

# WetLinks and Starlink on the Road

## Exploring The Stationary and Mobile Performance of Starlink

**Eric Lanfer**, Dominic Laniewski, Nils Aschenbruck

Distributed Systems Group  
Osnabrück University

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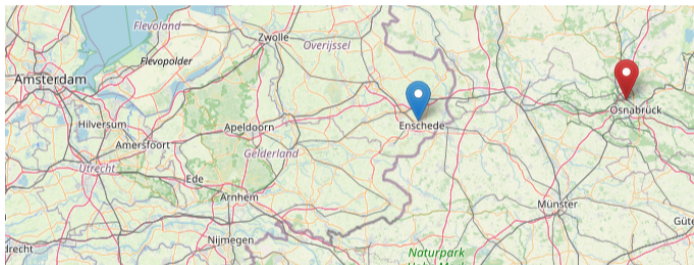
# WetLinks: a Large-Scale Longitudinal Starlink Dataset with Contiguous Weather Data

**Dominic Laniewski**<sup>1</sup>, **Eric Lanfer**<sup>1</sup>, Bernd Meijerink<sup>2</sup>, Roland van Rijswijk-Deij<sup>2</sup>, Nils Aschenbruck<sup>1</sup>  
<sup>1</sup>Osnabrück University - Institute of Computer Science, Osnabrück, Germany

<sup>2</sup>University of Twente - Design and Analysis of Communication Systems Group, Enschede, The Netherlands  
{laniewski, lanfer, aschenbruck}@uos.de, {bernd.meijerink, r.m.vanrijswijk}@utwente.nl

## Key Features

- 6 Months of stationary Starlink Measurements
- Autumn + Winter
- 2 European cities
- Network Performance
- Weather Data
- Approx. 140k Measurements
- Open Data



src: osm.org

# Measurement Setup I

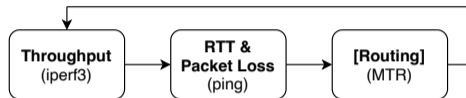


Osnabrück (DE)



Enschede (NL)

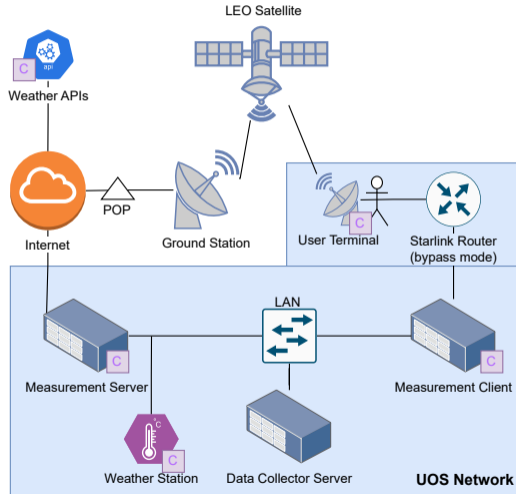
## Measurement Process



## Measured Parameters

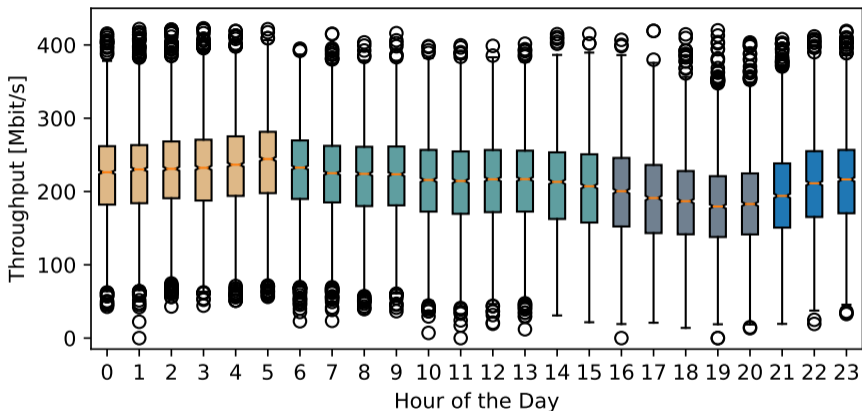
- Throughput (Up/Down) – **iperf3**
- RTT - **ping**
- Packet Loss - **ping**
- Traceroute - **MTR**
- Weather Data – **Froggit DP2000**

