

A satellite view of Earth from space, showing the curvature of the planet and the blue oceans and brownish-green landmasses. The text is overlaid on this image.

# Ground-Based PNT System

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# Company Introduction

- Founded in 2017 as a High Tech. Company in China
- Focus on Ground-based PNT technology research and development
- Unique algorithm provides high accuracy and reliable 3D positioning services up to centimeter level , even to millimeter level.
- So far, our products are serving various industries, such as Ports , Communication, Drone, Railway, Automotive, Petroleum, etc.



# The Importance of PNT

## PNT

**P** - positioning , ——— Where we are?  
**N** - navigation , ——— Where are we going?  
**T** - timing , ——— What time is it?

**PNT ——— is the base of intelligent and the core of sensing, it will boost the various applications in industrial and personal areas**

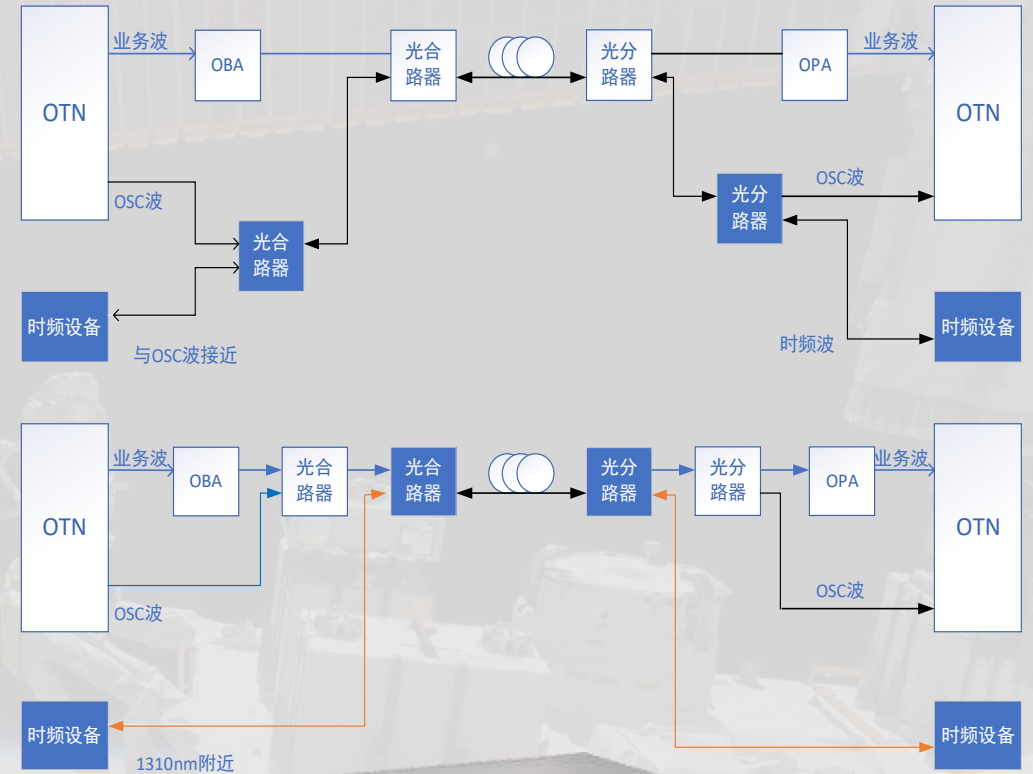
# The Trouble of Satellite Based Solutions

- Potential denied service politically
- Interferenced by the unknown reasons
- Suffered by the bad weather
- Out of service in indoor scenarios
- Accuracy can not fit the requirements
- and so on .....



# Our Product (1) - Fiber timing service

- High Accuracy: Timing accuracy up to 20 picoseconds with single hop, and  $\sqrt{\text{hops}N} * 20$  picoseconds with N hops, TOP in the world nowadays.
- Flexible and scalable.
- Fully compatible with existed OTN system.





