

Northwestern Polytechnical University Innovative Application of the 5G Hyper- Converged Private Network in Smart Education

Wen Wang
China Telecom



Developing
national pillars

Cultivating
national talent

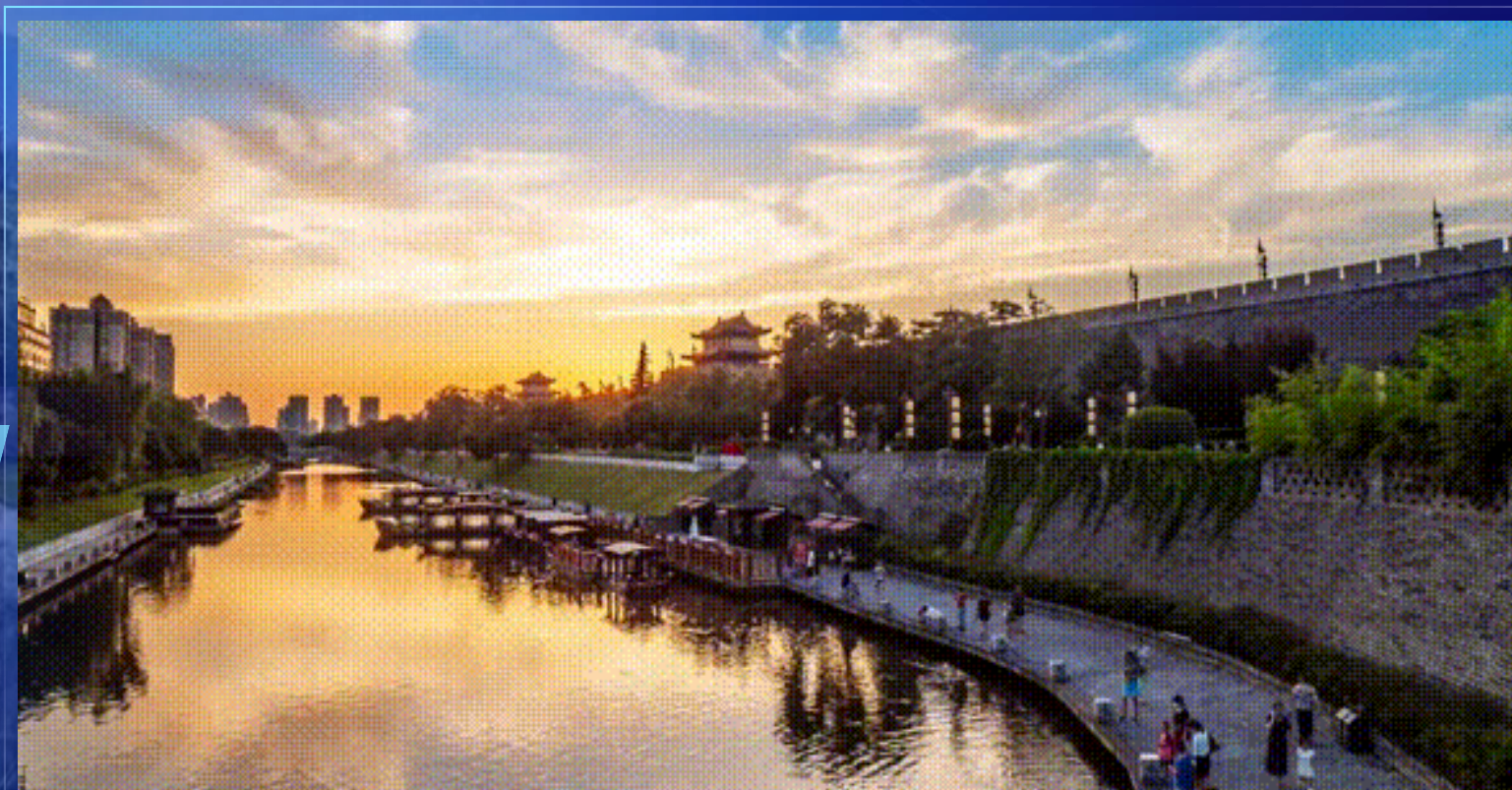
NWPU

50%+ of the chief engineers in the aviation industry

Two of the "Three Young Commanders-in-Chief" in aerospace

A large number of outstanding alumni in the field of navigation

The only university that has been jointly awarded the "**Major Contribution Award**" by the CPC Central Committee, State Council, and Central Military Commission for **two** consecutive times