# Measurement Setup II



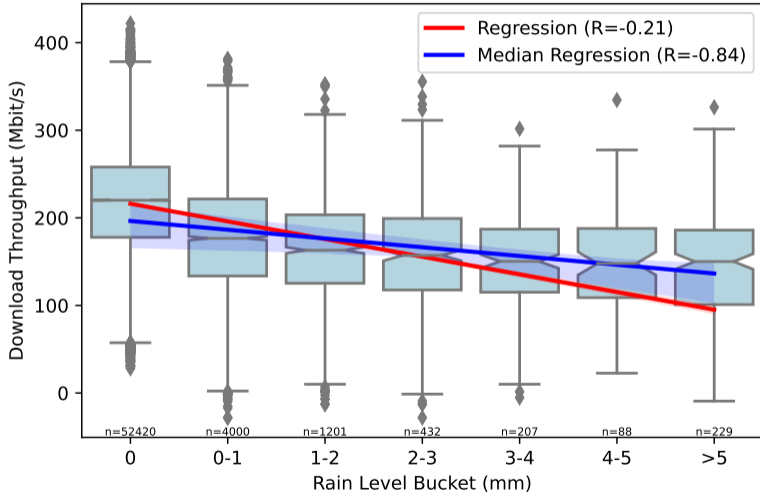
	<b>Mean</b>	<b>Median</b>	<b>25-percentile</b>	<b>75-percentile</b>
<b>Download</b>				
Osnabrück	212.8	215.8	168.2	257.2
Enschede	238.7	240.5	199.1	278.5
<b>Upload</b>				
Osnabrück	16.0	14.9	11.6	19.0
Enschede	17.1	16.2	13.0	20.0

# Diurnal Cycle (Download Throughput)



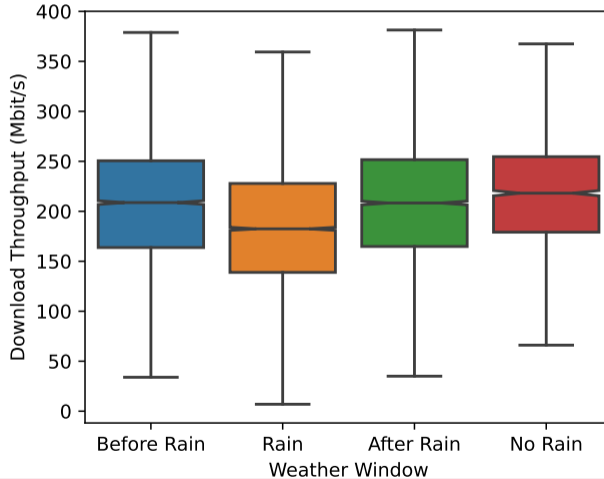
⇒ **Throughput depends on the time of the day**

# The Impact of Rain



⇒ DL-Throughput can almost halve





⇒ **Clouds likely have an impact (about 10 Mbit/s drop)**

# Starlink on the Road: A First Look at Mobile Starlink Performance in Central Europe

**Dominic Laniewski**<sup>1</sup>, **Eric Lanfer**<sup>1</sup>, Simon Beginn<sup>1</sup>, Jan Dunker<sup>1</sup>, Michael Dückers<sup>2</sup>, Nils Aschenbruck<sup>1</sup>

<sup>1</sup>Osnabrück University - Institute of Computer Science, Osnabrück, Germany

<sup>2</sup>SWO Netz GmbH - Osnabrück, Germany

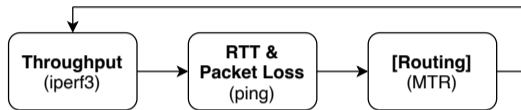
{laniewski, lanfer, sbeginn, jdunker, aschenbruck}@uos.de, michael.dueckers@swo-netz.de

## Key Features

- 2 Months of Mobile Starlink Measurements
- Winter (Jan. - March 2024)
- Osnabrück, Germany
- Network Performance
- Power Consumption
- Open Data



