3GPP TSG RAN Meeting #79
Chennai, India 19-22, 2018
Agenda Item: 9.1.2
RP-180390

HUAWEI

On NR mMTC Rel-16 use cases:

Support for connecting massive numbers of wireless video cameras

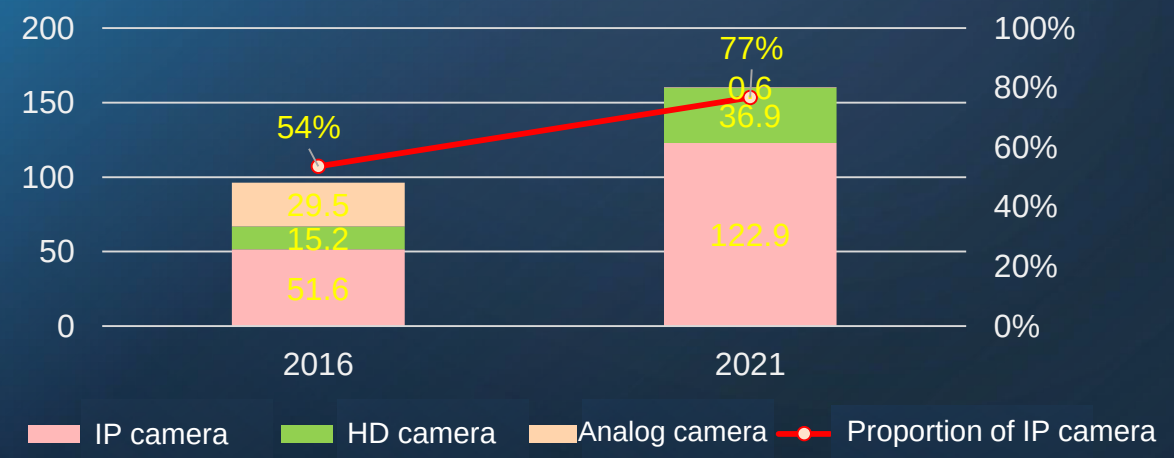
Introduction

- NB-IoT adequately addresses many use cases of the LPWA market
  - Enhancements are being proposed for Rel-16 to expand the use cases for the LPWA market, e.g. improving mobility, latency, etc (RP-180371/RP-180372)
- This paper explores an IoT use case for which opportunities are seen with NR, which do not overlap with the LPWA market addressed by NB-IoT
  - 3GPP RAN should consider approving Rel-16 NR work to define optimized NR support for the IoT market of wireless video surveillance cameras

HUAWEI

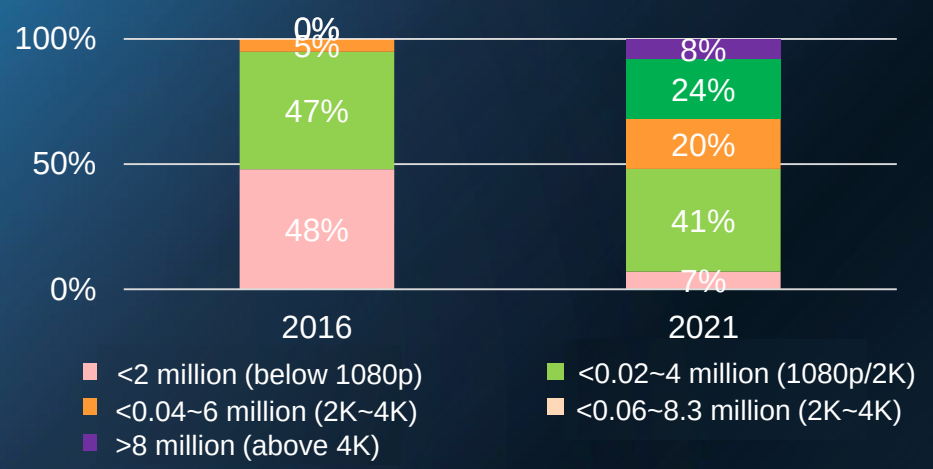
Video surveillance industry with massive connections and huge data traffic is an emerging business opportunity for wireless communications

The annual shipments of surveillance cameras will reach 160 million, where IP cameras account for 77%+, and the demand for networking cameras is continuously rising.