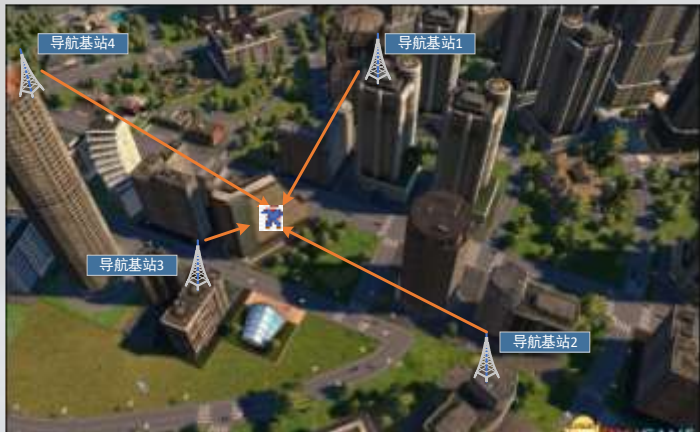
# Our Product(2)-Wireless timing service (HAAPH)

- One Base Station Cover up to 0.5-2Km
- Independent with Satellite services
- Easy installation and fast rollout
- Timing Accuracy:  $\leq 0.05\text{ns}$
- Dimension:  $20\text{cm} \times 24\text{cm} \times 7.5\text{cm}$
- Power consumption:  $\leq 20\text{W}$



# HAAPH - Minimal Implementation

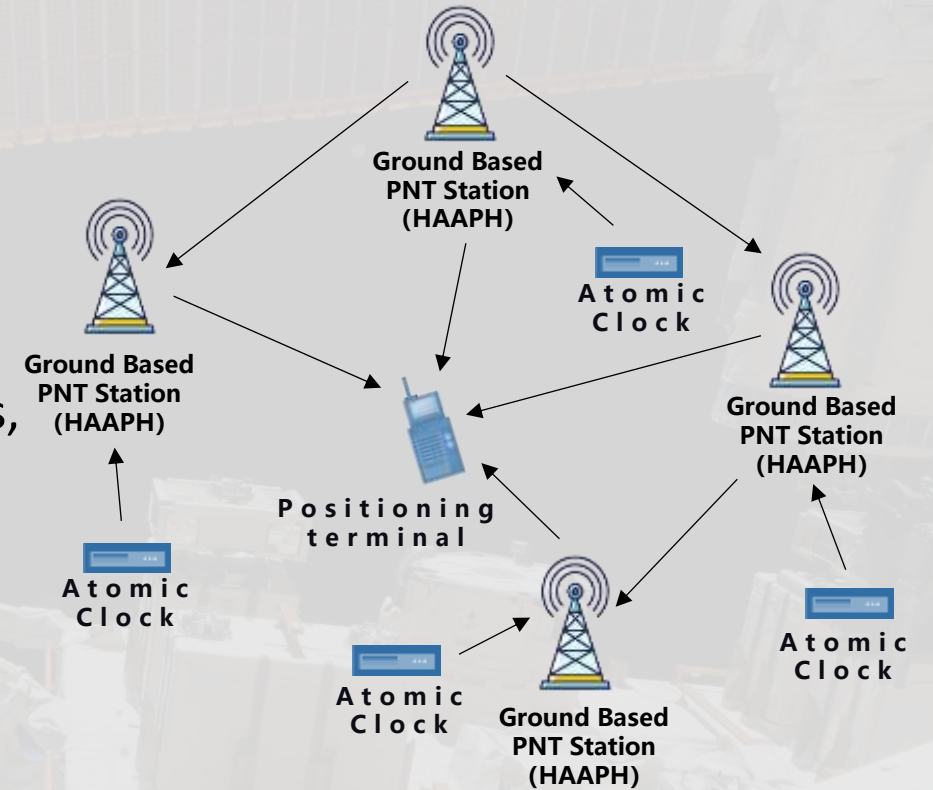
- 4 HAAPH base stations accomplish 3D positioning services
- Self-organizing network and sync. each other automatically
- Terminal receive the signal only without transmission, then the network interference will be minimized.
- Very flexible for Network scale based on usage and requirements, thus to improve the security and reduce the cost.



