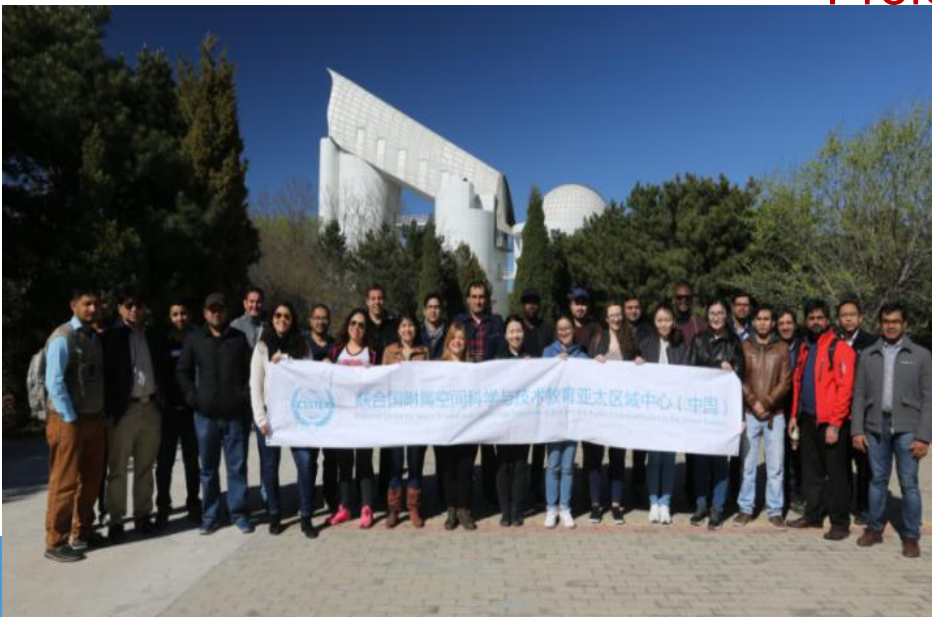Ms. Li Suju
National Disaster Reduction Center

Mr. Zhao Yun
Hongkong University

Degree Program

Professional Visits

Industry tour and collaboration

Achievement in GNSS degree program

- **Enrolment**

Program	Year	Number	Countries of Participants
Master's	2017	11	Bangladesh, Bolivia, Mongolia, Pakistan, Peru, Thailand, Turkey
Program	2018	6	Ethiopia, Peru, Turkey, Iran, Pakistan
Doctoral	2017	11	Algeria, Bangladesh, Iran, Pakistan, Thailand, Turkey, Venezuela
Program	2018	11	Bangladesh, Indonesia, Iran, Nigeria, Pakistan, Thailand

