# 1 Stream Reasoning Workshop 2019 - Challenge Track

# 2 Description

The idea of this Stream Reasoning (SR) Challenge originated in a session of the SR Workshop 2018, where several groups worked out a possible formats for comparing and evaluating stream reasoning/processing tools.

One conclusion was that our community misses an unified agreement which formalism, languages, and standards stream reasoning/processing includes. Hence a benchmark competition comparing the tool performance is not feasible yet.

Our idea is to host a "model and solve" challenge, where we evaluate the modelling skills independent of the formalism/language. For this, we provide a given scenario mixing cooperative intelligence transport systems and social media streams with one or more (if time allows) tasks to solve. At the end of the challenge, we will evaluate the development effort, easyness of use, and originality of the solutions.

**PS: Do we have the funding for awards?**

The different teams can bring their own tools or are encouraged to apply another preferred tools, which might be from a different community.

**Important: Please let us know what tool you will provide or would like to use, so we can prepare ourselves for it!**

# 3 Important Dates

- 08.04.2019: Team registration
- 14.04.2019: Start of the challenge
- 17.04.2019: Presentation of results and report

# 4 Problem Description, Scenario, Tasks

As mentioned, the format will be a "model and solve" challenge, where the modelling skills independent of the formalism/language are evaluated. We outline the two combined scenarios, introduce the tasks, and outline the rules.

## 4.1 Scenarios

**C-ITS.** This C-ITS scenario is in the area of cooperative intelligent transportation systems (C-ITS), where we are able observe and analyze streams of vehicle movements and traffic light signal phases. Additionally, we will include unexpected events (triggering by us) such as vehicle breakdowns.

In this scenario we can group the tasks to be tackled into:

- Gathering traffic statistics, e.g., counting the number of vehicles passing;
- Event detection, e.g. detecting, accidents or traffic jams;
- Diagnosis, e.g., finding the cause for a traffic jam;
- Motion planning, e.g., routing the vehicles optimally through the network.

The challenges of this scenarios originates from spatio-temporal nature of the traffic data, the possible hight velocity and volume, and as well the rather complex domain model.

**Social Media.** ...

**PS: Danh, please complete**

**Combined Scenario.** Both scenario are integrated into a transport social media scenarios, where messages are either send from the vehicles or form fixed places. The combination allows us to add contextual information to the vehicle movements and variable locations to the messages. One task could include to distinguish different causes for a traffic jam, i.e., the traffic jam could be caused by external causes, e.g. a concert, or internal causes related to an overload of the road network.

**PS: Danh, we still need to integrate both scenarios (via GPS positions)**

## 4.2 Tasks

Following, we present three fixed tasks, which are extended with user submitted task.

**Task 1 (C-ITS).** Traffic jam detection...

**Task 2 (Social Media).** To be defined...

**Task 3 (Combined).** External causes, e.g. a concert, versus internal causes related to an overload of the road network...

# 5 Rules and Evaluation

We introduce the following rules (open for discussion):

(1) The organizers select a number of problem tasks, which aree selected from the given (see above) and user-submitted tasks. A set of test streams for each task is predefined, expressed in possible instance input formats Datalog and RDF.

(2) The organizers provide a set of tools (list below), however, users are allow to bring their own tools, or even simply use scripts.

(3) For each task, teams are allowed to use a specific solver (or a solving script) and a problem encoding.

(4) Teams can either be assembled before the conference, or are on-demand set-up at the begin of the challenge.

(5) Solutions should be presented at the end of the competition.

After the solution presentation, a jury selected from the workshop participant give scores according on the criteria:

- Development effort,
- Operability and easyness of use,
- Problem coverage,
- Originality of the solutions.

# 6 Data, Platform, Systems

## 6.1 ITS Data

The provided data is based on a realistic traffic simulation of four intersections in a #-shaped layout. The scenario environment was developed with the microscopic traffic simulation *SUMO* or *PTV VISSIM* that allows us to simulate realistic driving behavior and signal phases. The structure of the intersection, driving patterns and signal phases are fixed, but we have adapted the traffic densities by light, medium, and heavy traffic.

We extracted the actual state of each simulation step, allowing us to replay the simulation from the logs.Throughput of the replayed streams can be increased by replaying the simulation with 5ms, 10ms, 50ms, and 100ms (real-time speed of traffic) delay.

**Static Knowledge:** As shown in the figure, each intersection connects four roads with two incoming and outgoing lanes for each road. For the two incoming lane one signal group is assigned. Further, for each lane we define is geometrical extension (a polygon) and the connection from in incoming to outgoing lanes. As an example, lane "i100_l1" in our model is described in Datalog as:

- `intersection(i100).`
- `mapLaneIn(i100_l1).`

- `isPartOf(i100_l8, i100).`
- `hasGeo(i100_l1, "POLY((0 1, 2 1, 2 3, 0 3, 0 1))").`
- `connected(i100_l1, i100_l3).`

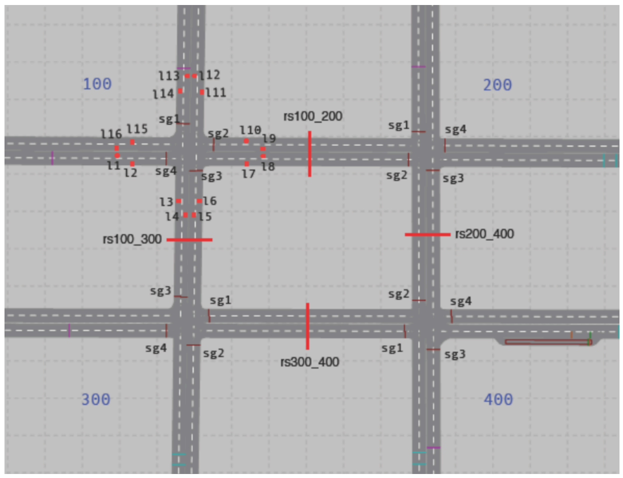


Figure 1: #-shaped intersections

The four signal groups are managed by one traffic light controller, which assigns red (stop) and green (go) states to signal phases. The signal phases for each signal group are encoded in a signal plan, where the green/red split of a full phase length is defined.

We provide two separate schemas for this, one is the ITS ontology (http://www.kr.tuwien.ac.at/research/projects/loctrafflog/ekaw2018/) and the other is simplified version of the ontology encoded in Datalog.

**Data Streams:** The microscopic model of the traffic is represented by four data streams extracted from simulation in each step. They include vehicle speed and position, heading, as well as signal phase states. each data point has an vehicle ID *id* (beside signal group id *group*, and a time stamp *ts* assigned:

- `speed(id, speed, ts)`
- `pos(id, point(x,y), ts)`
- `heading(id, angle, ts)`
- `signalPhase(group, state, ts)`

**PS: We could add a weather stream...**

## 6.2 Social Media Data

**PS: Danh, please complete**

### 6.3 Evaluation Platform

**PS: Needs to be clarified**

### 6.4 Systems

Besides the user-provided system, we already provide a selection of systems that could be used in the challenge:

- CQELS
- C-SPARQL or YASPER
- Hexlite
- RDFox
- Vlog

**PS: Need to check which each developer, to find out if we are allowed to us the tool**

## 7 Results

Will be announced...

## 8 Organization

The co-chairs of the event are:

- Patrik Schneider, TU Wien and Siemens AG, Austria
- Danh Le Phuoc, TU Berlin
- Daniel de Leng, Linköping University

Riccardo Tommasini, Politecnico di Milano, helped design the challenge and supported us with TripleWave and RSPLab.

Thanks to the developers, who provided us with tools: