



Data mules and their usage

Reinholds Zviedris

University of Latvia

Task

A photograph of a sandy beach. The sand is light brown and has a distinct ripple pattern. A series of dark footprints leads from the top center towards the bottom center. The text "Maximally efficient data exchange" is overlaid in white, bold font on the right side of the image.

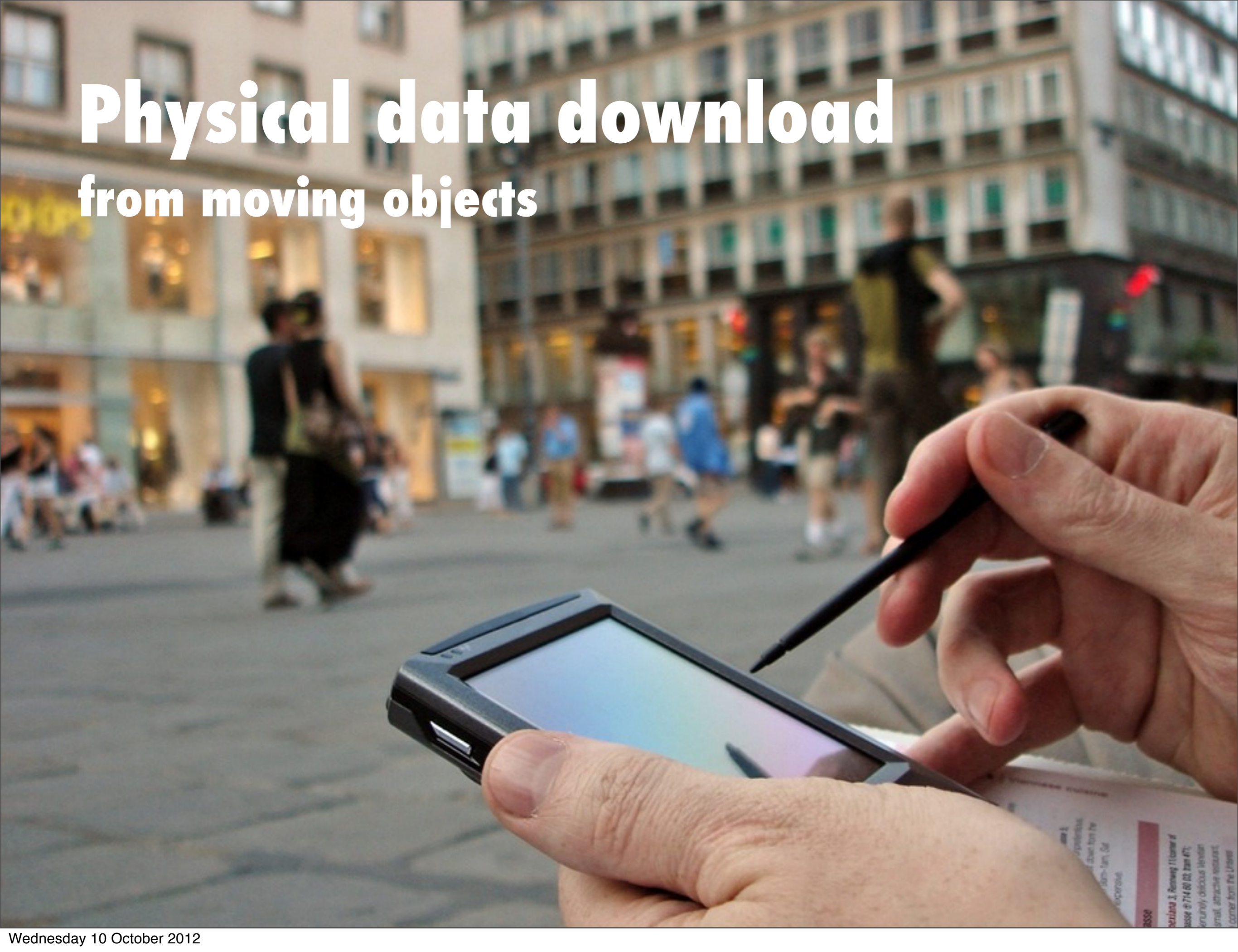
**Maximally efficient
data exchange**

Possible solutions

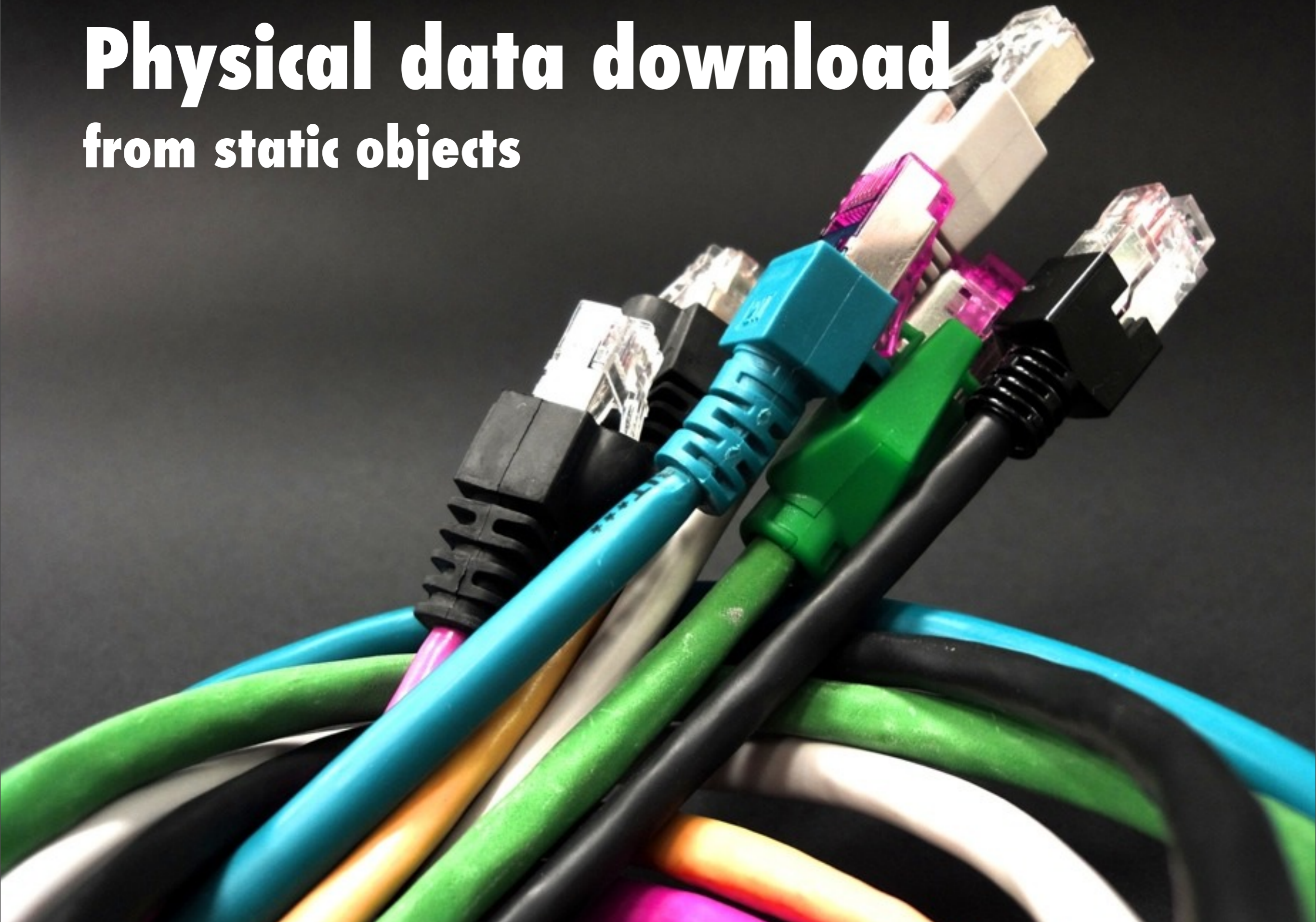


RADIO
WLAN
GPRS
SMS

Physical data download from moving objects



Physical data download from static objects



Multihop communication



Architecture

Architecture



Wireless Sensor Node

Architecture



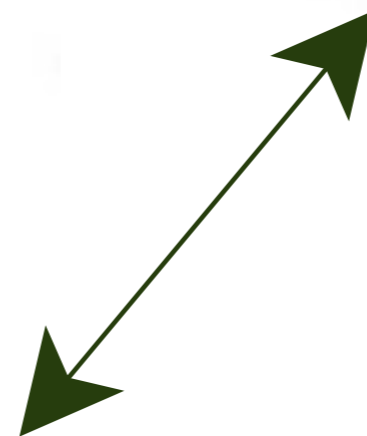
Data mule

Architecture



Data processing facility

Architecture



Advantages



Privacy



Mobility



Energy economy

Drawbacks

Undetermined latency





**No assurance for
data delivery**

