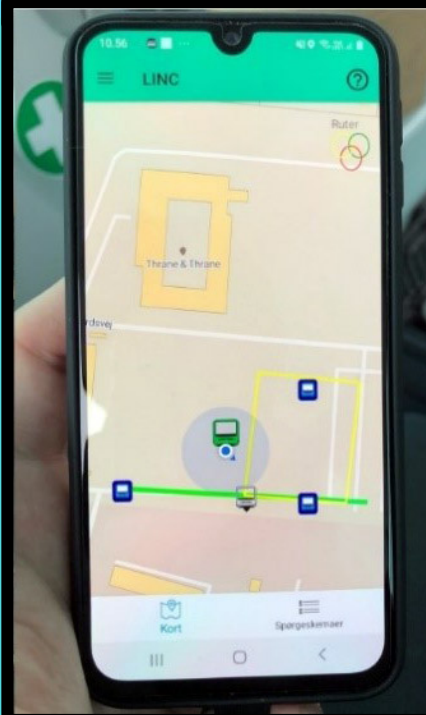


Combined Operational Insights from AV Shuttles and Smartphones

Søren Jacobsen
Maiken Lindberg
Valentino Servizi

Nobina Denmark
DTU
DTU

Valentino Servizi – PhD Candidate
Machine Learning for Smart Mobility Group @ DTU



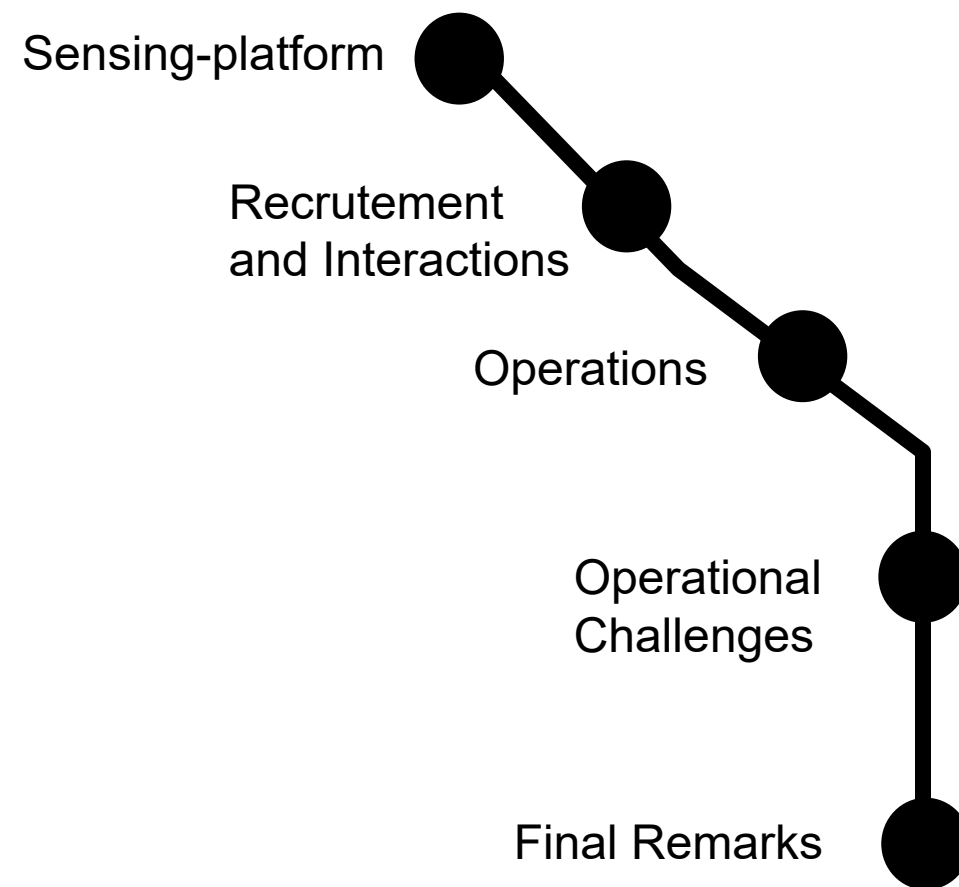
Outline

"[...] when you can measure what you are speaking about, and express it in numbers, you know something about it [...]"

