

CPN “百家讲坛”之：

大数据和5G

2020年10月3日

会议日程

- 14:00 开场及嘉宾介绍
- 14:05 浅谈大数据分析在移动数据领域的应用 张伟清
- 14:45 5G 101与下一代网络展望 甘奇韬
- 15:20 Q&A

浅谈大数据分析

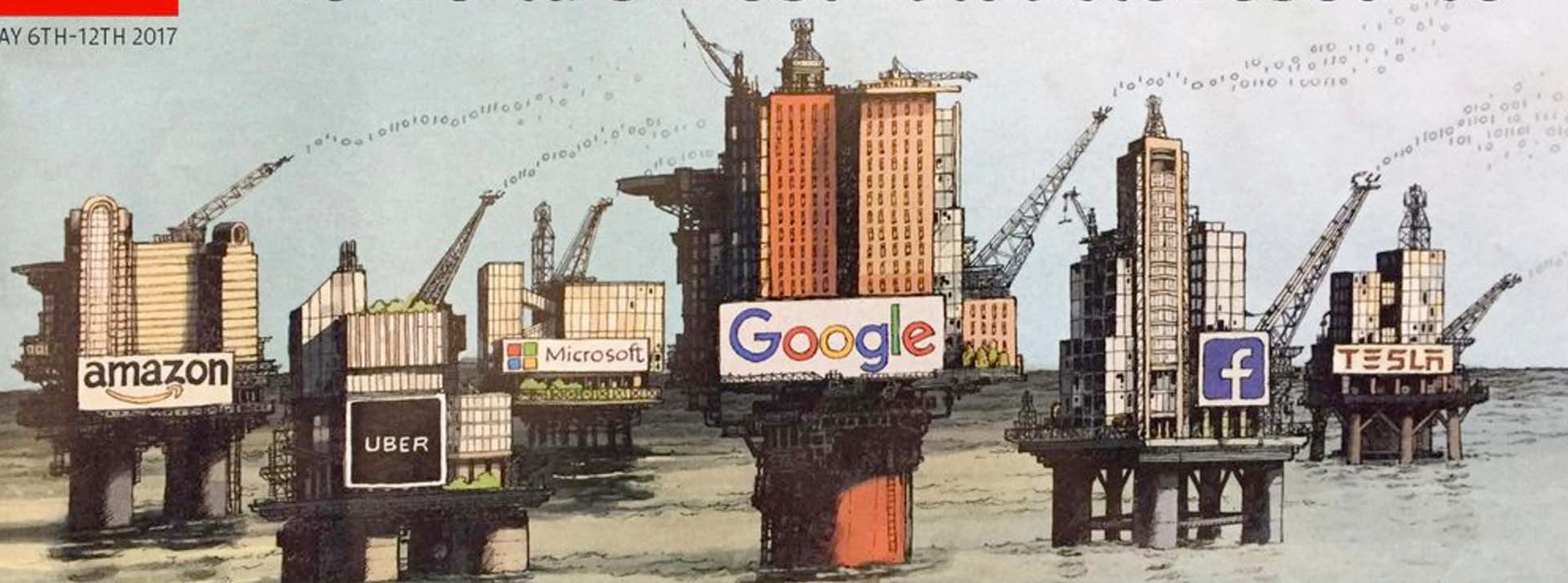
-----挪威电信研究院 张伟清



**The
Economist**

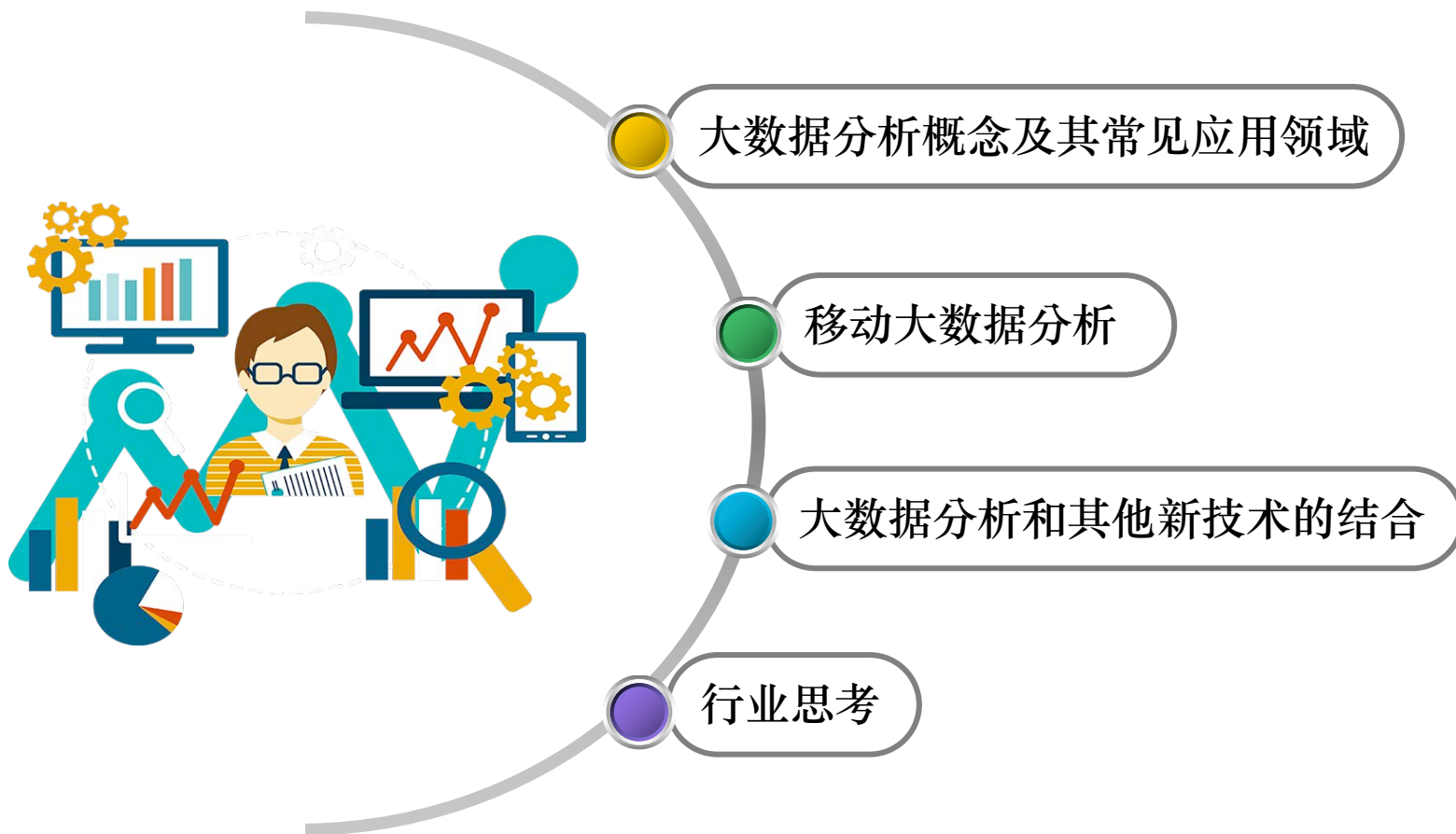
MAY 6TH-12TH 2017

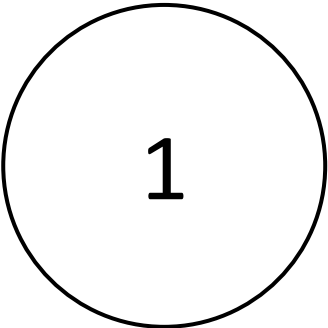
The world's most valuable resource



Data and the new rules of competition

Outline





1

大数据分析概念及其常见应用领域

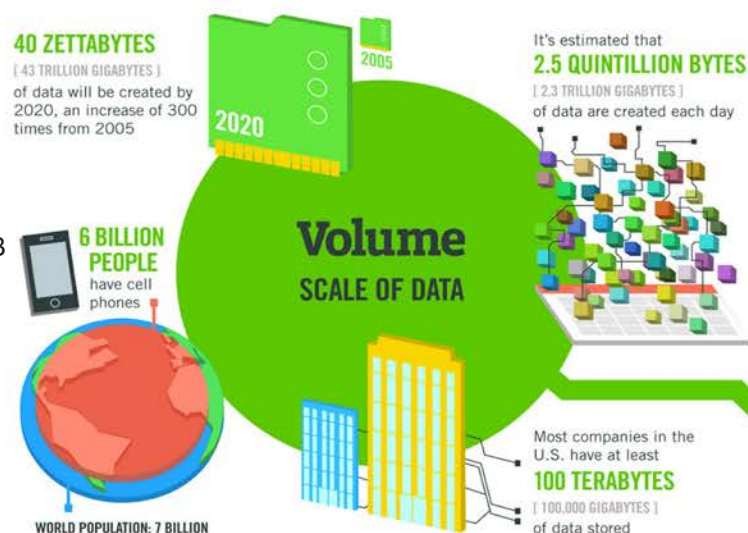
What is Big Data Analytics



大数据分析的相关特性

1 Quintillion Bytes = 1 EB

1 ZB
= 1000 EB
= 1000 000 PB
= 1000 000 000 TB
= 1000 000 000 000 GB



The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors, and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data, with 1.9 million in the United States



As of 2011, the global size of data in healthcare was estimated to be
150 EXABYTES
[161 BILLION GIGABYTES]



30 BILLION PIECES OF CONTENT
are shared on Facebook every month



By 2014, it's anticipated there will be
420 MILLION WEARABLE, WIRELESS HEALTH MONITORS

4 BILLION+ HOURS OF VIDEO
are watched on YouTube each month



400 MILLION TWEETS
are sent per day by about 200 million monthly active users

Variety DIFFERENT FORMS OF DATA



The New York Stock Exchange captures
1 TB OF TRADE INFORMATION
during each trading session



Modern cars have close to
100 SENSORS
that monitor items such as fuel level and tire pressure



Velocity ANALYSIS OF STREAMING DATA

By 2016, it is projected there will be
18.9 BILLION NETWORK CONNECTIONS
— almost 2.5 connections per person on earth



1 IN 3 BUSINESS LEADERS
don't trust the information they use to make decisions



Poor data quality costs the US economy around
\$3.1 TRILLION A YEAR



in one survey were unsure of how much of their data was inaccurate

Veracity UNCERTAINTY OF DATA

大数据分析的商业应用

■ 信息企业常见应用领域

- 用户画像
- 精准广告
- 个性推荐
- 趋势预测
- 用数据挖掘寻找关联商品
- 降低库存成本
- 分析客户诚信度
- 分析关键业务指标
- 分析NLP舆情因子
- ...

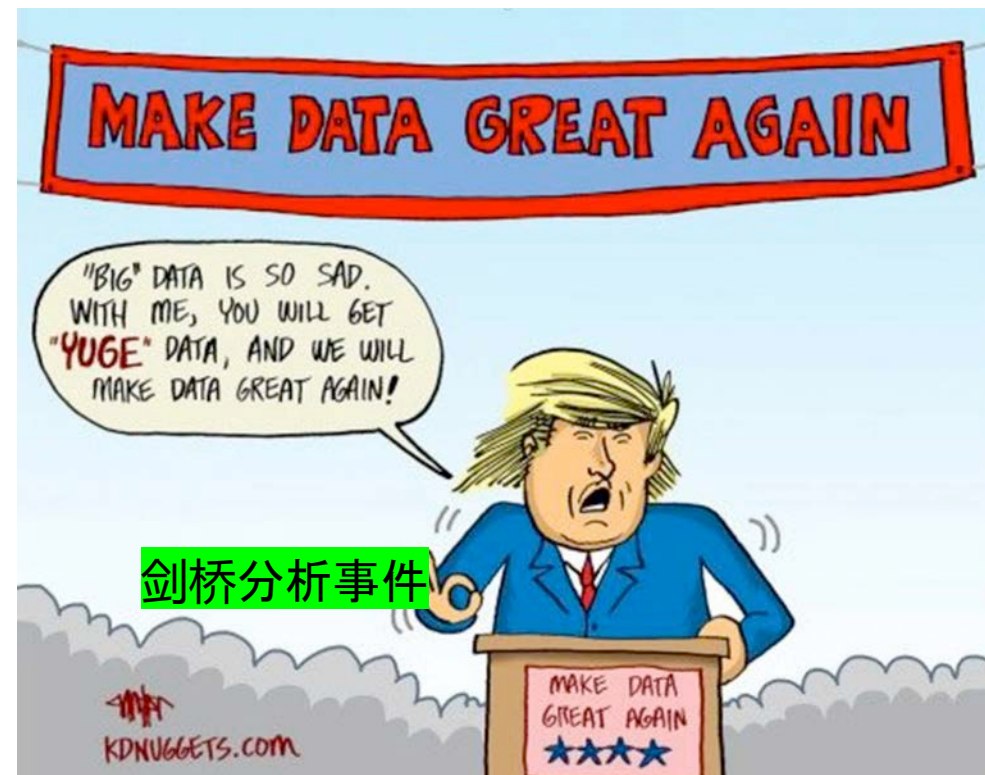
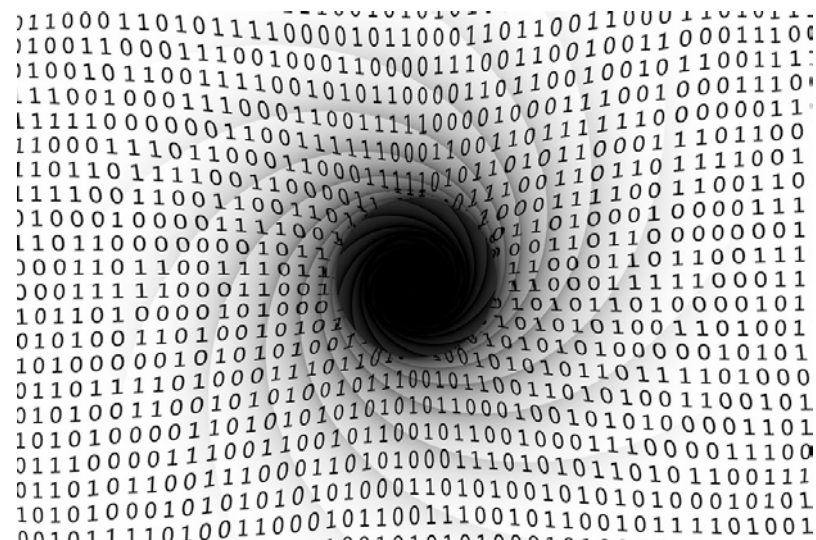
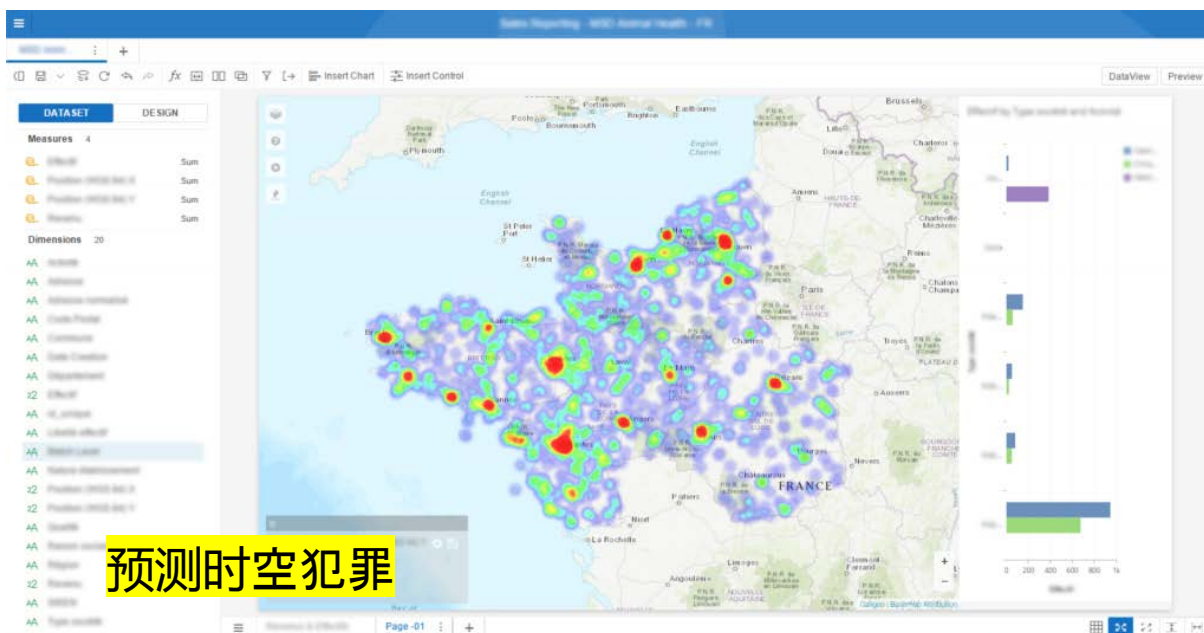
■ 常见的大数据服务

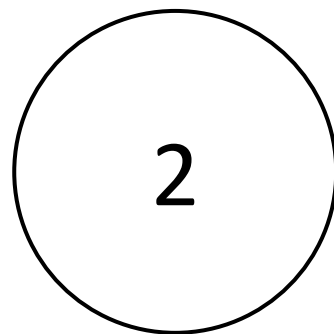
- 推荐产品或服务：Netflix，电商公司
- 推荐信息：今日头条，Tiktok...
- 社交媒体：Facebook，Twitter...
- 银行业：风控，欺诈检查...
- ...



大数据分析的社会治理应用

- 治安管理，犯罪预防，甚至政治选举
- 大数据应用广泛，是因为其
 - (1) 数据采集的多元化
 - (2) 时效性强
 - (3) 营销个性化
 - (4) 性价比高



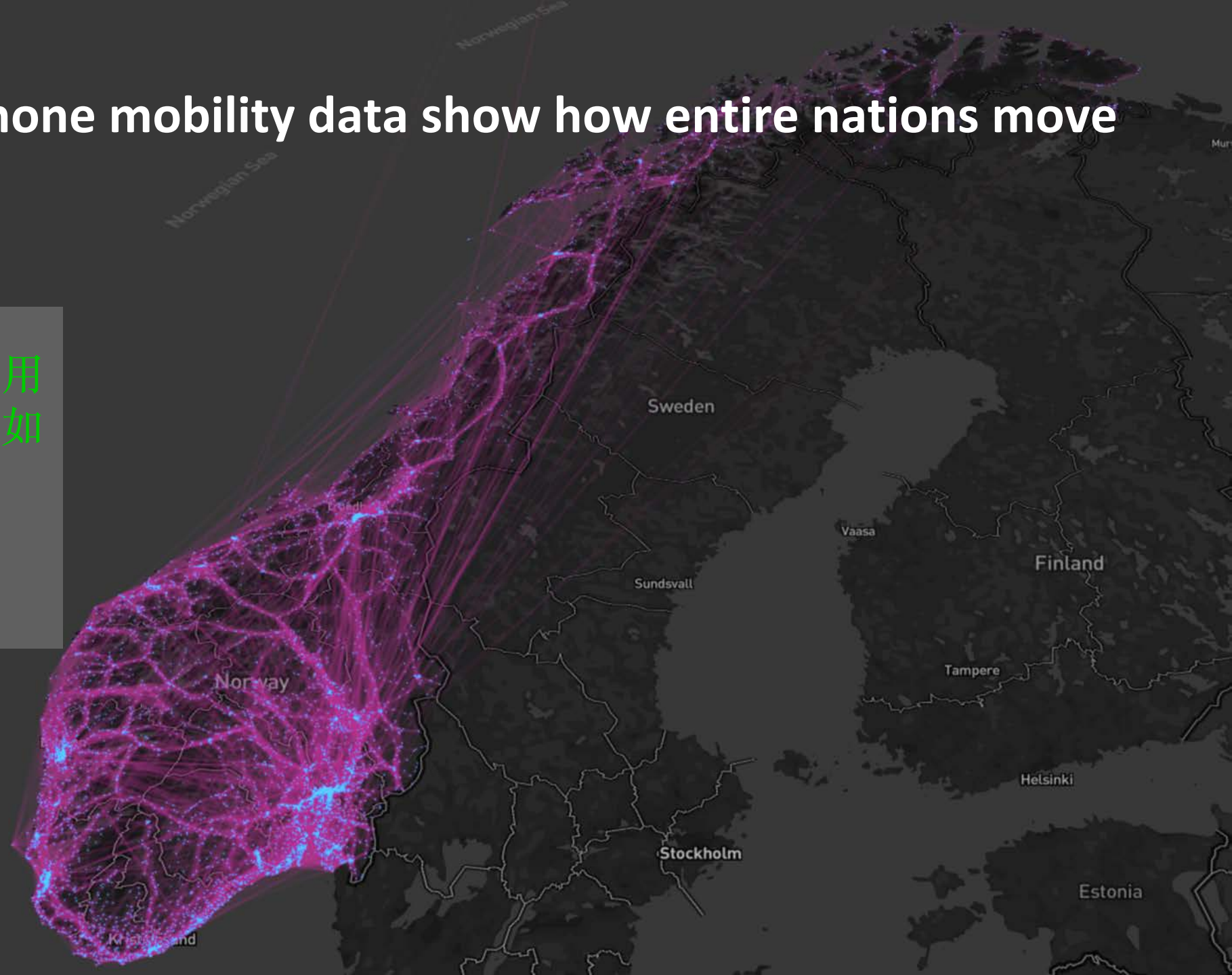


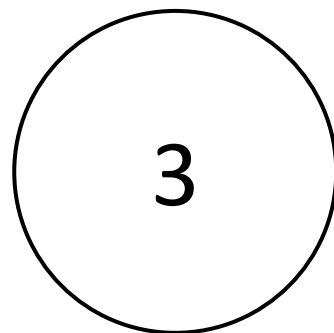
移动大数据分析

Aggregated cell phone mobility data show how entire nations move

移动大数据被广泛应用于社会各个方面，比如

- 交通管理；
- 旅游业；
- 公益事业；





大数据分析和其他新技术的结合

Big Data is the Foundation of AI

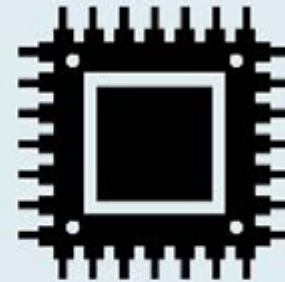
- The recent breakthroughs of AI&ML can be attributed to three different factors
 - Big Data
 - Theoretical advances
 - Faster computers



