

# Security for 5G

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# **Security standards for 5G**

## **More of the same**

### **Or**

## **What's new?**









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# Agenda

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- **Review of 5G Requirements**
- **Security Impact Analysis**
- **Call to Action**

# NGMN Use Cases

<p><b>Broadband access in dense areas</b></p> <p><b>PERVASIVE VIDEO</b></p> 	<p><b>Broadband access everywhere</b></p> <p><b>50+ MBPS EVERYWHERE</b></p> 	<p><b>Higher user mobility</b></p> <p><b>HIGH SPEED TRAIN</b></p> 	<p><b>Massive Internet of Things</b></p> <p><b>SENSOR NETWORKS</b></p> 
<p><b>Extreme real-time communications</b></p> <p><b>TACTILE INTERNET</b></p> 	<p><b>Lifeline communications</b></p> <p><b>NATURAL DISASTER</b></p> 	<p><b>Ultra-reliable communications</b></p> <p><b>E-HEALTH SERVICES</b></p> 	<p><b>Broadcast-like services</b></p> <p><b>BROADCAST SERVICES</b></p> 

Use case category	User Experienced Data Rate	E2E Latency	Mobility
Broadband access in dense areas	DL: 300 Mbps UL: 50 Mbps	10 ms	On demand, 0-100 km/h
Indoor ultra-high broadband access	DL: 1 Gbps, UL: 500 Mbps	10 ms	Pedestrian
Broadband access in a crowd	DL: 25 Mbps UL: 50 Mbps	10 ms	Pedestrian
50+ Mbps everywhere	DL: 50 Mbps UL: 25 Mbps	10 ms	0-120 km/h
Ultra-low cost broadband access for low ARPU areas	DL: 10 Mbps UL: 10 Mbps	50 ms	on demand: 0-50 km/h
Mobile broadband in vehicles (cars, trains)	DL: 50 Mbps UL: 25 Mbps	10 ms	On demand, up to 500 km/h
Airplanes connectivity	DL: 15 Mbps per user UL: 7.5 Mbps per user	10 ms	Up to 1000 km/h
Massive low-cost/long-range/low-power MTC	Low (typically 1-100 kbps)	Seconds to hours	on demand: 0-500 km/h
Broadband MTC	See the requirements for the Broadband access in dense areas and 50+Mbps everywhere categories		
Ultra-low latency	DL: 50 Mbps UL: 25 Mbps	<1 ms	Pedestrian
Resilience and traffic surge	DL: 0.1-1 Mbps UL: 0.1-1 Mbps	Regular communication: not critical	0-120 km/h
Ultra-high reliability & Ultra-low latency	DL: From 50 kbps to 10 Mbps; UL: From a few bps to 10 Mbps	1 ms	on demand: 0-500 km/h
Ultra-high availability & reliability	DL: 10 Mbps UL: 10 Mbps	10 ms	On demand, 0-500 km/h
Broadcast like services	DL: Up to 200 Mbps UL: Modest (e.g. 500 kbps)	<100 ms	on demand: 0-500 km/h

