eLTE Brings Yangshan Port Into Automation Era

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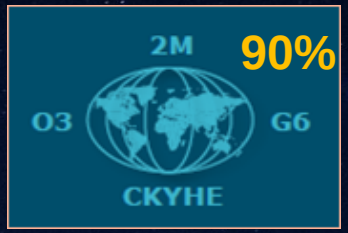
LEADING NEW ICT

Content

Shipping Ports: On The Way To Automation

Megashipping is forcing the port to enhance efficiency

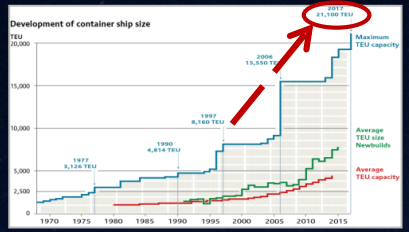
4 Shipping Alliance occupied 90% of global container cross-sea capacity



Source: Maersk Annual Report 2015& Alphaliner 2016

Goods Consolidation

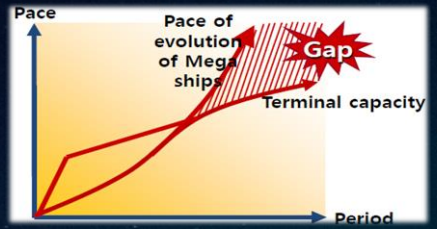
Single-ship capacity rapid growth: doubling in 10 years



Source : OECD / ITF 2015

Terminal capacity

Forcing the port to enhance loading and unloading efficiency



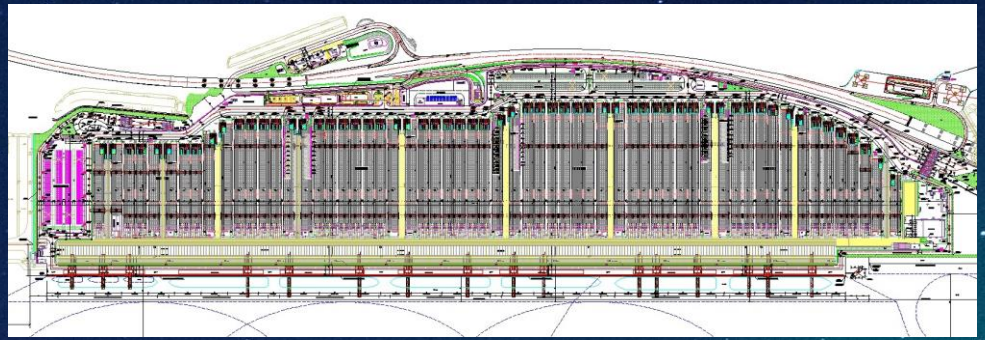
5 Key ICT Innovations

- Autonomous vehicles
- Internet of Things and Big Data
- Robotics and Automation
- Simulation and virtual reality
- Cyber security

Source : DP World

Background on the World's Largest Automation Port: Shanghai Yangshan Port

- Shanghai Yangshan phase IV port will be the world's largest and most-advanced automated port. With a length of 2,350 meters, it provides seven berths.
- 26 double trolley quay cranes (10 of which in the first-phase contract have been available for commissioning)
- 61 stackings and 120 rail-mounted gantry cranes (30 of which in the first-phase contract have been available for commissioning)
- 130 vehicles with automated navigation system (50 of which in the first-phase contract have been commissioned)



Requirements for Automation : Low Latency + High Reliability

AGV controlling

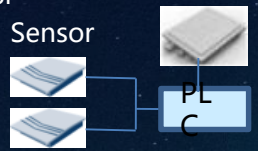
High Reliability + Low Latency

- UL: Transmission of data related to positions, speeds, sap pressures, and batteries
- DL: Transmission of data, such as moving area and turning instruction

RCMS operation

Reliable Connection + Wide Coverage

- Container truck: Container raising and lowering instructions
- Tally: Operation instruction
- Crane monitoring and fault alarm indicator



CCTV @ Wireless

High Speed + Low Latency

- To enable 2k video camera data transmission real time, single connection requires 2Mbps speed.
- As a complementary communication channel, fibre may get broke after certain time usage.