William Thomson (Lord Kelvin),

from a lecture delivered at the Institution of Civil Engineers

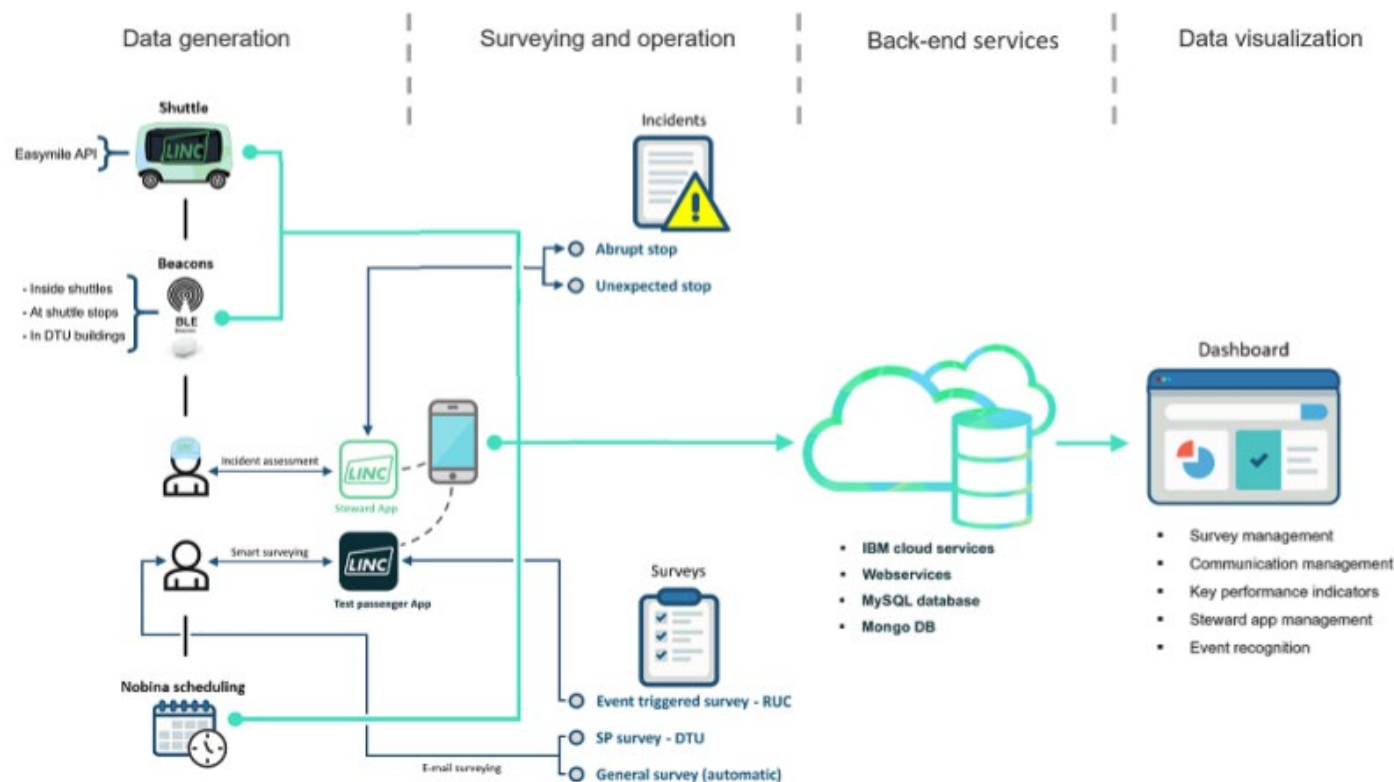
May 3, 1883



Smartphone Sensing-platform

A distributed sensorial data collection pipeline

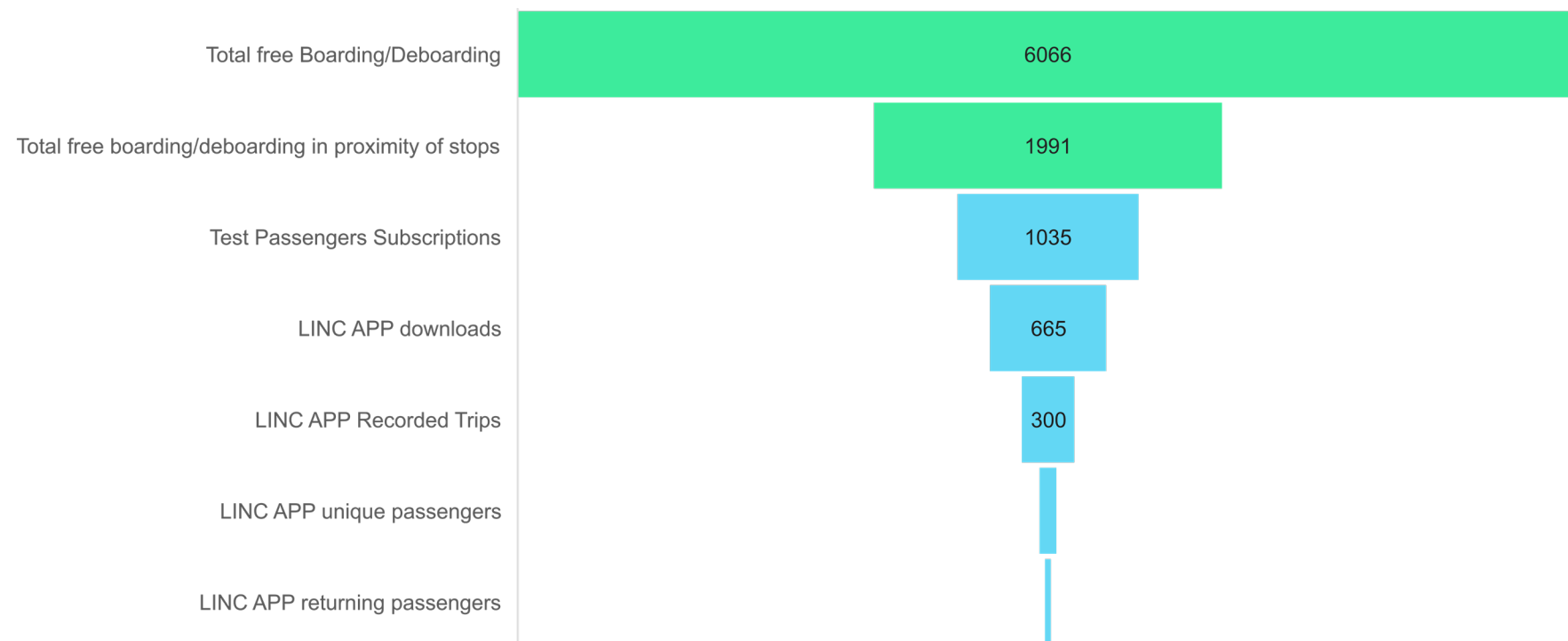
- Shuttle data
 - Telemetry
 - Operations
- Smartphone data
 - From Passengers
 - From Stewards
- Passenger Surveys
- Weather and more ...



Passengers Interaction-funnel

Service measurable penetration (Apr-Nov)

- Large number of physical interactions
- 3% retention rate on Subscriptions
- 15% trips from LINC App Users