Use case category	Connection Density	Traffic Density
<b>Broadband access in dense areas</b>	200-2500 /km <sup>2</sup>	DL: 750 Gbps / km <sup>2</sup> UL: 125 Gbps / km <sup>2</sup>
<b>Indoor ultra-high broadband access</b>	75,000 / km <sup>2</sup> (75/1000 m <sup>2</sup> office)	DL: 15 Tbps/ km <sup>2</sup> (15 Gbps / 1000 m <sup>2</sup> ) UL: 2 Tbps / km <sup>2</sup> (2 Gbps / 1000 m <sup>2</sup> )
<b>Broadband access in a crowd</b>	150,000 / km <sup>2</sup> (30.000 / stadium)	DL: 3.75 Tbps / km <sup>2</sup> (DL: 0.75 Tbps / stadium) UL: 7.5 Tbps / km <sup>2</sup> (1.5 Tbps / stadium)
<b>50+ Mbps everywhere</b>	400 / km <sup>2</sup> in suburban  100 / km <sup>2</sup> in rural	DL: 20 Gbps / km <sup>2</sup> in suburban UL: 10 Gbps / km <sup>2</sup> in suburban DL: 5 Gbps / km <sup>2</sup> in rural UL: 2.5 Gbps / km <sup>2</sup> in rural
<b>Ultra-low cost broadband access for low ARPU areas</b>	16 / km <sup>2</sup>	16 Mbps / km <sup>2</sup>
<b>Mobile broadband in vehicles (cars, trains)</b>	2000 / km <sup>2</sup> (500 active users per train x 4 trains, or 1 active user per car x 2000 cars)	DL: 100 Gbps / km <sup>2</sup> (25 Gbps per train, 50 Mbps per car) UL: 50 Gbps / km <sup>2</sup> (12.5 Gbps per train, 25 Mbps per car)
<b>Airplanes connectivity</b>	80 per plane 60 airplanes per 18,000 km <sup>2</sup>	DL: 1.2 Gbps / plane UL: 600 Mbps / plane
<b>Massive low-cost/long-range/low-power MTC</b>	Up to 200,000 / km <sup>2</sup>	Non critical
<b>Broadband MTC</b>	See the requirements for the Broadband access in dense areas and 50+Mbps everywhere categories	
<b>Ultra-low latency</b>	Not critical	Potentially high
<b>Resilience and traffic surge</b>	10,000 / km <sup>2</sup>	Potentially high
<b>Ultra-high reliability &amp; Ultra-low latency*</b> (* the reliability requirement for this category is described in Section 4.4.5)	Not critical	Potentially high
<b>Ultra-high availability &amp; reliability*</b> (* the reliability requirement for this category is described in Section 4.4.5)	Not critical	Potentially high
<b>Broadcast like services</b>	Not relevant	Not relevant

# Explicit 5G security requirements

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- **Subscriber authentication**
- **User privacy**
- **Beyond hop-by-hop security**
- **Network security**

# **Security Impacts**

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# Availability 99.999%

➤ Not only requirement but promise?

➤ Could be

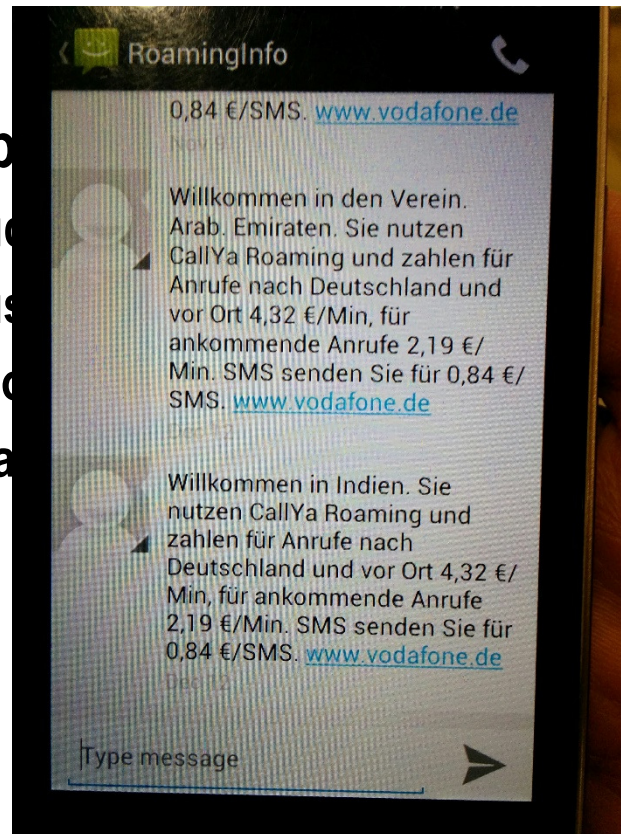
❖ Cloud

❖ Intrus

❖ Remo

❖ Upda

➤ But:



➔ Don't rely on availability

# Ultra low latency

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Ultra-high reliability & Ultra-low latency	DL: From 50 kbps to 10 Mbps; UL: From a few bps to 10 Mbps	Critical 1 ms
Ultra-high availability	DL: 10 Mbps	10 ms

- Includes transmission and verification of integrity check
- Quick check: 32bit message authentication code (MAC)
  - ❖ UL transmission in 1ms: 32kbps minimum speed
  - ❖ Assuming only one MAC
- Integrity check at multiple layers:
  - ❖ Radio access network / end to end

➔ New approach to integrity protection required

# Internet of things – authentication

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## ➤ What to authenticate?

- ❖ Subscriber
- ❖ Device
- ❖ Service

## ➤ Business view:

- ❖ Which party is authenticator?
  - Access provider?
  - Service provider?
- ❖ Who owns authentication data?

## ➤ Technical view

- ❖ Efficiently authenticate >50billion devices

**➔ New approach to authentication required**

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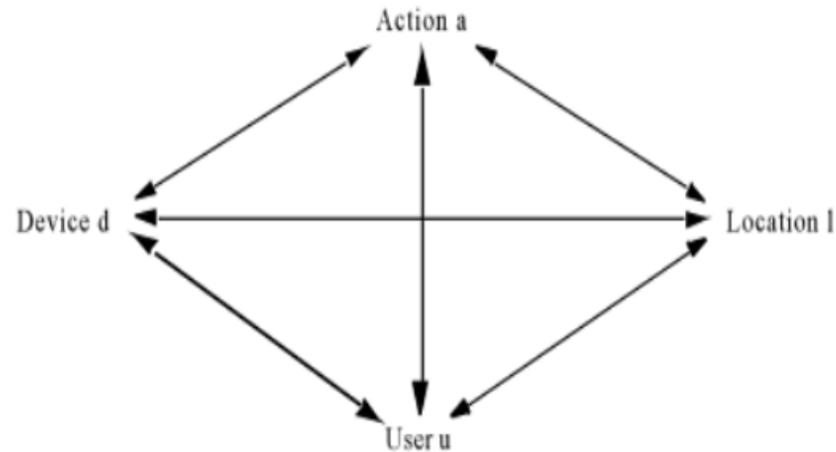
# Internet of things: traffic model

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- **Requirement**
  - ❖ > 15 years of battery life
- **Traffic model**
  - ❖ Infrequent small amount of data transfer
- **Security view**
  - ❖ Not only protocol, but also implementation
  - ❖ Software updates
    - Updates as frequent as data transfers
    - Not small amount of data

**➔ New approach to software patching required**

# Privacy



- Multiple devices per user
- Device temporary identifiers can be linked together

➔ New approach to user untraceability required

# New Applications



- New codecs required
- Security considerations
- Information leakage over side channels
  - ❖ Timing
  - ❖ Packet length



Uncle Milton Toys  
<http://www.amazon.com/Star-Wars-Science-Darth-Robotic/dp/B001UZN2Q>

➔ No variable bitrate codecs!

# Integration of Verticals

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- **Anything as a service**
- **Network sharing**
- **Connectivity providers**
- **Open APIs**
  
- **Who „owns“ the customer relationship?**
- **Where does authentication take place?**
- **Who gets access to which data**

**➔ Trust models may need redefinition**

# Regulatory Requirements

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- **National privacy regulation**
- **Lawful interception required in most countries**
  
- **Transnational over the top service providers**

**→ Update of regulatory definitions**

- **Spectrum licences**
- **Spectrum sharing**

**→ Detecting, identifying and deterring illegal spectrum users**

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## **Call to action**

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# Conclusion

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- **5G introduces new security issues**
  - **Requires rethinking**
  - **Opportunity for research to become relevant**
- ➔ The window of opportunity is NOW!**

# Thank you for your attention



<http://www.gamingpsych.com/a-definition-of-critical-thinking-2/>