- **In 2016, the number of surveillance cameras in operation reached 200 million, and it is expected to reach 500 million by 2021.**
- **Distribution of the annual surveillance camera shipment:**
  1. About 40% --- replacement of malfunctioned cameras
  2. About 40% --- newly-deployed cameras
  3. About 20% --- camera upgrade

By 2021, the resolution of 90%+ cameras will be higher than 1080p, and 24% of them will be 4K. Thus, the demand for bandwidth is substantially increasing.



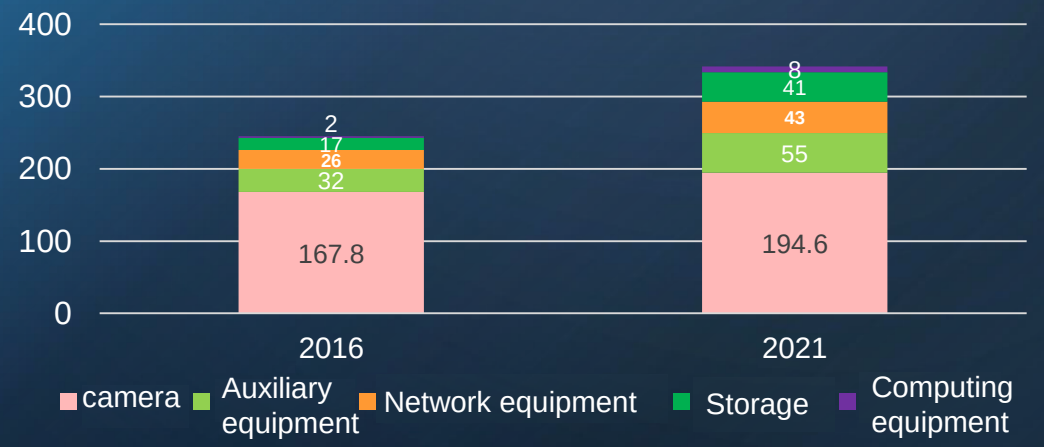
Resolution	720P	1080P	2K	4K
Average bitrate (H.264)	2Mbps	4Mbps	8Mbps	16Mbps
Average bitrate (H.265)	1.5Mbps	**2Mbps**	4Mbps	8Mbps

- *Note: 1) For real-time surveillance with guaranteed quality, the bandwidth required will be 1.2~1.8 times of the average bitrate. 2) Huawei's most advanced H.265 codec based IP camera can reduce the average bitrate to 1Mbps@1080p*

HUAWEI

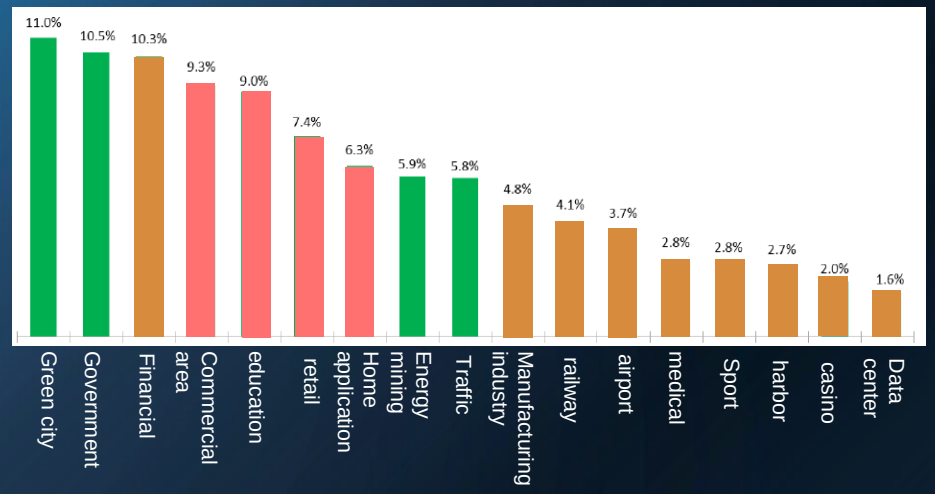
Market space of video surveillance equipment is over $30 billion

Network equipment will reach $4.3 billion by 2021, accounting for 10~15% of the equipment market. Wireless equipment, mainly Microwave and Wi-Fi, took a market share of $0.4 billion in 2016.



