

# ITEF - INTEGRATED TEST AND EVALUATION FRAMEWORK

## Domains

- Field Operational Tests
- Connected Driving
- Maps
- Sensor data processing (e.g. Lidar)



## Application Scenarios

- Preparation/Conduction:
  - Setup/ Planning
  - Orchestration
  - Control incl. Validation
  - Evaluation
- Data Ingestion
  - Mobile and stationary sources
  - Real and synthetic data
- Existing connections for mobile nodes, e.g. vehicles, smart phones, sensors, virtual data sources

# ITEF - INTEGRATED TEST AND EVALUATION FRAMEWORK

## Data ingestion for analysis

- Real data, e.g. vehicle, smart phone, sensors
- Synthetic data, simulations

## Setup

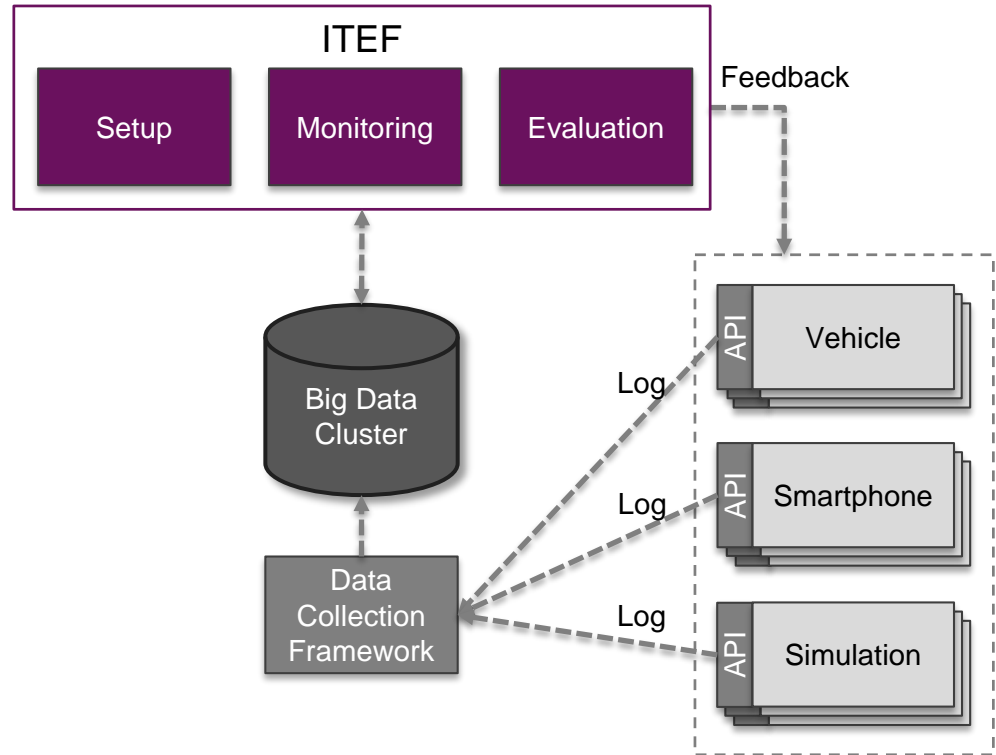
- Definition of scenarios/ data baskets for evaluation