Innovative application of the 5G hyper-converged private network in smart education



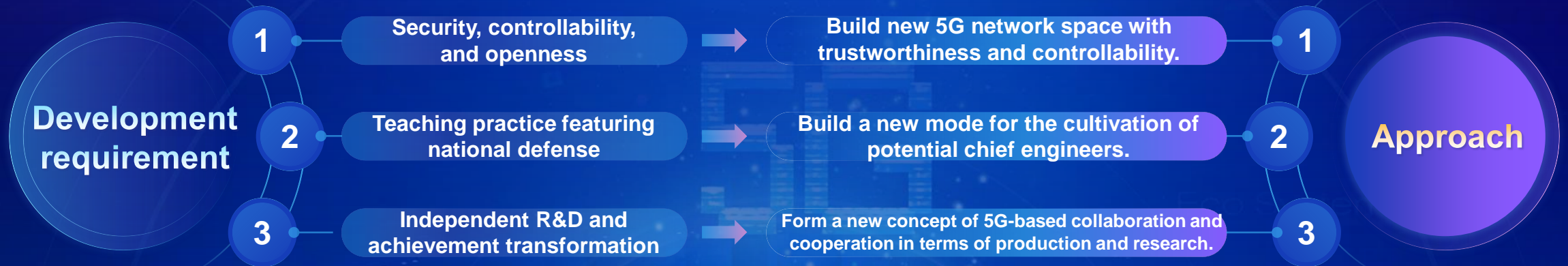
Chinese Universities on the US *Entity List*

序号	院校名称	列入时间
1	北京航空航天大学	2001年5月
2	西北工业大学	2001年5月
3	电子科技大学	2012年9月
4	四川大学	2012年9月
5	湖南大学国家超级计算长沙中心	2015年2月
6	中国人民解放军国防科技大学	2015年2月
7	哈尔滨工业大学	2020年5月
8	哈尔滨工程大学	2020年5月
9	北京理工大学	2020年12月
10	北京邮电大学	2020年12月
11	南京理工大学	2020年12月
12	南京航空航天大学	2020年12月
13	天津大学	2020年12月
14	中国科学技术大学合肥微尺度物质科学国家研究中心	2021年11月

中国大学排行榜官网「CNUR」



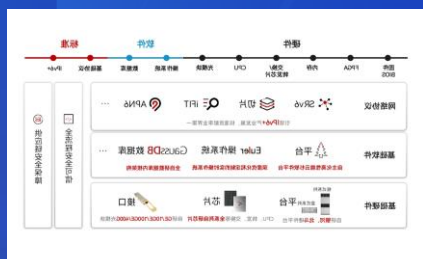
Innovative application of the 5G hyper-converged private network in smart education



Built the first trustworthy and controllable "5G + Wi-Fi + IoT hyper-converged private network" in China

Security and trustworthiness construction standards for 5G converged private networks of universities

1. Supply chain security



Use the self-developed systems in an E2E manner.

2. Access security



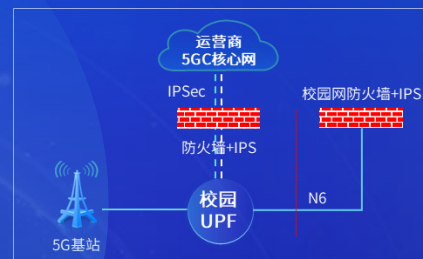
Resolve authorized device access issues based on IMSI real-name authentication to ensure management, controllability, and traceability.