- **Video surveillance equipment market of China accounts for 47% of the global market.**
- **E2E market of video surveillance includes cloud computing, MEC, smart analytics, storage, networks, cameras…**

- **The market is diverse, but nearly half of it is for heavy-weight industry and outdoor monitoring.**
- **We provide both solutions with dedicated network or operator's public cellular networks.**



Public cellular network

For small enterprises, operators can be a wholesale CCTV service provider.

Dedicated network

For large enterprises, outdoor, medium-area coverage.

Hybrid network

Other cases, partially dedicated network, and partially public cellular network.

HUAWEI

Wireless video surveillance meant to meet essential demand with low cost (market share ~30%)

- Fiber-only solution cannot be deployed in numerous video surveillance scenarios.
- Wireless solution becomes essential to meet these challenging demands.

➢ Third-tier/fourth-tier cities lack of fiber resources (about 15%)

Case : Public security project of Tuoketuo, Inner Mongolia, China

➢ Areas of metropolis are forbidden from excavation, (about 10%)

Case : Qianmen, Chongwen district, Beijing, China

➢ Some areas with non- rigid pavement are difficult to deploy fiber, (about 5%)

Case : People' s park, Zibo, Shandong, China

- Wireless backhaul may reduce the cost by about 60% compared to fiber backhaul.
- Wireless solution is competitive for cost-sensitive enterprises (no cost for renting tower).

Methods of deployment	Total cost	Cost ratio
70km fiber-deployment	840000	100%
Microwave with small new sites	486700	58%
Wireless solution with existing base tower (cost of renting the tower not included)	299900	36%
Wireless solution with existing base tower (cost of renting the tower included)	655100	78%

1. Wireless backhaul enjoys an advantage in cost when the distance between monitoring point and aggregation point is greater than 50 meters.
   - *Cost of deploying fiber: 200 RMB/meter*
   - *A single monitoring point usually accommodates 2~3 cameras. Thus, cost of backhauling 2~3 wireless links is needed*
2. Other advantages of wireless solution: better scalability, fast deployment.

HUAWEI

Enhancing uplink capacity and reducing the per-bit cost are critical for enabling connection to the massive data demands of wireless video cameras

The number of surveillance cameras in dense urban areas is set to increase rapidly in the next few years, reaching 100+ cameras/km²

Public security departments require 24/7 real-time video surveillance, including 1080p video in dense urban settings

The number of video surveillance cameras in central areas of Shenzhen, China: 67 659, which translates to average: ~80 cameras/km²

LTE vs. NR sub-6G
capability for supporting wireless video surveillance (uplink)

Compared with fiber-based solution, the per-bit data cost of wireless video surveillance has to be reduced.

Rental Method	Technology	Cost
Rental of wired-networks	*HEVC flow* *HEVC flow*	**10000 RMB/Year/Camera**
Rental of wireless networks	*HEVC flow* *HEVC flow*	**35000 RMB/Year/Camera**
Rental of wireless networks	*SHVC flow*	**20000 RMB/Year/Camera**

