



智慧网络论坛  
AI in Network Seminar –  
Powered by Beta Labs

**Keynote**  
**主题演讲**

**Ritchie Peng 彭红华**  
CMO, Wireless Network Product  
无线网络产品线首席营销官  
Huawei 华为



# 人工智能开启5G自治时代

Start a Autonomous 5G Era with AI

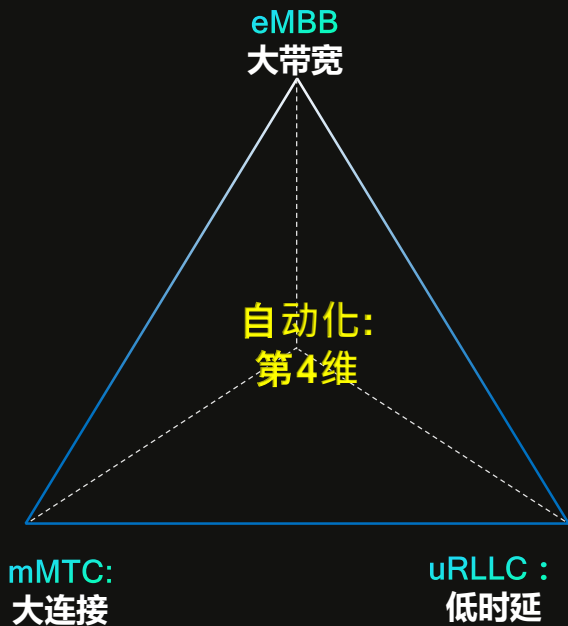
彭红华  
无线网络产品线首席营销  
官  
华为



# 自动化成为5G第4维

## Automation is 4<sup>th</sup> Dimension of 5G Era

### 自动化能力引入构筑自治5G



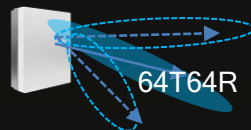
### 自动化是5G时代的必需

#### 保持5G OPEX平滑



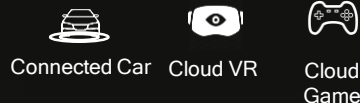
网络运维复杂度

#### 提升资源利用率



通道/频段/制式

#### 支撑新业务敏捷



新业务SLA保障

# 架构创新是突破自动化能力的基础

Architecture Innovation is the Foundation to Breakthrough the Auto. limits

|      | L0: 人工管理网络  | L1: 辅助自动网络  | L2: 部分自治网络  | L3: 有条件自治网络   | L4: 高度自治网络  | L5: 完全自治网络  |
|------|---|---|---|---|---|---|
| 意图驱动 |  |  |    |    |   |  |
| 脑：决策 |  |  |    |   |    |  |
| 眼：感知 |  |  |   |    |    |  |
| 手：执行 |  |  |    |    |    |  |

+ AI: 单点问题驱动



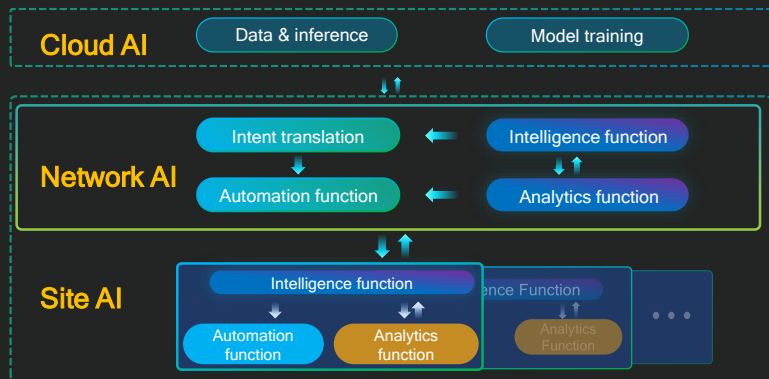
AI+: 结构性问题驱动

架构创新实现自动化能力突破

# 拥抱架构红利，实现Autonomous 5G三大目标

## Embracing Architecture Dividend, Reach 3 Goals of Autonomous 5G

### 面向移动网络自动驾驶的三层架构



MR data



RU location



SLA data



KPI data



Hardware status



Network load

Autonomous 5G

敏捷商业：5x 业务发放

极致性能：20%+ 网络性能

极简运维：10x 运维效率

# 迈向Autonomous 5G的三大转变

## 3 Transformations towards Autonomous 5G

极简运维



面向网元→面向场景

极致性能



粗放化→精细化

敏捷商业



数据开放→场景化能力开放

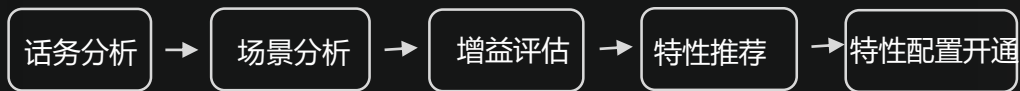
# 场景化网络运维：化繁为简提升运维效率

## Scenario-Oriented Operation, Improving Efficiency with Simplicity

### 基于运维场景的自动化

|    |                                    |
|----|------------------------------------|
| 规划 | 5G站点仿真<br>...                      |
| 部署 | 5G锚点改造<br>4G MM改造<br>容量特性部署<br>... |
| 维护 | 多制式节能                              |
| 优化 | 工程网优<br>热点容量提升<br>...              |
| 运营 | WTTx业务发放<br>...                    |

### Case：AI使能容量特性部署

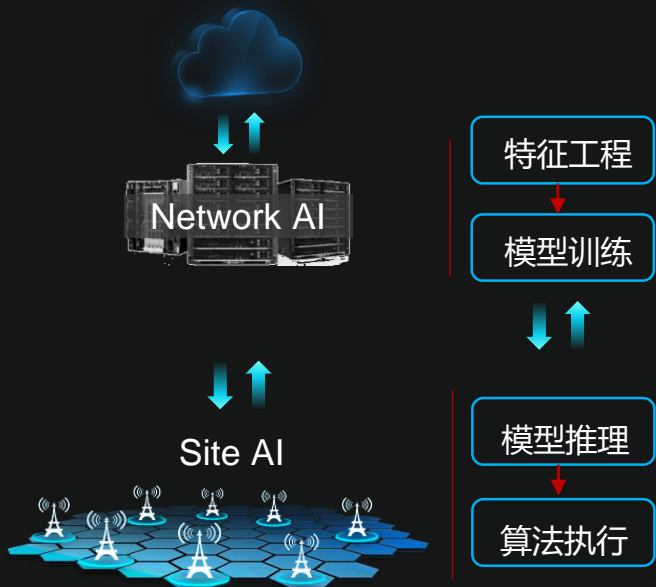




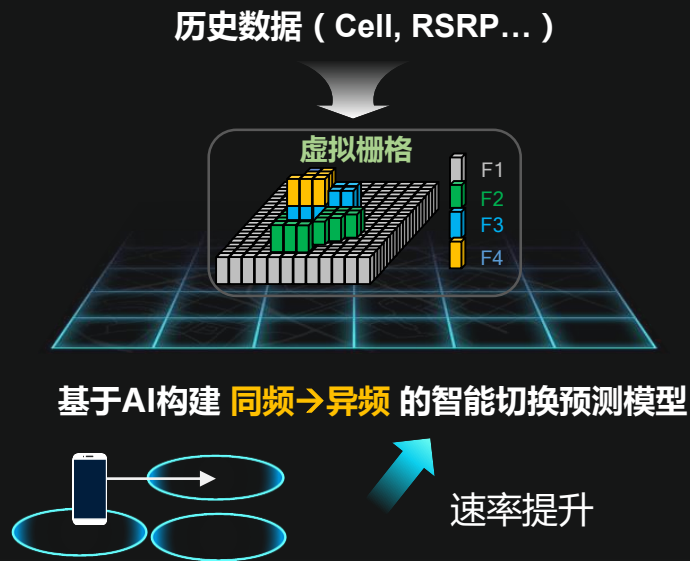
# 智能化资源协同，精细化提升网络性能

## Intelligent Resource Coordination, Improving Network Performance

### 面向无线资源管理的垂直协同



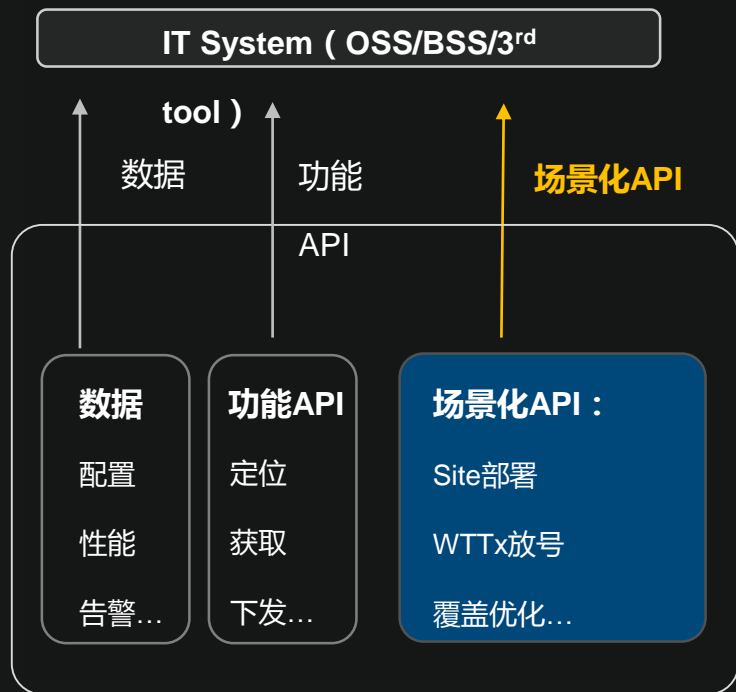
### 基于虚拟栅格的无损异频切换



# 意图化开放生态，使能E2E业务自动化

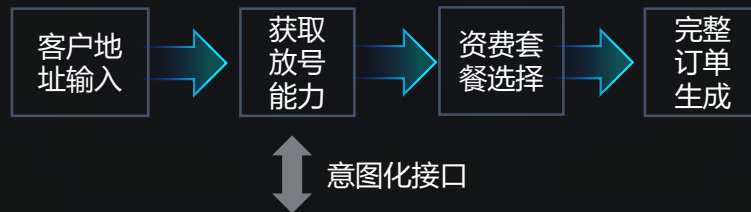
## Intent Driven Openness, Enabling E2E Business Automation

### 场景化API开放使能意图驱动



### 营业厅一键式WTTx业务放号

业务发放流程：



WTTx放号场景API

# 3

3层架构

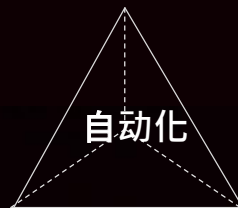
Cloud AI

Network AI

Site AI

# 4

第4维



# 5



HUAWEI



智慧网络论坛  
AI in Network Seminar –  
Powered by Beta Labs

**Keynote**  
**主题演讲**

**Xiongyan Tang 唐雄燕**  
Chief Scientist, Research Institute  
网络技术研究院首席科学家  
China Unicom 中国联通



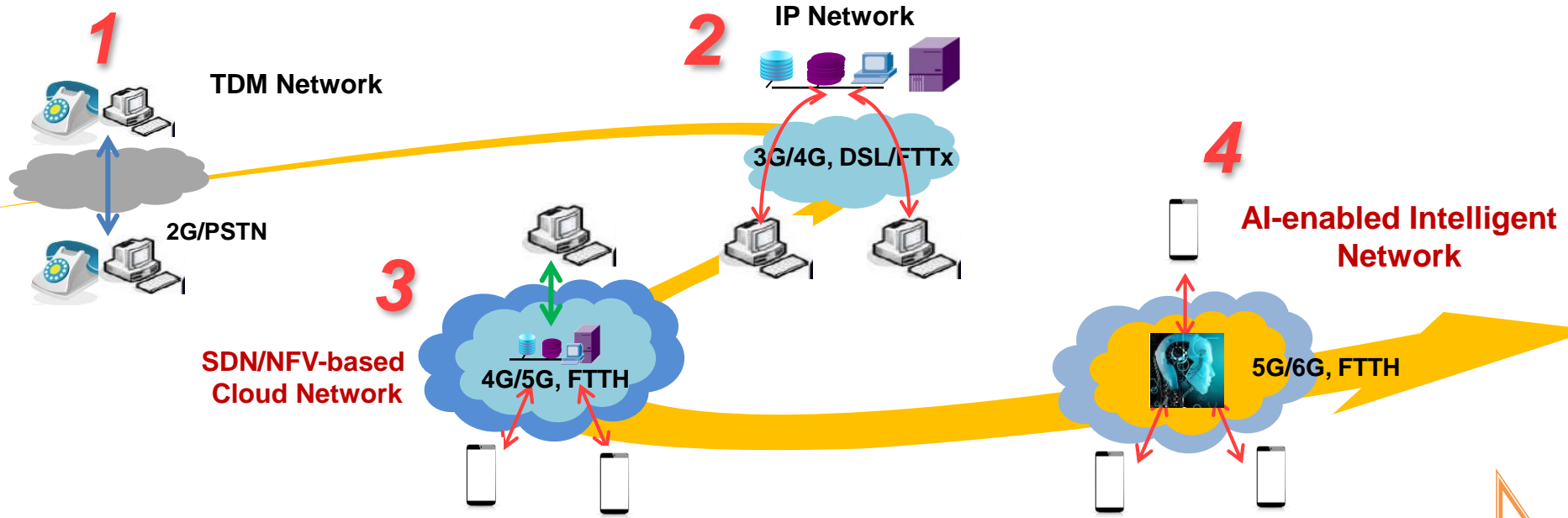
# AI-enabled Network Transformation and Service Innovations

