



The Internet of e-Bikes

Presentation at the workshop “Cellular Internet of Things”
organised by VDE/ITG Section 5.2.4 “IP and Mobility”
at TU Munich on 01.12.2017
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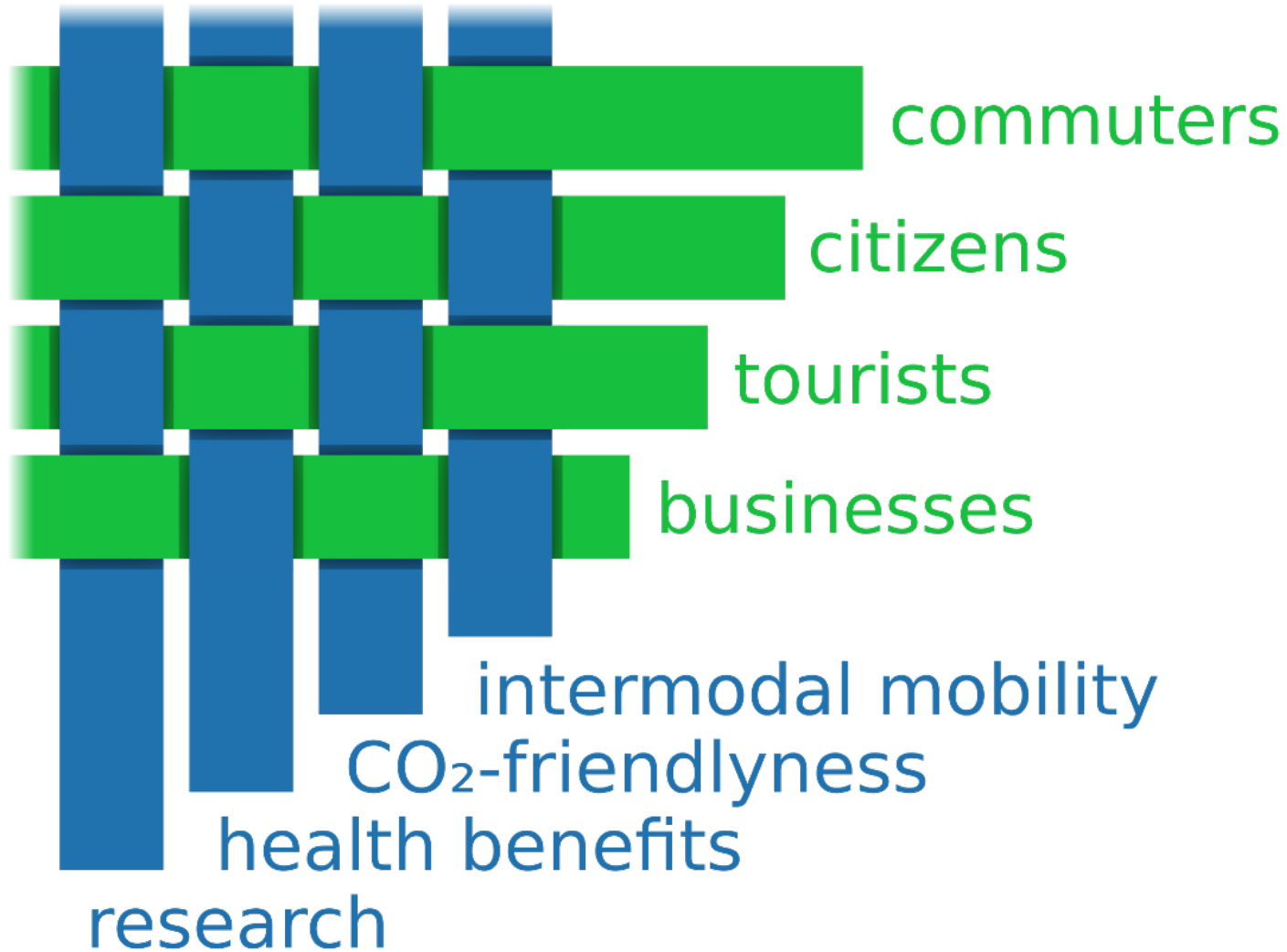