## Monitoring

- Supervision and Control

## Evaluation

- Quality Assurance
- Verification of data collection



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## Frontend

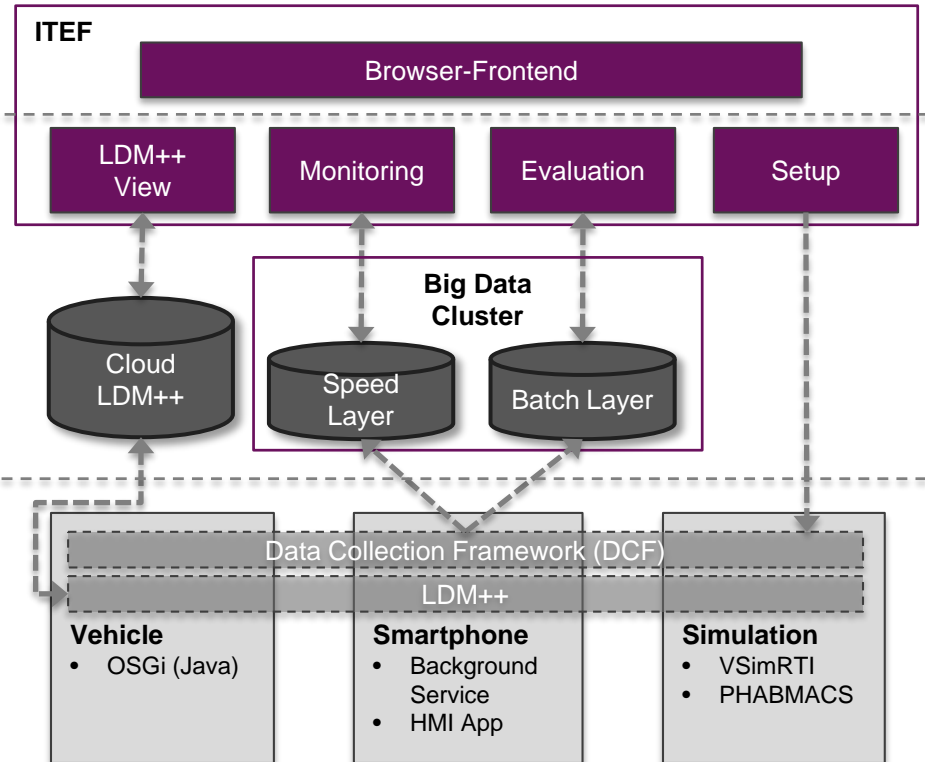
- Completely web-based

## Backend

- Tomcat / J2EE
- Hadoop
- Accumulo
- Flink

## Client

- DCF & LDM++ Libraries in Java
- Wrapper for Android, OSGi, C#



# MOBILITY BIG DATA: HARMONIZATION AND COLLECTION

- Every measurand is pre-defined, including a data type
- Individual measurands can be combined to log entries
- API with type-safe logging functions for developers
- Mapping of different measurands across different projects

The screenshot displays the Fraunhofer FOKUS mobility data management interface. It features a map on the left showing a vehicle's location and a main panel with three tables:

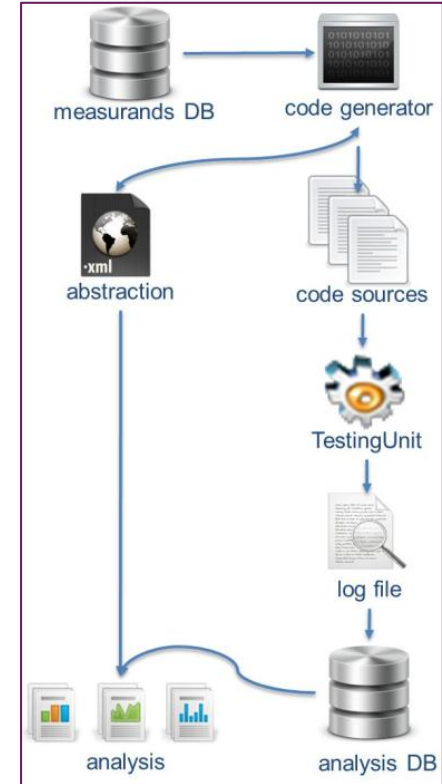
ID	Name	Contact	Description	Version	Bundle generated on	Download LogDefinition	Download LogTuple
1	TestComponent	Ralfert Groß	For testing only	2	2017-04-11-10-46-01-688	Download XML	Download ZIP
2	reporter	Daniel Becker	For testing the upload of log files only	2	2017-04-21-19-03-00-415	Download XML	Download ZIP

ID	Name	Description	Param1	Param2	Param3	Param4	Param5	Param6	Param7	Param8	Param9	Ext_Id	Ext_Ext
1	pos	Position data and speed	lat	lng	speed							101000000100000006	
2	pos	Position data and speed	lat	lng	speed							101000000200000009	