Scientific problem



PROBLEM:
No delay tolerant IP protocol



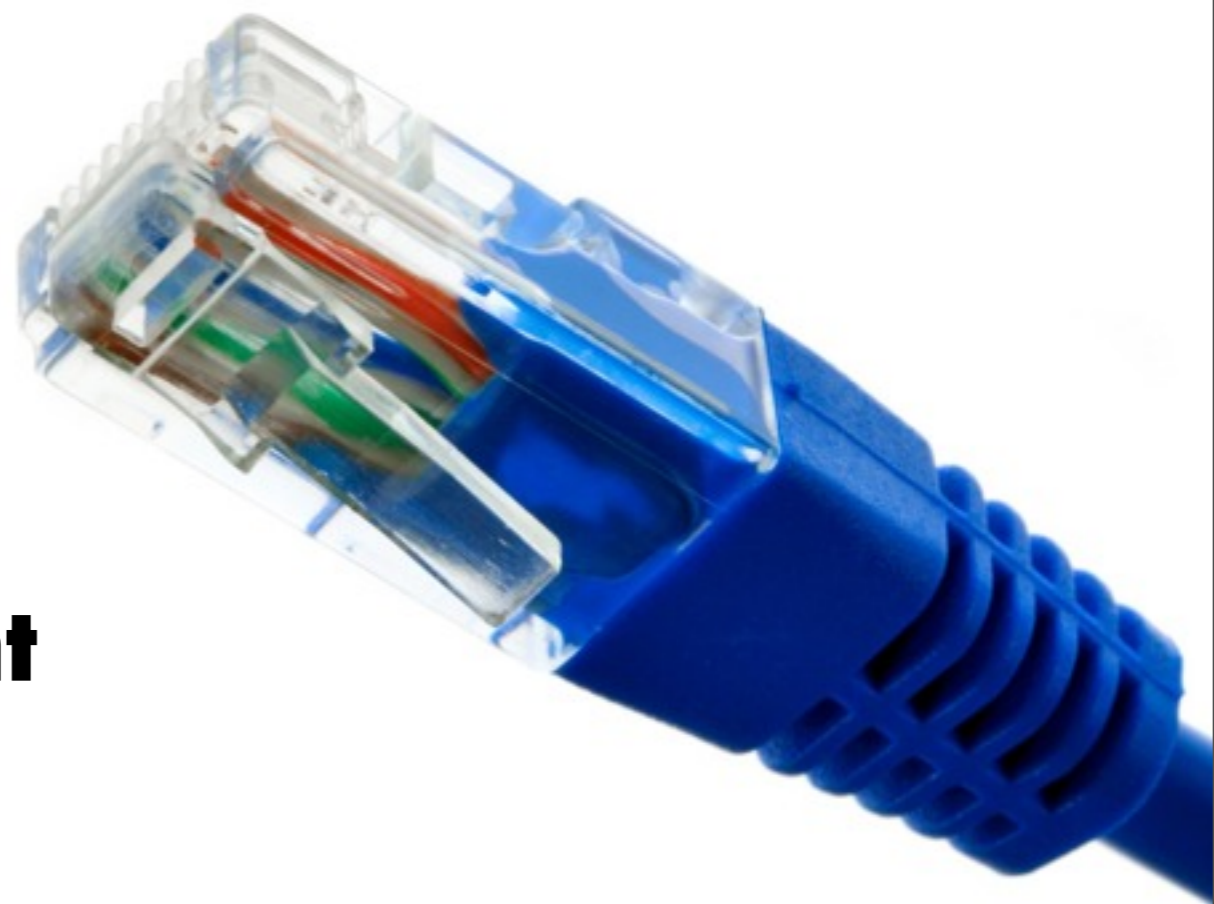
CHALLENGE:
Fixity against latency

SOLUTION:
Adaptive protocol



Data transmission protocol

- ➔ **OS module**
- ➔ **Session based, store-and-forward type protocol**
- ➔ **Data transmission using packets**
- ➔ **Packet prioritization**
- ➔ **Packet encryption**
- ➔ **Two way realization:**
 - ▶ **with acknowledgement**
 - ▶ **without acknowledgement**
- ➔ **Address space**



