# Coexistence of H2H and M2M types of connections in LTE technology

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# Objectives

# SMART CITY

#### Requirements:

- Enabling M2M communication
- Satisfying "Plug&Play" principle

Solution: Exploiting LTE network



**Question**: Is LTE able to support both M2M and H2H communications? **Objective**: Simulating a Smart City scenario and testing network

performances with NS3

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# Connection Release - LENA+ Extension

- NS3's LENA module was designed as connection-oriented
- Didn't support Connection Release, only handovers
- Many devices
  - $\Rightarrow$  We need Connection Release!
  - ⇒ SRS Periodicity needed to be increased!



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# M2M Communications

 $\begin{array}{l} \mbox{Self-intercommunicating devices} \Rightarrow \mbox{IoT and Smart-Cities} \\ \mbox{Huge growth: } +34\% \mbox{ annual from 2016 to 2021 (Cisco)} \\ & 50.000 \mbox{ devices per cell site (3GPP)} \end{array}$ 

- short packets
- small # packets

#### Features:

- uplink-dominant
- low duty-cycle packets

 $\downarrow$  5G requirements are outlined



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# H2H Communications

Communications between humans: Smartphones, Laptops, Modems. HTCs provide different type of services (VoIP, Video-Streaming, Gaming,...)

### Heterogeneous traffic:

- Packets of different sizes
- Variable # packets per transmission
- No evident temporal statistic for the access on the channel



Inter-arrival time of RACH request



G. Foddis, R. G. Garroppo, "On RACH preambles separa-

tion between human and machine type communication"

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# System Model

#### M2M Periodic Traffic Model (3GPP)

- APP-layer payload size  $\rightarrow$ Pareto distribution (lpha = 2.5, [20,200] Bytes)
- Header = 65 Bytes (CoAP, DTLS, UDP and IP headers)
- Half of devices has ACK in downlink (payload size = 0)

#### H2H Traffic Model (UMTS study)

We built a custom On-Off application to model Hyper-exp inter-arrival and:



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# Three Scenarios:

Simulation Time = 30 minScale-down from 50.000 (3GPP) to 400 MTDs

- 1) H2H only: 100, 200, 400, 800
- H2H: 400
  M2M with transmission period = 90 s: 50, 100, 200, 400
- 3) H2H: 400
  M2M: 200
  M2M transmission period: 8, 15, 30, 60, 90 s

# Measured performances:

- Packet-loss
- Average end-to-end delay
- Total throughput
- User throughput

H2H Results

# H2H Results



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#### H2H Results



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#### Conclusions

M2M communications do not seem to have a great impact on the network performances, excluding extreme cases

#### Future Works and Improvements

- Modeling H2H downlink traffic
- Implementing M2M traffic following exactly 3GPP standards:
  - $\cdot~\sim$  50.000 MTDs per hex-sector
  - MTDs express a periodic traffic with different periods
  - · Poisson Traffic
- Considering a bigger scenario