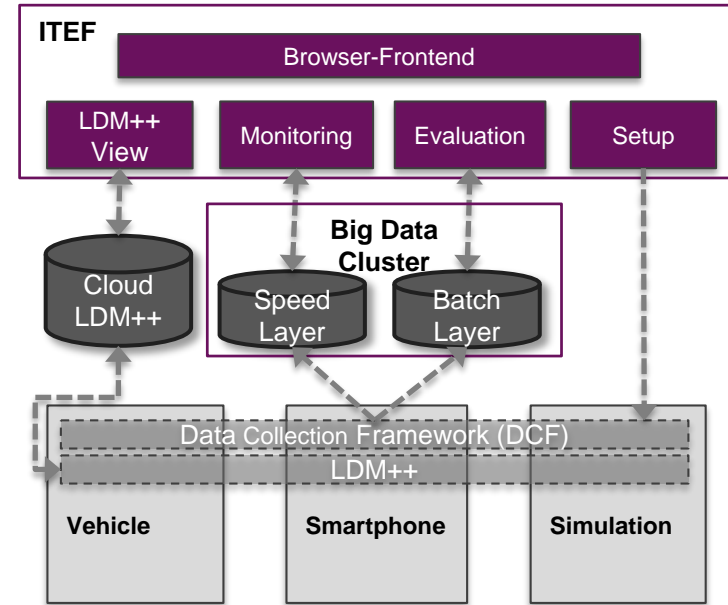
  

ID	Name	Description	Data Type	Unit	Min	Max	Enum	Ext_Id	PID Ref
1	lat	Latitude in degrees	float (F)	degrees	-90.0	90.0		101000000100000001	100000000100000001
1	lng	Longitude in degrees	float (F)	degrees	-180.0	180.0		101000000100000002	100000000100000002
1	speed	Speed	float (F)	km/h	-50.0	300.0		101000000100000003	100000000100000005
1	test	A test message	string					101000000100000004	100000000200000002
1	test	A binary value that is probably encoded	byte	byteOffsetType	0	4096		101000000100000005	100000000200000001
2	lat	Latitude in degrees	float (F)	degrees	-90.0	90.0		101000000200000001	100000000100000001
2	lng	Longitude in degrees	float (F)	degrees	-180.0	180.0		101000000200000002	100000000100000002
2	speed	Speed	float (F)	km/h	-50.0	300.0		101000000200000003	100000000100000005
2	test	A test message	string					101000000200000004	100000000200000002
2	LEGALAR	A binary value that is probably encoded and represents a LEGAL score	byte	LEGALAR	0	10240		101000000200000005	100000000200000010
2	OCIDOMEIDRY	A binary value that is probably encoded and represents an OCIDOME message	byte	OCIDOMEIDRY	0	4096		101000000200000006	100000000200000011
2	VIDEORNAME	A binary value that is probably encoded and represents a VIDEO message	byte	VIDEORNAME	0	10240		101000000200000007	100000000200000012
2	LOCALGATICAID	A binary value that is probably encoded and represents a LOCALGATICA message	byte	LOCALGATICAID	0	4096		101000000200000008	100000000200000013