Internet of Things



**Internet
of Things**

Benefits for Society



health monitoring

predictive maintenance

mobile air quality
monitoring

quantified self



big potential through ICT

macroscopic
usage patterns

traffic monitoring

driver assistance

road condition
monitoring



Vision

help understand and establish e-Bikes
as sustainable means of transportation
in the context of mobility 4.0
by using big data and IoT technologies



Areas of Research

environment

bicyclist

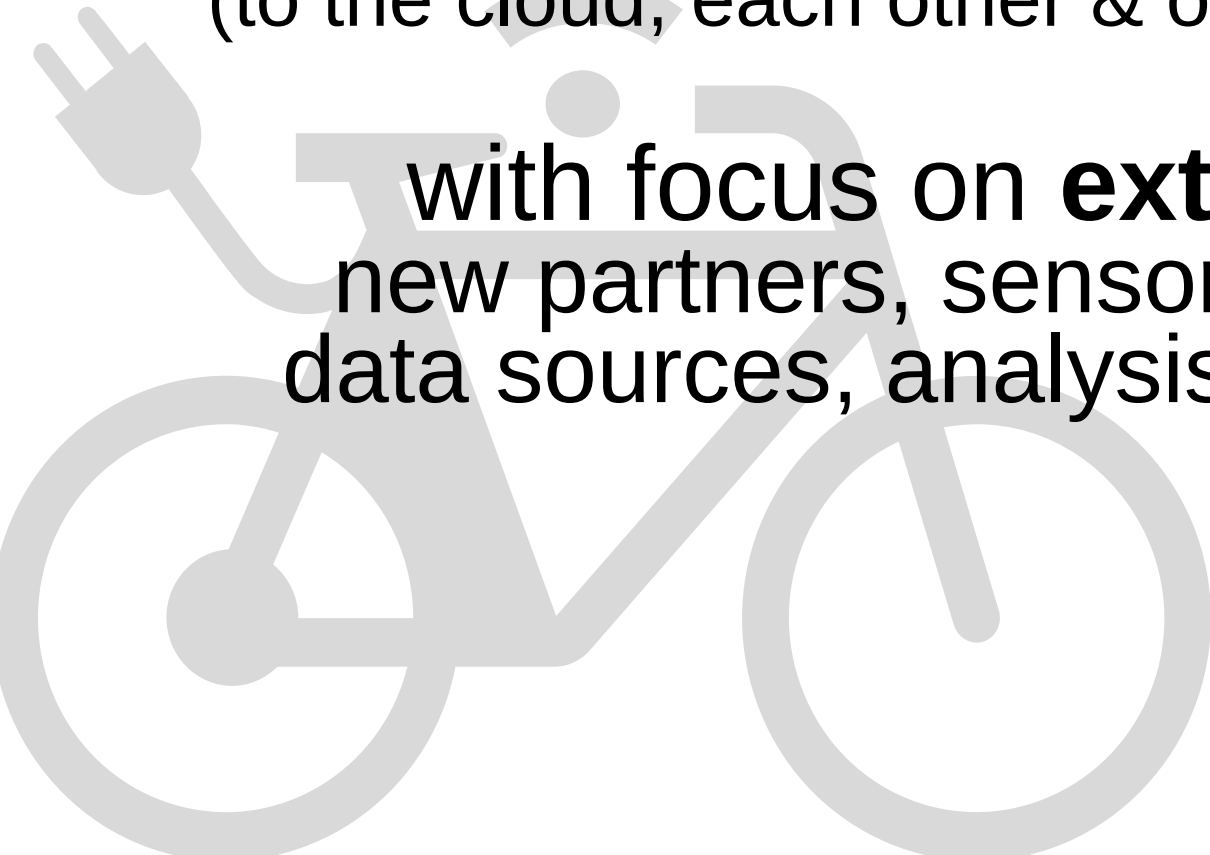
bike



Mission

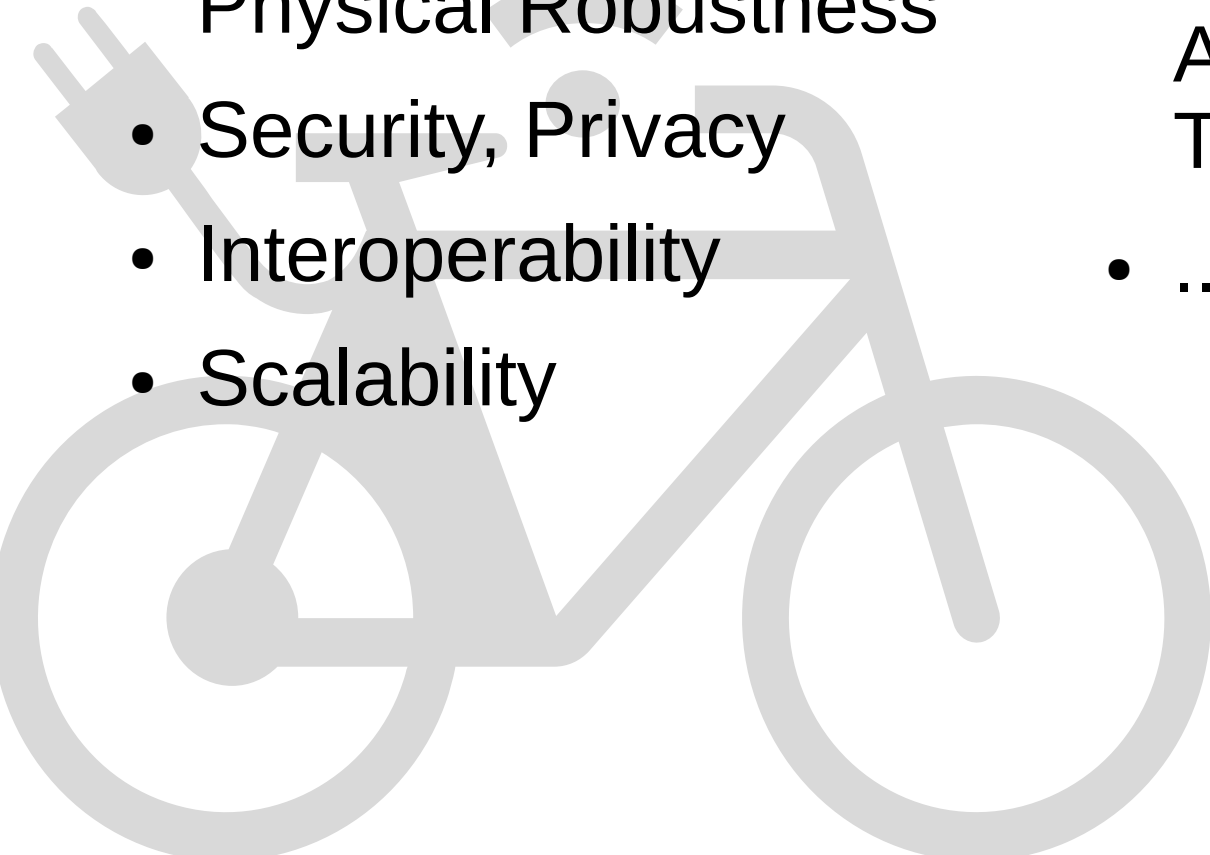
open platform / framework
for connecting smart e-Bikes
(to the cloud, each other & owners' smartphone)

with focus on **extensibility**:
new partners, sensors, hardware,
data sources, analysis algorithms, ...