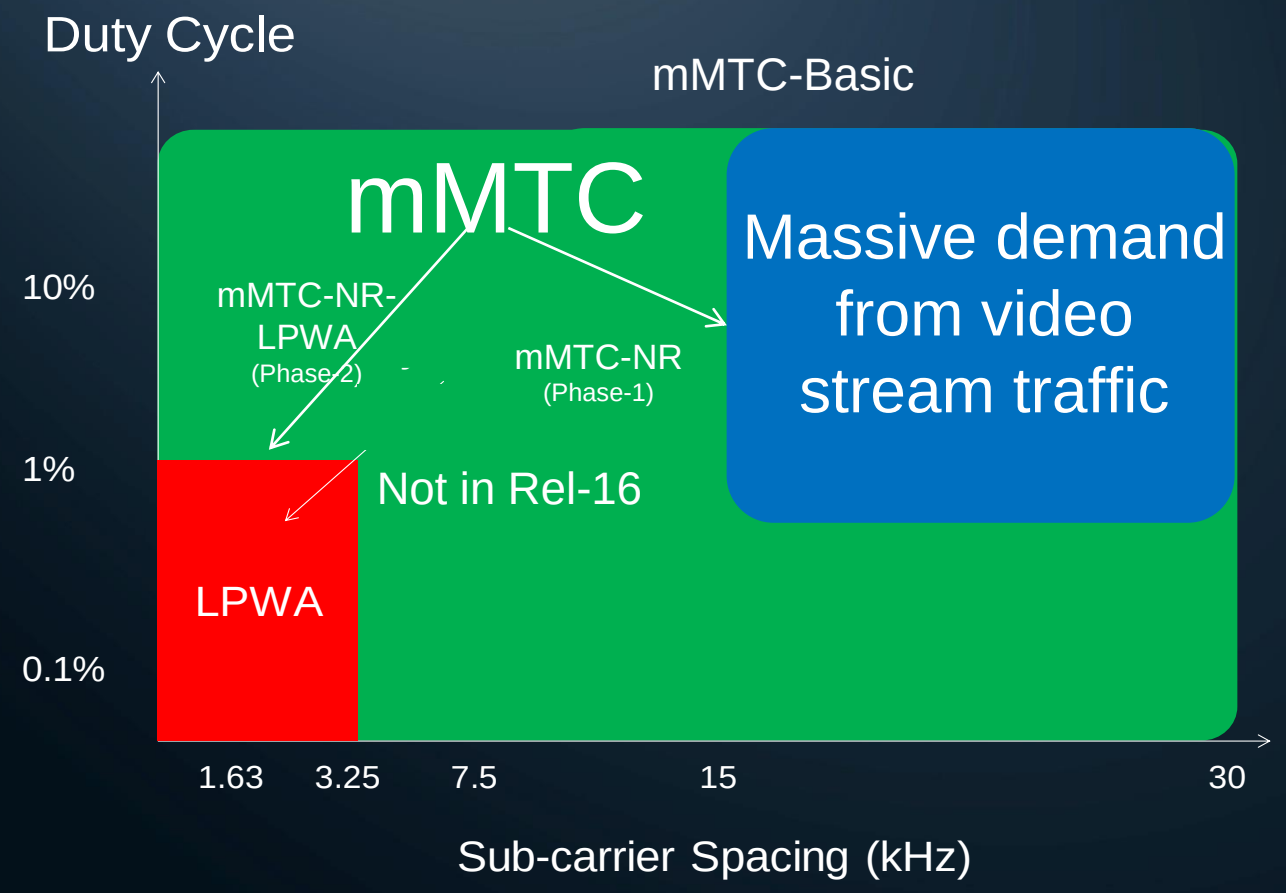
Reduction of UL capacity demand by video streaming is needed

- *SHVC: About 30%-40% bitrate reduction compared to its HEVC simulcast counterpart.*
- *Pre-processing and analysis of image stream to compress video data*
- *Network scheduling which is sensitive to particular characteristics of video streaming, e.g. unequal priority of different parts of the stream*

HUAWEI

NR mMTC Use-cases

Computer Vision: Opportunities and Challenges



Enabling Features

- UL NoMA
- UL Grant Free
- UL Closed Loop MIMO
- UL UE cooperation
- UL MU-MIMO
- UL Joint Reception

Conclusion

- Enhancing uplink capacity and reducing the per-bit cost are critical for enabling NR to connect massive numbers of wireless video cameras with high data-rate demands:
  - Characteristics of video traffic include QoE influenced by unequal importance in data: frame type, position of bits representing pixels
  - A terminal-network collaborative solution based on special video features can allow improving effective uplink capacity and reducing bandwidth demand
- Rel-16 mMTC should include optimization of NR for this use case

HUAWEI

Copyright©2018 Huawei Technologies Co., Ltd. All Rights Reserved.
The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.