**Dr. Xiongyan Tang**

CTO, Intelligent Network, China Unicom

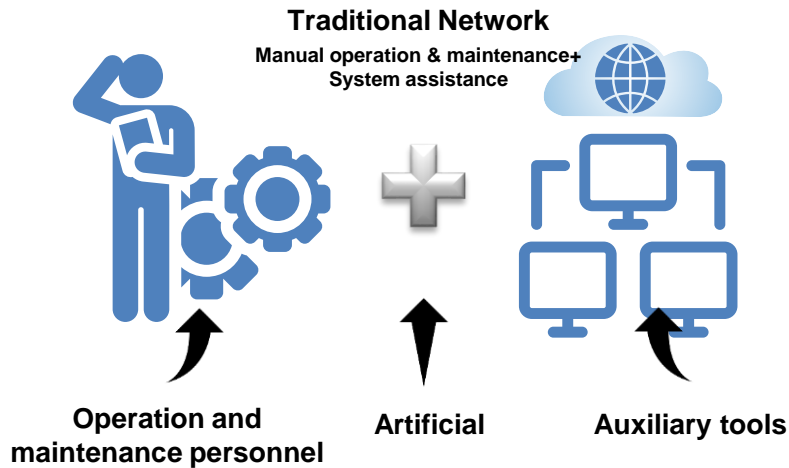
2019-06-27

# AI-enabled intelligent network is the future network

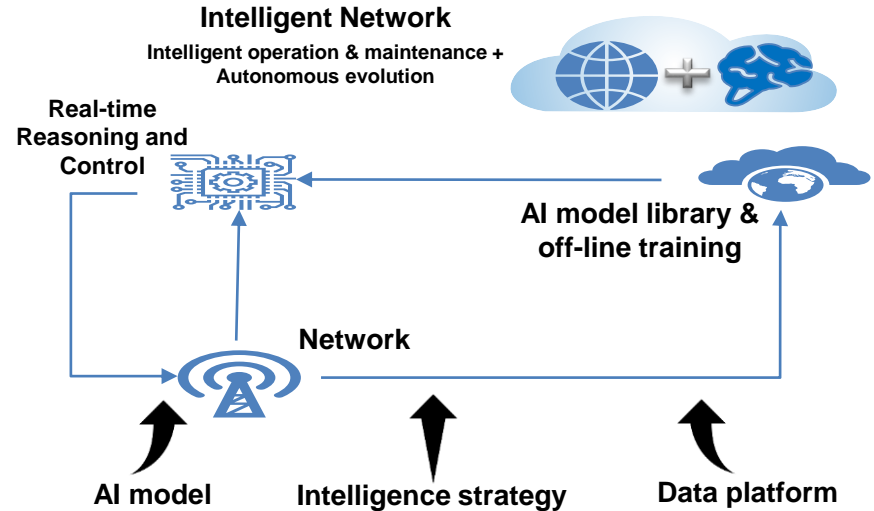


# The core value of AI for telecom networks : Intelligent network operation

- Along with the expansion of the network and the increased number of connections, as well as the virtualization of the network, the network operation faces great challenges. It becomes essential to realize the intelligent network with AI and big data.
- SDN/NFV laid the foundation for applying AI in telecom networks.



- Artificial maintenance
- Post-optimization
- Open-loop of planning, construction and maintenance



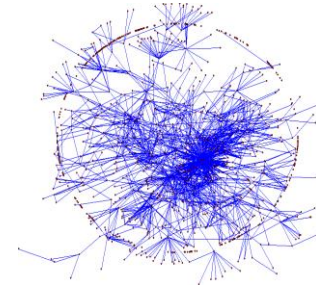
- Network self-operation
- Automatic inspection, self-evolution
- Closed-loop for planning, construction and maintenance



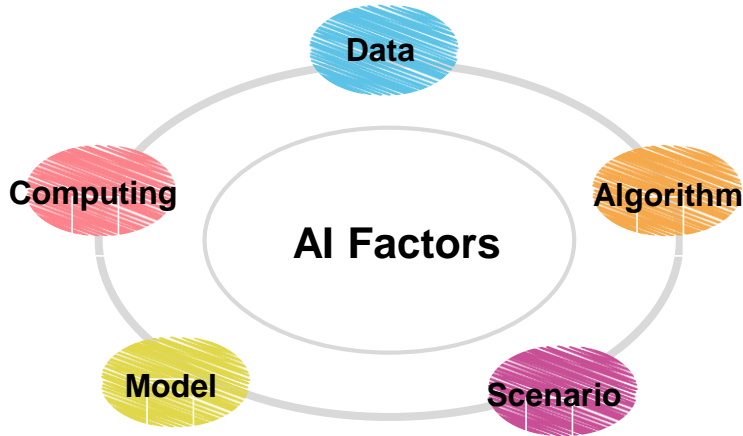
# Network transformation and 5G development need AI

## Challenges

- Increasing network traffic and connections make the size of network is greatly expanded. Network management and OPEX face challenges.
- **SDN/NFV/Cloud** greatly increases the complexity and difficulty of network management and operation.
- The flexibility and complexity of **5G** networks bring challenges to network planning, maintenance and optimization.
- **Service innovations** put forward higher requirements for automation and intelligence of network operation.



AI is a must for 5G and network transformation

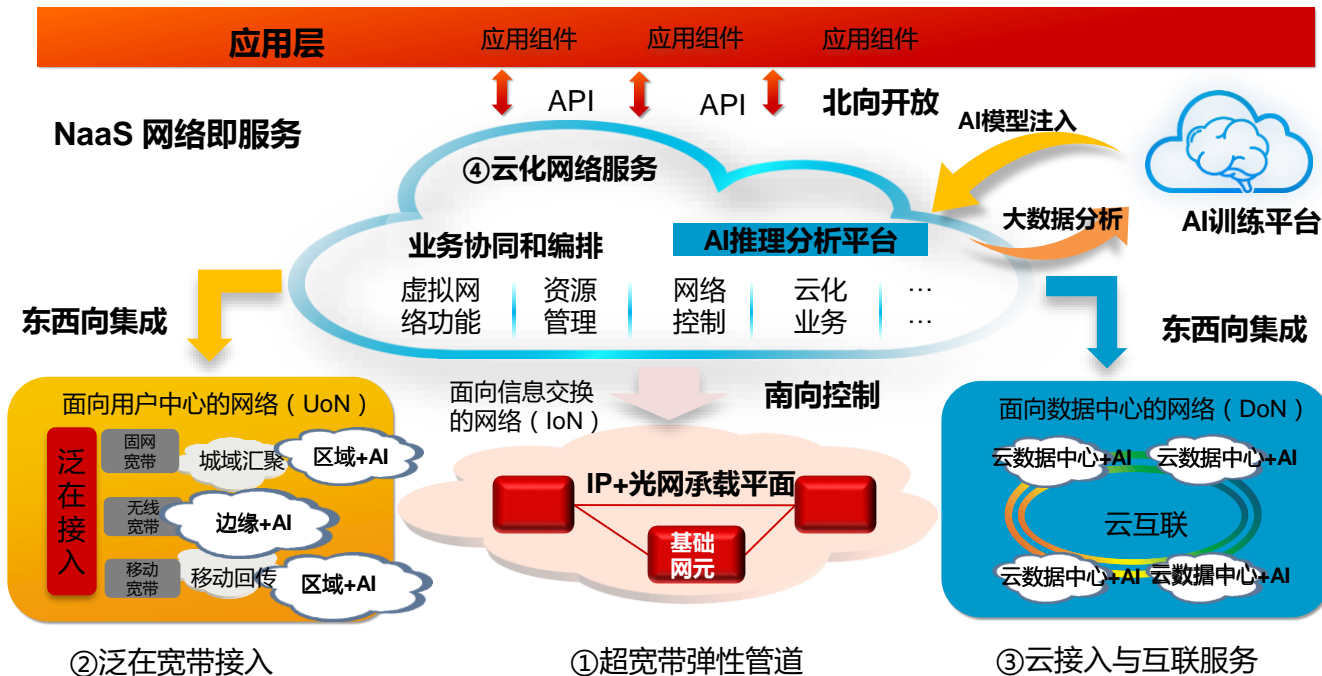


## Opportunities

- **Data:** A large amount of data generated by network, terminals and services lay the foundation for AI mining and analyzing.
- **Computing Capability:** Operators have abundant computing resources for AI applications including DCs, edge computing, and network connectivity.
- **Algorithm:** Matured ML and DL algorithms provide convenient tools for network AI applications.
- **Scenario:** AI can be not only applied in network operational scenarios, but also applied to service innovations.

# China Unicom's new generation intelligent network: CUBE-Net 2.0+

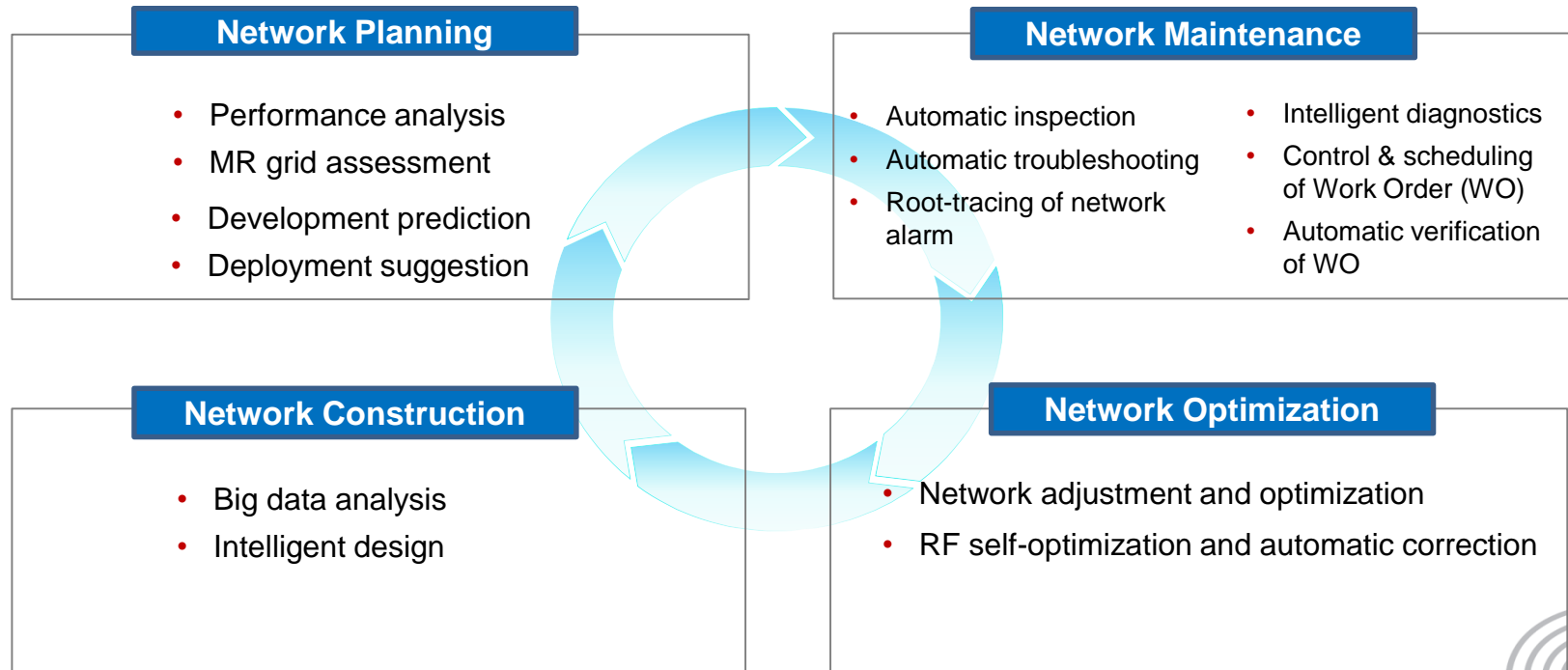
## CUBE-Net 2.0+ : AI-powered Intelligent Network based on SDN/NFV/Cloud