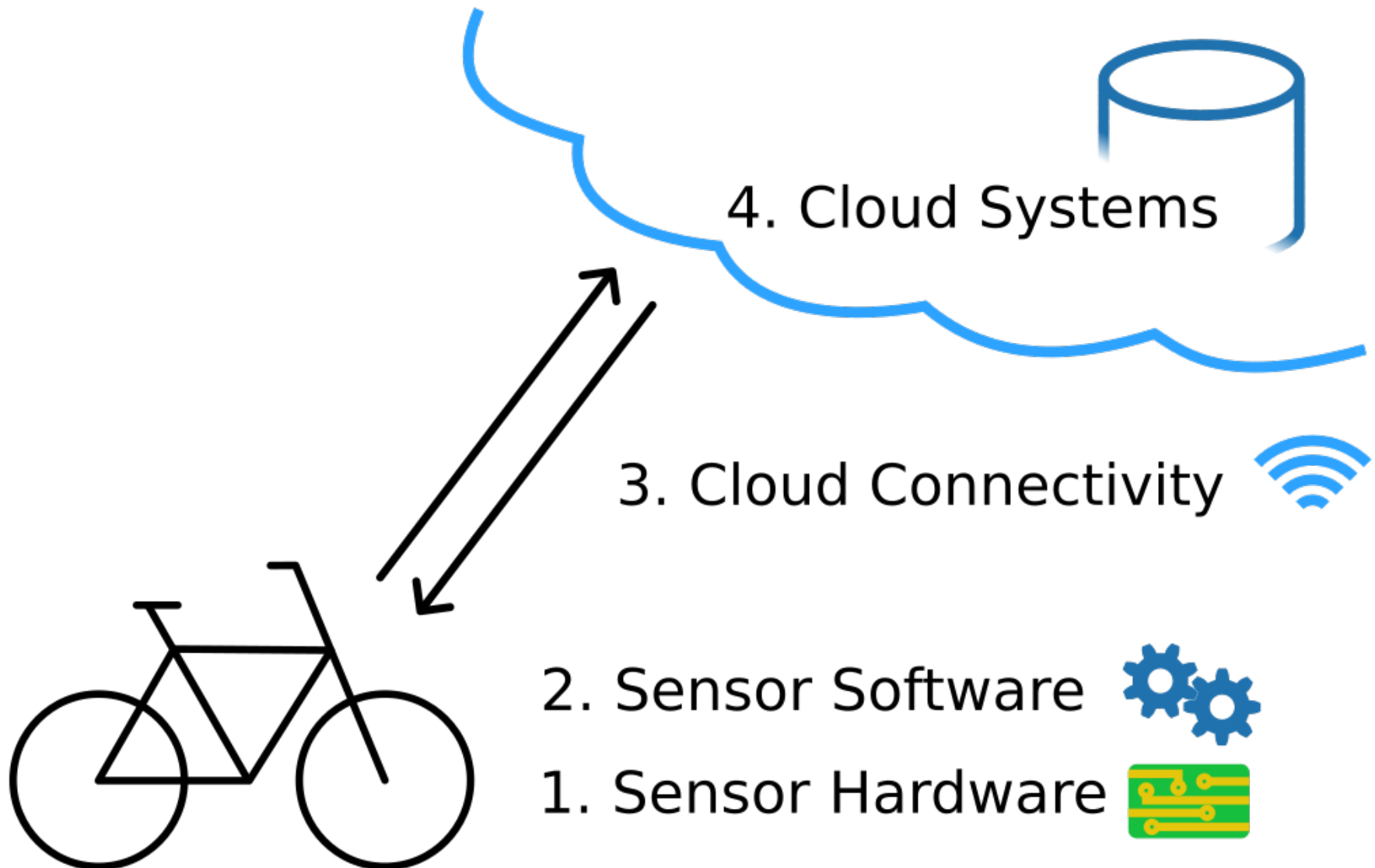


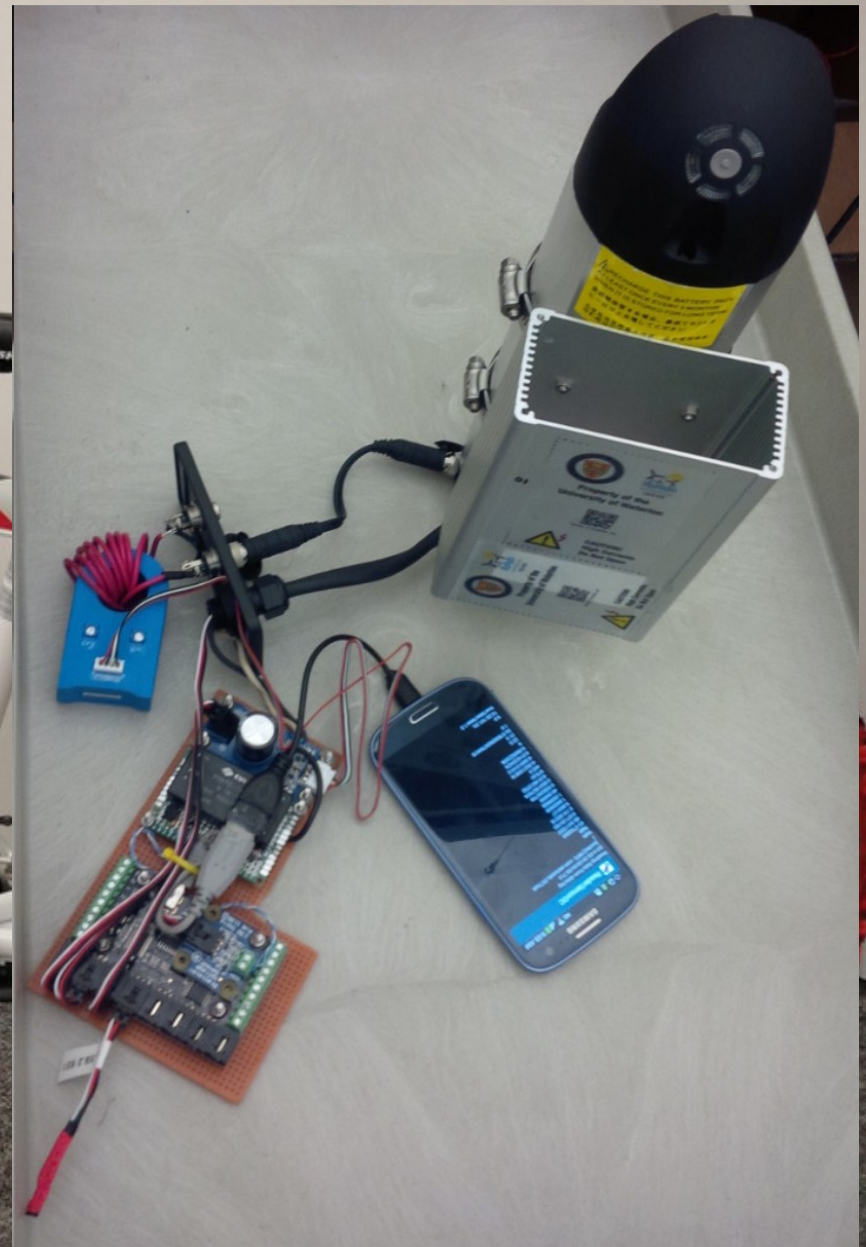
Constraints

- Energy Consumption
- Affordability, Cost
- Longevity, Form Factor, Physical Robustness
- Security, Privacy
- Interoperability
- Scalability
- Manageability, Maintainability, Updateability
- Connectivity; Availability, Throughput, Latency
- ...