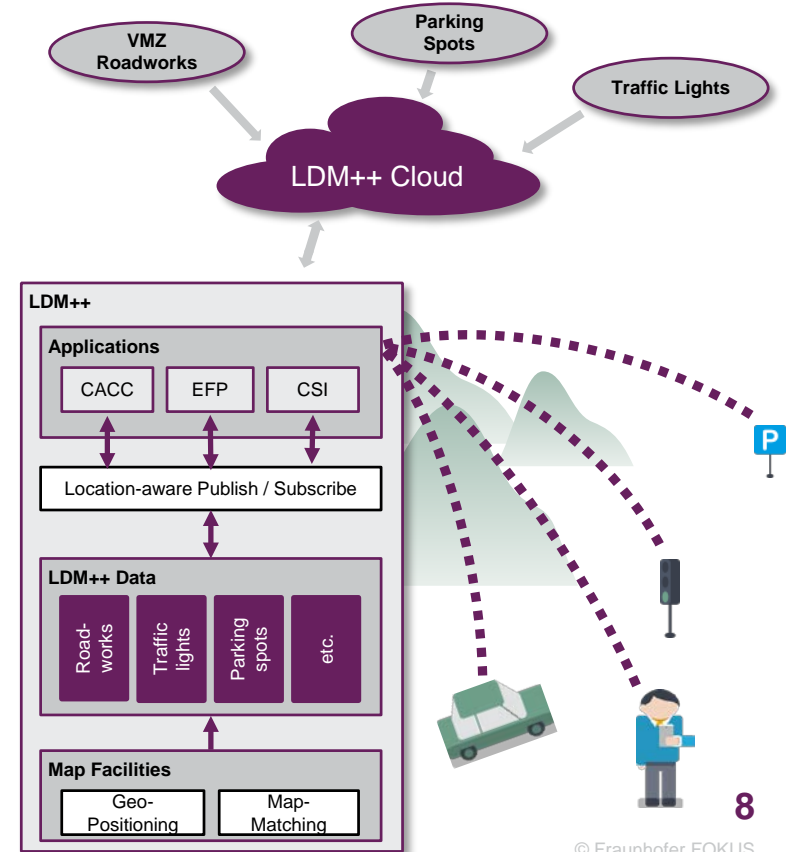
# DATA COLLECTION – SUMMARY

- **LDM++ (combined data sink and source)**
  - Cloud-based, locally deployed instances, online data access, low frequency changes, small amounts of data, e.g. traffic signs, parking spots
- **Monitoring (Speed Layer)**
  - Infrastructure deployment, online access and visibility, high frequency changes, small amounts of data, e.g. vehicle status, traffic light phases
- **Evaluation (Batch Layer)**
  - Infrastructure deployment, offline, any frequency, **big** amounts of **data**



# LOCAL DYNAMIC MAP++

- Location-based data distribution
- publish/subscribe model
- Locally deployed LDM++ instance on each participating node
- Event based close-to-realtime distribution of data
- Best effort synchronisation to cloud