Introducing AI+SDN/NFV/Cloud to build the next generation intelligent, agile, intensive and open network

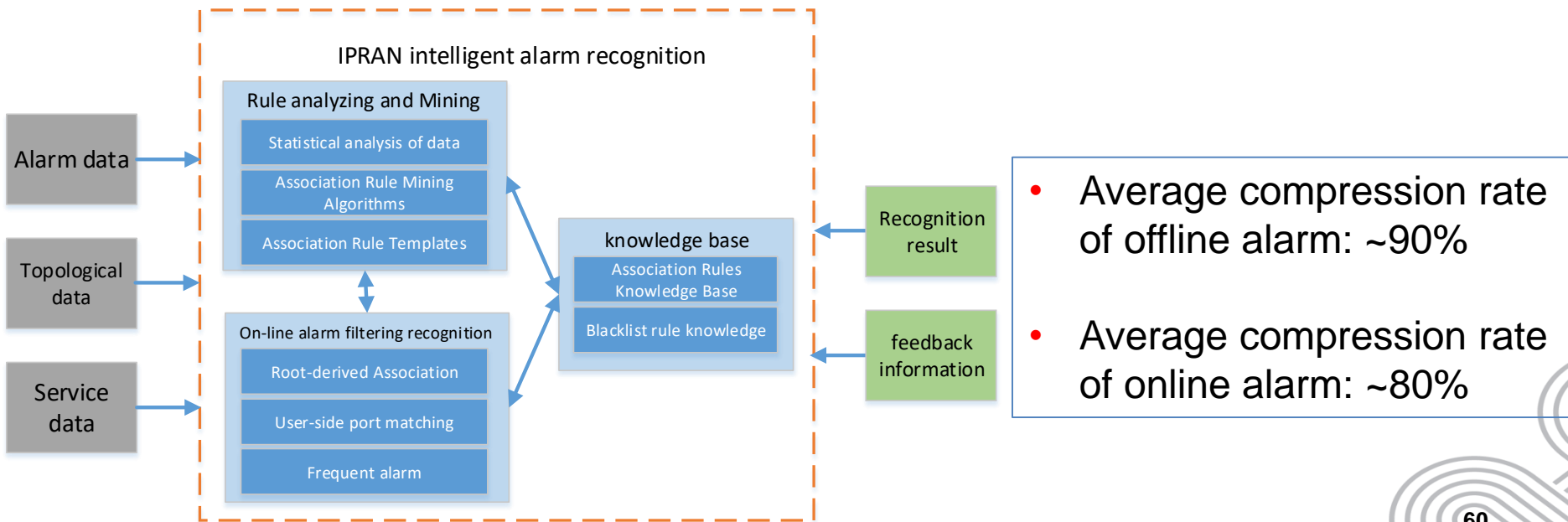
# Today: AI Introduced into current network operation

Applying AI to network planning, construction, operation and optimization to accelerate network transformation and improve network intelligence.



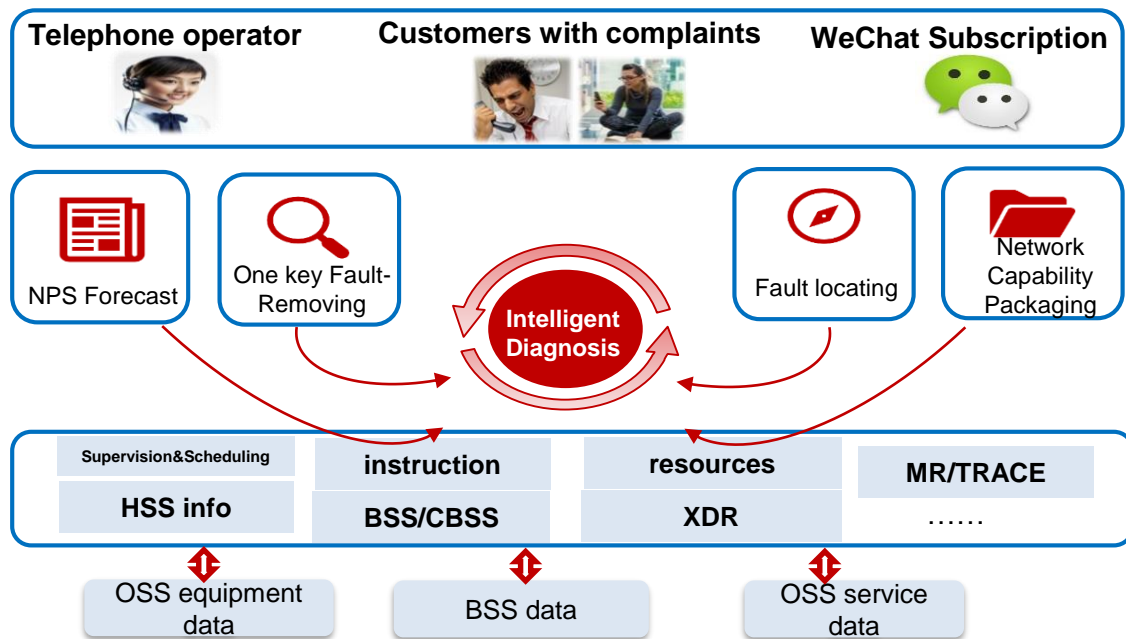
# Use Case 1: IPRAN intelligent alarm recognition

- This system realizes the roots-tracing of network alarm and has been deployed in some provincial branches of China Unicom.
- It has a high accuracy of root-cause location, and plays a supporting and assistant role in the maintenance and planning of IPRAN network.

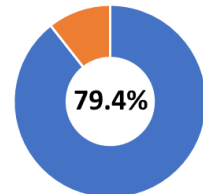


# Use Case 2: Intelligent data analysis for customer care

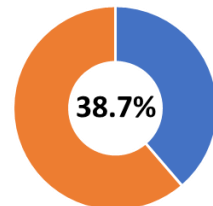
- This system integrates user's authentication and consumption information, terminal capability and service behaviors with network data to do collaborative intelligent analysis.
- It realizes the intelligent diagnosis of customer complaints and assists the maintenance engineer to solve the problem quickly.



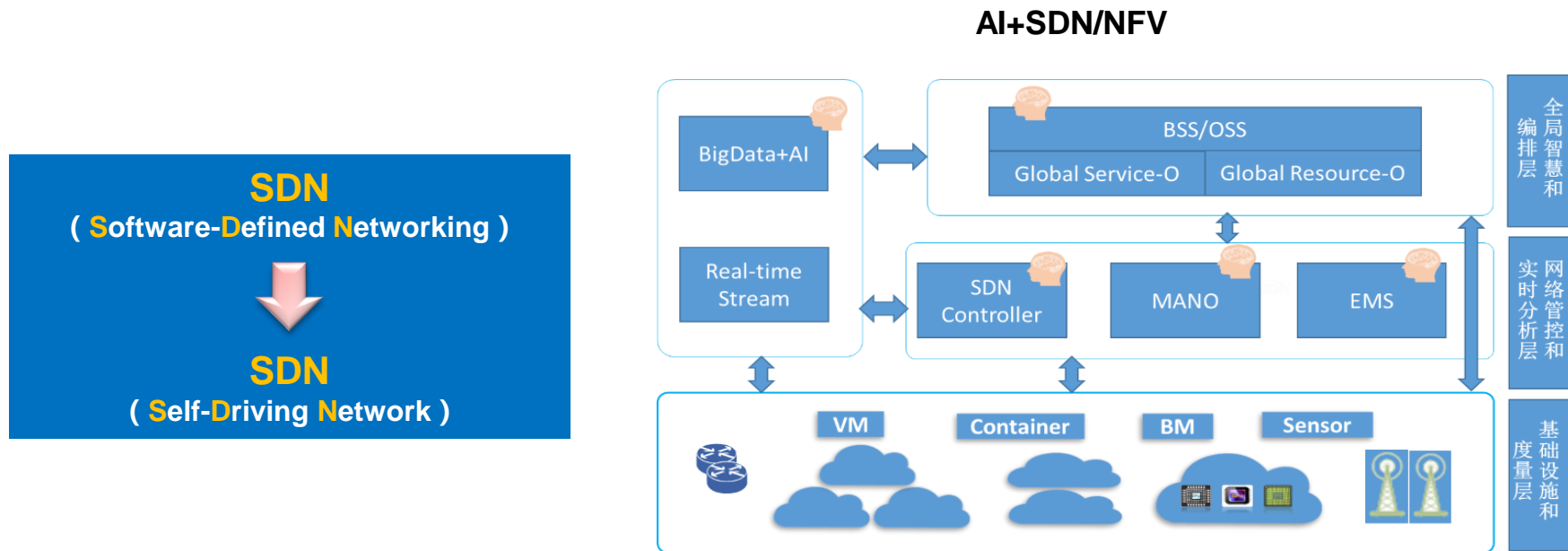
Mobile network first call resolution



Fixed network first call resolution



# Tomorrow: AI-enabled network re-architecture



On different layers of the network (infrastructure and measurement, network control and real-time analysis, overall intelligence and orchestration), AI capability could be introduced step by step and embedded into the network system.

# 5G+AI : AI for 5G intelligence and 5G for AI applications

- AI promotes the intelligence of 5G network and improve the overall network performance, as well as maintenance and operation efficiency.

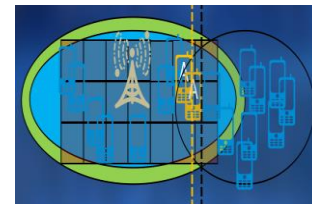
## AI-powered beam management

AI-powered beam management enables quick adaptation to environment change, enhancing access experience



## AI-based wireless network optimization

Optimize parameter adjustment; Improve the utilization rate of wireless resources and network capacity; Predict user trajectory/service requirements; Optimize content cache and enhance QoE of users.



## AI and 5G MEC

Edge computing provides key capabilities for AI applications, and edge AI provides support for the edge computing applications.