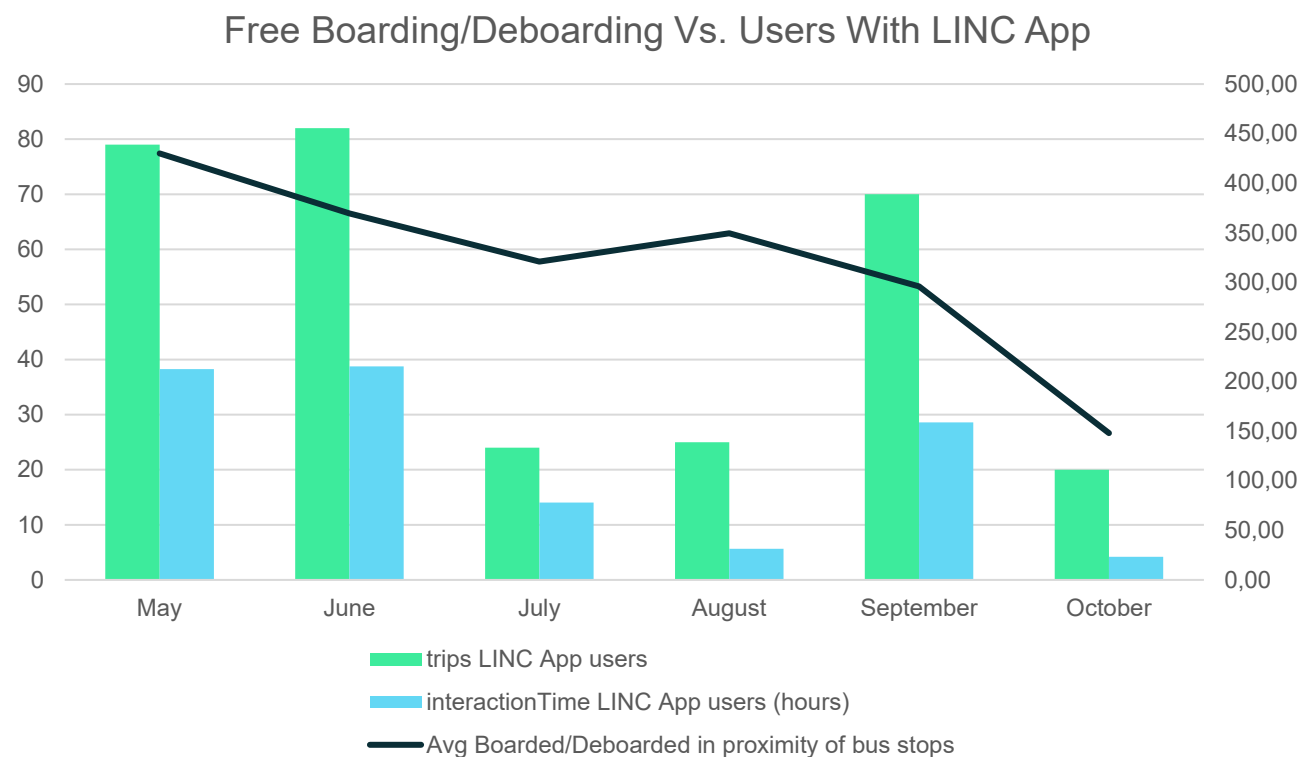
LINC er støttet af:



Interactions LINC App users Vs All

Independent measures of shuttles/passengers interactions

- Consistent with DTU reduction of campus activities in July
- Consistent trend across measurements methods