## Measurement Process

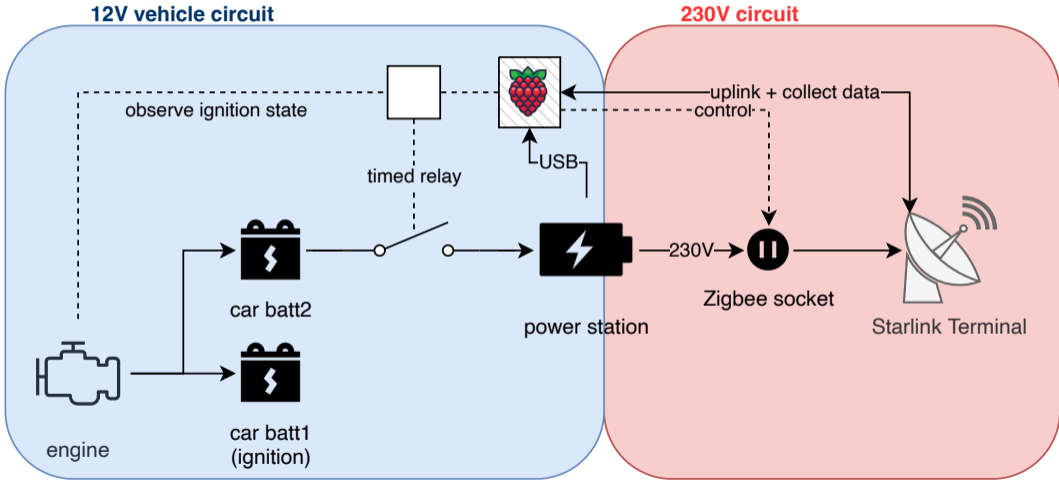


## Measured Parameters

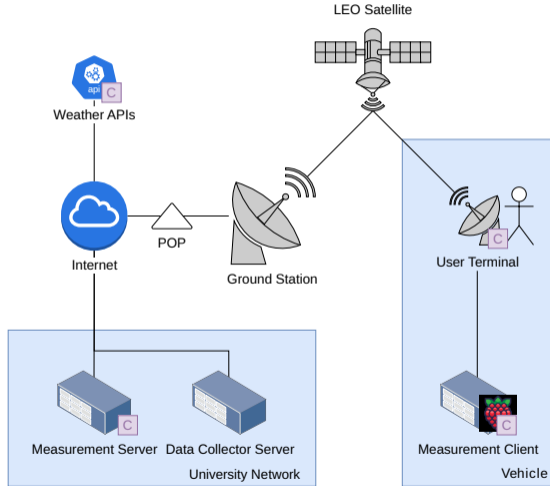
- Throughput (Up/Down) – **iperf3**
- RTT - **ping**
- Packet Loss - **ping**
- Traceroute - **MTR**
- Weather Data – **DWD**
- Power Consumption – **Smart Plug**



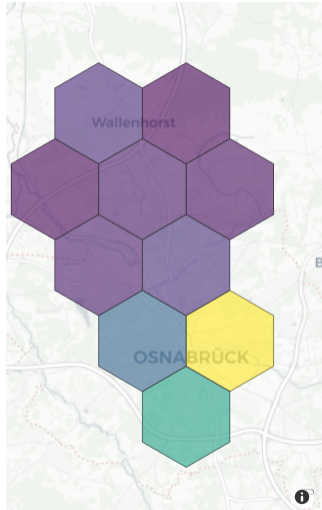
# Measurement Setup II



# Measurement Setup III

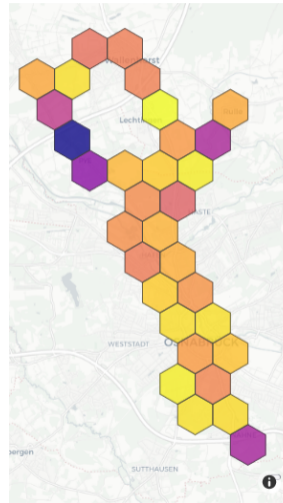


# Throughput Map



Samplecount

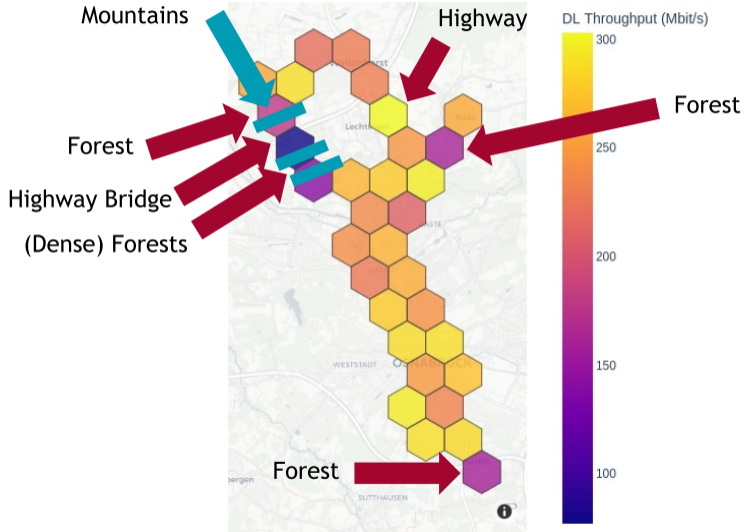
6000  
5000  
4000  
3000  
2000  
1000



DL Throughput (Mbit/s)

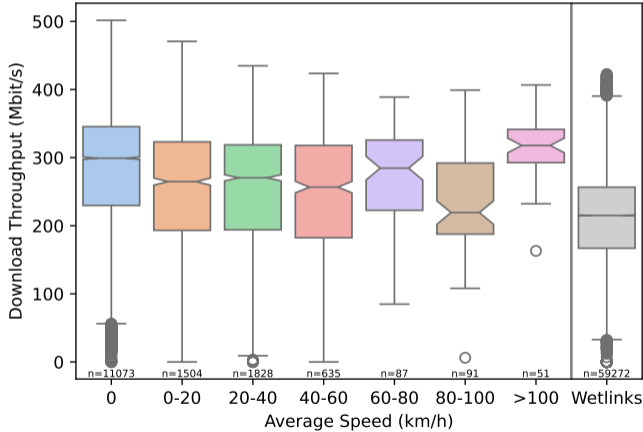
300  
250  
200  
150  
100

# Throughput Map





# The Impact of Speed



- ⇒ Significant difference between standing and moving vehicle
- ⇒ Likely strong impact of obstruction
- ⇒ Significant impact of the dish version

- Curated public dataset containing stationary and mobile Starlink measurements
- Time of day throughput decreases observed
- Rain impacts DL-throughput
- Cloud interference observed
- Stationary performance better than mobile (10% DL-Throughput)
- Impact of dish version
- Power consumption in mobile setup is an issue (avg. 113W peaks to 190W)

Thank you very much for your attention!

Contact information and dataset links:



`sys.cs.uos.de/lanfer`

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