PART TWO
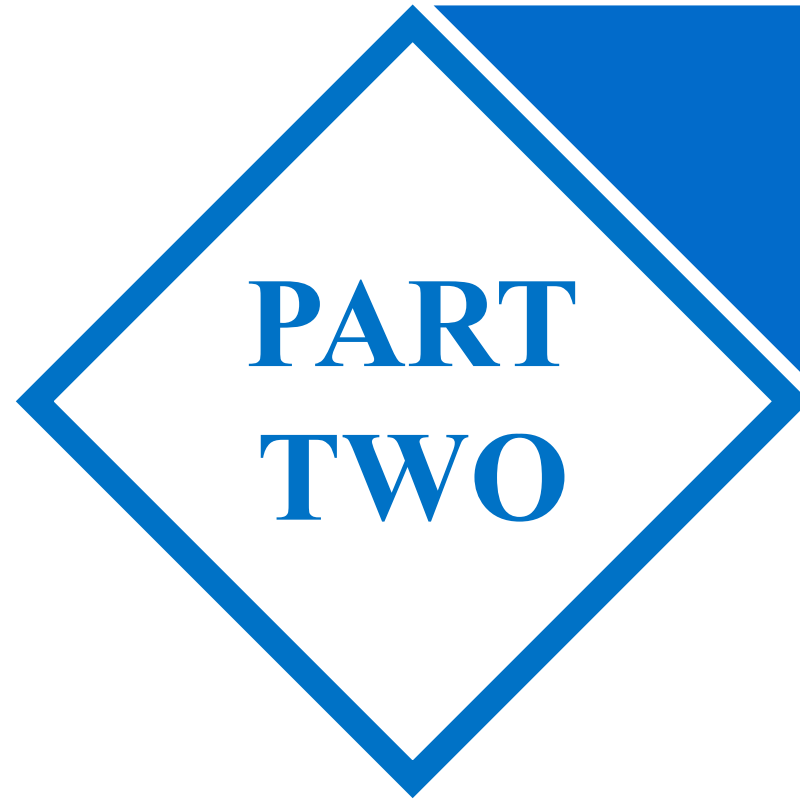
Training Activities

Training Activities

GNSS Short Term Training

Topic	Date	Place	Trainee
2017 International Workshop on BDS Technology & Applications	Nov.26-Dec.8, 2017	Beihang University, China	23 (Egypt, Gambia, Nigeria, Iraq, Thailand, Indonesia, Sudan, Pakistan, Mongolia, Bangladesh, Bolivia)
GNSS and BeiDou System Deep Understanding Training	April 11-13, 2018	China-Arab BDS/GNSS Center (AICTO) , Tunisia	38 (Tunisia, Morocco, Egypt)
CRASTE-LF & RCSSTEAP-China GNSS Workshop and Applications	April 23-26, 2018	African Regional Centre for Space Science and Technology Education (in French Language), Morocco	Nearly 30 (Morocco, Algeria, Niger, Senegal, Tunisia, Cameroon, Central Africa Republic)
BeiDou System Technology and Applications	August, 2018	Naresuan University, Thailand	More than 30 (Thailand)
The 2nd GNSS Short-term Training of AICTO	Sep. 24-26, 2018	The Friendship Hall, Khartoum, Republic of Sudan	162 (Sudan, Egypt, Zambia, Lebanon)

Training Activities

China-Arab BDS/GNSS Center (AICTO) Opening Ceremony & GNSS and BeiDou System Deep Understanding Training

April 11-13, 2018 & April 1-2, 2019 in Tunisia

CRASTE-LF & RCSSTEAP-China GNSS Workshop

April 23-26, 2018 in Rabat, Morocco

Training event in 2019 was just finished

Training Activities

BeiDou System Technology and Applications

August, 2018 in Thailand

BeiDou Agricultural Applications Seminar

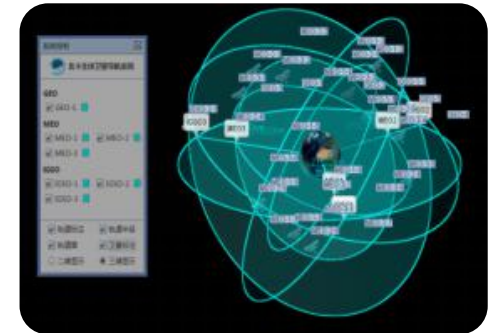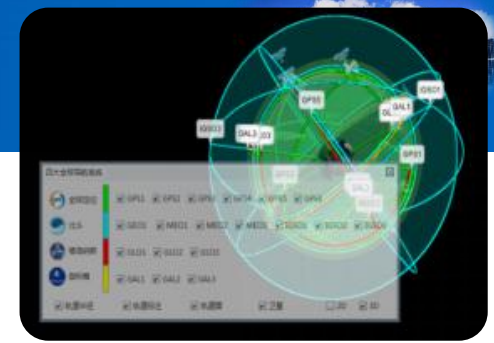*July, 2018 in Laos*