Architecture





Connectivity

Requirements

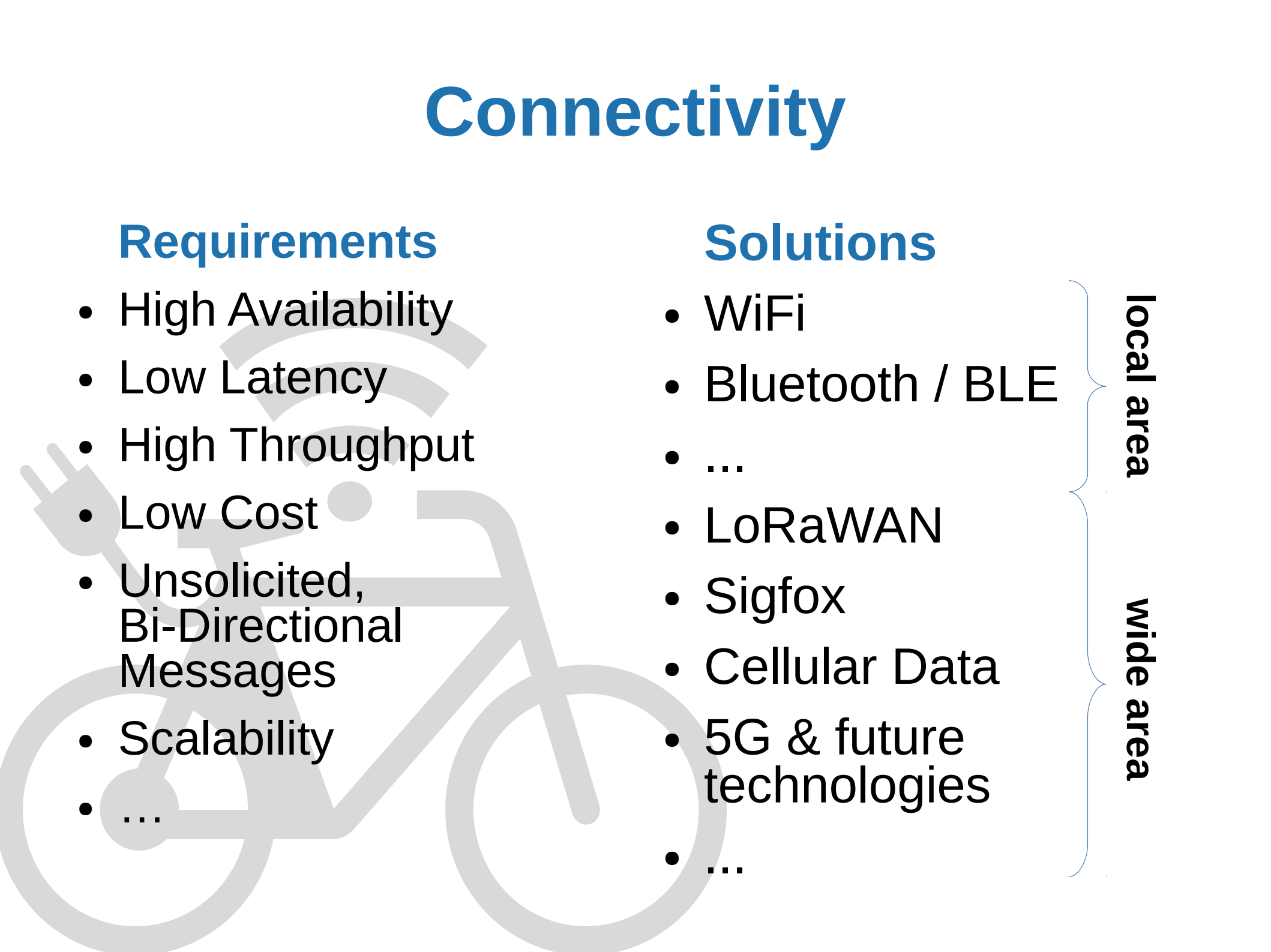
- High Availability
- Low Latency
- High Throughput
- Low Cost
- Unsolicited, Bi-Directional Messages
- Scalability
- ...

Solutions

- WiFi
- Bluetooth / BLE
- ...
- LoRaWAN
- Sigfox
- Cellular Data
- 5G & future technologies
- ...

