



# 5G-enabled Sensors

Chancen und Möglichkeiten der Datenaggregation im Feld

# Projektvorstellung - DAVE

- Sensoren
  - Kamera
  - LiDAR
  - Wind
  - AIS
  - GPS
- ROS 2 Humble




# Dashboard


merged\_bag\_0.mcap

MEM 151% LAYOUT Default Sign In

/ipcamera/image\_raw

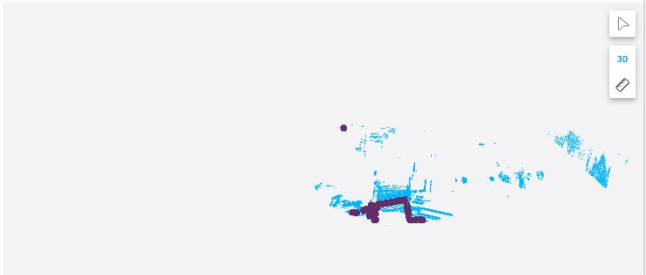


Map



3D

/image\_rect



/ugps/navsatfix

```
sensor_msgs/msg/NavSatFix @ 1698143304.139865495 sec
  header {} frame_id:
  stamp 2023-10-24 12:28:24.137 PM CEST
    sec 1698143304
    nsec 137824821
  frame_id ""
  status {} 2 keys
    status 0 (STATUS_FIX)
    service 0
  latitude 53.8724168
  longitude 10.6821164
  altitude -4.024
  position_covariance Float64Array(9) [0, 0, 0, 0, 0, 0, 0, 0, 0]
  position_covariance_type 0 (COVARIANCE_TYPE_UNKNOWN)
```

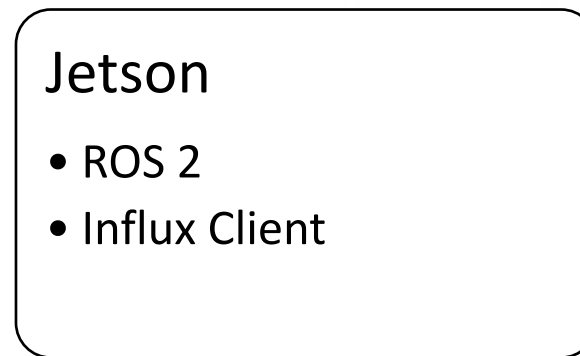
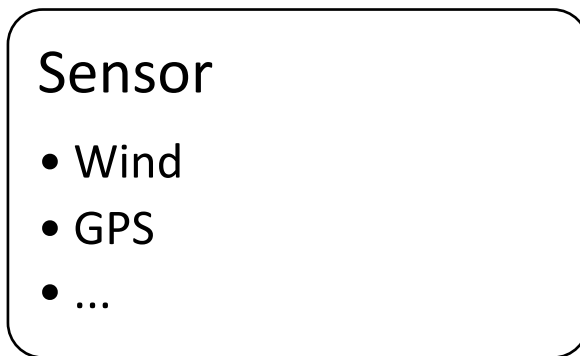
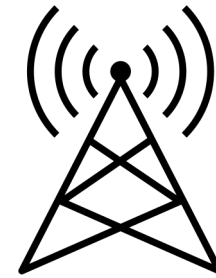
/nmea/nmea/wind

```
std_msgs/msg/String @ 1698143384.056978188 sec
  data "SWIMWW,178.2,R,5.9,N,A*23"
```

Data Source Info

Topic Name	Datatype	Message count	Freq
/camera_info	sensor_msgs/msg/CameraInfo	2,891	24.
/events/write_split	rosbag2_interfaces/msg/WriteSplitEvent	2	0.0
/image_rect	sensor_msgs/msg/Image	5,456	47.
/ipcamera/camera_info	sensor_msgs/msg/CameraInfo	2,874	24.
/ipcamera/image_raw	sensor_msgs/msg/Image	2,609	22.
/nmea/nmea/gps	std_msgs/msg/String	379	3.2
/nmea/nmea/wind	std_msgs/msg/String	564	4.8
/rosout	rcl_interfaces/msg/Log	36	0.3
/rslidar_points	sensor_msgs/msg/PointCloud2	1,158	10.
/scanner/cloud_in	sensor_msgs/msg/PointCloud2	1,158	10.
/scanner/scan	sensor_msgs/msg/LaserScan	949	8.2
/tf_static	tf2_msgs/msg/TFMessage	3	0.0
/ugps/gpsQual	std_msgs/msg/String	182	1.5
/ugps/gpsQualString	std_msgs/msg/String	182	1.5
/ugps/lat	std_msgs/msg/String	182	1.5
/ugps/long	std_msgs/msg/String	182	1.5
/ugps/navsatfix	sensor_msgs/msg/NavSatFix	182	1.5
/ugps/numSat	std_msgs/msg/String	182	1.5
/ugps/time	std_msgs/msg/String	182	1.5
/wind/angle	std_msgs/msg/String	1,158	10.