*AGV: Automated Guided Vehicle
RCMS: Remote Crane Monitoring System

Challenges of Traditional Wireless System in Port Deployments

Wireless is easy to be blocked and lead to blind zone

High latency when large amount of devices to access

High failure and service interruption when device move with high speed

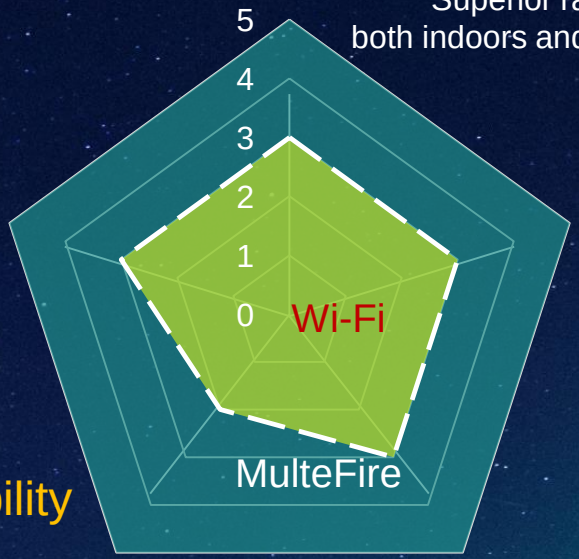
Interference with each other leads to abnormal stop

Limited coverage area ,need more APs and high cost for maintenance

MulteFire Delivers Key Performance Advantages

Coverage
Superior range
both indoors and outdoors

Easy Deployment
Light and small equipment
Less sites for same area



Multi-user Latency
LTE schedule mechanism
guaranteed latency

Industry-grade Reliability
High anti-interference
Customized QoS classes

Seamless Mobility
Seamless handovers
High mobility

And More

LTE-based Security
Both SIM & Non-SIM credentials
LTE authentication and encryption