Joint Laboratory through training

BDS Constellation

Experiment equipment

Courseware/Tools

Receivers

Reference station

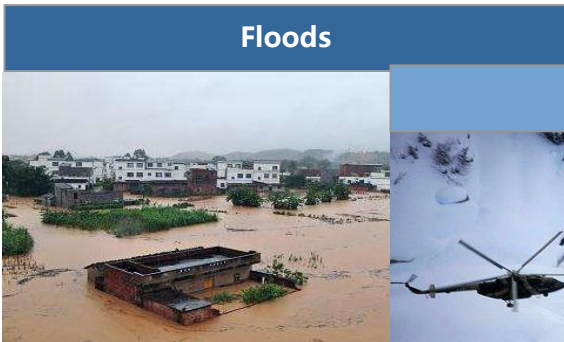# Exchange of personnel after trainning

R&D with pilot projects after training

Car navigation

Location Service

Floods

Blizzards

Construction monitoring:
Dam, Mansion, Building

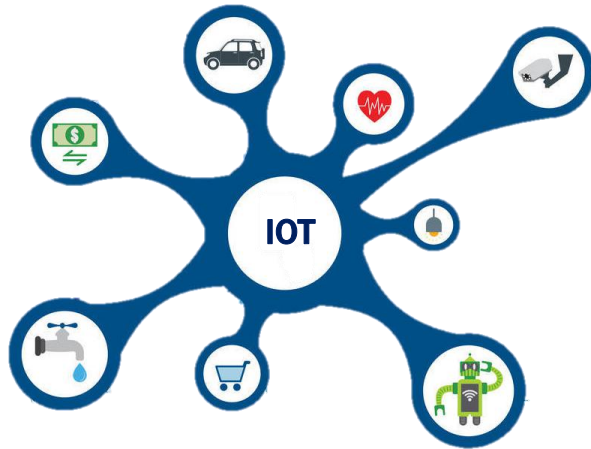Disaster Monitoring
& Mitigation

PART THREE

Suggestions to do

Inter-things Location Network, ITLoN

IOT/5G

BDS Location label

Together with development of BDS applications emerged in China

Using BDS location labels as coordinate, connecting the Internet and the Internet of Things to a superimposed, computable network, provides the basis for ubiquitous information services

Urban delicacy management

Combination of Beidou/5G, the unified access of water, gas, fire, mobile terminals, cameras and other sensing devices at the most basic level of urban facilities

Building an Inter-things Location Network in a city with billion-level nodes

Learning the status of components in real time and building information management center

Urban data exchange and millisecond response, manage the city in real time and provide service for residents

ITLoN for Digital Twin

BDS/GNSS

GBAS

GBAS

PNT

Ubi Info

Global triangulation and coding

IPv6 location mapping

Physical ← → **Cyber**

Sensor

Mobile

Pho ne

Video

......