Usages

real and potential



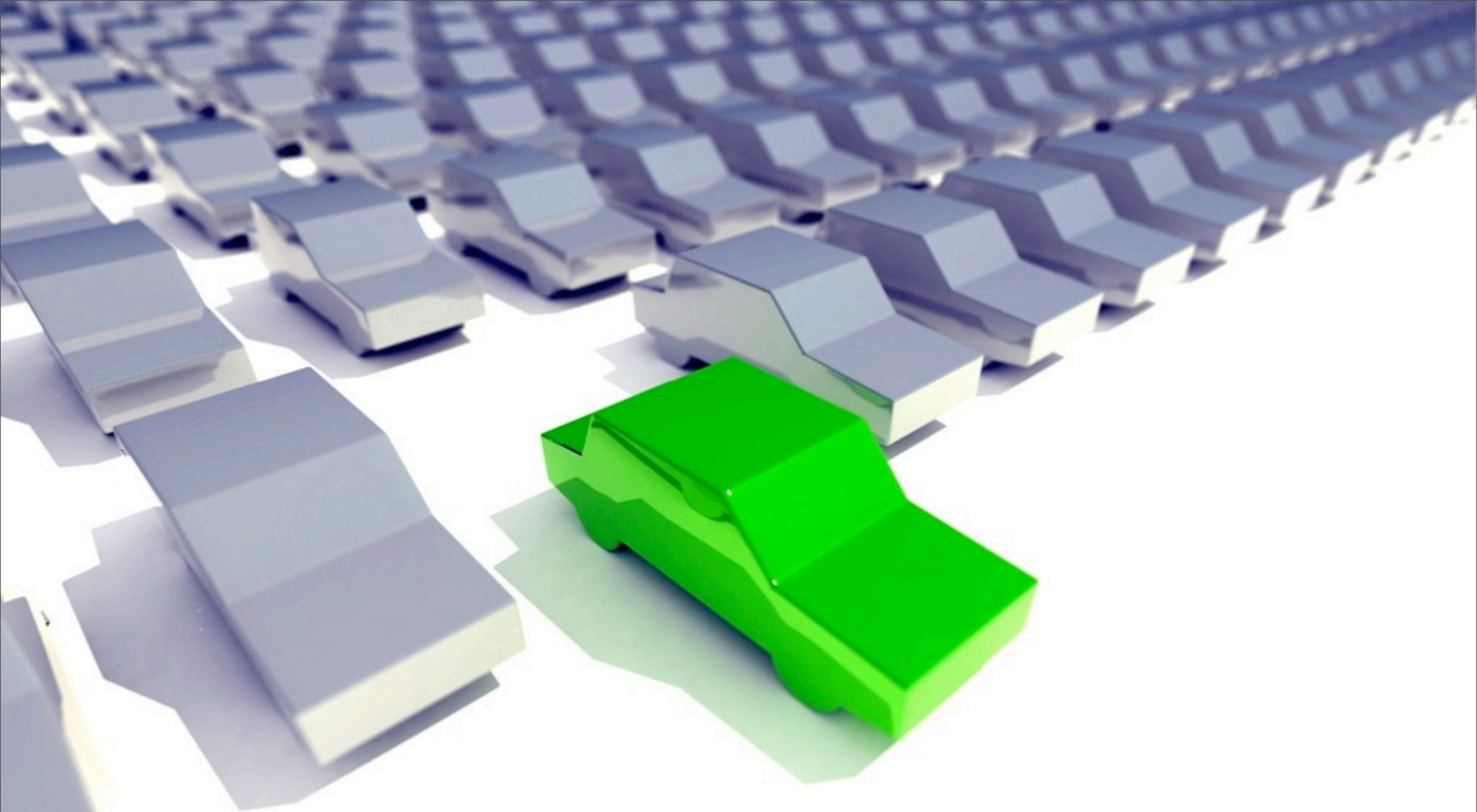
ZebraNet

<http://www.princeton.edu/~mrm/zebranet.html>



BikeNet

<http://bikenet.cs.dartmouth.edu/>



CafNet

<http://cartel.csail.mit.edu/cafnet/>




LynxNet

<http://jupiter.cs.fmf.lu.lv/dilab/index.php/LynxNet>



CARS as data mules

A low-angle, upward-looking photograph of a traffic light. The traffic light is black and has three large, cylindrical lenses stacked vertically. The background is a bright blue sky filled with scattered white clouds. The lighting is bright, suggesting a sunny day.

**ROADSIDE
INFRASTRUCTURE
as base stations
or static data
mules**

Scientific expectations

from “Smithy of Ideas 2010”



**More potential
usages for
data mules**

THANK YOU!

Questions?

My contacts:

reinholds@zviedris.com

Photos sources:

Google (<http://www.google.lv>)

stock.xchng (<http://www.sxc.hu>)

HubbleSite (<http://www.hubblesite.org>)