## Edge computing and AI

## AI to manage network slicing

- Automatic network slice configuration
- Automatic network slice fault recovery
- Optimizing network slice performance



## Intelligent network slicing

# China Unicom is developing the Network AI platform CUBE-AI

01

CubeAI based on the design concept of the Linux AI Foundation (FLAI) project Acumos

02

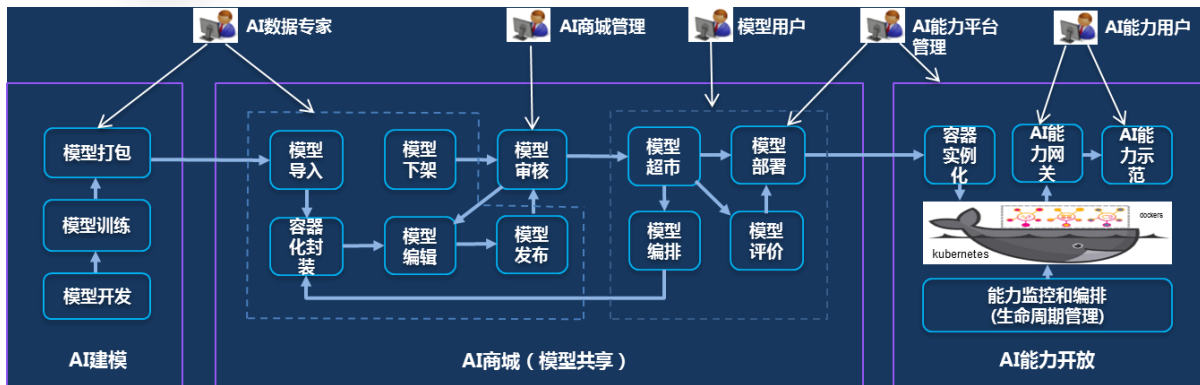
CubeAI platform integrates AI model development, model sharing and capability opening



**Technical service platform** to meet the needs of network AI applications and business innovation

**Industry cooperation platform** to create an multi-win AI ecosystem

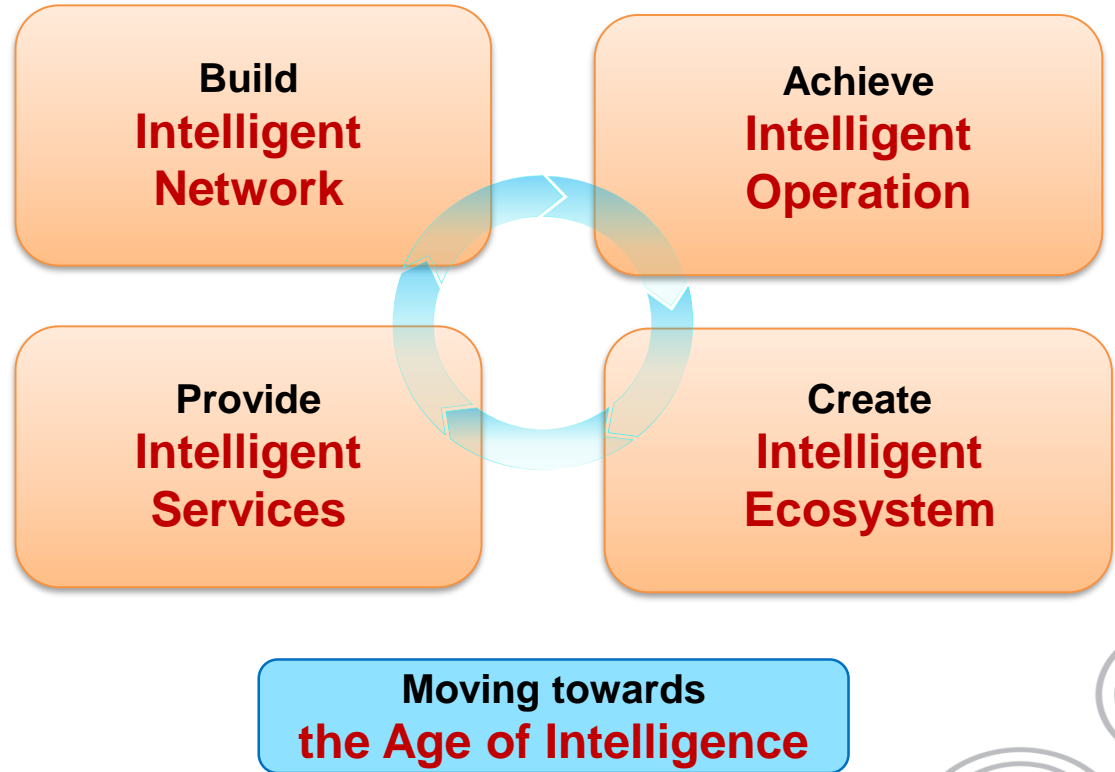
**Technology sharing platform** for open source contributions, technology exchange, and application demo





# Summary and Prospect: AI-enabled intelligent operators

- AI-enabled intelligent network is a new trend of telecom network development, which has far-reaching impact and great potential.
- The application of AI in telecom network is still in the early stage and needs continuous attention and exploration.
- China Unicom will actively conduct network AI applications and apply AI to improve network operation efficiency and service intelligence.
- China Unicom is looking forward to working with industry partners to promote the development of network AI and co-create the new era of network intelligence.



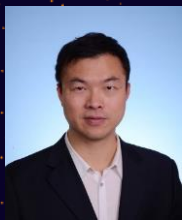
**Thanks!**



# 智慧网络论坛 AI in Network Seminar – Powered by Beta Labs

## Panel: AI in Network Opportunities and Challenges

### 小组讨论：智慧网络的机遇和挑战



Moderator 主持:  
**Hong Liu 刘鸿**  
Head of Technology, Greater China  
大中华区技术总经理  
GSMA



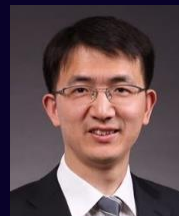
**James Sun 孙鹏飞**  
Chief Product Portfolio & Lifecycle Mgmt  
Wireless AI & Automation Domain  
无线智能化与自动驾驶首席规划  
Huawei 华为



**Kan Lin 林侃**  
Head of GS NCS Analytics Mobility,  
Great China  
大中华区网络认知部门大数据分析  
总监  
Nokia Shanghai Bell 诺基亚



**Feng Xue 薛峰**  
Staff Algorithm Engineer  
高级算法专家  
Ant Financial 蚂蚁金服



**Huabin Tang 唐华斌**  
Director of Cloud Delivery Technology  
Research and Verification Center  
研究院网络所电信云交付技术中心主任  
China Mobile 中国移动



**Mingchuan Yang 杨明川**  
Director, New Information Technology  
新兴信息技术研究所所长  
China Telecom 中国电信



# 智慧网络论坛 AI in Network Seminar – Powered by Beta Labs

**Keynote**  
**主题演讲**

**Junlan Feng 冯俊兰**  
Chief Scientist  
人工智能首席科学家  
China Mobile 中国移动





中国移动  
China Mobile

# 通信网络智能化之路

中国移动研究院 冯俊兰

2019.06

[www.10086.cn](http://www.10086.cn)

Talk a Lot: Concepts, Possible Applications in Future,  
5G for AI, AI for 5G

5G/Telecom Communication Network + AI

Deliver little: Demos, Small Trials, Research Prototypes,  
Applications Deployed in a limited scale, Use cases



- **State-of-Art AI technologies are evolving fast. It succeeds in many fields, but faces serious challenges on robustness, cost-effectiveness , as well as a general learning capability.**

——As a Truth

- **5G is speeding up to be commercially deployed in large scale, but with quite distance from an ideal 5G network at many aspects.**

——As a Fact

- **Where should they meet ? What AI technologies will be contributing most to Network Intelligence? Can 5G facilitate AI applications to be cost-effective, more robust and large-scale?**

——Questions for the Telco industry?

- **Are we sincerely working on bridging the gap? Are we on the track to solve the fundamental problems? If not , what way should we action on ?**

——Questions for the community?

Phrase-I:

Problems Hard for Human,  
but relatively straightforward  
for Machines if the problems  
can be formally described  
with symbols and math rules

Phrase-II:

Problems easy for human to  
perform, but hard for People  
to formally describe

Phrase-III:

Robustness, Cost-Effective,  
Reliable, General AI

Multi-dimension Single  
Data Points

Time Series Data

Grids

Graph

Dynamic Environment

Machine Learning

Deep Learning

Adversarial Learning

Reinforcement Learning

GI: Meta-Learning,  
Transfer Learning, Multi-  
Task Learning

Bayes Learning , PAC-  
Bayes Learning

Classification

Regression

Prediction

Generation

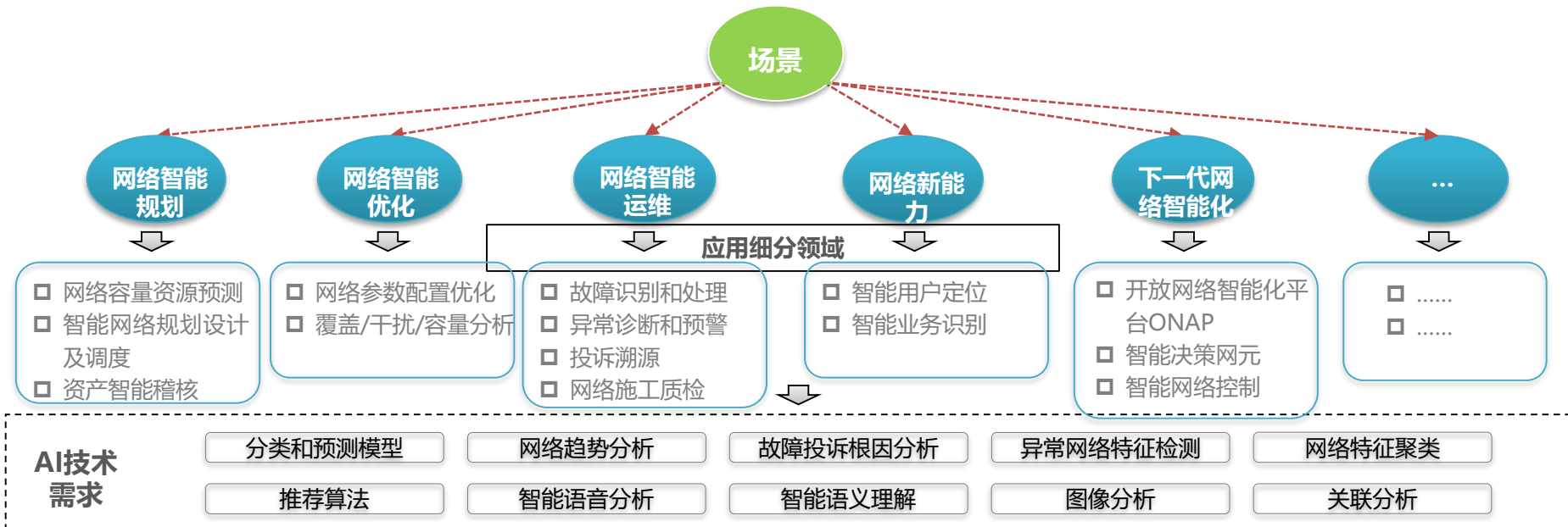
Clustering

Visualization

Summarization

# AI助力网络，推进网络智能化，增强网络核心竞争力

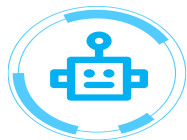
- AI可用于网络的方方面面，包括网络规划、设计、优化、运维、新能力提取等，赋能价值大；网络智能化专业性强、行业壁垒高，且整体处于起始推进阶段。





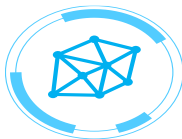
中国移动  
China Mobile

## 聚焦网络、安全、管理、服务和市场五大领域，做大应用规模



### 网络自服务机器人

客户投诉处理效率提升20倍  
研究院、江苏公司



### 智能覆盖优化系统ACOS

TopN小区覆盖率提升6%  
设计院



### 智能稽核

每年可节省上亿成本  
IT公司、广东公司、研究院



### 智能VoLTE语音质量评估

语音分析成本降低83%  
网络部、研究院、浙江公司



### 智能审计

合同、票据等24个审计点  
IT公司、苏研、杭研



### 智能家宽装维质检

所需人工降低95%  
网络部、杭研



### 智慧营销

ARPU环比增加7.5%  
市场部、研究院



### 智能客服“移娃”

月峰交互量2.1+亿次  
在线公司、研究院



### 反欺诈系统

诈骗电话月拦截量1400万+  
信安中心



### 视频智能剪辑

剪辑效率提升130倍  
咪咕公司

**Thoughts : Definition , Systematic ,  
Scale , Cost , Present Network , Future  
Network**



# 1 , Network Intelligence Definition ?

## 2 , Can the efforts be Systematic?

Easy to Hard  
L1- L5

Service—  
Operation—  
Core Functions

Wireless to Core  
Network

Planning-  
Construction-  
Operation-  
Optimization

Data Sensing  
Storage-  
Analytics -  
Prediction



# Top Challenge: Can we represent our Network in Math?

Multi-dimension Single  
Data Points

Time Series Data

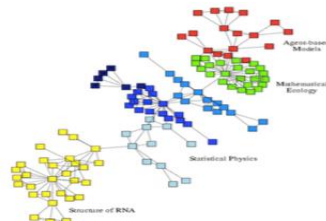
Grids

Graph

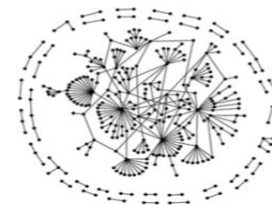
Dynamic Environment



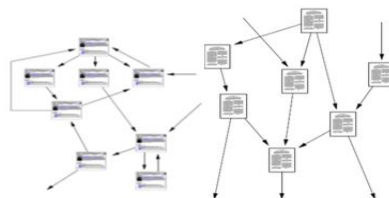
Social networks



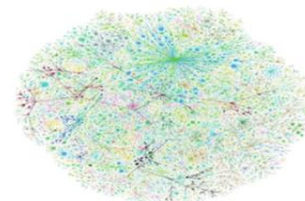
Economic networks



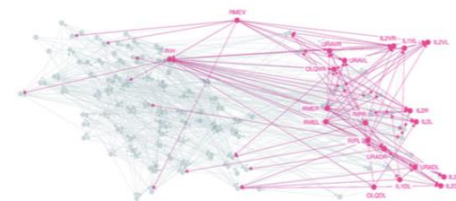
Biomedical networks



Information networks:  
Web & citations



Internet



Networks of neurons

Is it a graph? Way too complex to represent the nodes and edges in Math? How to sense our network?

