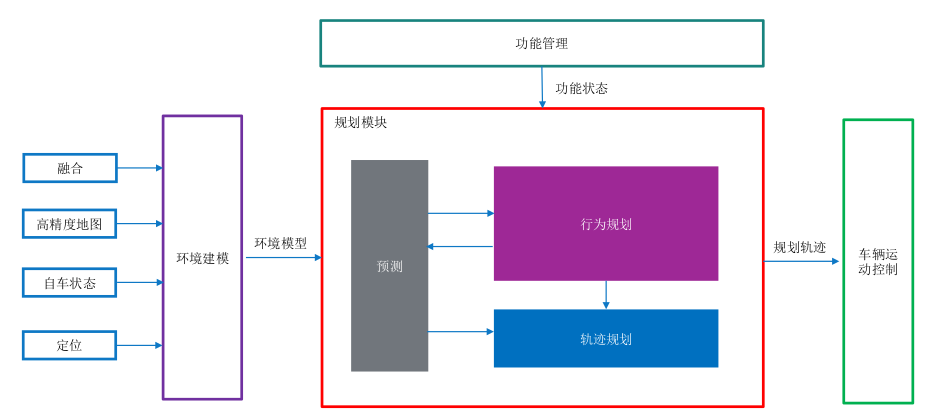
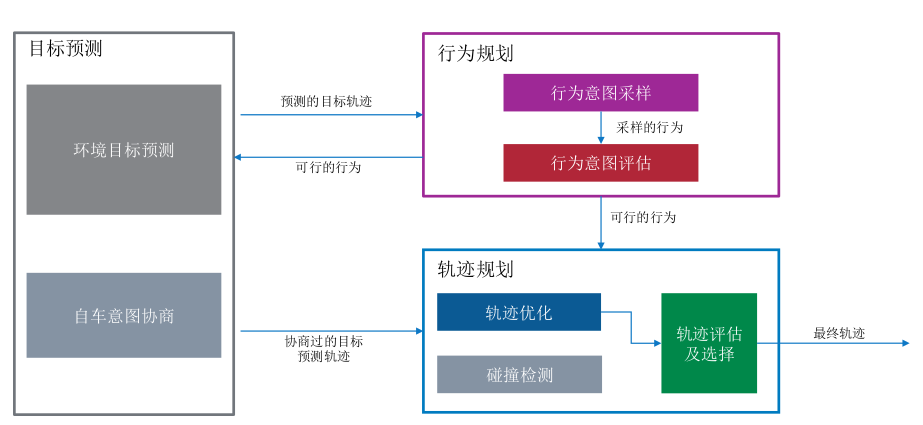
planning

FCT

planning模块划分为环境建模，预测，行为规划，轨迹规划。

**2 Planning Functional Requirements**





**2.1 Environment Model**

2.1.2.1 Perception

2.1.2.2 Road Topology

2.1.2.3 Localization

**2.2 Prediction**

The prediction module provides the estimated future info of objects.

Prediction module shall provide trajectory prediction for cyclist for future p\_MAX\_pred\_time seconds with each step being p\_pred\_step\_time s. Predicted information shall include:

- position;

- velocity;

- orientation;

Prediction module shall provide intent prediction for vehicle. Intent shall include:

- lane keeping

- left lane change

- right lane change

- left turn

- right turn

- U turn

**2.3 Function Manager**

The function manager shall output the following evaluations for the supported behaviors requested by FCT:

- Assessment, reflecting confidence that its model assumptions are fulfilled and that it can assess the current situation and behavior accurately;

- Driver intention match, implement the driver's agreement with the behavior;

- Necessity, which can be summarized as the collision probability of ego vehicle with an object (pedestrian, cyclist, vehicle, road side boundary) or regulation (lane lines) if the course of the ego vehicle is not altered.

- Collision Probability, which is interpreted as the collision probability conditioned on the system reaction being executed continuously.

- Whether valid and recommended (m\_reactionPattern.isValid or m\_isReactionPatternValid)

The function manager shall at least output the intention values for the following behaviors requested by FCT:

- ALD\_LongLat

- ALD\_Long

- ALC\_Left\_LongLat

- ALC\_Right\_LongLat

- E2E\_highway

- E2E\_urban

**2.4 Behavior Planner**

The behavior planner is a module which provides the behavior level info for trajectory planning module as input.

The behavior planner shall consider multiple trajectories predicted by prediction module to make a decision.

The behavior planner shall provide required inputs for the trajectory planner.

**Driving scenarios**

**2.4.1 Adaptive Cruise Control**

**2.4.2 In-lane Driving (TJA/ICA)**

**2.4.3 Automatic Lane Change (ALC)**

**2.4.4 End to End**

**1 Lane following**

The Behavior Planner shall working properly to drive safely, efficiently and comfortably under Lane-Following status in below scenarios:

- Stop & Go traffic situation;

- Driving in lane with vulnerable road users;

- Driving in lane with crosswalk in front;

- Static objects in the ego driving lane in front;

- Other vehicle cutin into ego driving lane;

- Neighbor lane with parked vehicles, vehicles parking out, parked vehicles with door open;

- Passing through truck driving on neighbor lane;

- Driving in lane in tunnel;

- Entering new speed limit zone indicated by new speed limit sign;

- Driving in big curvature lane;

**2 Lane change procedure**

**3 Lane Merge/Split**

**4 Urban E2E Intersection**

**5 Urban E2E Roundabout**

**6 Safe Stop**

The behavior planner shall propose a safe stop behavior to let ego stop with deceleration lower than p\_u\_Safestop\_Axlimit if safe stop is requested by FCT.

**7 Intelligent evasion**

**8 Intelligent Speed adaption(ISA)**

**9 Side Pass**

**2.5 Motion Planner**

The trajectory planner receives the environment model info and behavior planning result, plans a trajectory for ego vehicle to follow

The trajectory planner shall plan a furture trajectory for ego vehicle for p\_max\_plan\_horizon s

**Remark:p\_max\_plan\_horizon=8s**

基础信息：

Coordinate introduction:

- Local Coordinate Frame

This coordinate frame uses the initial position when turned on as origin point, and the vehicle direction as axis orientation, updates with odometry accumulation and localization delta.

- Frenet Coordinate Frame

This cooridnate frame is built based on a reference line, uses the distance along the ref line as S direction, the distance in normal direction to the ref line point as L direction.

- Ego Vehicle Coordinate Frame

This coordinate frame origin is within the center point of the rear axle of the ego vehicle. Its x-axis points towards the positive driving direction. The y-axis towards the left side and the z-axis out of the plane of drawing.

The environment model shall provide time synchronization to:

- dynamic object

- static world

- odometry

- localization information.

**3 Planning Non-Functional Requiremnets**

**4 Planning Safety Requirements**

# 输入和输出

2.1.2.1.0-1 The perception information mainly includes:

- dynamic world

- static world

- free space, indicates the space could be traversed by vehicles

- visible grid map, the grid value indicates whether the grid could be detected by any sensor

## 感知输入：

The perception information mainly includes:

- dynamic world

- static world

- free space, indicates the space could be traversed by vehicles

- visible grid map, the grid value indicates whether the grid could be detected by any sensor

目标

车道线

## 定位与地图输入：

自车绝对位置

地图拓扑

# 输出:

**轨迹**

**行为**

## 预测：预测模块

## 轨迹预测：

### intent预测：

预测交通参与者可能会执行的行为

## 行为规划：

环境坐标转化：转换为frenet坐标系

搜索算法：A\*

曲线选择：cost计算

## 路径规划：

路经编码：贝赛尔曲线

动态目标避障：