New Services for 5G: Smart Cities

Taylor Spencer

The Expanding Internet of Things

- The number of devices on the Internet is expected to expand to 50 billion by 2025 (Sachs 5).
  - Machine-to-machine communication will spread into all facets of society – “everything that benefits from being connected will be connected” (Sachs 6).

(“Hyper Text Coffee Pot Control Protocol”)

The Expanding Internet of Things

- Devices in the Internet of Things can be grouped into three categories:
  - Meters and Sensors
  - Intelligent Transport Systems
  - Critical Communication

(Sachs 7)

(“Internet of things”)

Meters and Sensors

- Meters and sensors are small, simple, low-cost, use little energy, and have long-range coverage (Sachs 7).

Intelligent Transport Systems

- Intelligent transport systems connect vehicles, transport infrastructure, and transport management, including safety-related services.
  - These devices need low delay communication with a high degree of mobility.

(Sachs 7)

(UrbanGrammar)

Critical Communication

- Critical communication systems consist of distributed embedded control and cyber-physical systems.
  - These devices require high reliability and availability, low delay, and are run autonomously.

(Sachs 7)

(“Variable-message sign”)

What is a Smart City?

- There is neither a single framing template nor a one-size-fits-all definition of smart city (Nam & Pardo 2).
  - A smart city is best described as an instrumented, interconnected, and intelligent city that seeks to connect its infrastructure and components to better optimize its resources and services to citizens (Nam & Pardo 3).

(Pedro Szekely)

Meters and Sensors in Smart Cities

- Meters and sensors could be used to monitor infrastructure in smart cities, including:
  - Availability of Parking Lots
  - Status of Trash Containers (how full are are they?)

(Sachs 17)

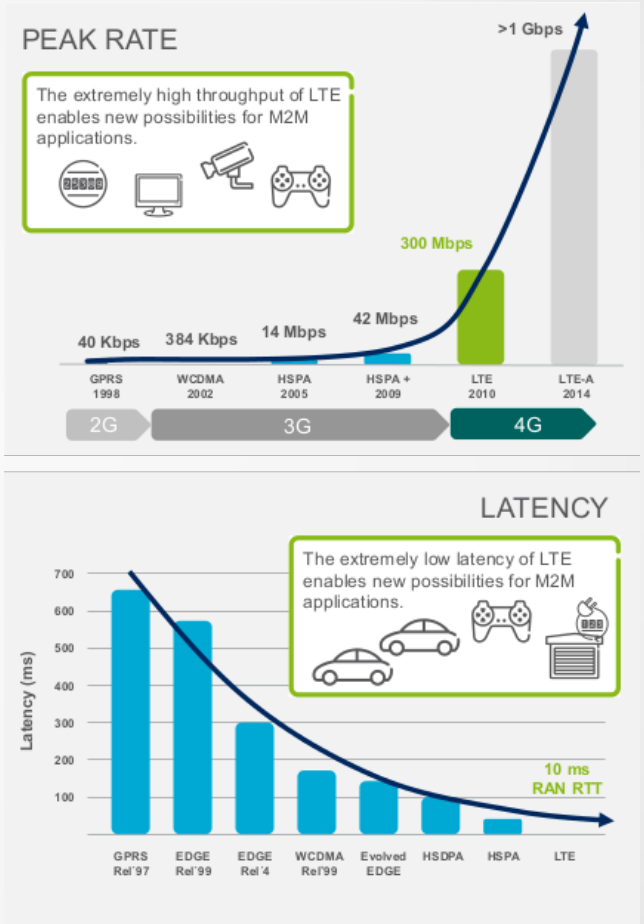
Intelligent Transport Systems in Smart Cities

- Machine-to-machine communications will play an important role in connecting cars and buses with traffic lights, trams, roads with embedded sensors, and emergency crews (Zhang et al. 3).

("Radio-frequency identification")

Machine-to-Machine Performance

- The extremely high throughput and low latency of LTE and the upcoming 5G enables new possibilities for machine-to-machine applications, such as those used in smart cities (Sachs 8).