## 3 , Level of Sharing ?



**4 , Efficient Way to improve Collaboration  
Between Industry and Academia ? Is Open  
Source easier for this integration  
comparing to commercial software?**



# 5 , Methodology or Process to Efficiently Deploy AI Enabled Functions ?

# 6 , Ways of Business Organization to Match Intelligent Network ?



# 7 , Can AI make our Network Simpler ?



智慧网络论坛  
AI in Network Seminar –  
Powered by Beta Labs

**Keynote**  
**主题演讲**

**Ming Yang 杨名**

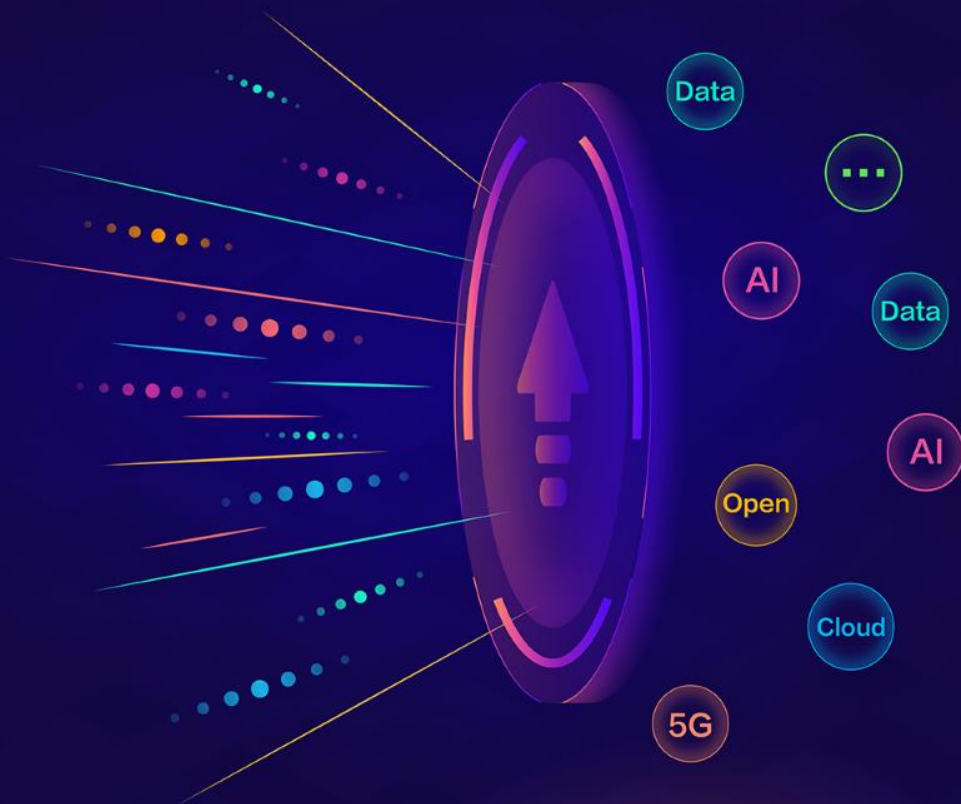
Vice President, Ali Cloud & CSO, Whale Cloud  
阿里云副总裁 · 浩鲸科技首席战略官  
Whale Cloud 浩鲸科技



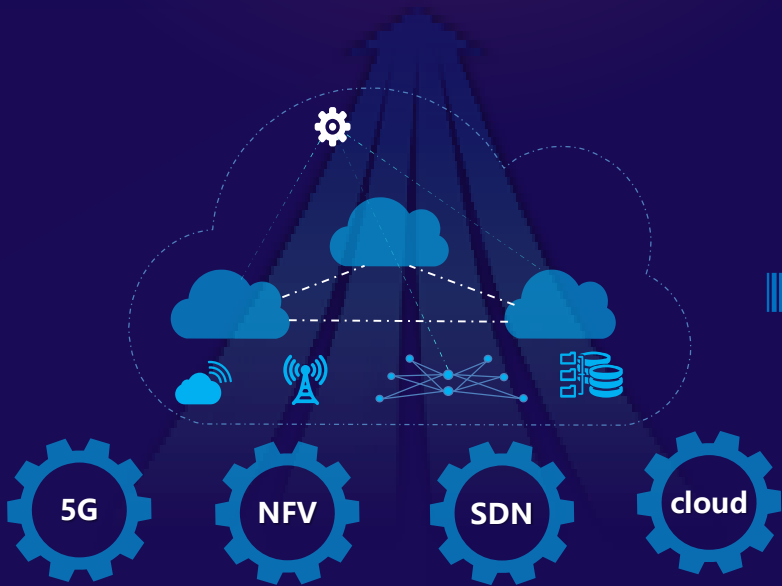


# 人工智能助力提效网络 运维

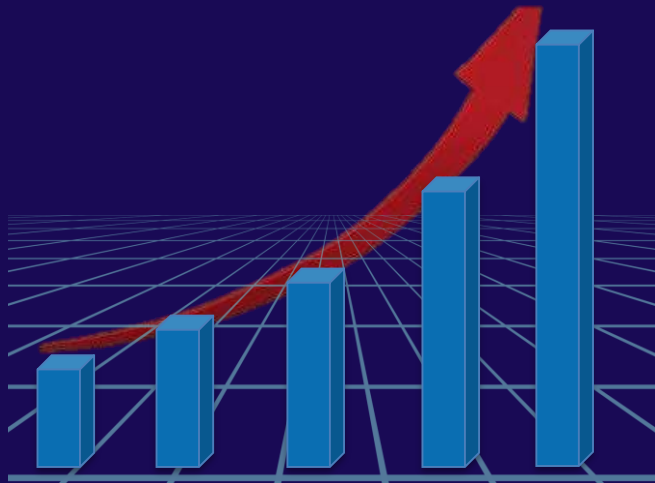
AI assisted network operation and  
maintenance to improve efficiency



# 网络运维工作日益复杂，成本投入多收益低



网络日益复杂



运维工作难度指数级增长

# 运维工作的出路在哪里？



自动



智能



敏捷

引入AI是大家不约而同的选择

## 技术门槛高



- 专业人员少
- 运维场景复杂
- 训练工具少
- .....

## 建设成本高



- GPU成本高
- 算力资源浪费
- 人员难复用
- .....

## 服务共享难



- 能力复制推广难
- 迭代优化周期长
- 能力分散见效慢
- .....