# Integration

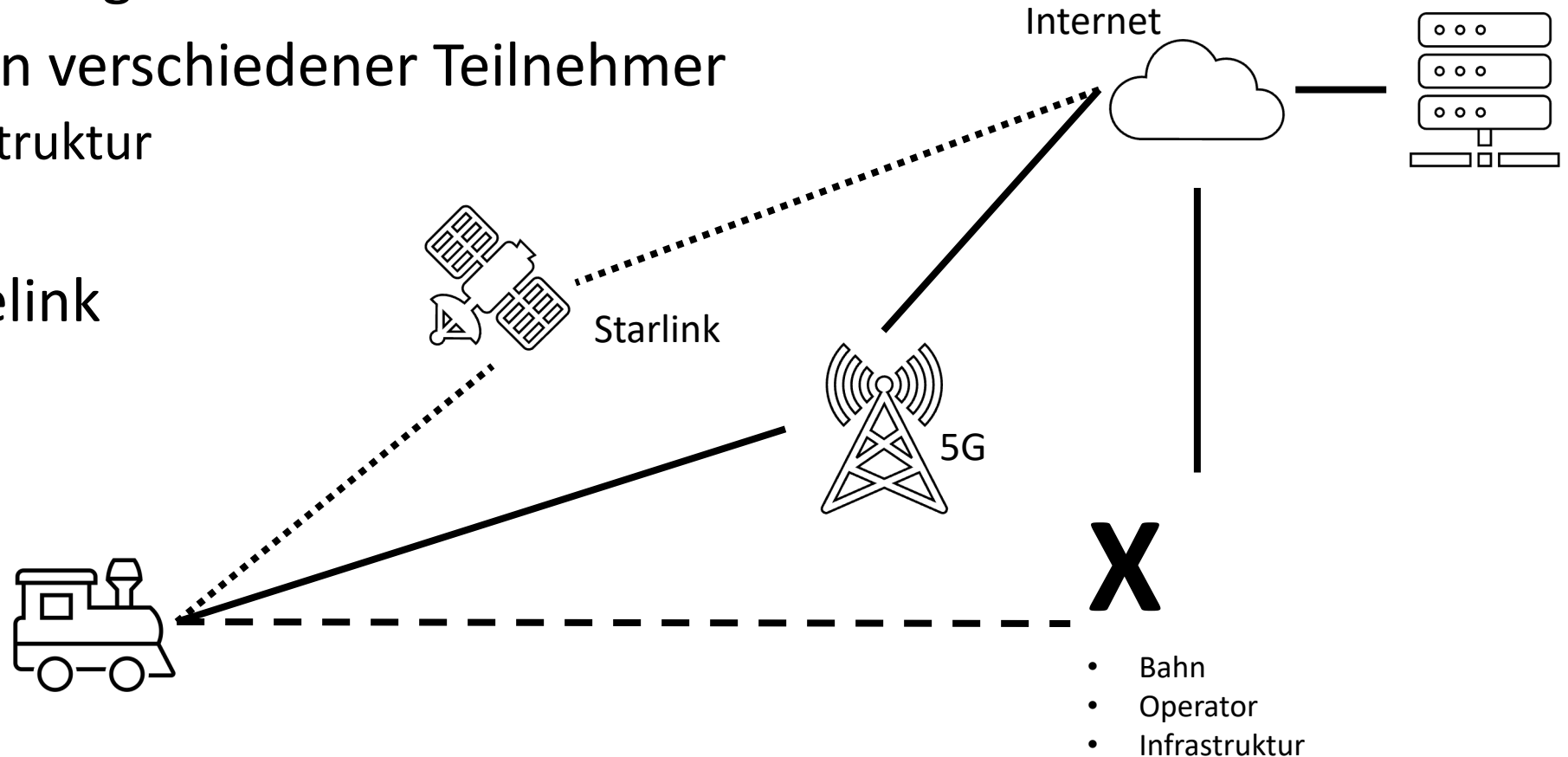


# Datenraten

- Lidar
  - 63,2 Mbps
- Kamera
  - 1280x720
  - 15 Mbps
- NMEA
  - Wind, GPS, AIS
  - 20 Kbps
- 5G
  - Up 2,9 Mbps (klein) / 130 Mbps (groß)
  - Down 24,4 Mbps (klein) / 643 Mbps (groß)

# Anwendung Bahn

- Integration verschiedener Sensoren
- Echtzeit Monitoring über 5G
- Kommunikation verschiedener Teilnehmer
  - Bahn – Infrastruktur
  - Bahn – Bahn
- Zukünftig: Sidelink





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