Dense Urban

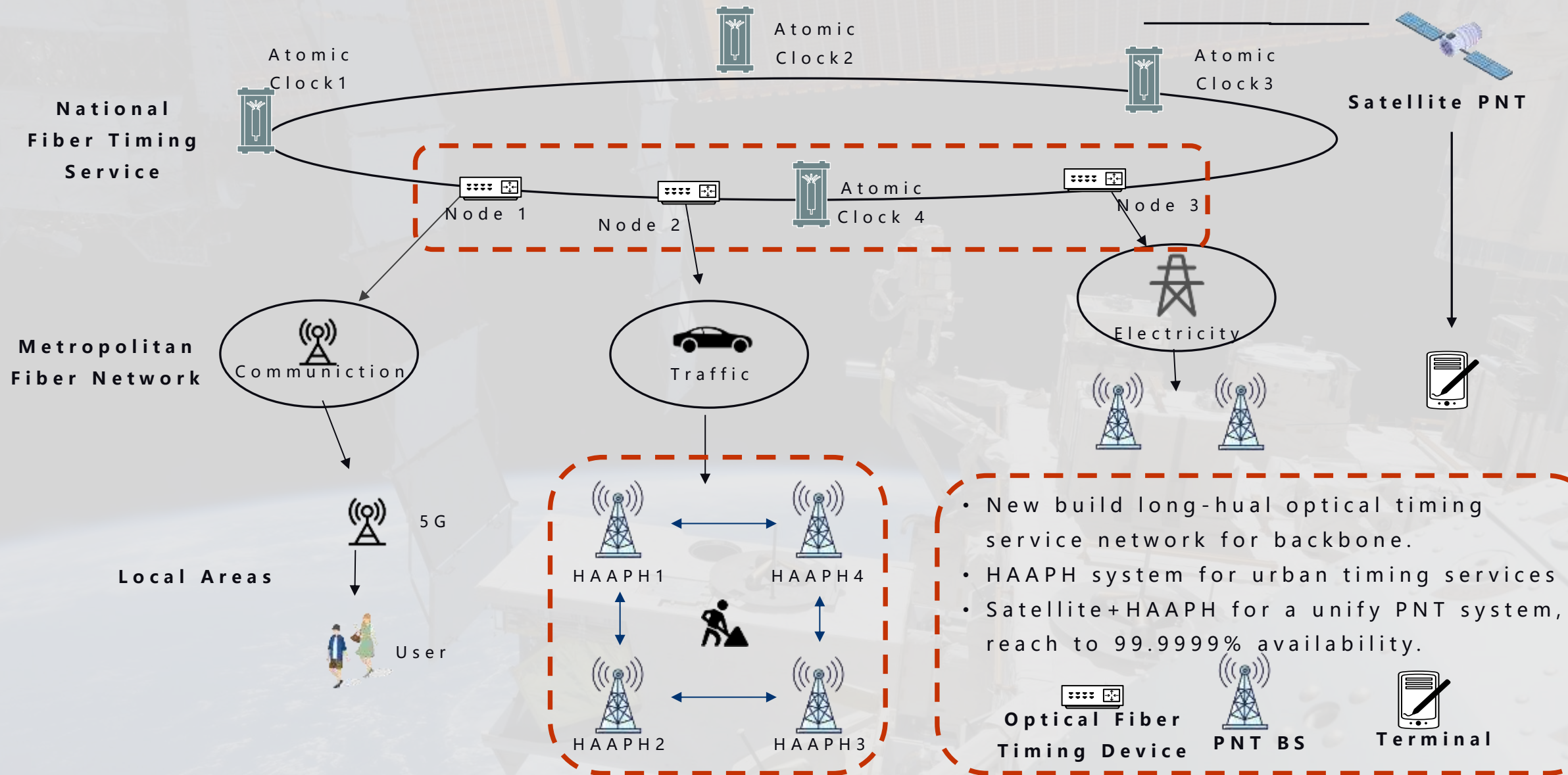


Indoor



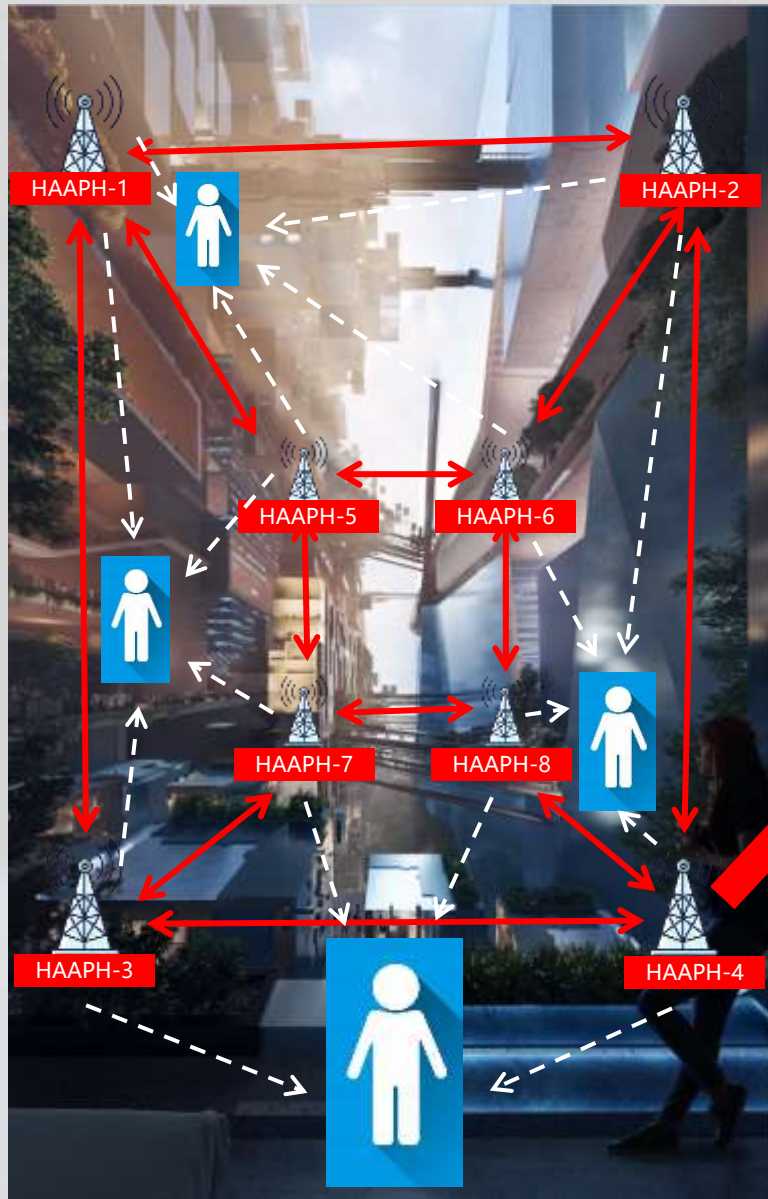


# Our Enabled Fullset Most Advanced Ground Based PNT





# Our Enabled Fullset Most Advanced Ground Based PNT



166F  
88F  
87F  
Ground  
-8F



In each layer, each 500 meters of HAAPH base station deployment, you can provide real-time four-dimensional high-precision navigation positioning and timing services to every person, vehicle, and object wearing the terminal product in NEOM.

HAAPH base station has strong penetration ability, can achieve indoor and outdoor integration positioning, is the world's only land-based pnt product that can provide services in ultra-complex Spaces.



# Our Enabled Fullset Most Advanced Ground Based PNT





# Comparison of various technologies

category	PNT tech	positional accuracy	time service accuracy	coverage area	limiting condition	final cost (attainability)
Inertial navigation	conventional inertial navigation	1-2n mile/1-15d	—	global	requires external continuous calibration accuracy, the mass volume cost is higher, small and medium-sized platforms are hard to use	million RMB
	microinertial navigation	10m/3min	—		requires external continuous calibration accuracy	hundred-thousand RMB
matching navigation	gravity navigation	hectometre hm	—	an area with distinct gravitational features	a higher gravity field map is required, not available for commercial use	custom terminal, million RMB
	magnetic navigation	hectometre hm	—	an area with a strong magnetic signature	a high magnetic field pattern is required, not available for commercial use	custom terminal, ten thousand
ultrasonic navigation	audio navigation	meter	—	local, single base station coverage 10-30 meters	high-density base stations are required, audio signal processing is difficult	thousand