# 鲸能Ops：AI赋能网络运维整体化解决方案



# 解决方案亮点：高效、低成本的AI能力建设

## AI资源云化管理



硬件投资节省**30%**以上

## 集中调度与推理



Ai训练提速**40%**以上

## AI工厂化生产



AI生产周期缩短

**50%**

## AI能力复用



AI投资减少**30%**以

上



# 鲸灵天圭：接入网络装维效能提升



## 节约人力/成本 ≈30人月 save

- 平均每月质检15万笔工单
- 每月质检的图片数量达到130万以上
- AI自动图片质检代替每月人工抽检节约人力30人/月。



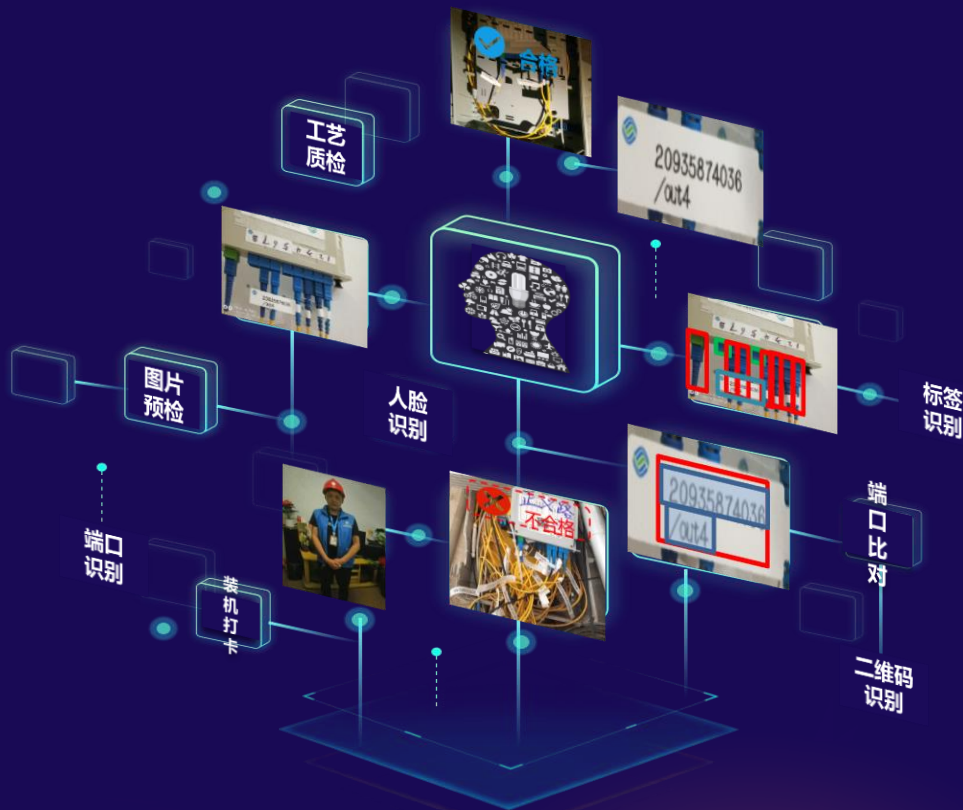
## 装机规范提升 10%—>60% up

- 由于AI能力的赋能，能针对施工图片全量检查的，要求外线施工人员更规范施工和拍照，拍照达标率从10%提升到60%。



## 二次上门率下降 10%—>4% off

- AI图片质检应用上线半年来，有效提升了施工质量，降低了二次上门的比例，二次上门率从之前的10%降低到4%





动态计划



全面综合资源、历史、天气等各项数据分析，**动态生成巡检计划**

自动巡检



无人机代替人工巡检，360度+7\*24h自动巡查巡检，巡检图像实时传送

视频巡检



运用在线/离线质检技术**自动对巡检图像/识别进行分析**，识别资源类型和故障异常

自动修复

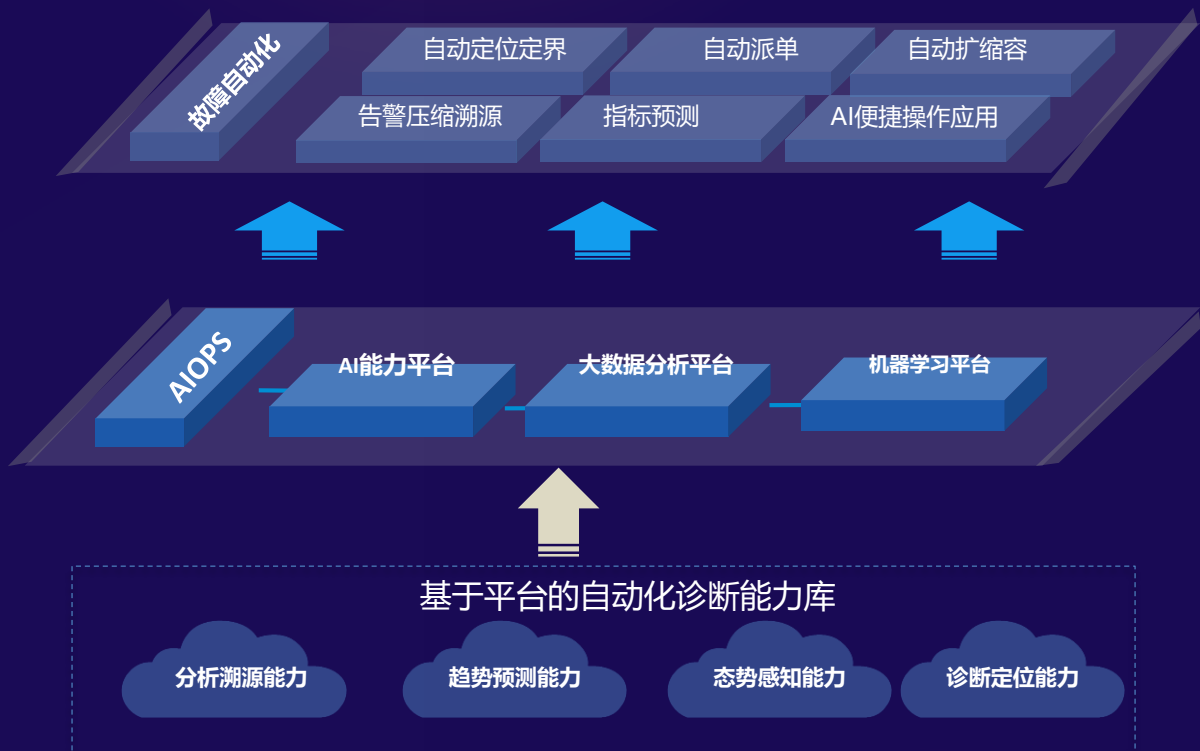


识别出异常后，根据巡检知识图谱和故障修复知识图谱进行**自动化异常修复**，减少人工投入

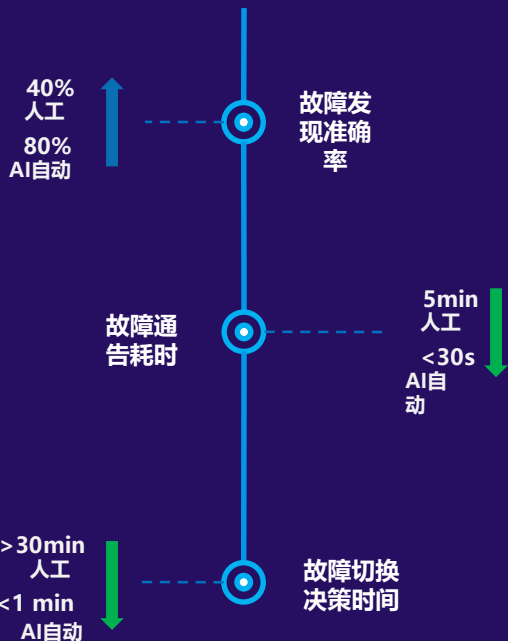
## 用AI能力简化人力成本

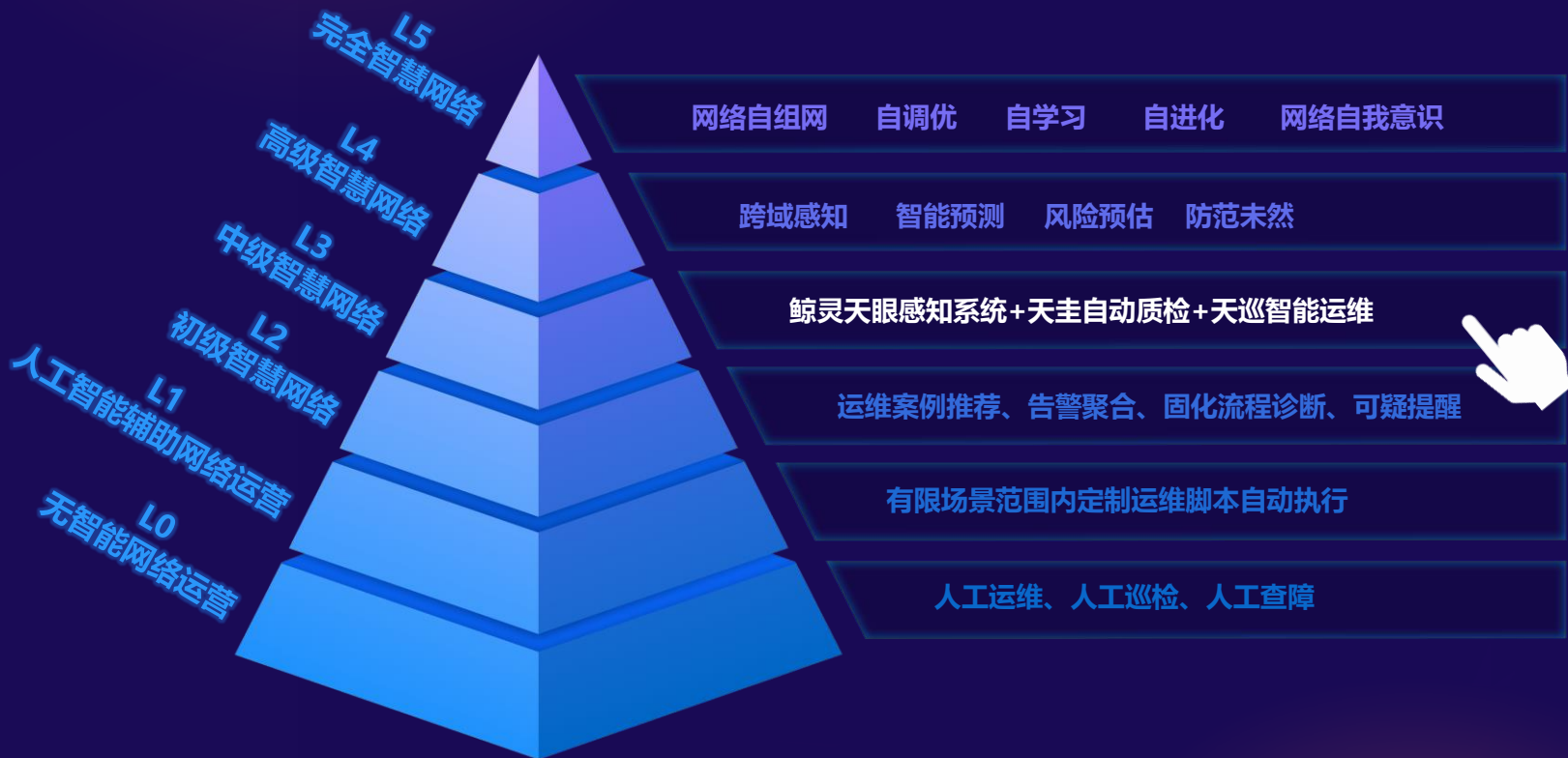


# 鲸灵天眼：网络故障诊断处理



## 效率提升





谢谢



# 智慧网络论坛 AI in Network Seminar – Powered by Beta Labs

**Keynote**  
**主题演讲**

**Yachen Wang 王亚晨**  
General Manager, Tencent Cloud  
腾讯云网络总经理  
Tencent 腾讯





*Tencent*

# AI在腾讯DC与IoT网络中的应用

王亚晨

腾讯云网络总经理  
Linux基金会边缘计算董事会董事



# 腾讯云AI能力







# 腾讯云AI已开放成熟能力

## 人脸识别类

人脸检测及属性分析  
/五官定位及人脸跟踪

人脸识别 (1:1)

人脸识别 (1:N)

活体检测

人脸聚类

## 图像识别类

图像分类

色情、暴恐等识别

医学影像识别

车辆识别及分析

人群、交通等事件检测

## 文字识别类

通用OCR

证件类OCR  
(身份证/驾驶证/营业执照等)

名片OCR

手写体OCR

银行卡OCR

## 语音及理解类

语音识别 (语音转文字)

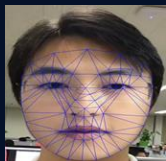
语音合成 (文字转语音)

声纹识别

自然语言理解

人机交互

# 腾讯AI优图：凭一张3岁的照片，找回了被拐十年的孩子



人脸配准追踪技术



1:1人脸比对身份认证技术

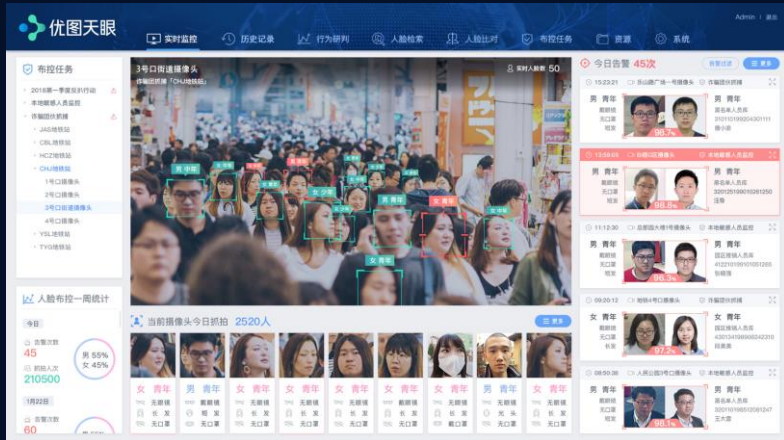


活体检测技术



1:N海量人脸检索技术

## 天眼系统的背后



- 天眼系统人脸检索技术，即给定一张或N张照片，和数据库中N个人脸进行对比，给出是否为其中某一个人或者相似度排序。
- 技术指标：最高可支持上亿级别人脸数据库的检索。实际应用时，1000W规模时：速度<1秒；100W规模时：速度<20 ms；百万规模库评测top1命中率：证件/注册/自拍等>95%，自然监控>85%（与照片库质量有关）。

## 腾讯AI觅影：医疗显微镜的病理分析进化之旅

### ● 结直肠癌检测筛查

结直肠癌是5大恶性肿瘤之一，每年新发病例超过120万。腾讯AI基于深度学习，将图像分割成小块，在每块上计算息肉的可能性，然后综合起来定位息肉。准确率可达96.93%、区分腺癌97.2%。



### ● 乳腺癌早期筛查

乳腺癌是女性最常见的恶性肿瘤，其发病率逐年上升，这种趋势在中国更为严重。2012年我国乳腺癌的发病率仅占全球的11.2%，到了2030年将增加到29.8%。

腾讯AI Lab利用多视窗的深度学习网络，在每张0.2个假阳下，检测钙化的敏感度是99%，恶性肿块敏感度90%，良恶性敏感度和特异度分别是87%和96%，已达到或超过普通医生的水平。