5G 超融合专网设计及部署白皮书

西北工业大学
2023年6月

4. Border security



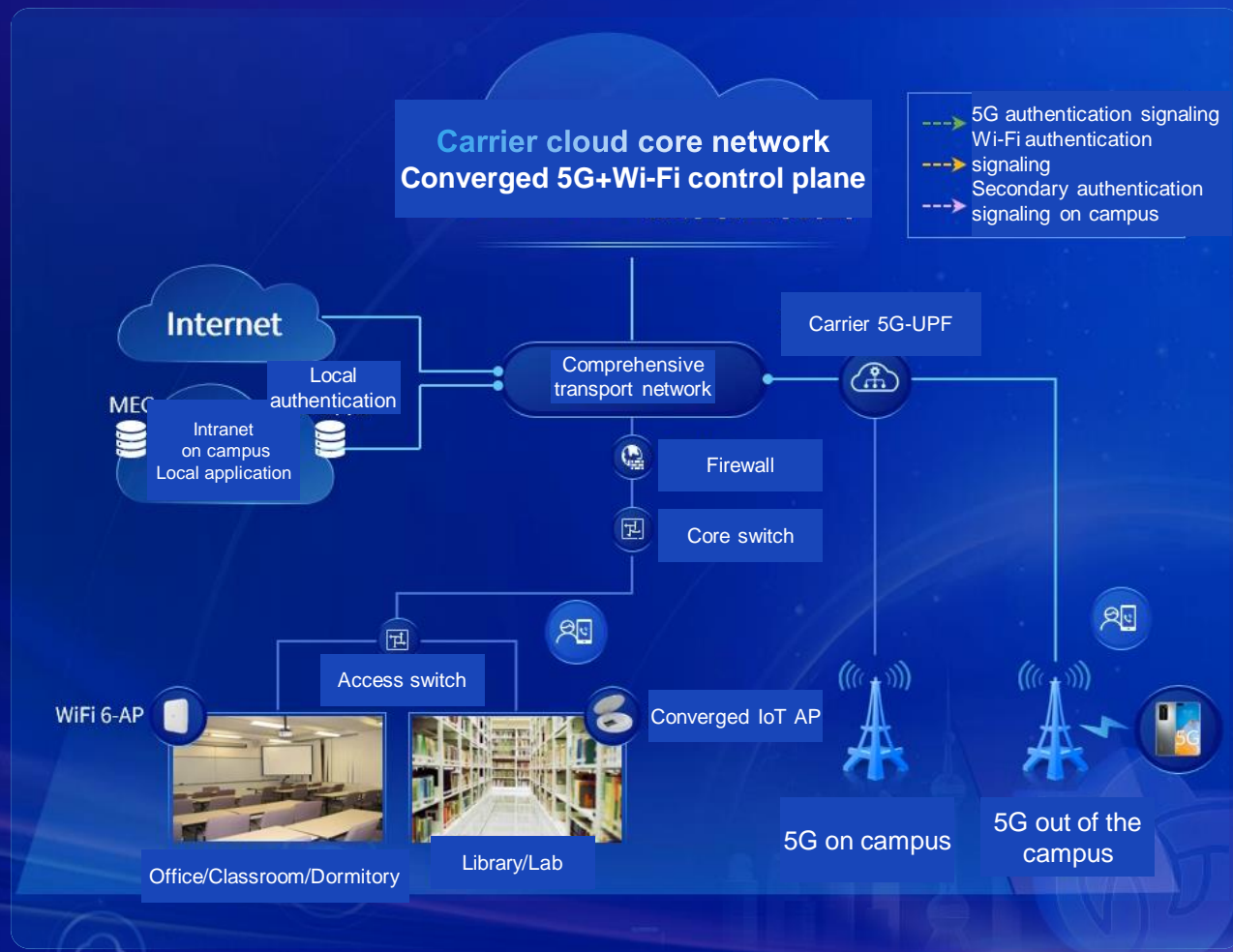
Implement network isolation and private line encryption and air interface data protection through UPFs deployed on edges.

5. Operational security



Build a unified management platform without carriers and device vendors.