Algorithms



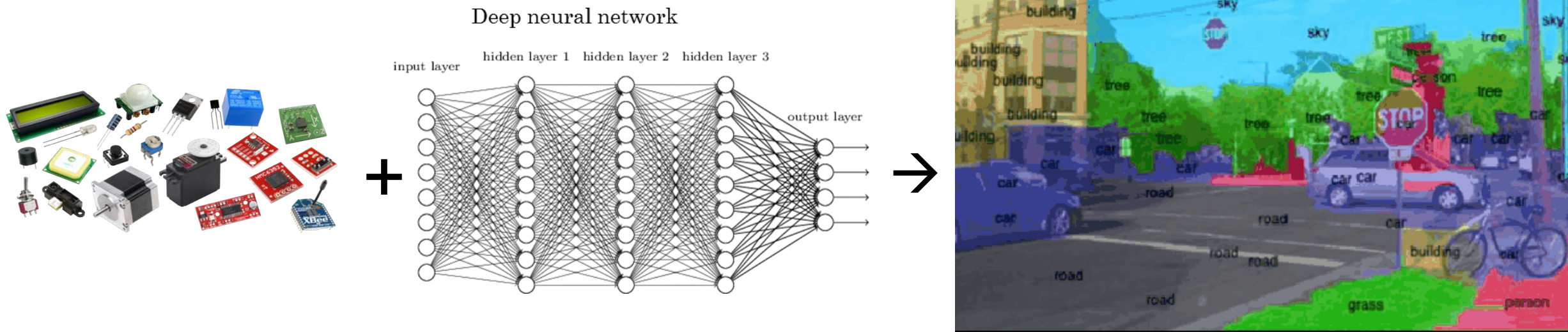
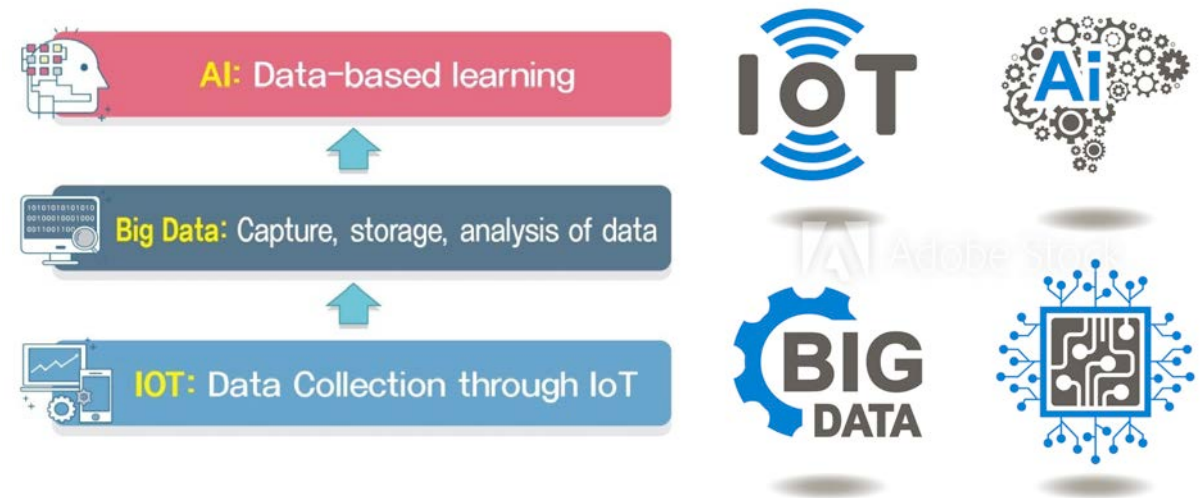
Data



Computing
Power

IoT Generates Big Data used for AI

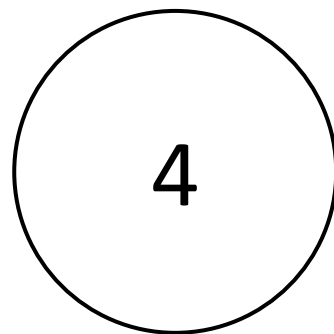
- IoT sensors in use with common features
 - Supports with Low Power Wide Area Networks (LPWA)
 - Wireless communication
 - Low power usage (battery life time are longer)
 - Enables good indoor and outdoor coverage
 - Low cost (both radio module and traffic usage)
- Many (intelligent) transport related use cases
 - AI is driving the digitization of transportation through self-driving cars
 - Self-driving cars, trucks, parking sensors and apps (free/busy), surge pricing



Face Recognition Based Surveillance System

- 商业化公司：商汤，旷视，依图，海康威视，华为
- 市场规模：2020年达到7000-8000亿





行业思考

尊重用户隐私及数据安全

© MARK ANDERSSON WWW.ANDERSTOONS.COM



"Before I write my name on the board, I'll need to know how you're planning to use that data."



© marketoonist.com



WHAT IS THE EU GDPR?

European Union General Data Protection Regulation

the European Parliament aims to **protect the personal data** of its citizens in all 28 EU member states



worldwide

Any company worldwide that collects or processes personal data of an individual in the EU, are subject to these regulations



takes effect

MAY 25, 2018

finest

for data breaches or non-compliance are up to

€20 MILLION

OR

4% OF ANNUAL WW REVENUE

(whichever is higher)



notification

Data breaches must be reported to protection authorities and affected individuals **within 72 hours**

protection

encompasses a wide variety of **personally identifiable information**, for example:

DATA ON A PERSON'S RACE
POLITICS
WEB BROWSING COOKIES
BIOMETRICS
ETC.



need help becoming EU GDPR compliant? we can help!

rsisecurity.com | 858.999.3030



New Business Opportunities in Big Data Analytics & AI

■ 大数据商业机会的特性

- 多数据源融合;
- 和具体的行业结合;
- 切入细分市场领域;
- 有好的落地场景;
- 有切实的市场需求;



■ 案例：

- 阿里巴巴新零售犀牛智造、菜鸟物流
- 绿色能源，智能发电
- 大数据医疗，大数据农业
- ...



BRIDGING RESEARCH – **ENTREPRENEURSHIP** - BUSINESS





如果你有数据和相关领域知识，
有商业或研究方面的想法，
或是希望了解更多的数据分析的方法和应用，
欢迎一起探讨。



Email: weiqing.phd@gmail.com
<https://www.linkedin.com/in/weiqingzhang>



扫一扫上面的二维码图案，加我微信

The image features a person from the waist down, wearing a grey checkered suit jacket, a white shirt, and dark trousers. They are holding a thick, old book in their right hand and have a brown leather satchel slung over their shoulder. The background is a dark green gradient with faint, glowing mathematical formulas and geometric diagrams, including a coordinate system with axes labeled 'a' and 'b', and various equations like $P=2l+z$, $a \times b$, and $|a \times p|$.

5G 101

5G 与下一代网络
之用户需求初探

探讨内容



1

5G 是啥?

2

5G 能干啥?

3

5G 使用案例

4

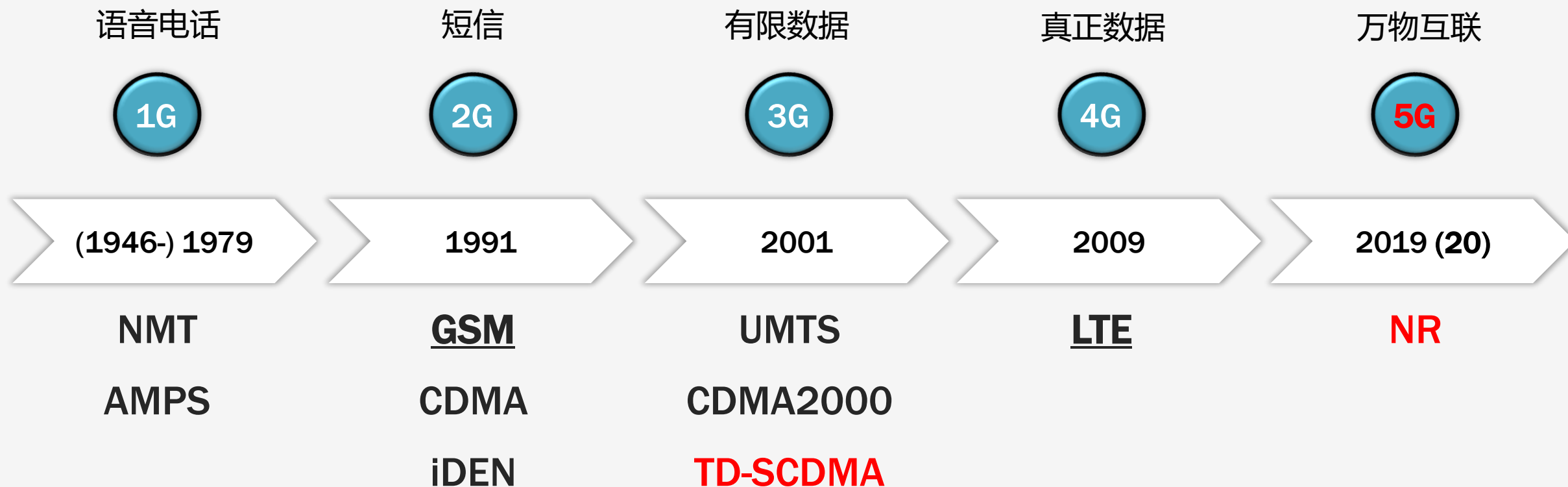
我需要 (换) 5G (手机) 吗?



下一代网络发展需求

5G 是啥?

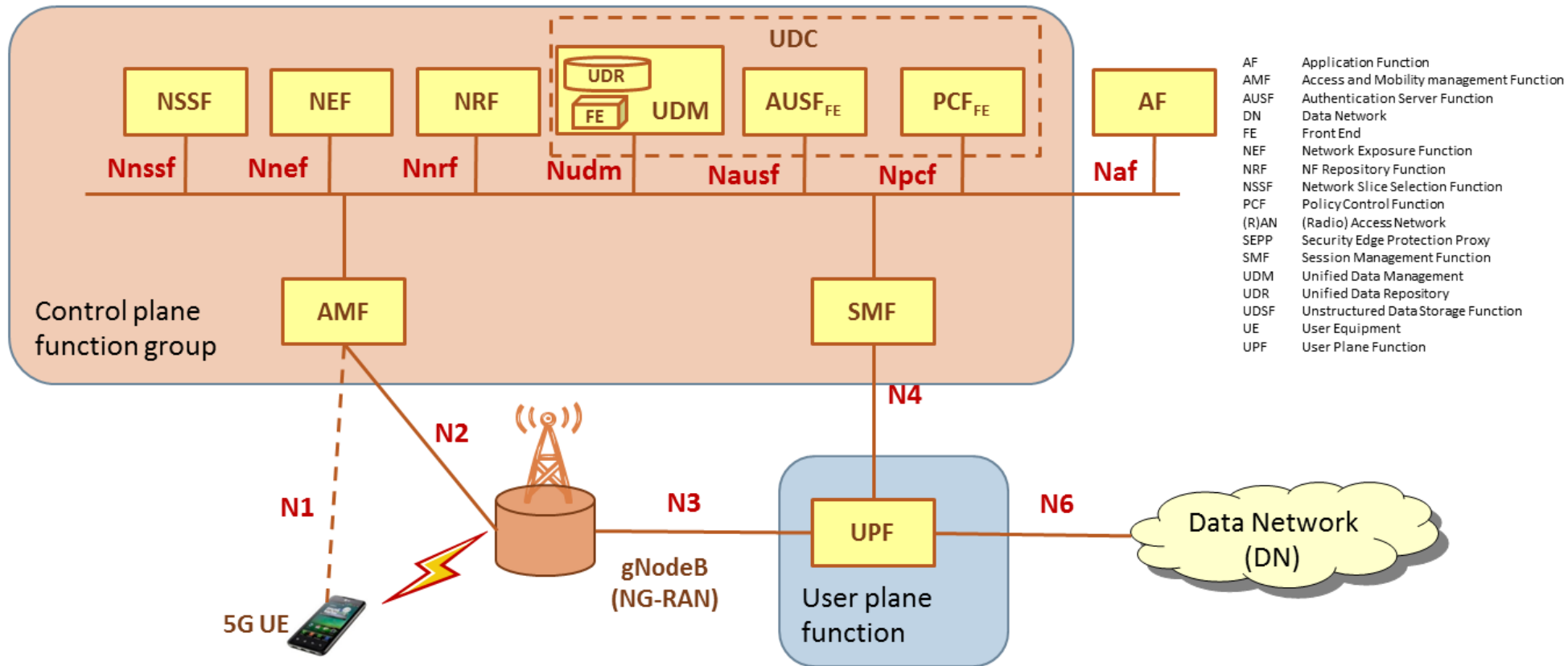
3



5G 是啥? 啥? ? ...

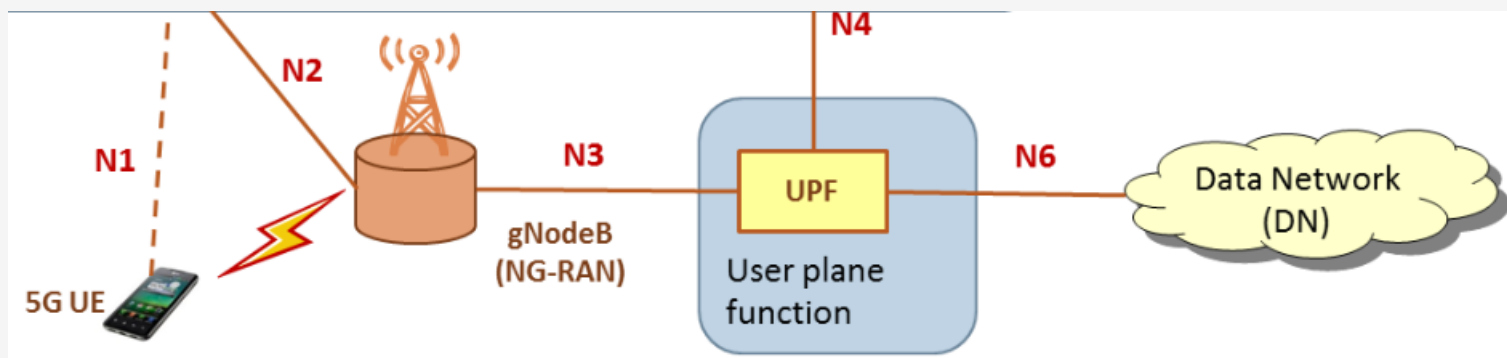
4

5GS Service Based Architecture (SBA)



5G 是啥? 啥? ? ...

5



无线 蜂窝
(频谱)(基站)

NR (RAN)

核心
(网络)

(5GC)

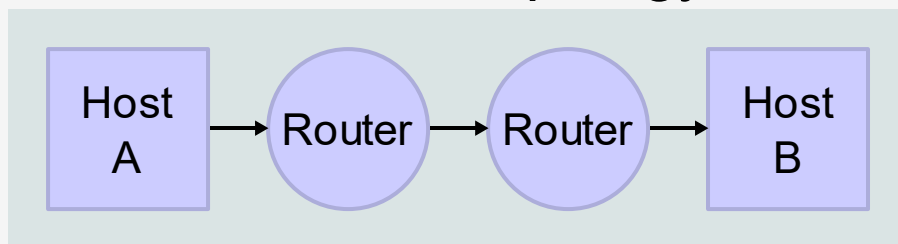
相关内容
(数据服务)

(5GS)

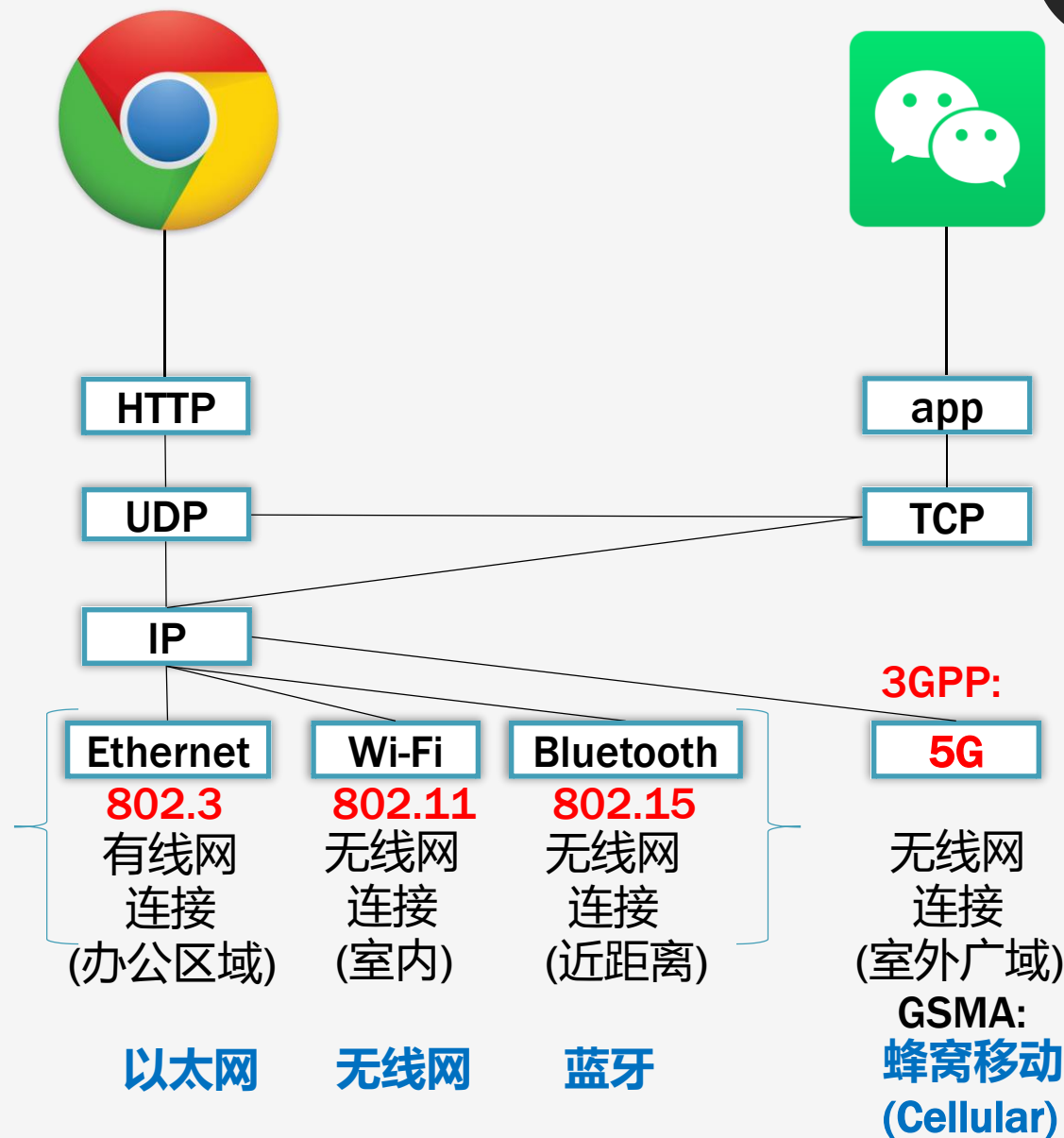
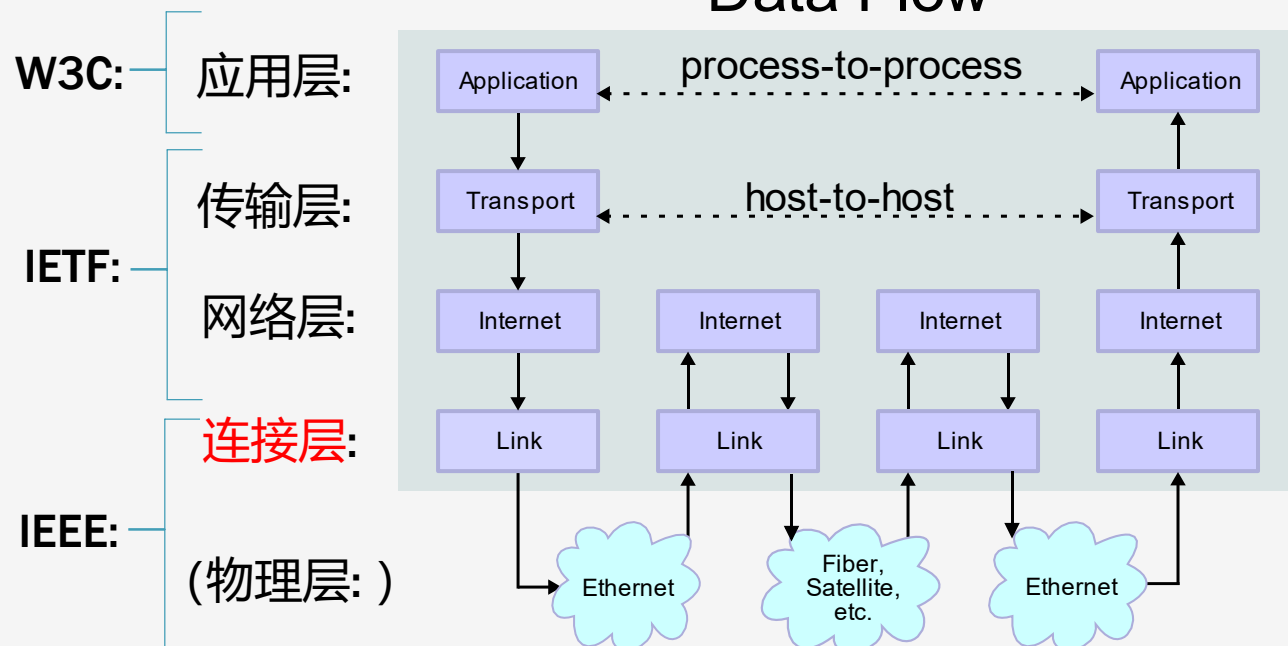
- 1) 语音 (电话)
- 2) 短信 (消息)
- 3) 数据 (流量)
- 4) 宽带 (接入)
- 5) 电视 (内容)
- 6) 卫星 (海事)
- 7) 其他 (物联网)

5G 其实就是个 ... 无线网连接

Network Topology



Data Flow



探讨内容



① 5G 是啥?

➔ ② 5G 能干啥?

③ 5G 使用案例

④ 我需要 (换) 5G (手机) 吗?

● 下一代网络发展需求

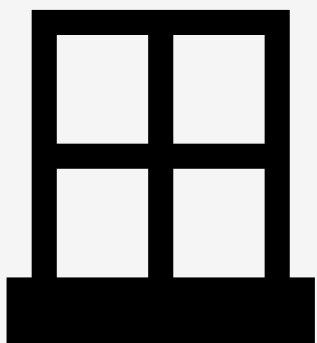
5G 三大使用案例

8

1

高带宽

enhanced Mobile
Broadband (eMBB)

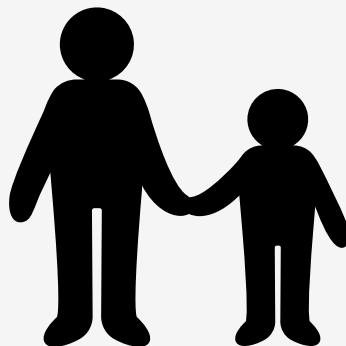


更快！

2

广连接

massive Machine-Type
Communications (mMTC)

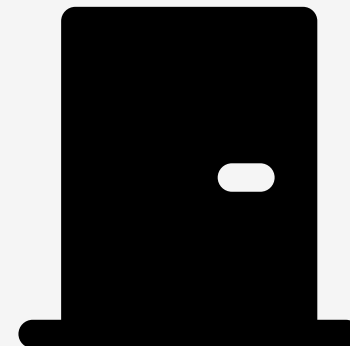


更高！

3

低延迟

Ultra Reliable Low Latency
Communications (URLLC)



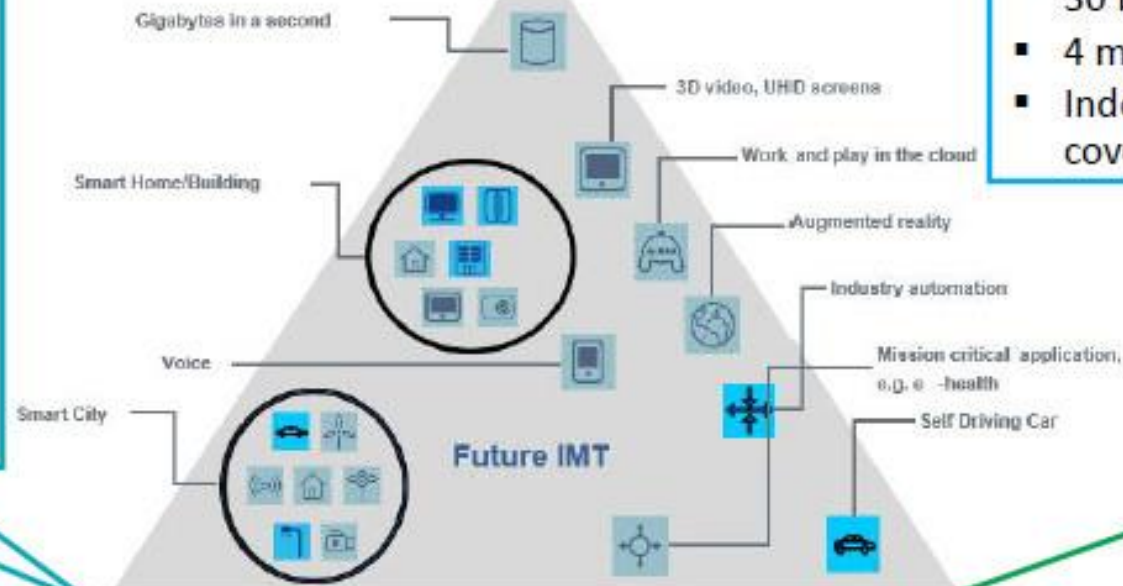
更强！

5G Use Cases & Requirements

Key challenge for 5G design: support for different services having diverging requirements

Massive Machine Type Communications (mMTC)

- Low data rates (1 to 100 kbps)
- High device density (up to 1,000,000 /km²)
- Latency: Seconds to hours
- Low power: Up to 15 years battery life



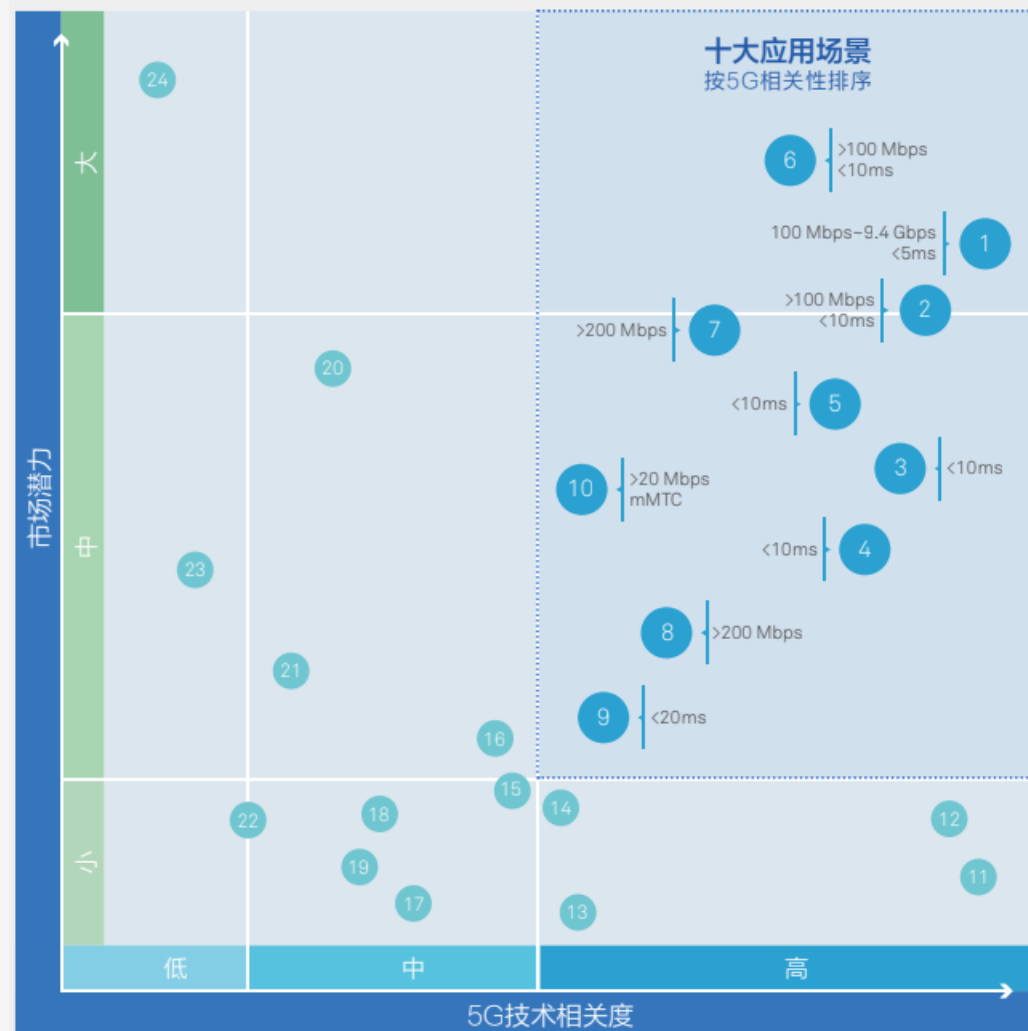
Enhanced Mobile Broadband (eMBB)

- Peak data rates: 20 Gbps (DL) and 10 Gbps (UL)
- Peak spectral efficiency: 30 bps/Hz (DL) and 15 bps/Hz (UL)
- 4 ms user plane latency
- Indoor/hotspot and enhanced wide-area coverage

Ultra-Reliable and Low Latency Communications (URLLC)

- Low to medium data rates (50 kbps to 10 Mbps)
- 0.5 ms user plane latency
- 99.999% reliability and availability within 1 ms
- High mobility

1. 云VR/AR - 实时计算机图像渲染和建模
2. 车联网 - 远控驾驶、编队行驶、自动驾驶
3. 智能制造 - 无线机器人云端控制
4. 智慧能源 - 馈线自动化
5. 无线医疗 - 具备力反馈的远程诊断
6. 无线家庭娱乐 - 超高清8K视频和云游戏
7. 联网无人机 - 专业巡检和安防
8. 社交网络 - 超高清/全景直播
9. 个人AI辅助 - AI辅助智能头盔
10. 智慧城市 - AI使能的视频监控



探讨内容



① 5G 是啥?

② 5G 能干啥?

➔ ③ 5G 使用案例

④ 我需要 (换) 5G (手机) 吗?

● 下一代网络发展需求

1) 应急 通讯

Mission-Critical Communications (MCC)

- URLLC
- 政府要求（出资）
- 公众认可（流量优先级）

2) 深海 养鱼

Offshore Fish Farming (OFF)

- eMBB + mMTC
- 渔场金主出资（钱多）
- 只要解决方案

3) 无人驾驶

Autonomous Driving

- URLLC
- 要求低时延 1ms (~10ms)
- 要求高可靠性 (>99.999%)
- 需要保障人身安全 (人命关天)

探讨内容



① 5G 是啥?

② 5G 能干啥?

③ 5G 使用案例

➔ ④ 我需要 (换) 5G (手机) 吗?

● 下一代网络发展需求

我需要 (换) 5G (手机) 吗?

1

高带宽

enhanced Mobile
Broadband (eMBB)

AR/VR

2

广连接

massive Machine-Type
Communications (mMTC)

智能家居

3

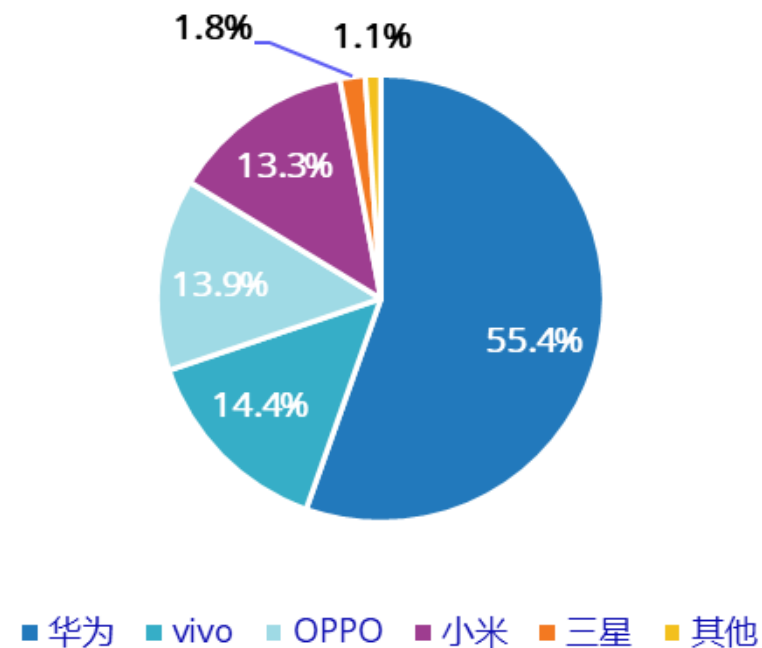
低延迟

Ultra Reliable Low Latency
Communications (URLLC)

无人驾驶

5G 手机 哪家强？

2020年第一季度中国5G手机市场厂商份额



来源：IDC中国，2020

探讨内容



① 5G 是啥?

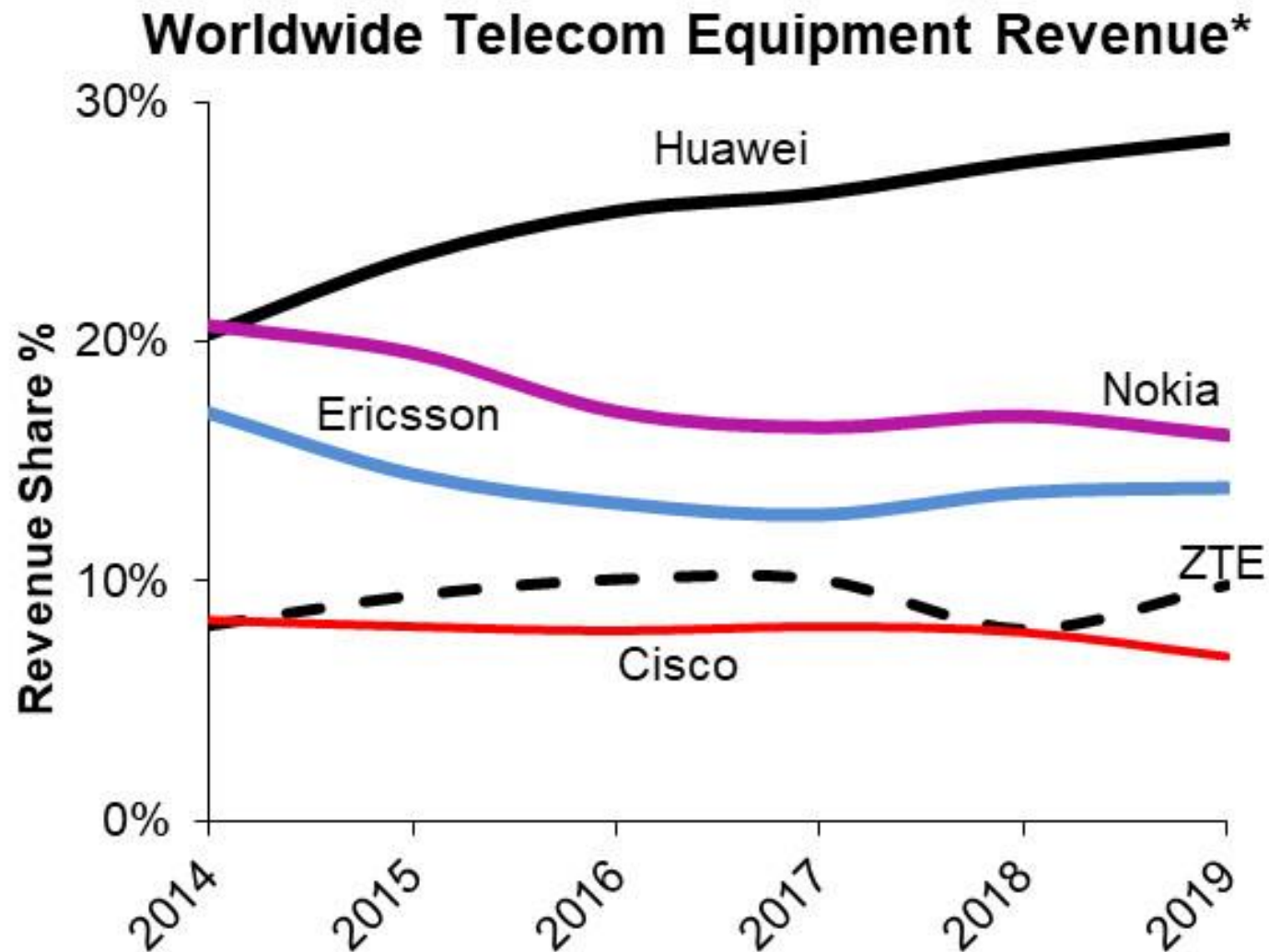
② 5G 能干啥?

③ 5G 使用案例

➔ ● 几个热点问题

● 下一代网络发展需求

5G 技术（设备） 哪家强？



Dell'Oro Group

**Equipment includes: Broadband Access, Microwave & Optical Transport, Mobile Core Network & Radio Access Network, SP Router & CE Switch*

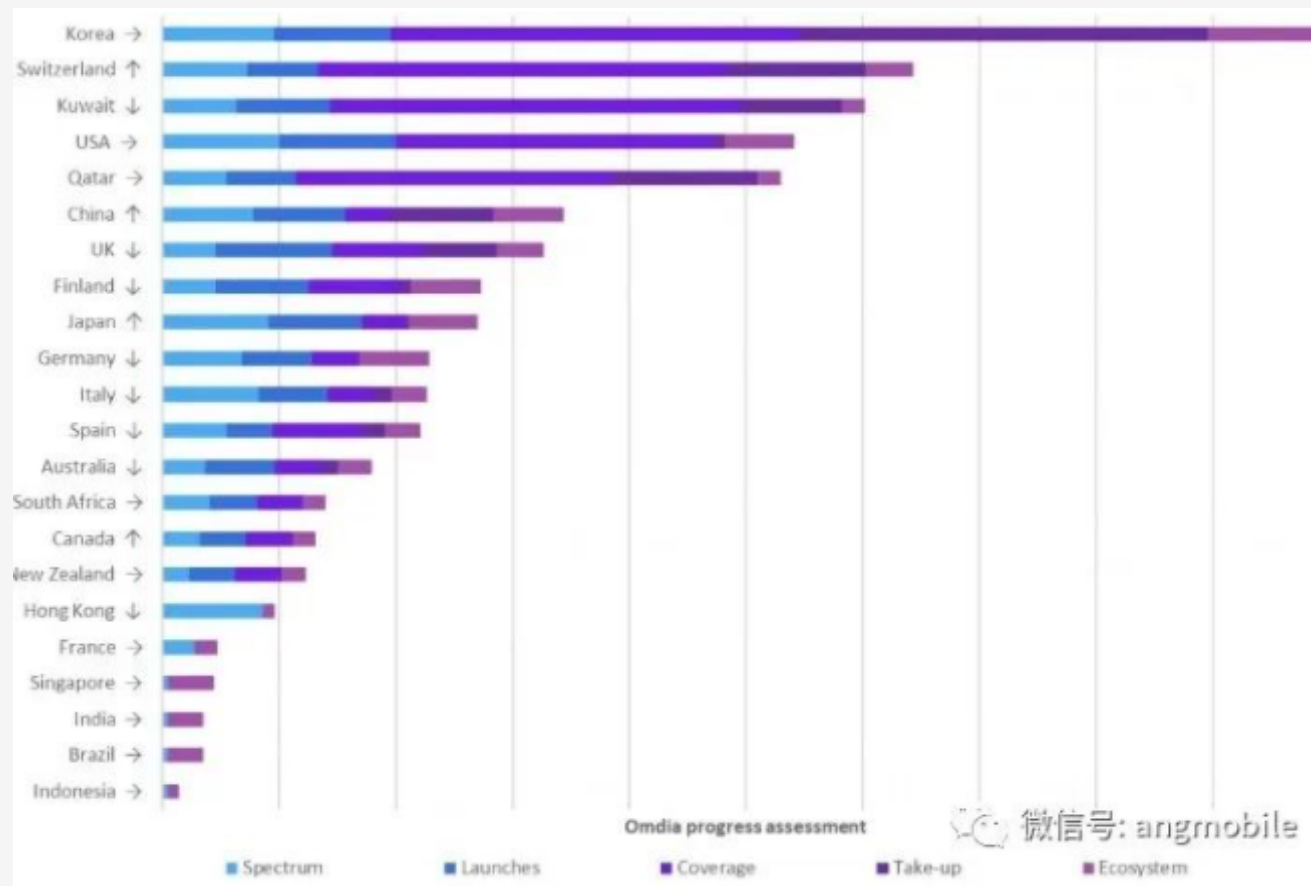
5G发展情况 哪里强？

5G Capability by Country:

- 1) Spectrum availability 频谱可用性
- 2) Widespread 5G trials 大规模试验
- 3) 5G roadmaps by national regulator 国家路线图
- 4) Government commitment 政府支持
- 5) Industry commitment to early 5G launch 业界早期投入与支持

Source: Defense Innovation Board, 2019-04

(Risks & Opportunities for DoD)



1) 频谱

5) 投入
推出产品

2) 覆盖
范围

3) 接纳

4) 生态
系统

5G 网络安全 安全吗?

Function	LTE	5G
Privacy and Integrity Cipher	- Encryption on radio path between mobile station and eNodeB (LTE base station) - Control plane ciphering and integrity between UE and Mobility Management Entity (MME) 128-bit algorithms supported	In addition to LTE: - Current support of 256-bit algorithms proposed for future release - Integrity implemented preventing unauthorised change of user data.
Authentication Key Agreement (AKA)	- Shared key provisioned in the UICC and the AUSF (Authentication Server Function) in the network. - This provides mutual authentication between the UE and the network.	In addition to LTE: - Access-agnostic authentication (EAP). 5G-AKA and EAP-AKA' supported for both 3GPP and non-3GPP access technologies. - Protects the confidentiality of the initial non-access stratum (NAS) messages between the device and the network.
Security Anchor Function (SEAF) or anchor key	None	Allows re-authentication of the UE when it moves between different access networks or even serving networks without having to run the full authentication.
Subscriber Permanent Identifier (SUPI)	Identifier sent in plaintext prior to network authentication	The Subscription Concealed Identifier (SUCI) provides a mechanism to use the home network public key to encrypt the MSIN part of the subscriber identifier (IMSI). Protecting the confidentiality of the initial non-access stratum (NAS) messages between the device and the network.
Home Control	None	HPMN can verify that the UE is present and requesting service from the VPMN - useful in roaming scenarios and fraud prevention.
Network Exposure Function (NEF)	None	- Network Functions securely expose capabilities and events to 3rd party Application Functions (AF) via NEF. - Enables secure provision of information in the 3GPP network by authenticated and authorized Application Functions. - Certificate based mutual authentication may be used. - After the authentication, NEF determines whether the Application Function is authorized to send requests for the 3GPP Network Entity.
Security Edge Proxy Protection	None	Protects the home network edge, acting as the security gateway on interconnections between the home network and visited networks.

Source: <https://www.gsma.com/security/securing-the-5g-era/>

探讨内容



- ① 5G 是啥?
- ② 5G 能干啥?
- ③ 5G 使用案例
- 几个热点问题
- ➔ ● 下一代网络发展需求

下一代蜂窝式移动通讯网 ... 6G

23

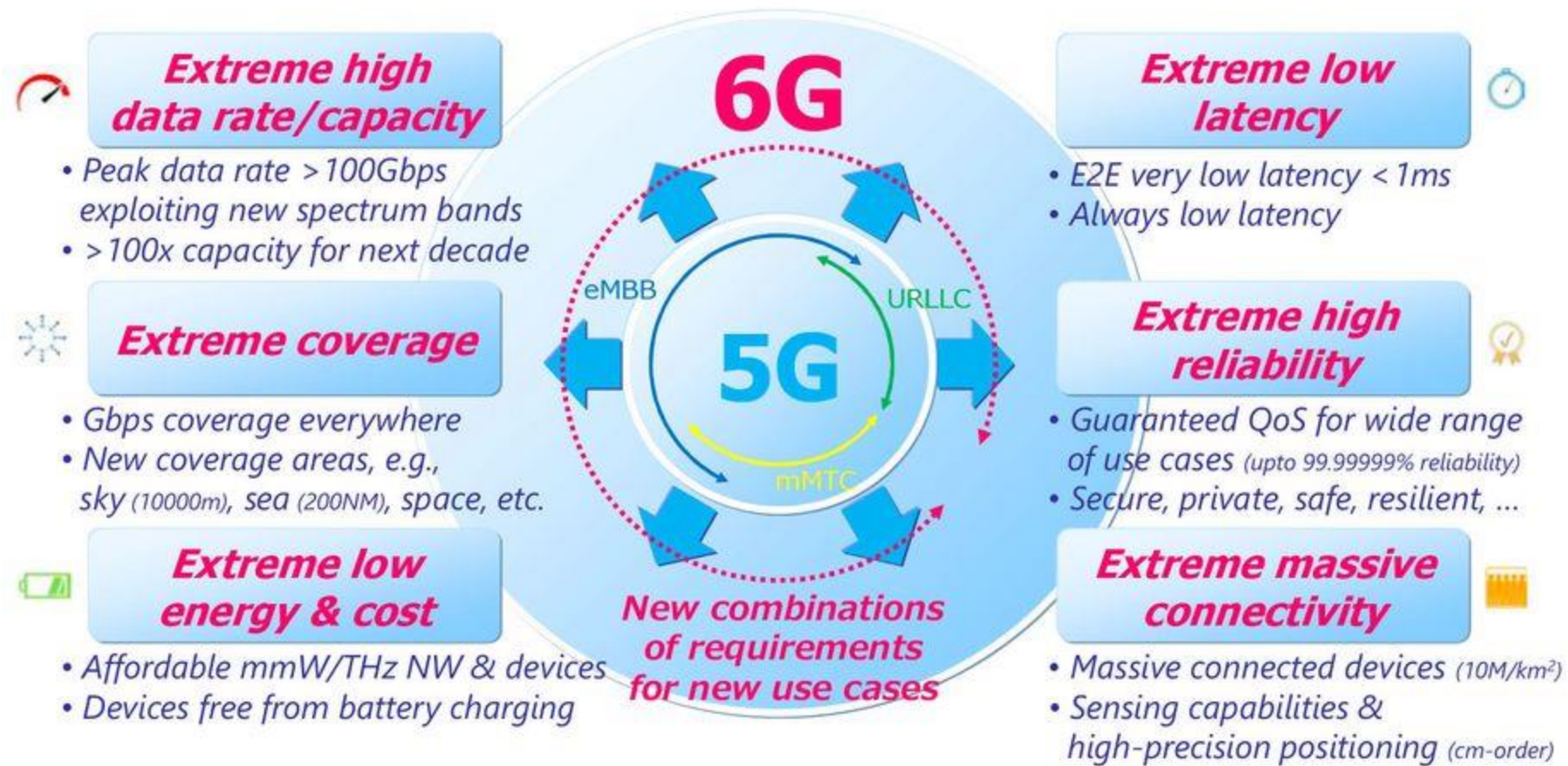


Figure 3-1. Requirements for 6G wireless technology

下一代室内互联网 ... Wi-Fi6

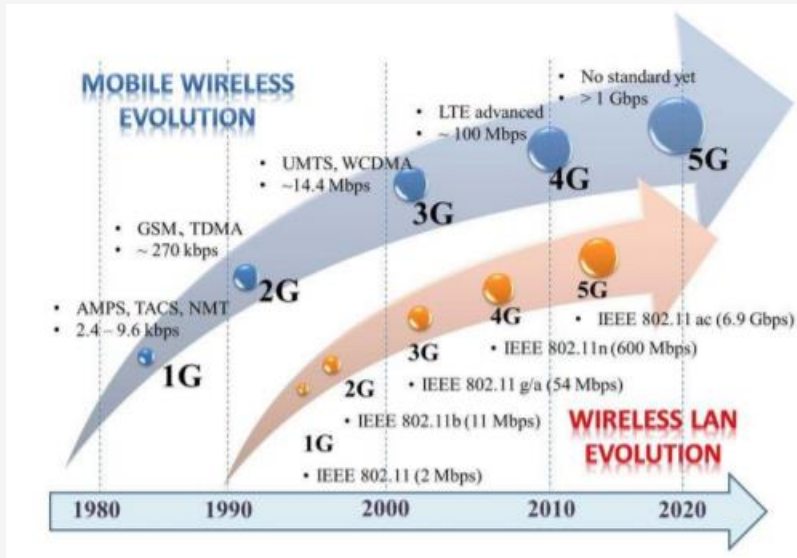
24

Wi-Fi6

- 带宽: ~9.6Gb/s
- 组网方式: 网格 (Mesh)
- 覆盖范围: 室内, 厂区, 办公区域, (Wi-Max)

5G

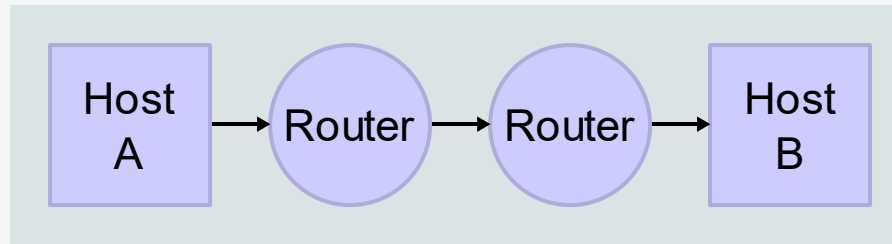
- 带宽: 10Gb/s (UL)
- 组网方式: 微基站 (Micro)
- 覆盖范围: 广域 (全球通), 国内覆盖, 国际漫游



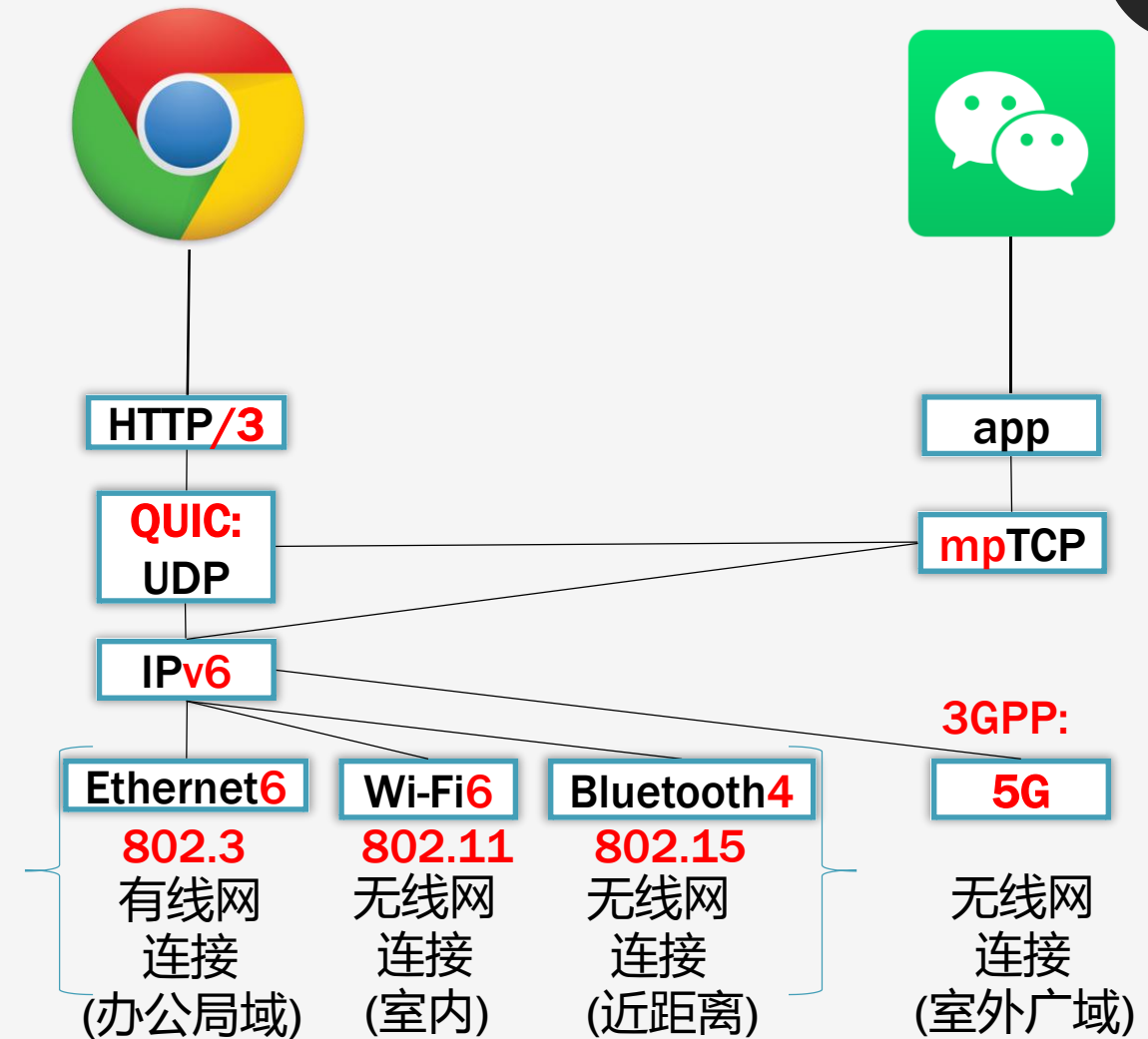
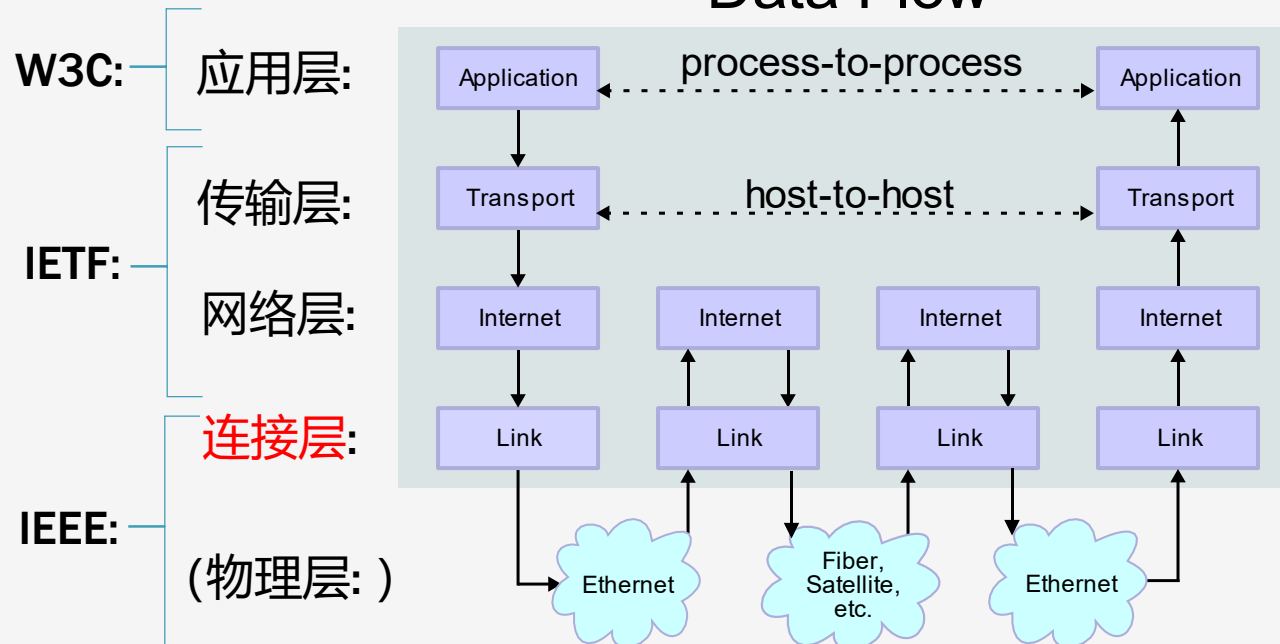
- 2G
- 3G
- 4G Wi-Fi4 (802.11n)
- Wi-Fi5 (802.11ac)
- 5G **Wi-Fi6** (802.11ax)

下一代国际互联网 Internet ... IPv6

Network Topology



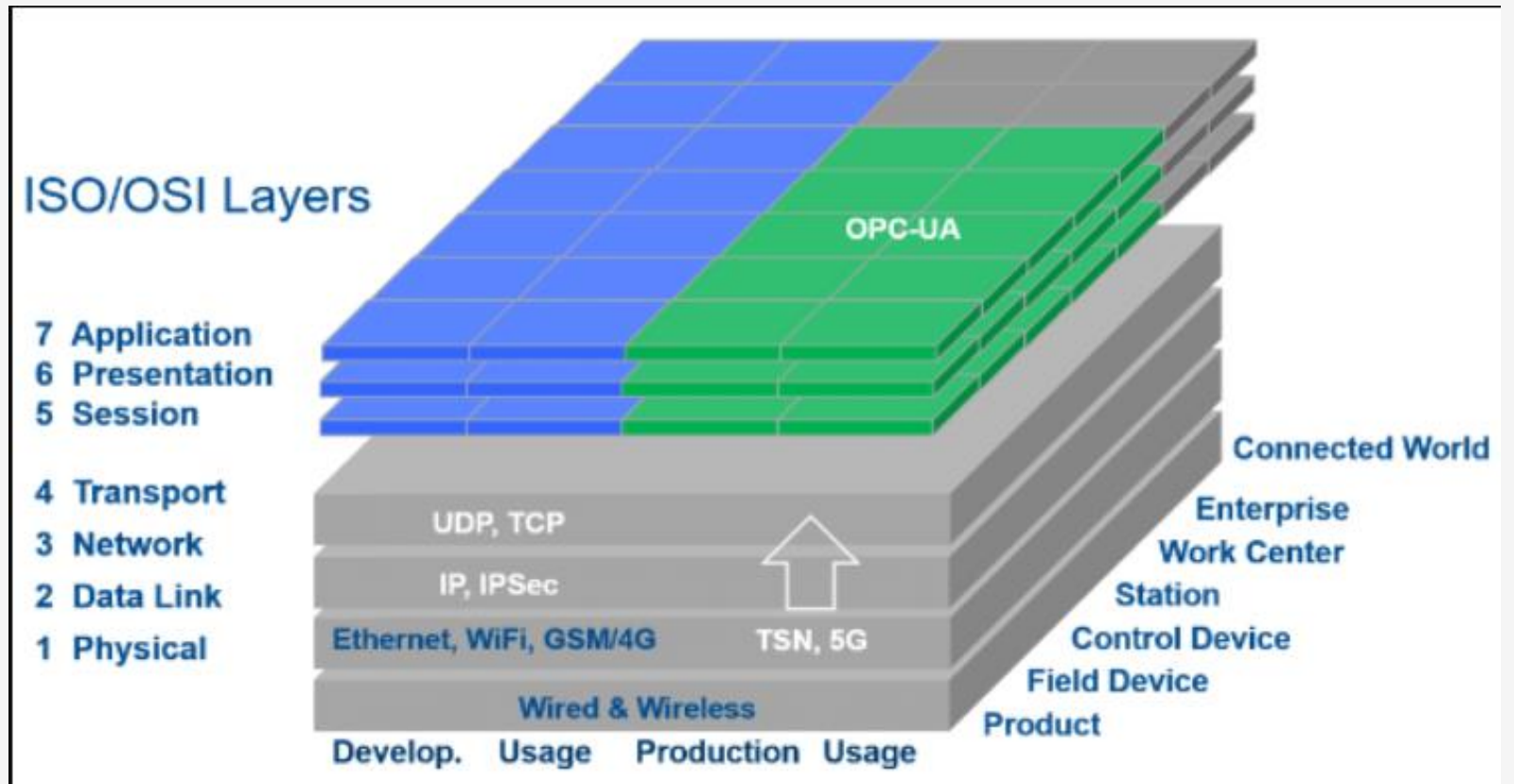
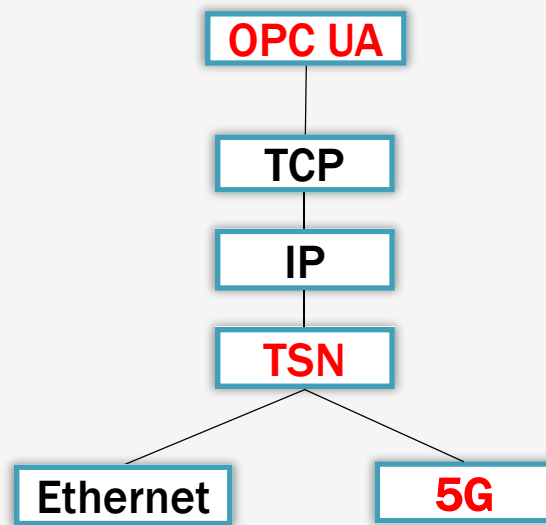
Data Flow



NDN = Named Domain Networks

下一代工业互联网 Industrial IoT ... TSN

26



时间敏感网络
(Time-Sensitive Networking)

感谢聆听！ 欢迎讨论！

27

1

Cyber Safety
信息系统集成
安全保险
与软件可靠性

甘奇韬

2

Cyber Security
网络安全防护