Future Proof
Rich LTE roadmap: VoLTE/voice,
5G evolution

Content

Based on MulteFire Technologies, eLTE is Born for Industrial Automation

Industrial Wireless

eLTE

Licensed + Unlicensed

Broadband + Narrowband

Easy to Deploy + Easy to maintain

All-in-one wireless

Voice/Video/IoT
Trucking/Positioning

Industry adaptation

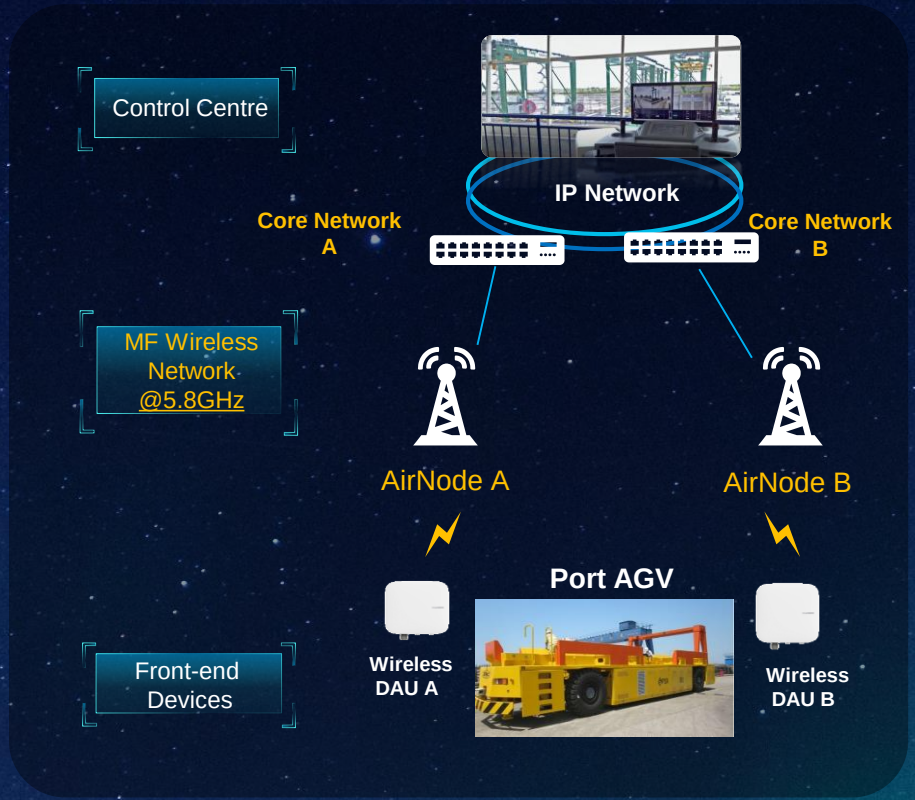
Diverse Terminals
Cloud service engine

Anywhere available

High mobility
Better coverage

eLTE (enterprise LTE) is a Huawei trademark

eLTE-U for Yangshan Port Automation



Low Latency
<30ms @ 60 AGVs

Wide Coverage
2~3 X Wi-Fi, less sites

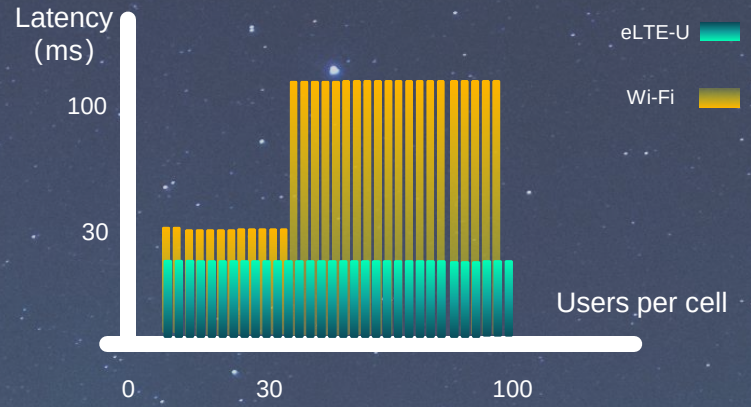
High Reliability
Anti-interference/Redundancy/Encryption

Seamless Mobility
Smooth handover/No interruption

Easy Deployment
Small equipment/Easy maintenance

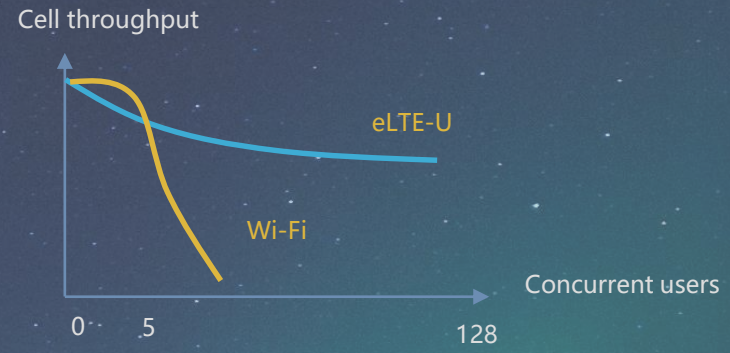
Low Latency @ Multi-user

<30ms latency @ multi-user



Stable low latency as users increasing

Max 128 concurrent users

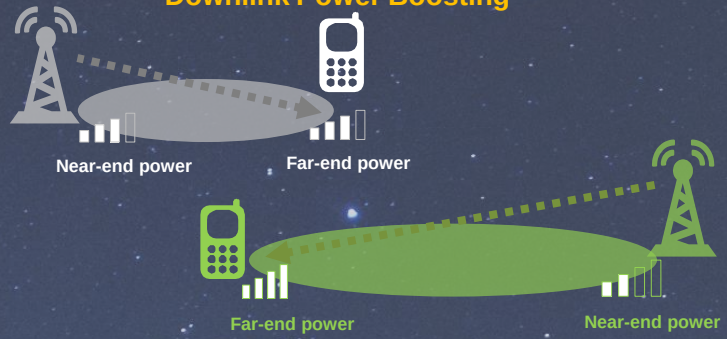


eLTE-U can process concurrent services from 128 terminals with no significant deterioration in throughput.

Unplanned shutdown 50% ↓

Wide Coverage, Less number of Sites for Same Area

Downlink Power Boosting

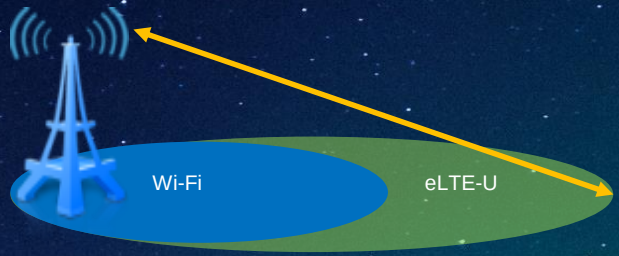


- The transmit power of resource blocking group is adjusted to centralize the power for one PRB.