Built the first trustworthy and controllable "5G + Wi-Fi + IoT hyper-converged private network" in China



01

Converged internal & external network

- Borderless campus & national roaming
- Promote the capabilities of inclusive operations and communication & collaboration.

02

Converged air & ground network

- 5G and Wi-Fi for seamless switchover
- Provide three-dimensional network space.

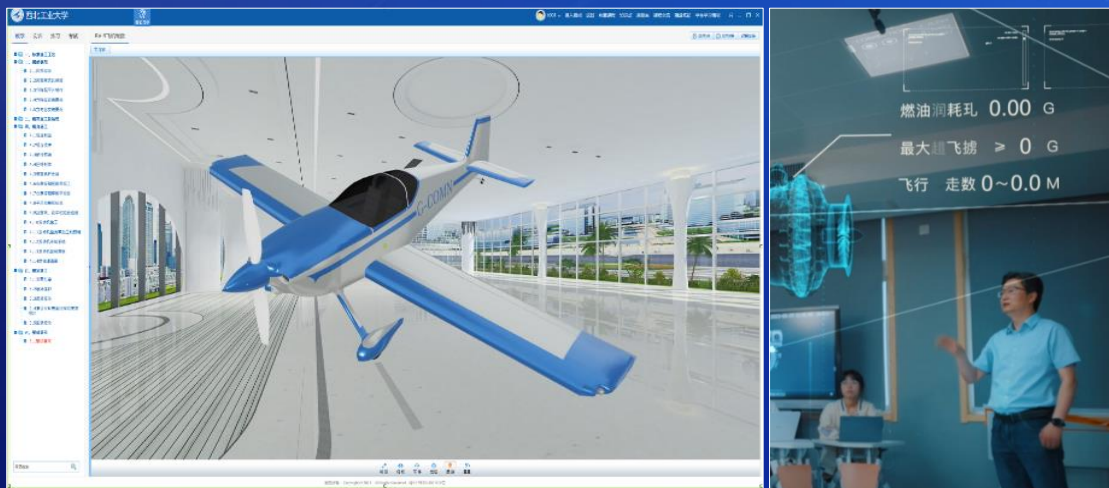
03

Converged management network

- Converged IoT for unified management
- Higher efficiency at lower cost

Built a new 5G-based immersive talent cultivation mode for future chief engineers

5G+VR simulation experiment platform



5G for the expansion of teaching capacity and VR for immersive learning

5G+ real-life UAV flight teaching in low air space

Live streaming demo of 5G+UAV innovative teaching

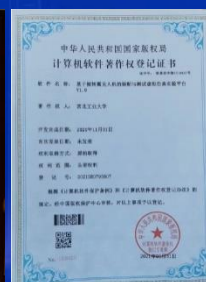


5G fixed-wing UAV live streaming view

Full-process follow-up UAV live streaming view

5G hyper-converged air-to-ground networks for HD image backhaul and real-time flight control

The innovative application has been awarded as one of the **Excellent Cases of Digital Shaanxi Development**. Developed **six sets** of virtual simulation teaching software. Won **a** first prize and **a** third prize respectively in the national teaching competitions. Offered **50** practical courses, and **12** of which have been rated as first-class courses at the school level.



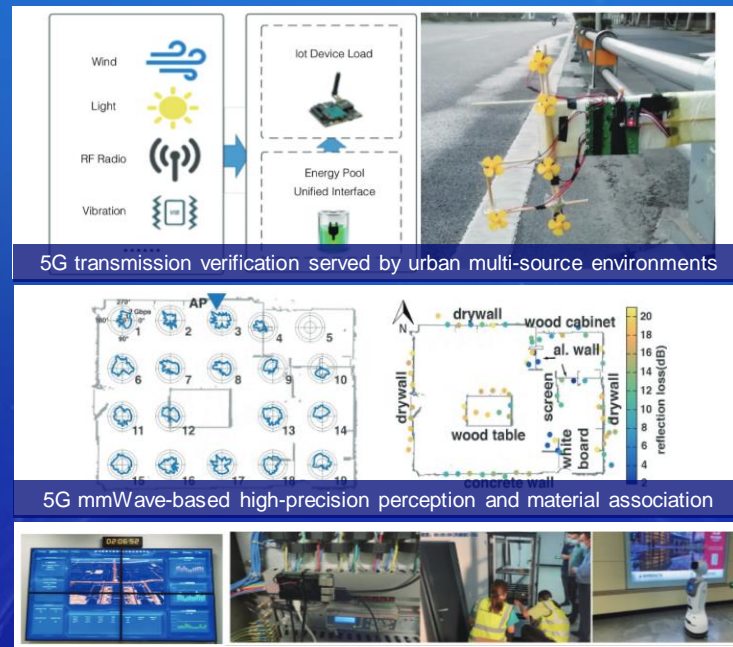
5G-enabled organized scientific research delivers fruitful achievements

Heterogeneous intelligent twins based on 5G and foundation models



5G **E2E deterministic latency**: real-time control and time sequence assurance
 5G **slicing private network: local secure forwarding** of scientific research data
 Provide typical cases of networking for military scientific research projects.

5G+human-machine-thing converged intelligent system



5G **WAN + Wi-Fi LAN for converged transport**: Urban IoT sensors and patrol robots can switch **across wireless networks**, forming a solution for smart city construction in terms of indoor and outdoor environment awareness and precise management.

5G spatiotemporal channel model



The team achievement won the First Prize of the Science and Technology Award of Colleges and Universities in Shaanxi.

The **channel prediction model** is included in 3GPP 4G/5G international standards to further **improve channel reliability and transmission efficiency** and provide technical specifications for the installation of 5G base stations and 5G device development.

Core innovation and leading advantages



Innovation 1

The **first** 5G+Wi-Fi+IoT hyper-converged solution, officially released at MWC, was highly recognized by **3GPP and IEEE**. The solution has also been **nominated for the GLOMO Award** (only 20 in China).



Innovation 2

Under the leadership of the chief engineer atmosphere, a new **5G+ teaching mode** for national defense universities has been formed, which focuses on cultivating leaders of new engineering, and continues the **"NWPU phenomenon"** in talent cultivation.



Innovation 3

NWPU has been the first university which created the new mode for the collaborative development in terms of **5G production & research**. Through the **5G-enabled research platform** and the **independent innovation of 5G technical standards**, the new transformation of the industry has been facilitated.

Market and business model

Business model



Broad market

ToB market

Colleges & universities and military institutes
1600+

Hospitals and healthcare institutions
30,000+

Industry chain of national defense technologies

Cloud network facilities
CNY130 billion+

Education devices
CNY150 billion+

Information innovation industry
CNY420 billion+

The network construction cost is reduced by **CNY24 million**, and the O&M personnel cost is reduced by **CNY630,000** per year. The teaching and scientific research costs of universities are increased by **23%**, which makes 5G applications and industries more diversified. The average monthly 5G traffic usage of teachers and students is increased by **27 GB**.

Market and business model

Large-scale output

Integration of networks,
learning, and research

Network architecture



Students' registration for Internet access



Online class



5G VR teaching



Scientific research in universities



Cultivation of excellent talent



100+ universities and military institutes
80+ hospitals and healthcare institutions

Seven universities of
national defense
[HIT HEU BUAA]
[BIT NJUST NUAA]

Aviation Industry Corporation of
China (AVIC)

China Aerospace Science and
Technology Corporation (CASC)

China Aerospace Science and
Industry Corporation (CASIC)

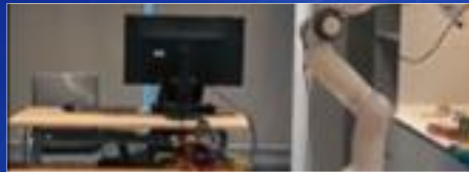
China State Shipbuilding
Corporation (CSSC)

Industrial
upgrade

5G + UAV



5G + AI



5G spatiotemporal channel model



Production &
research
cooperation

20+ institutes jointly built the research institute for 5G converged innovation in science and education.