》》 除此之外，我们在数据中心和物联网网络方面也进行AI探索



AI for Network



AI与数据中心网络

Network for AI



AI与物联网



2

# AI与数据中心网络: AIOps

**AI for Network**



# 腾讯全球数据中心网络越来越复杂，如何快速检测并排除故障？

50+  
国家及地区

1M+  
服务器总量

100TB+  
出口带宽储备

15EB  
存储数据量

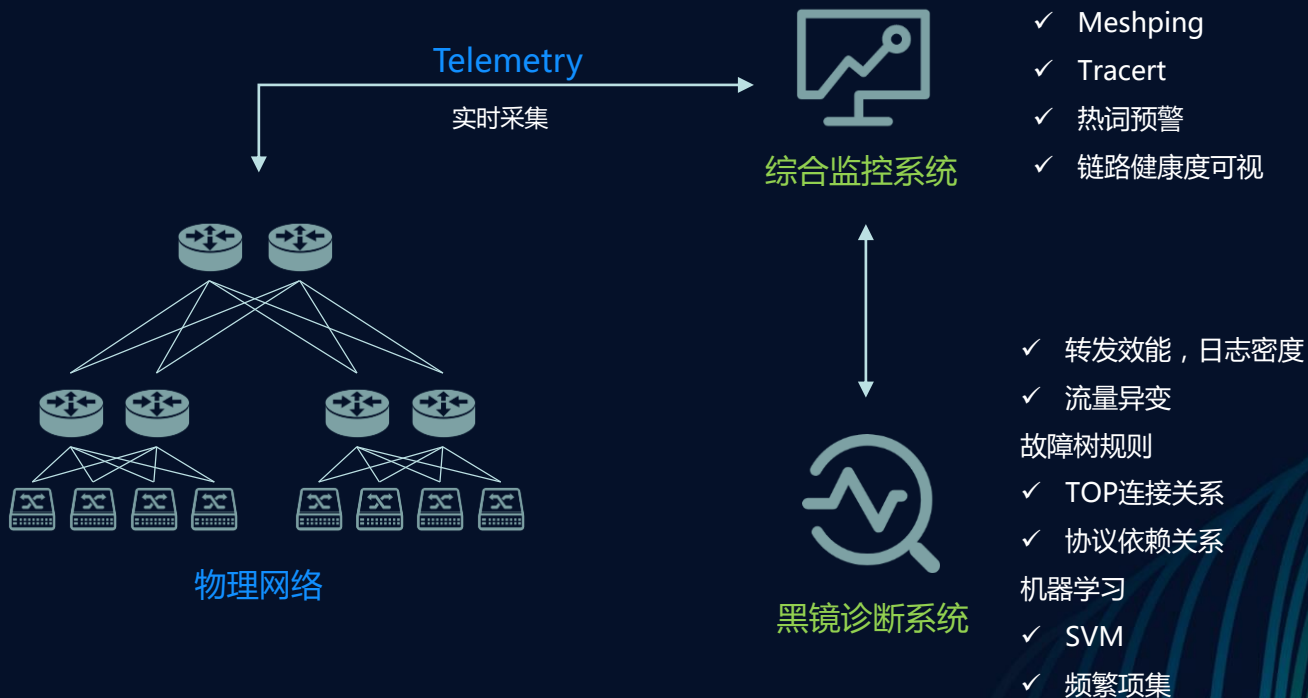


## 我们面临的问题

- 1、如何将复杂的网络可视化呈现以简化运维？
- 2、如何快速甚至提前发现故障，并自动排除故障？

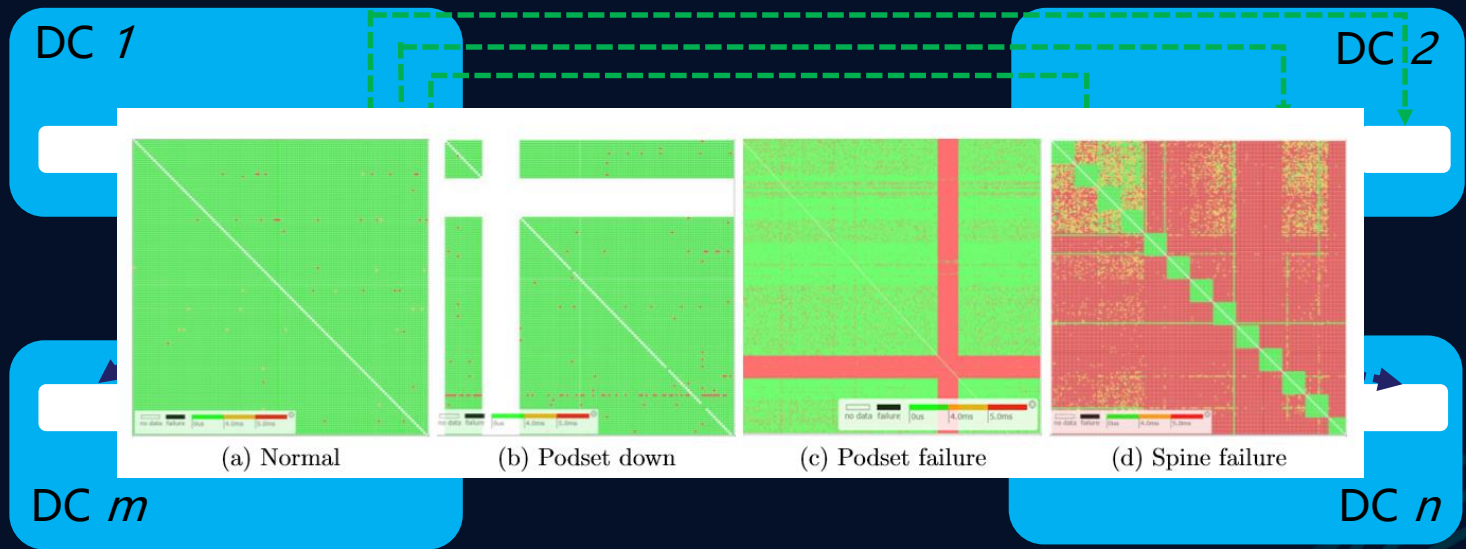
- 腾讯云已开放了25个区域内的53个可用区
- 腾讯云提供包括计算、数据库、网络、存储、DDOS、智能AI、大数据等60+产品能力

# >>> 基于AIOps的智能监控与诊断平台



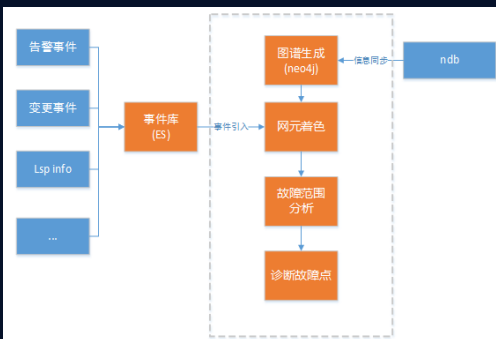


## 实践效果1：实时Telemetry，大数据分析，网络链路健康度可视化

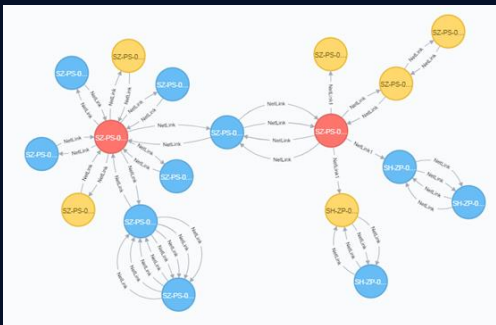


- 海量的服务器作为agent做近似fullmesh 链路测控，并记录探测流路径样本；
- 海量样本送至机器学习平台清洗，分类。DC网络链路健康度可视化，运维效率大幅提升；