Uplink TTI Bundling

- Cell edge users with a low signal to interference plus noise ratio in the uplink can retransmit the same data block in continuous sub-frames

2~3 X Wi-Fi Coverage



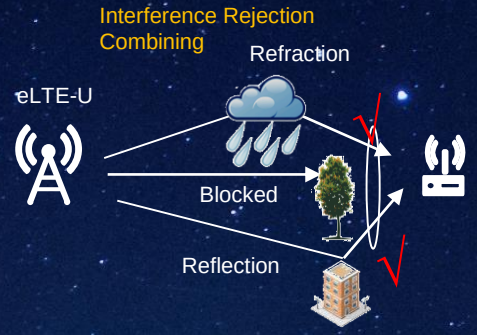
Fewer Sites

No need separate pole installation

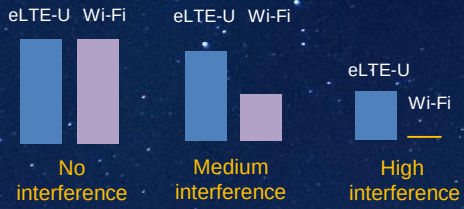
Pole installation costs $1.5 million per pole

Industry-grade Reliability

High Anti-interference



Throughput comparison @ interference

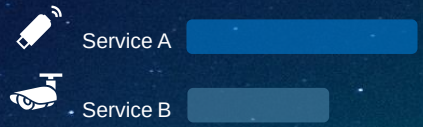


System level redundancy

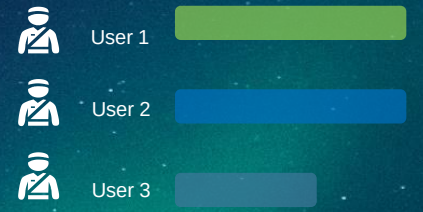
QoS Guarantee

Maximum 9 level QoS guarantee mechanism
Flexible adjustment

Based on business priority



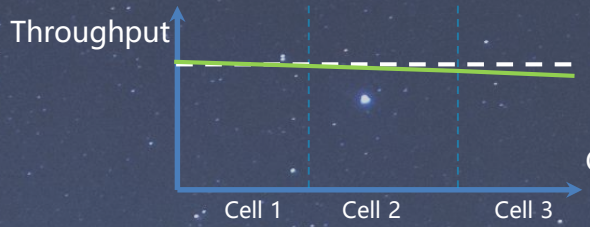
Based on user priority



* The size of the box represents the assigned resource priority

Seamless Mobility

Smooth Handover



Handover without package lose

High Speed Access

Max 160 km/h

Handover latency<50ms for remote control

Ease of Deployment For Self-built Enterprise Network yielding higher efficiency

HUAWEI

Integrated and lite equipment

eCore

3U

1U

One box includes multiple logical network elements

AirNode/AirEdge

290 mm x 210 mm x 85 mm

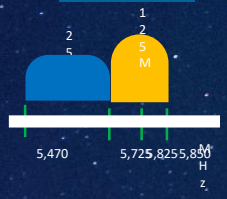
Small base station with PoE power for all installation scenarios

DAU

231 mm x 205 mm x 85 mm

Outdoor data access unit with PoE power, IP67

Unlicensed spectrum



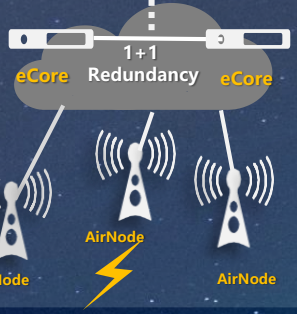
Simplified networking, saving cost

DAU: Data Access Unit

AGV Dispatching Platform

eLTE-U

20m tower，5 AirNodes cover 2000+m shoreline



AGV

AGV

DAU installed in AGV onboard Control Room

Manpower Reduced

4 Man @1 AGV

1 Man@4 AGV

Efficiency Improved

28TEU/HOUR

40TEU/HOUR

Practices of eLTE in diverse industries

Metro

- Reliable CBTC in high speed
- Remote operation

Manufacturing

- Goods tracking
- AGV control
- Robotics monitoring

Industrial Park

- Inspection
- SCADA
- Gas detection

eLTE Makes Metro Smarter – BYD Sky Rail

CBTC

PIS

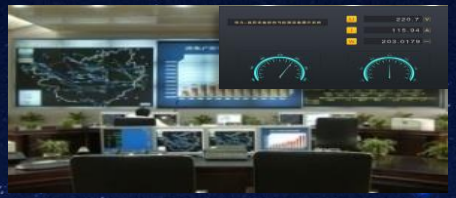
CCTV

Deployed in 9th Flower Expo, China

- **One eLTE-U for all: 5.8 GHz** Unlicensed LTE, for CBTC, PIS and CCTV of Sky Railway
- **Ultra Reliability: 90ms** latency and **0.05%** packet loss
- **High speed: 26Mbps**@uplink and **32Mbps**@downlink for PIS and CCTV
- **Cost-effective: 500m** site interval, low TCO