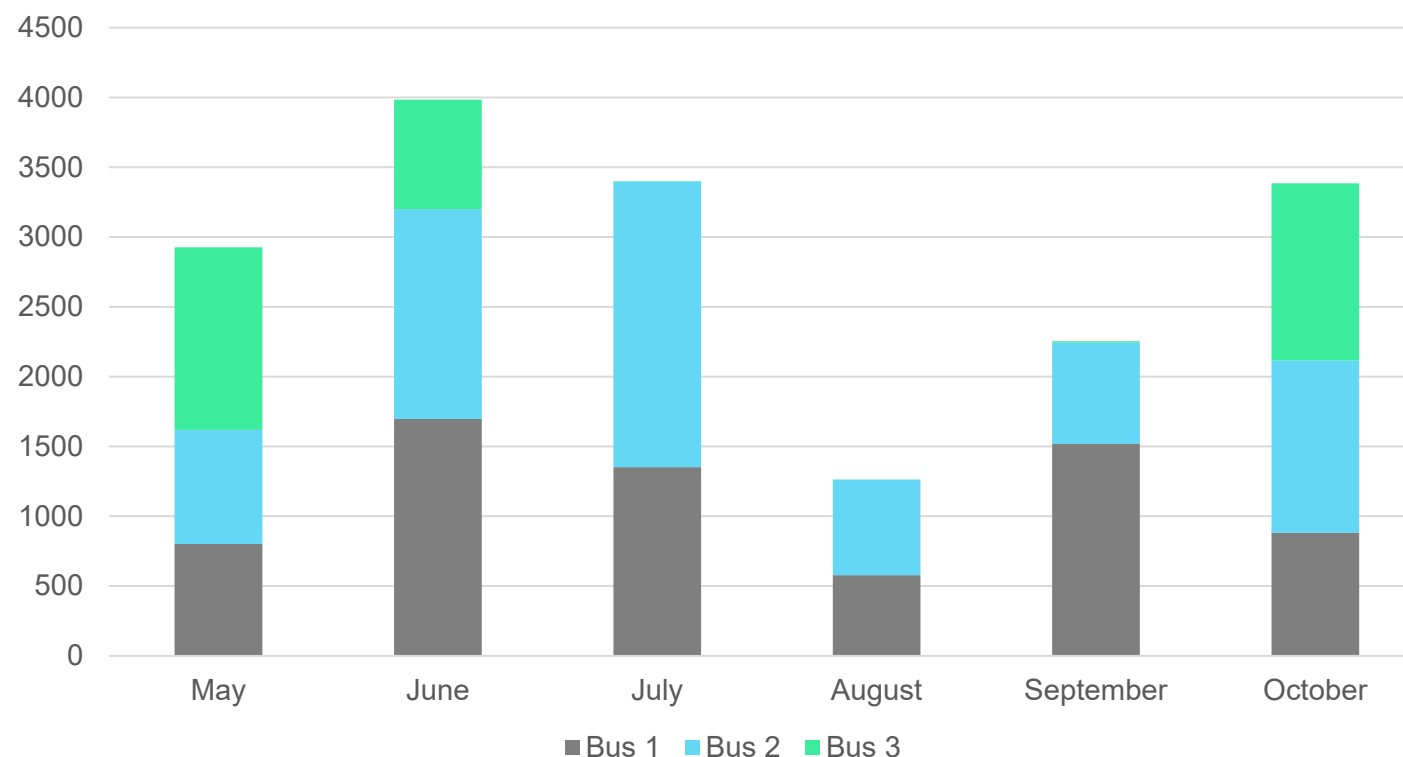
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Shuttles Distance (May – Oct 2021)

- > 17.213 km covered
- min 2 shuttles operational in the main period
- 3 shuttles operational half of the main operations' period

Km of effective operations

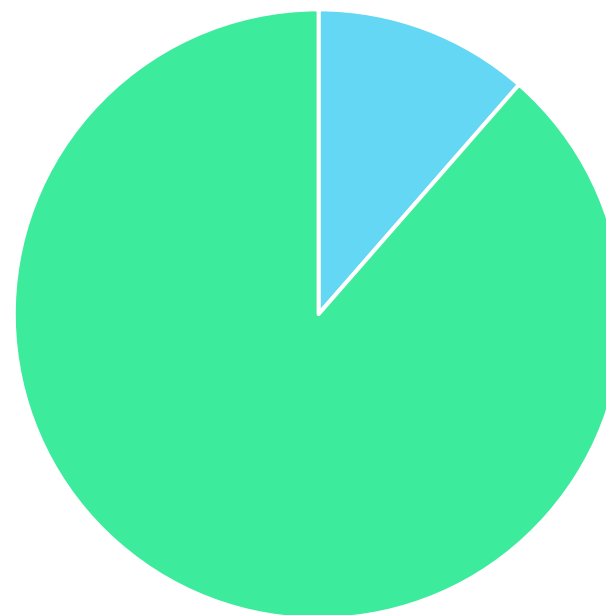


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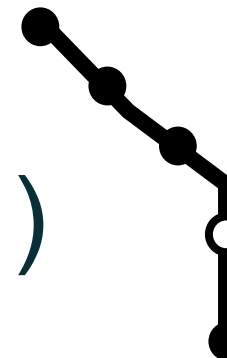
Autonomus Vs. Manual