## 实践效果2：故障发现和恢复时间提升5倍



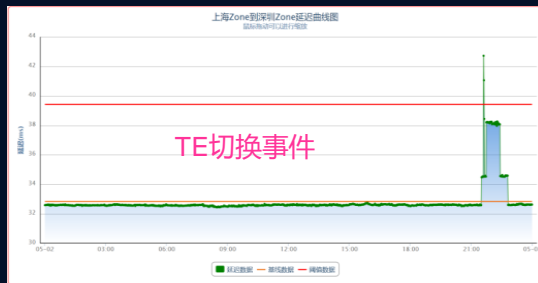
- ✓ 基于图数据库存储设备及连接关系
- ✓ 根据事件信息，着色网元



- ✓ 基于故障分治思想划分故障簇
- ✓ 基于中心点的方法找故障点



网络质量告警由15分钟优化为3分钟；  
准确率90%以上；



3分钟发现异常，微信推送告警；  
7分钟初步定位，自动建单处理；  
故障恢复时间由 1h → 10~30m内



3

# AI与物联网网络: AIOT

Network for AI



## 物联网场景下，更多数据需要在边缘侧处理，AI能力下放成为趋势

痛点1：海量数据场景，高度依赖云端集中计算



视频流数据上传云端处理



海量数据在本地产生

- ✓ 带宽浪费
- ✓ 效率低下
- ✓ 云端集中计算压力大

痛点2：海量连接场景，高度依赖云端控制和决策



温度数据上报云端

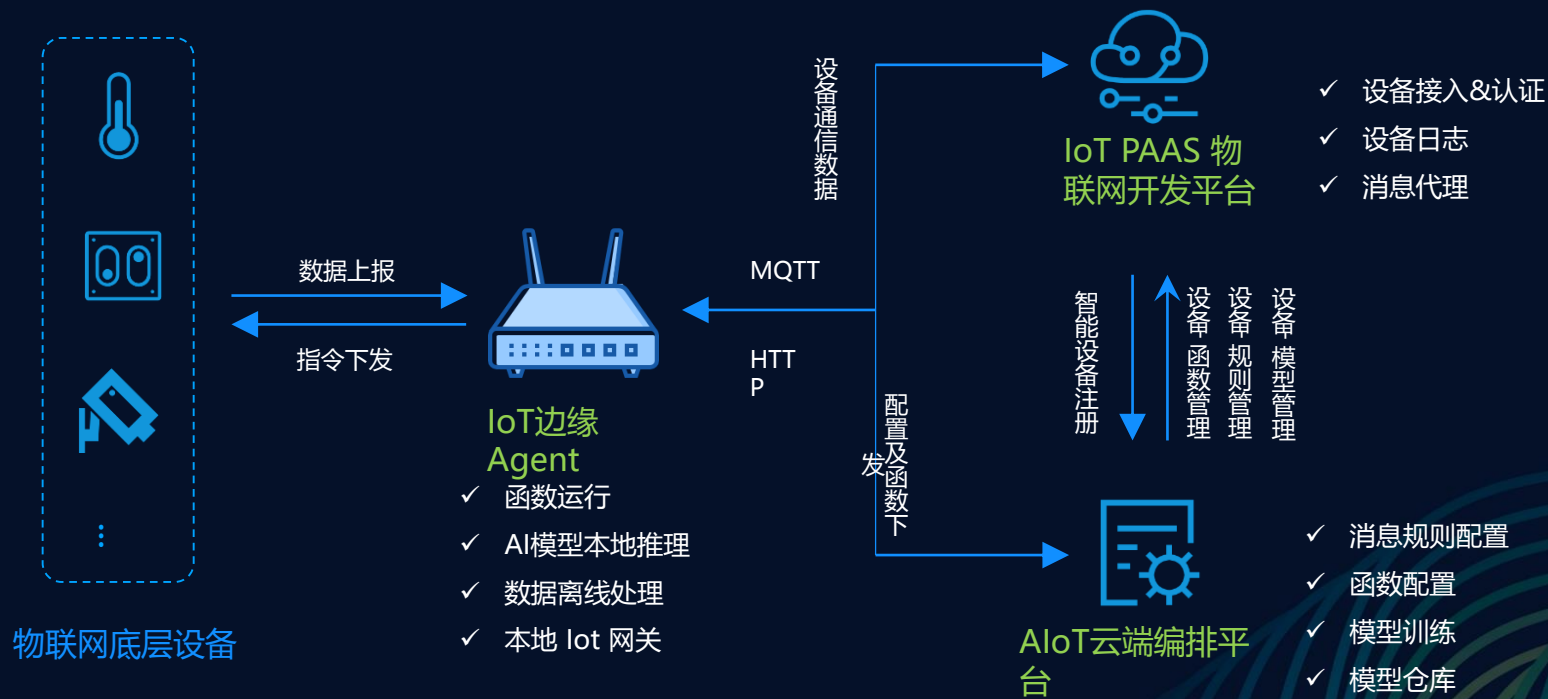


云端下发执行动作

海量连接在本地产生

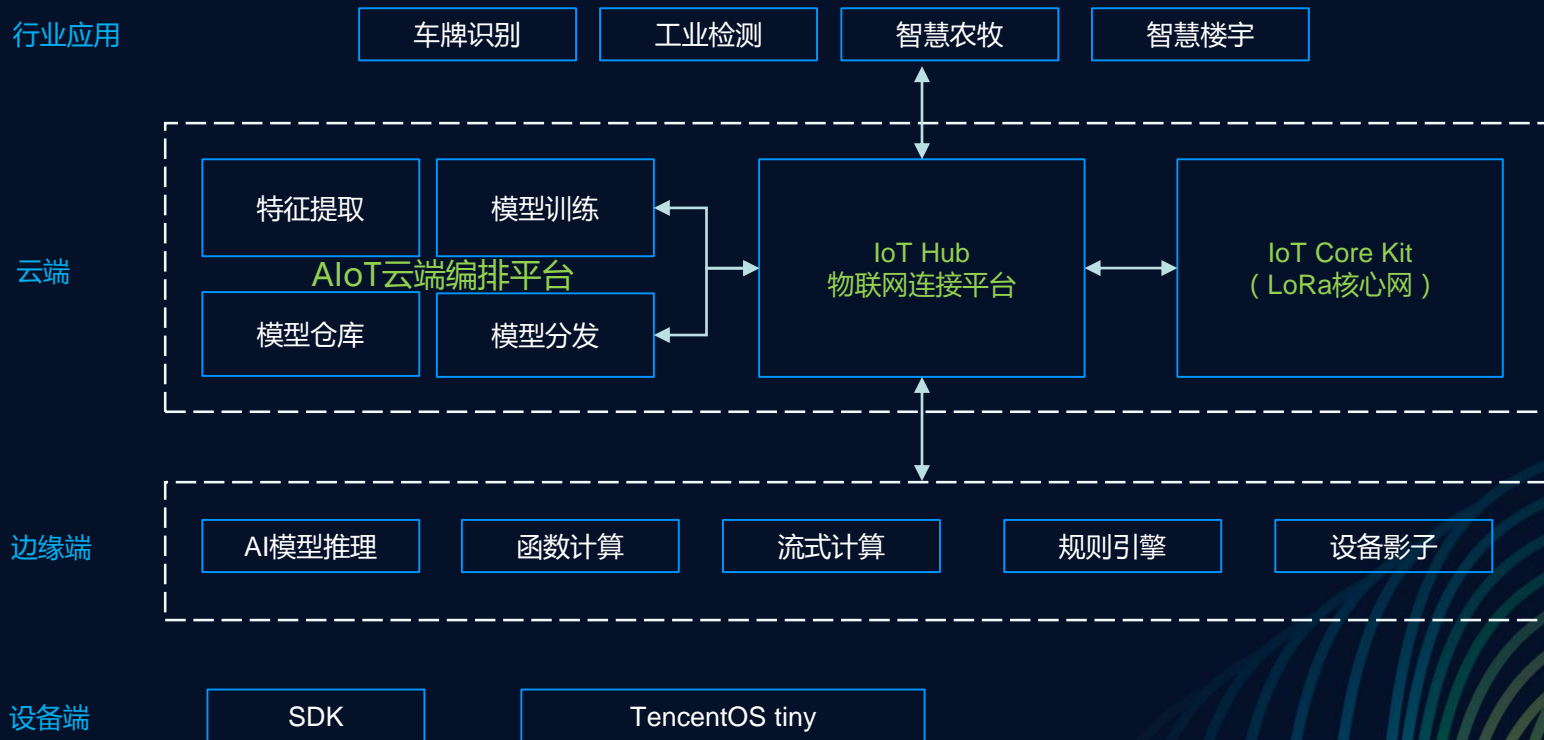
- ✓ 依赖互联网连接
- ✓ 无本地自动化能力，云端控制时延高

# AIoT边缘计算平台



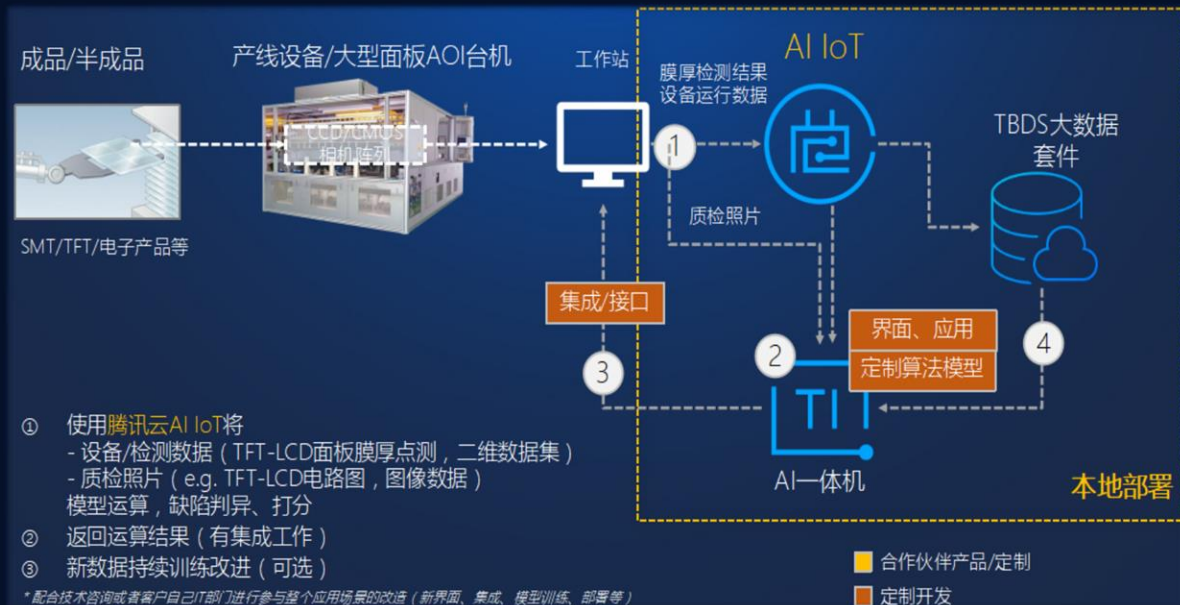
基于x86/ARM，可选内置GPU/VPU

# 腾讯AIoT架构：云-边-端一体化协同





# 工业物联-华星光电 面板缺陷检测



客户需求：

- 替代人力：使用AI来完成缺陷检测和分类
- 优化工艺：提升AOI缺陷分类的准确率和效率
- 预见问题：提前发现和预测同批次基板的膜厚、平均质量系数

实践效果：

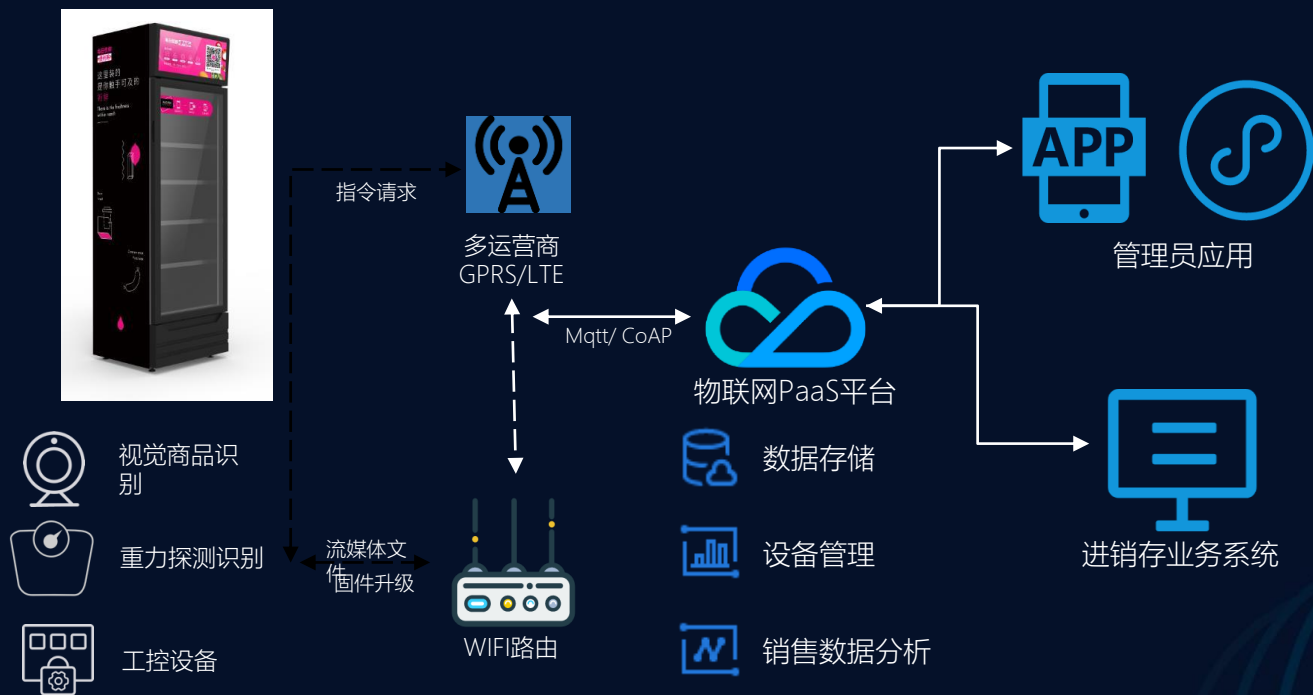
- 准确率90%：TFT电路详细缺陷子分类的识别率
- 提速10倍：TFT电路扫描图缺陷识别速度
- 实时物联：设备数据、测试数据（二维+图像）实时物联

# 消费物联 - 每日优鲜

20000+ 终端货柜

2s 完成商品识别+支付请求

100+ 次交易/天/终端



## 方案亮点：

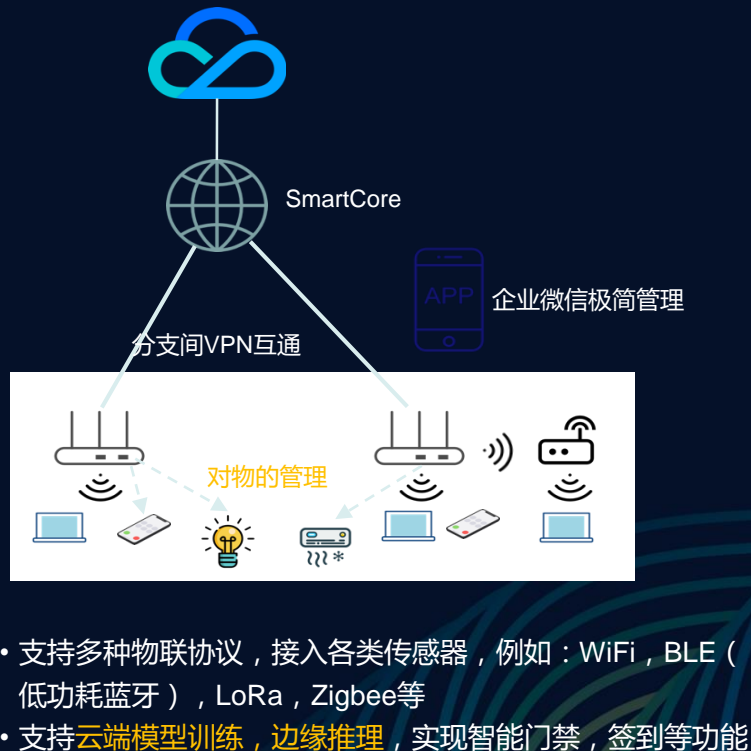
- 1、基于腾讯AI能力、实现多种商品智能识别模式，满足不同货物场景
- 2、精准实时开关柜状态管理
- 3、一键部署云端货柜订单管理系统
- 4、集成微信通知与微信支付，提升用户与交付体验

## 办公物联 – 智慧办公空间

中小企业降本增效需求：提高工作效率，降低企业运行成本

- 对管理者
  - 考勤，各种OA电子流
- 对员工个人
  - 好用的办公网络，文件共享等；
  - 个人关怀（个性化灯光，加湿器，空气质量，温湿度等）
- 对员工协作
  - 在线会议，统一UC通信
  - 会议室管理
    - ✓ 利用传感器检测人员存在，实时释放未使用的会议室
    - ✓ 无线投屏
- 对公司运营
  - 能耗管理（灯，空调，漏水检测）

IoT边缘网关





连接一切、开放共赢

Thank you!



# 智慧网络论坛 AI in Network Seminar – Powered by Beta Labs

## Panel: AI in Network Basic Elements and Roadmap

### 小组讨论：智慧网络的基本要素和实现路径



Moderator 主持:  
**Jessie Chang 刘鸿**  
Head of Ecosystem Engagement,  
Greater China  
大中华区生态圈总经理  
GSMA



**Zhen Gan 甘震**  
AI expert, Intelligent Network Center  
智能网络中心网络AI负责人  
China Unicom 中国联通



**Rulin Xing 邢如林**  
Senior Staff Engineer  
高级资深工程师  
Qualcomm 高通



**Luo Zuo 左罗**  
Director, System Product Marketing  
and Solution  
通讯系统方案部部长  
ZTE 中兴



**Duozhi Zhu 朱多智**  
General Manager, Telecom Network  
Product and Delivery Center  
网络域产品与交付中心总经理  
AsiaInfo 亚信科技





# 智慧网络论坛 AI in Network Seminar – Powered by Beta Labs

**Closing Remarks**  
总结

**Sihan Chen**  
Head of Greater China  
GSMA