# MONITORING / SPEED LAYER

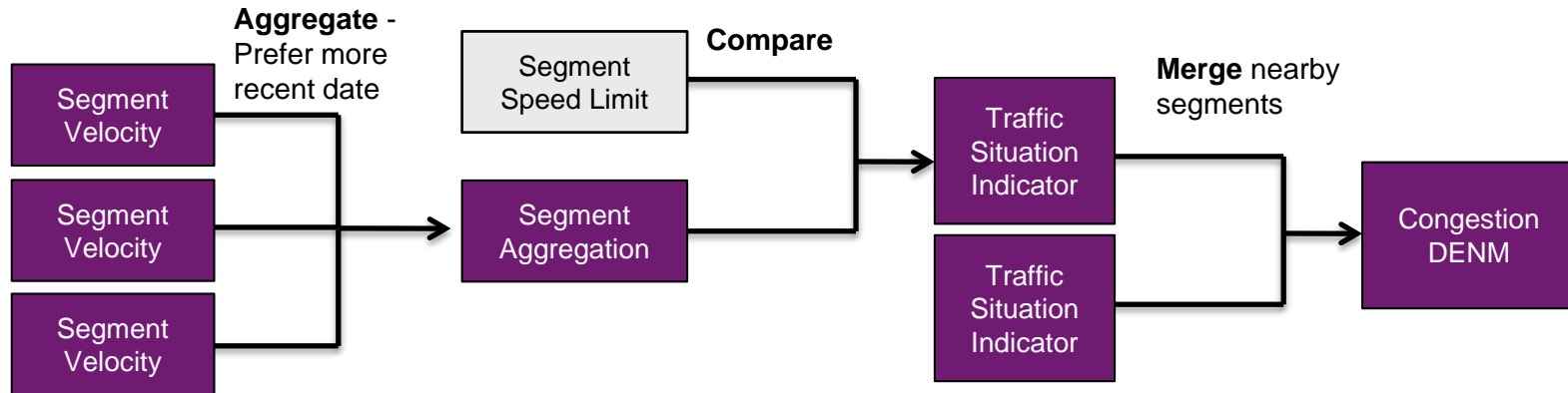
## Example: Change Detection in HD Maps

**Observation** Use Case: Operator inspects measurements

**1<sup>st</sup> level of automation:** Inspection of thresholds → immediate validation

**2<sup>nd</sup> level of automation:** Aggregation by pipelining

- Aggregation of speeds of vehicles per road segment over place/ time  
→ Generation of traffic jam DENM



# EVALUATION / BATCH LAYER

- Analysis of **big** amounts of **data**
- Definition of **data baskets**
- Queries in **5 dimensions**:
  - time
  - location
  - node/ station id
  - signal type
  - signal values
- Plot functions and data export



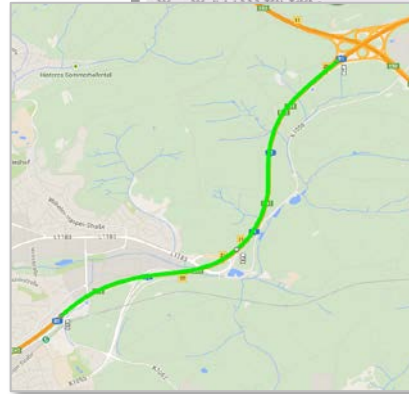
The screenshot shows the ASCT software interface with the following data:

Scenario: 201 - N\_A\_1.2.2.2\_IP01\_A642P\_a (Run 1671) (17/17): 31.10.12, 11:30 - 12:30

SCENARIOS		Repetitions
161	161 - T_F_1.2.2_05_K0101	0 / 0
162	162 - T_F_1.2.2_04_K0101	0 / 0
163	163 - T_F_1.2.2_01_K0102	0 / 0
169	169 - N_A_2.2.4.1_TG01_T600a_b	27 / 0
174	174 - N_A_2.1.4.1_TG01_T600a_a	18 / 1
184	184 - N_A_1.2.3.2_IP01_D0220_d	2 / 0
193	193 - N_A_1.2.3.2_IP01_D0220_e	2 / 0
194	194 - N_A_1.2.3.2_IP01_D0220_f	13 / 0
200	200 - N_A_2.2.2.1_TG01_T622P_a	5 / 0
201	201 - N_A_1.2.2.2_IP01_A642P_a	17 / 0
203	203 - N_A_1.3.3.3_TG01_T606P_a	4 / 0
204	204 - N_A_1.3.3.3_TG01_T626P_a	3 / 0
205	205 - N_A_1.3.3.3_TG01_T636P_a	3 / 0

TEST RUNS		Start time	Stations ...	Status
201	17 / 17	31.10.2012 11:30	102	FINISHED
277	83 / 105	31.10.2012 11:00	35	FINISHED
261	10 / 15	31.10.2012 10:00	33	FINISHED
271	35 / 35	31.10.2012 10:00	35	FINISHED
260	8 / 11	31.10.2012 09:00	35	FINISHED
83	24 / 27	30.10.2012 14:00	20	FINISHED
277	82 / 105	30.10.2012 12:00	21	FINISHED
218	24 / 28	30.10.2012 10:00	68	FINISHED
302	24 / 35	29.10.2012 16:00	22	FINISHED
278	59 / 67	29.10.2012 14:30	38	FINISHED
169	25 / 27	29.10.2012 14:30	22	FINISHED
269	18 / 26	29.10.2012 13:00	22	FINISHED
234	8 / 8	29.10.2012 13:00	38	FINISHED





# SUMMARY

- FOT as basis for big data, complemented by Simulations
  - Challenges due to distributed collection, formats
  - Additional value by employing Big Data techniques
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- With new sensor technologies, amount of data will again increase, higher demand for proper tooling