- 89% of autonomous operations' time
- 11% of steward manual driving
- Apr - Nov



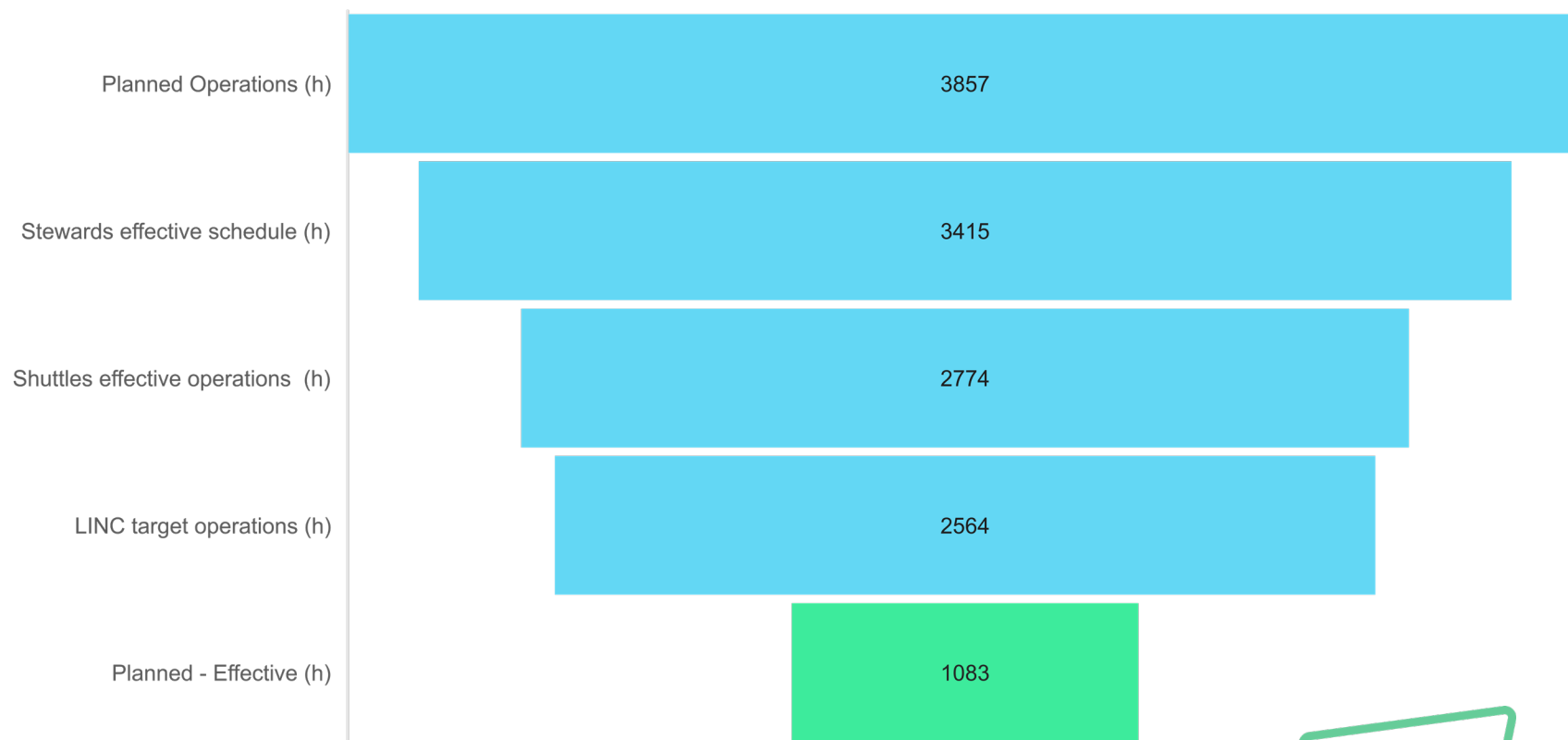
- Percentage of time in MANUAL mode at non-null speed
- Percentage of time in AUTO mode at non-null speed

Operations Funnel (April – November 2021)



Challenges between planning and operations

- only 2/3 of the plan translated into effective operations
- 90% of Stewards time still necessary

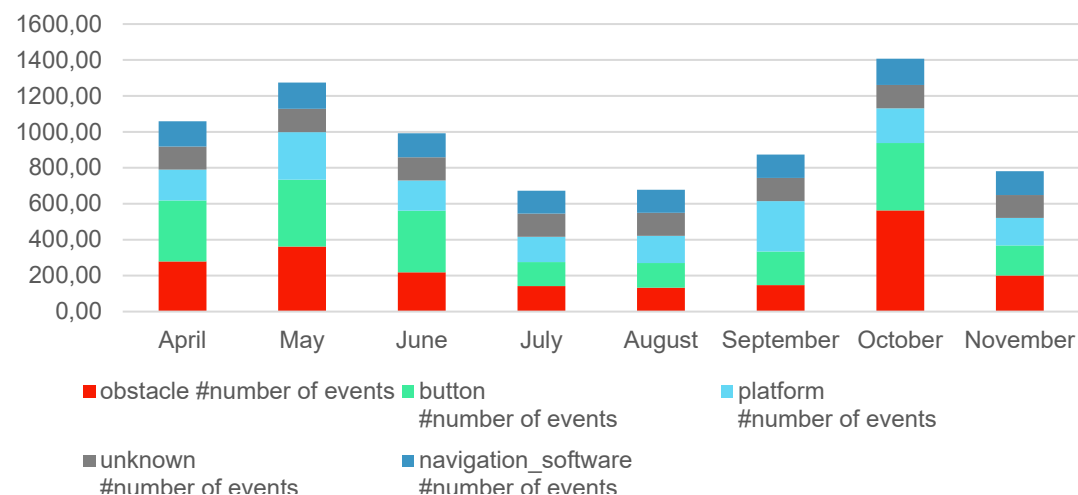


Operational Challenges

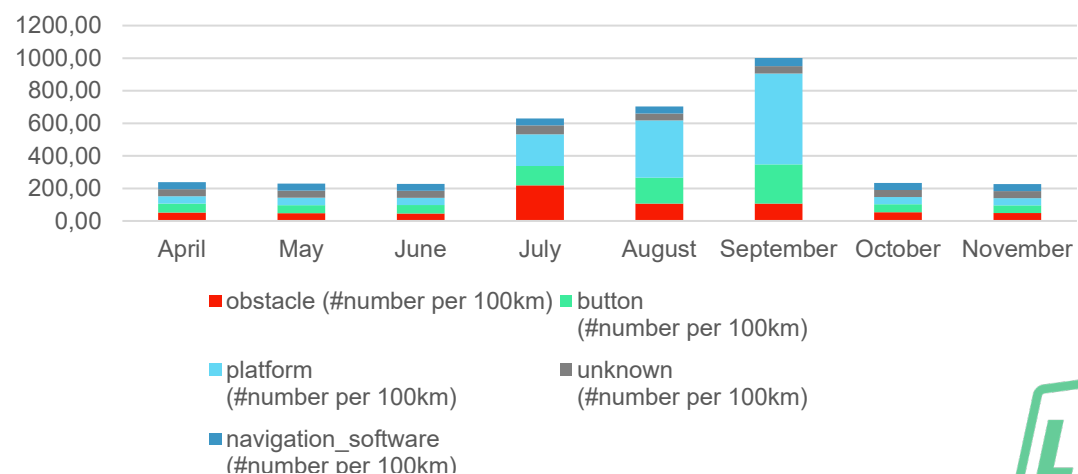
Towards full automation

- No accidents on the road
- Average commercial Speed ~5km/h
- Seasonal challenges impact on the ability to drive autonomously
- Seamless automation for 0.5 km in average (in normal conditions)
- 2 reported injuries due to abrupt stops

Number of auto-drive disconnection (all buses)



Average Number of Disconnections per 100km driven (all buses)



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Final Remarks

Data shows

- People is interested, regardless from the following challenges, vehicles low average speed, and Covid-19 restrictions
- No Stewards No LINC!
Personnel on board necessary to reduce the number of abrupt stops in critical traffic conditions.
- Insufficient ability to turn operational planning into actual operations probably due to technical issues
- Full automation at scale requires integration and harmonization of a HUGE amount to data. Edge Intelligence not yet in place to support it.

Thank you for your attention – Valentino Servizi, valse@dtu.dk

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