Social value

Education, science and technology, and talent are the basic and strategic support for building a socialist modern country in an all-round way.

— *Report to the 20th National Congress of the Communist Party of China*

5G industry incubation

National key R&D plan projects

- Human-machine-IoT converged intelligent computing lab
- 5G science & education convergence innovation research institute
- Key project of the "next-generation artificial intelligence"

1000+ smart education experts

Training and communication in 90+ countries

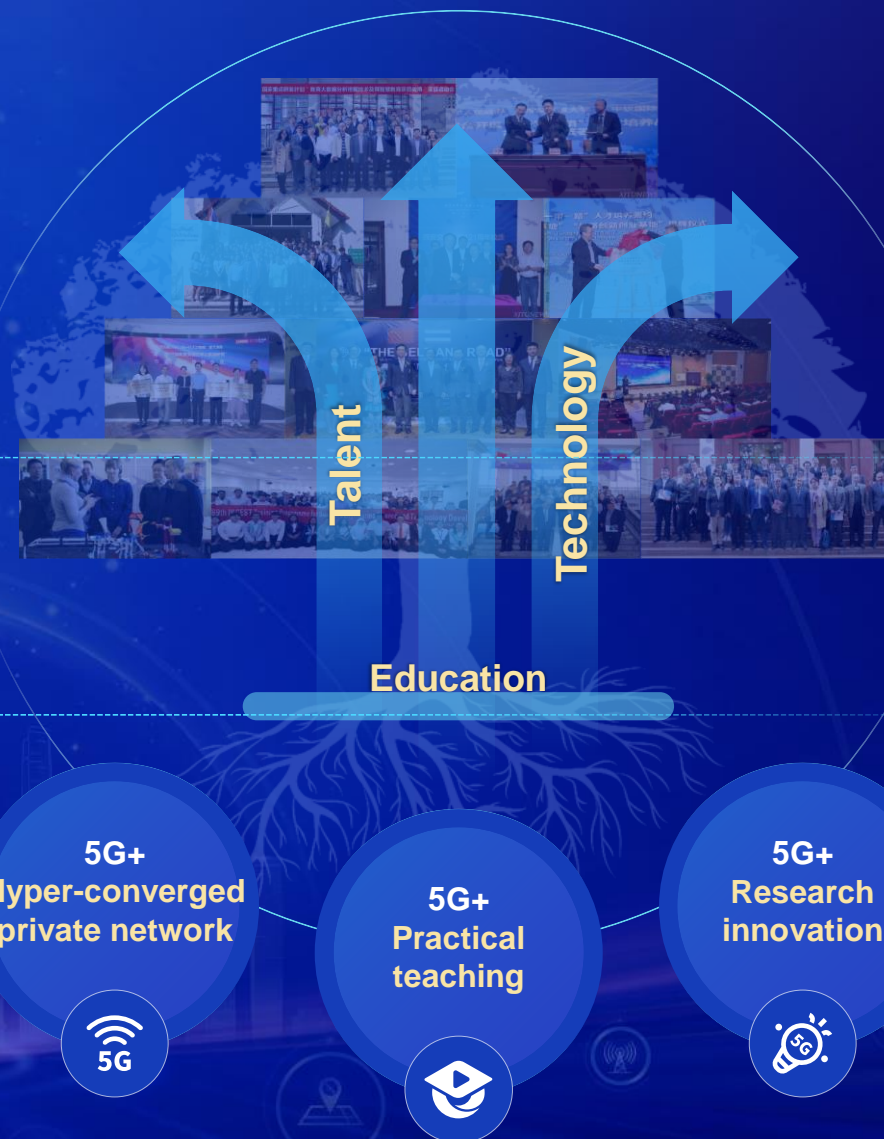
Service for **26,000** engineering science & technology experts

NWPU's standard solution featuring security authorization based on the 5G hyper-converged networks

Achievement

Basis

Foundation



5G+
Hyper-converged
private network



5G+
Practical
teaching



5G+
Research
innovation





Developing National Pillars While Keeping a Low-Profile

Thank you!