radio navigation	communication base station	20-300meters	hundred-nanosecond—microsecond	local, single base station coverage 300-2000meters	occupy communication time slot	thousand (rely on the communication terminal)
	wifi	meter	—	local, single base station coverage 10-30 meters	high-density base stations are required	hundred
	bluetooth	meter	—	local, single base station coverage 10-30 meters	high-density base stations are required, capacity limitation	hundred
	RFID	meter	—	local, single base station coverage 10-30 meters	high-density base stations are required	hundred
	UWB	decimetre	—	local, single base station coverage 30-200 meters	high-density base stations are required, capacity limitation, high-speed moving objects are not supported	custom terminal, hundred-thousand
	Pseudosatellite	meter	hundred-nanosecond—microsecond	local, single base station coverage tens of kilometers	interferes with the satellite, can not solve the tunnel depth positioning	thousand, shared terminal with satellite
	Loran C navigation	hectometre hm	hundred-nanosecond	wide area, single base station coverage 0.15-10000 kilometers	low density base stations are required	custom terminal, one hundred thousand
	Beidou satellite + 5G	meter	hundred-nanosecond	local, single base station coverage 500-2000 meters	need wiring, interferes with 5G	thousand
	Locata	decimetre	nanosecond	local, single base station coverage 500-30000 meters	a lower density base station is required, there are obstacles to large-scale networking	thousand
	HAAPH (oue products)	centimeter	picosecond ps psec	local, single base station coverage 500-30000 meters	a lower density base station is required	thousand

# Hope to be the partner of the world