CBTC: Communication Based Train Control
PIS: Passengers Information System
CCTV: Closed-Circuit Television

eLTE in Digital Factory



Production Visualization

Narrowband IoT

- I/O，Alarm， Status（Rotating speed）
- 1K+ connections per AirNode
- Low power consumption for easy maintenance

Robot Control

Reliable broadband access

- AGV， Robotics
- <50ms latency, avoid abnormal stop
- Stable links when mobile access

Property Management

Narrowband IoT

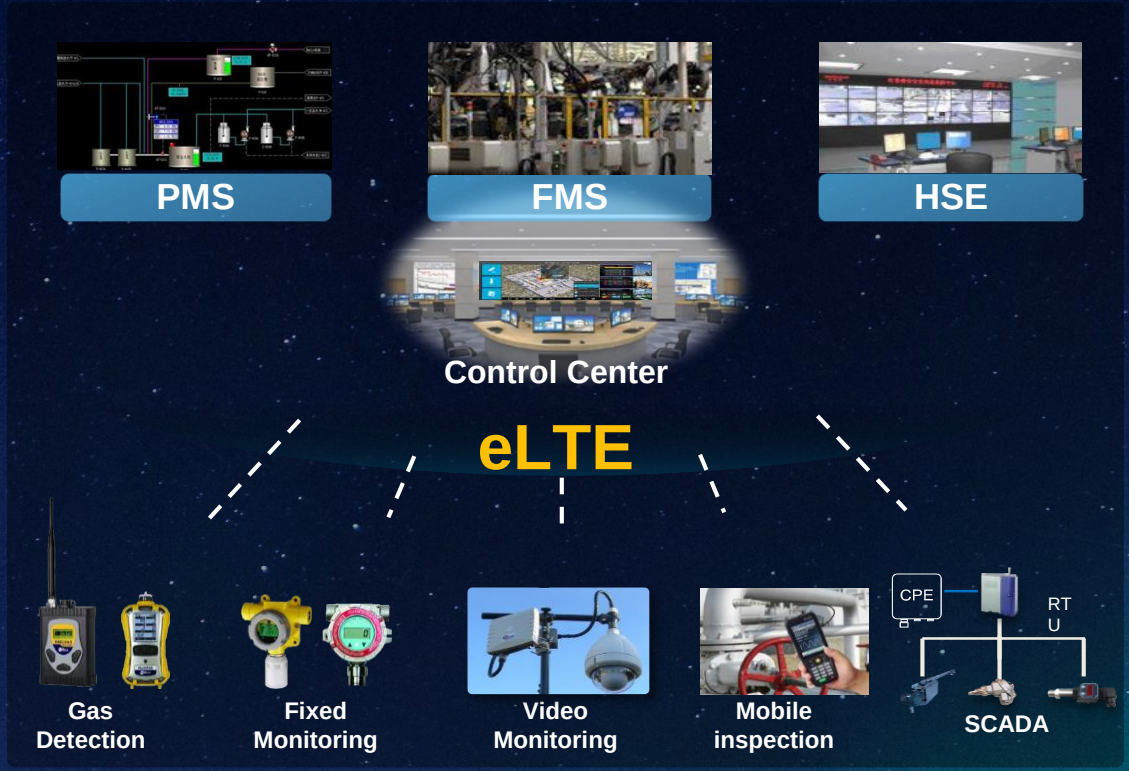
- Periodically reports asset info
- Goods tracking
- Wireless scanner

30%
Production efficiency

20%
Production cost

10%
Management efficiency

eLTE in Industrial Park



Convenient Expansibility

- One network for multiple services
- Production data collection
- GAS Detection
- Automatic inspection

Easy Deployment

- Simple Architecture and light equipment
- Reduce Deployment Cycle by 85%

* 100 monitoring points

High Performance

- Wide coverage, less sites
- High reliability
- High mobility

PMS: Production Management System
PFMS: Precision Flexible Manufacturing System
FMS: Flexible Manufacture System

Openness, Cooperation, Win-win

Openness

Pipeline strategy

Open API

Standard module

Investment

10% Income

5,00+ Employee

Thank you!