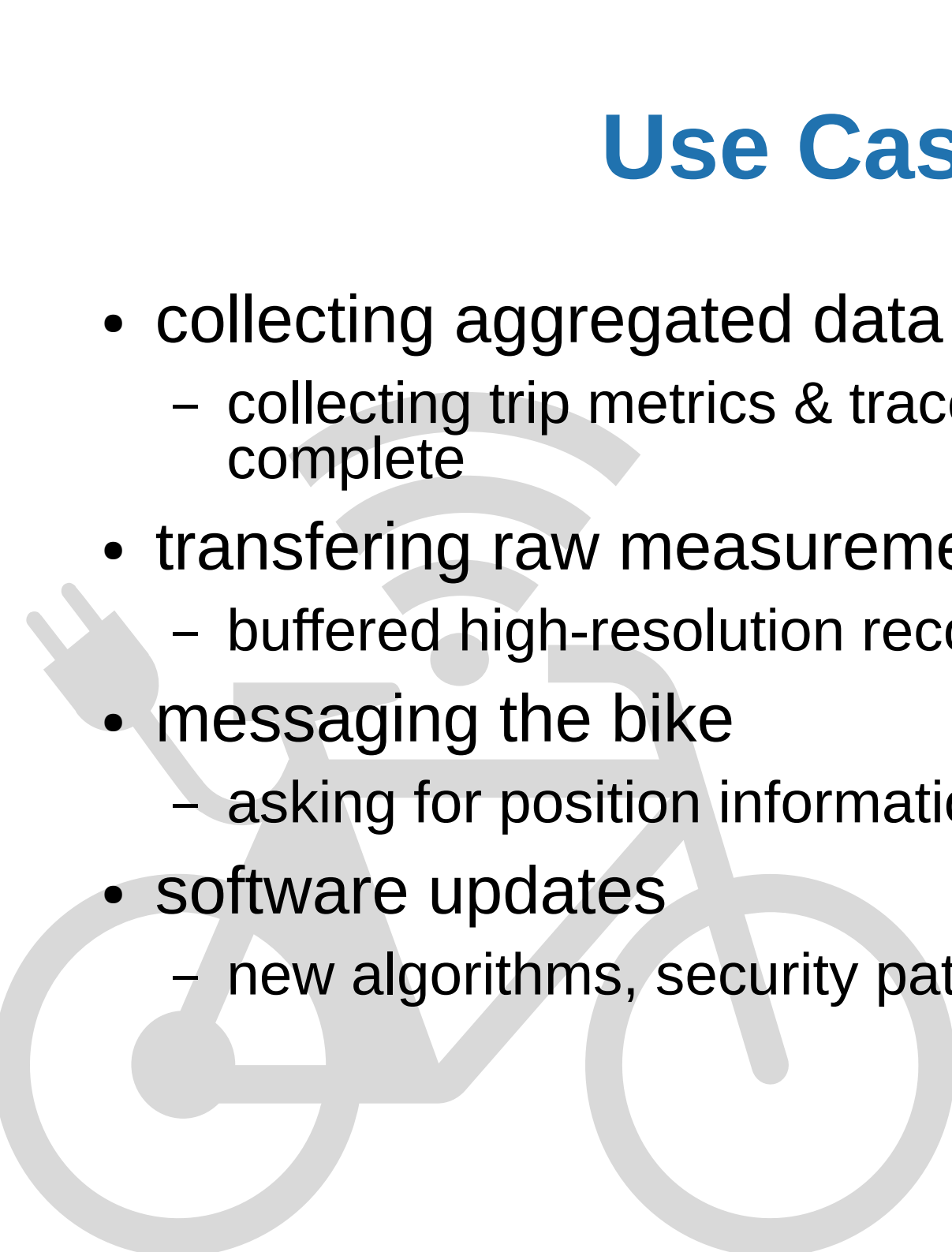
local area

wide area



Use Cases

- collecting aggregated data
 - collecting trip metrics & traces once the trip is complete
- transferring raw measurements
 - buffered high-resolution recordings of 1h
- messaging the bike
 - asking for position information
- software updates
 - new algorithms, security patches



Hybrid Solution?

combine **multiple technologies**

(e.g. WiFi, mobile data)

and use

service-oriented, smart **network virtualization**

for the

tradeoff between cost, bandwidth, latency