Municipal

Security

Service

.GOV

.COM

U, me

LBS

带位置的泛在信息

Comprehensive Location Map Center

Sensor network, IOT

Internet
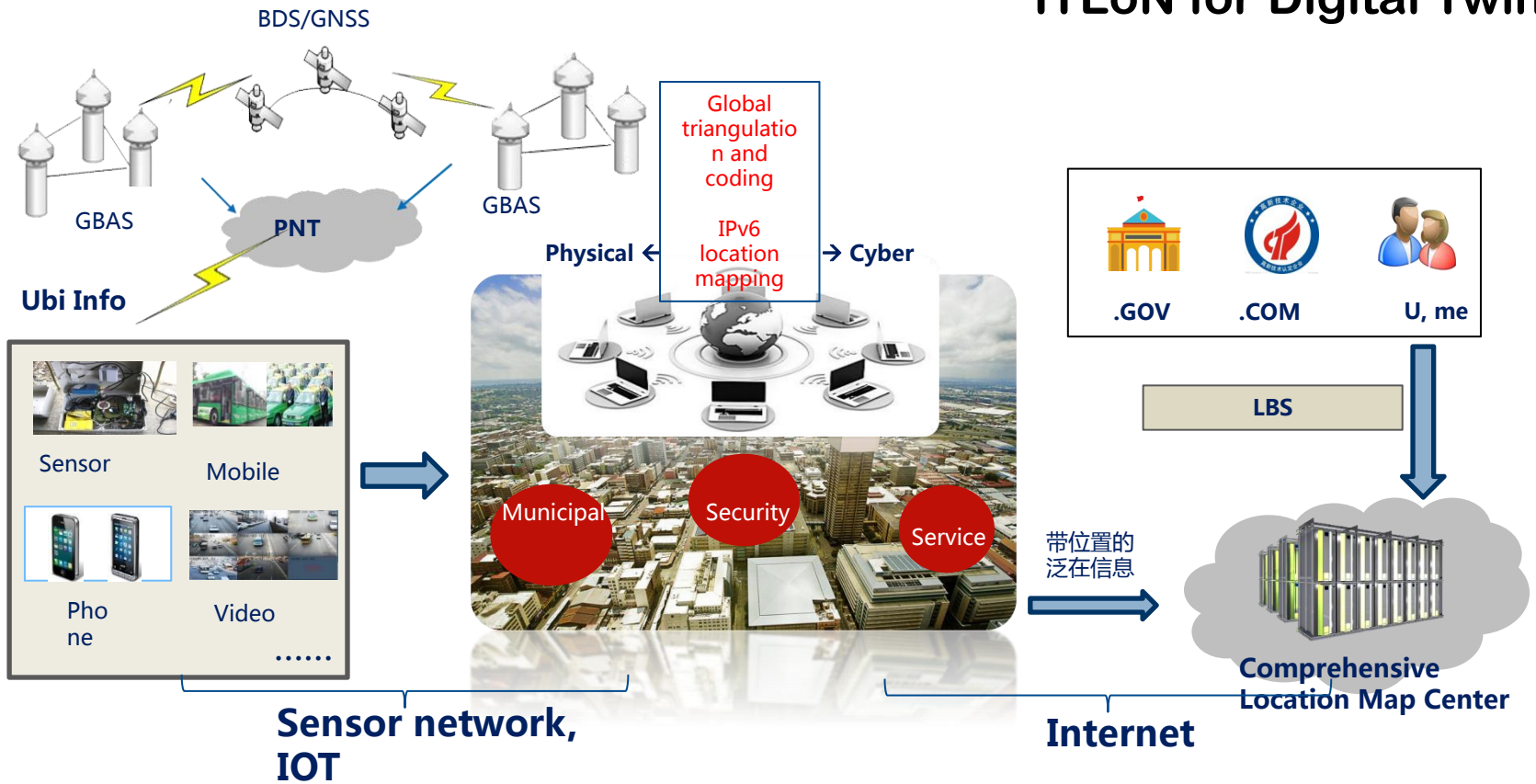
Capacity Building Index: effort in China/under discussing

- Choose a standard to evaluate the development of Capacity building and take it as a guidance

- Besides Education, capacity building should include the other areas, such as:
  - ✓ Research and development
  - ✓ Experiment facilities
  - ✓ Manufacture of HW and SW
  - ✓ Management
  - ✓ Quality guarantee
  - ✓ Policy environment

- Capacity Building index need to consider the weighty rate of different factors

Personal Preliminary recommendation

No.	Content	Weighty score
1	Research standards and management	150
2	Human resources	150
3	Infrastructure and related equipment	150
4	Manufacture and Management	100
5	Finance	150
6	Quality	100
7	Policy environment	100
8	Reputation	100
	Total	1000

PART FOUR

Summary

Summary

- BDS/GNSS and Mobile Internet/5G/AI provide innovation in PNT signals and markets, show better business in China

- BDS will provide SIS in global scale in 2020, emerged new space for GNSS R&D, education, training

- We are willing to cooperate with colleagues in areas of education, technology transfer, training

Thanks for your attention!

Dr. JING Guifei

Beihang University, China

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