(Sachs 8)

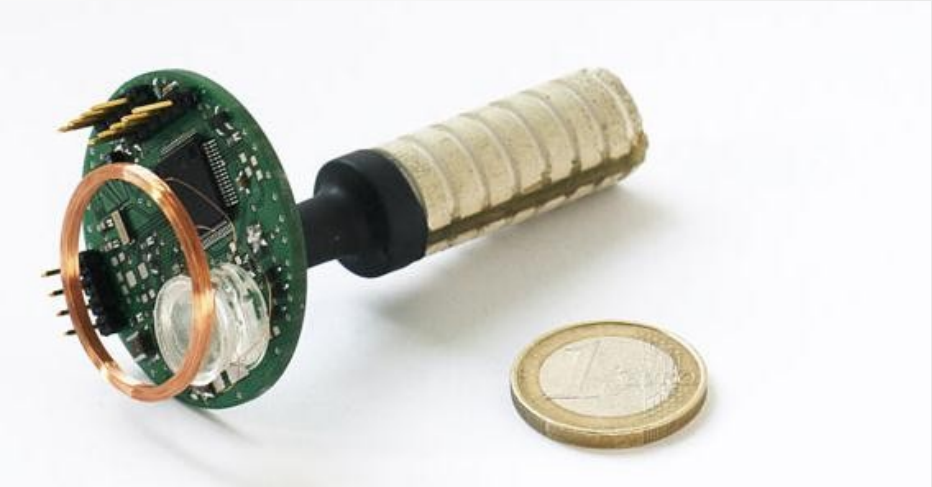
Applications of M2M Technology in Smart Cities

- Meters and sensors can be used to monitor traffic in a city.
  - The city of Zargoza, Spain used a system of 150 sensors to monitor the traffic on its roads by detecting mobile devices (Haubensak 37).

(Haubensak 37)

Applications of M2M Technology in Smart Cities

- Meters and sensors can also be used to detect road conditions in a city.
  - The city of Braunschweig, Germany, worked with the Fraunhofer institute to develop a new sensor to detect the buildup of rust in bridges (Haubensak 38).



(Haubensak 38)

Machine-to-Machine Challenges

- Increased Traffic
  - Large numbers of M2M devices can cause serious system challenges in regards to congestion and overload (Chin, Fan, & Haines 5).

(Sachs 10)

Machine-to-Machine Challenges

- Security
  - The unattended nature of M2M presents an opportunity for attackers to compromise M2M nodes (Lu et al. 3).
  - Additionally, the nature for these nodes to switch into sleep mode makes these attacks harder to detect (Lu et al. 3).

Machine-to-Machine Challenges

- Privacy
  - In certain M2M applications, such as e-healthcare systems, compromise of information could cause negative consequences (Lu et al. 6).

Works Cited (Images)

“Hyper Text Coffee Pot Control Protocol.” Wikipedia, the free encyclopedia 14 Nov 2014. 15 Nov 2014. <http://en.wikipedia.org/w/index.php?title=Hyper_Text_Coffee_Pot_Control_Protocol&oldid=632174682>.

“Internet of things.” 15 Nov 2014. <http://dadallone.deviantart.com/art/Internet-of-things-160576482>.

UrbanGrammar. “Flexible, Personal Transport.” Flickr 18 Aug 2013. 15 Nov 2014. <https://www.flickr.com/photos/22392855@N08/10564209134/>.

“Variable-message sign.” Wikipedia, the free encyclopedia 14 Nov 2014. 15 Nov 2014. <http://en.wikipedia.org/w/index.php?title=Variable-message_sign&oldid=618776219>.

Works Cited (Images)

Pedro Szekely. “Toronto Yonge-Dundas Square.” Flickr 14 May 2010. 15 Nov 2014. <https://www.flickr.com/photos/pedrosz/5173748531/>.

“Radio-frequency identification.” Wikipedia, the free encyclopedia 5 Nov 2014. 15 Nov 2014. <http://en.wikipedia.org/w/index.php?title=Radio-frequency_identification&oldid=632541964>.

Works Cited

Sachs, Joachim. “Potential of LTE for Machine-to-Machine Communication.” : n. pag. 14 Nov 2014. <http://www.gcl.i.u-tokyo.ac.jp/wp-content/uploads/2013/11/20131128Joachim.pdf>.

Nam, Taewoo, and Theresa A. Pardo. “Conceptualizing smart city with dimensions of technology, people, and institutions.” ACM Press, 2011. 282. 14 Nov 2014. <http://libproxy.library.unt.edu:2235/citation.cfm?id=2037602>.

Works Cited

Haubensak, Oliver. “Smart cities and internet of things.” Business Aspects of the Internet of Things, Seminar of Advanced Topics, ETH Zurich. 2011. 33–39. 15 Nov 2014. <http://www.im.ethz.ch/education/FS11/iotsem11_proceedings.pdf#page=33>.

Zhang, Yan et al. “Cognitive machine-to-machine communications: visions and potentials for the smart grid.” IEEE Network 26.3 (2012) : 6–13.

Works Cited

Chin, Woon Hau, Zhong Fan, and R. Haines. “Emerging technologies and research challenges for 5G wireless networks.” IEEE Wireless Communications 21.2 (2014) : 106–112.

Lu, Rongxing et al. “GRS: The green, reliability, and security of emerging machine to machine communications.” IEEE Communications Magazine 49.4 (2011) : 28–35.