



全球

World Of Tech 2017

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软件开发技术峰会

DEVELOPMENT



人工智能在车载交互的应用

郭霄
出门问问
技术总监

自我介绍

- 哈佛硕士，复旦本科
- Endeca (Oracle) – 大数据可视化
- LinkedIn – 职场社交
- Uber – 智能出行
- Uber ATG – 自动驾驶
- 出门问问 – 智能车载负责人



更快速 更省钱 更环保 更简单 更愉悦

车联网
Connected Cars

无人驾驶
Autonomous Driving

电动(新能源)驱动
Electric Powered

传统媒体
(电视, 杂志, 报纸)

- 物理媒介
- 单向信息传递
- 集中分发

电子传媒
(门户网站, 论坛, 博客)

- 电子化
- 双向信息传递
- 信息过载

智能推荐
(头条)

- 主动推送
- 个性化, 场景化
- 智能学习

AI CAR is the natural evolution from connected-car, similar as the evolution from internet media to AI era media



驾车体验

换道

保险涨价了

找车位

没机油了

人有三急

导航

接电话

调温度

音乐不好听

找加油站

调整后视镜

- 10年前，iPhone
- 多点触摸为核心交互的智能手机

- 10年前，iPhone
- 多点触摸为核心交互的智能手机

- 剑桥大学2017年4月发布
- 52%的撞车是由于使用智能手机导致
- 过去几年美国汽车保险公司为此蒙受数十亿美元的损失



Principle for safe-driving

- Eyes on the road
- Hands on the steering wheel
- Minds on the drive

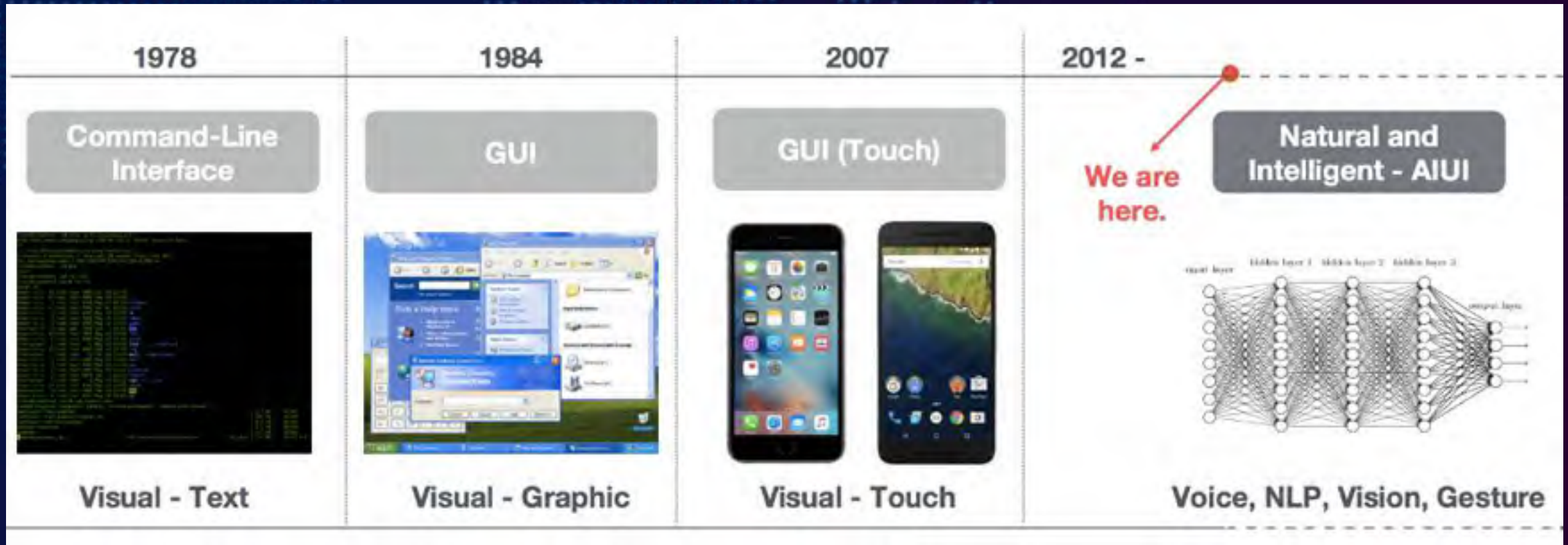


Fast and less distraction HMI Design

- Glanceable UI (Bigger fonts size)
- Shorter steps (ideally within 2 steps)
- Natural Voice Interaction (handsfree)
- Physical button for blind operation (high frequency features)

- 语音交互
- 知识图谱
- AI助手
- 智能推荐
- UBI保险
- 计算机视觉

AI enabled Voice Interaction is the key for the next generation vehicle HU, thus should be deeply reflected in HMI design



“提醒我下午三点钟和徐总开会”

ToDo; Reminder

“空调调到23度”

AC control

“搜一下沿途的加油站”

Gas Station

“播放我的收藏歌曲”

Favorite playlist

“吴亦凡的饶舌歌”

Singer

“打电话给吴宝昌”

Phone

“导航到虹桥机场T2楼”

Navigation

“打开天窗到一半”

Car control

你好，请问有什么可以帮助你？

你可以试试问我

“附近有什么餐厅”

“今天有什么有趣的头条新闻？”

“明天北京的天气”

“北京明天的限行尾号”



“安亭镇上最好吃的川菜”

Restaurant

“要评价最好的”

“发短信给吴博士，说我晚十分钟到”

SMS sent

“今天的PM2.5？”

Weather

“来个关于奥巴马的笑话”

Jokes

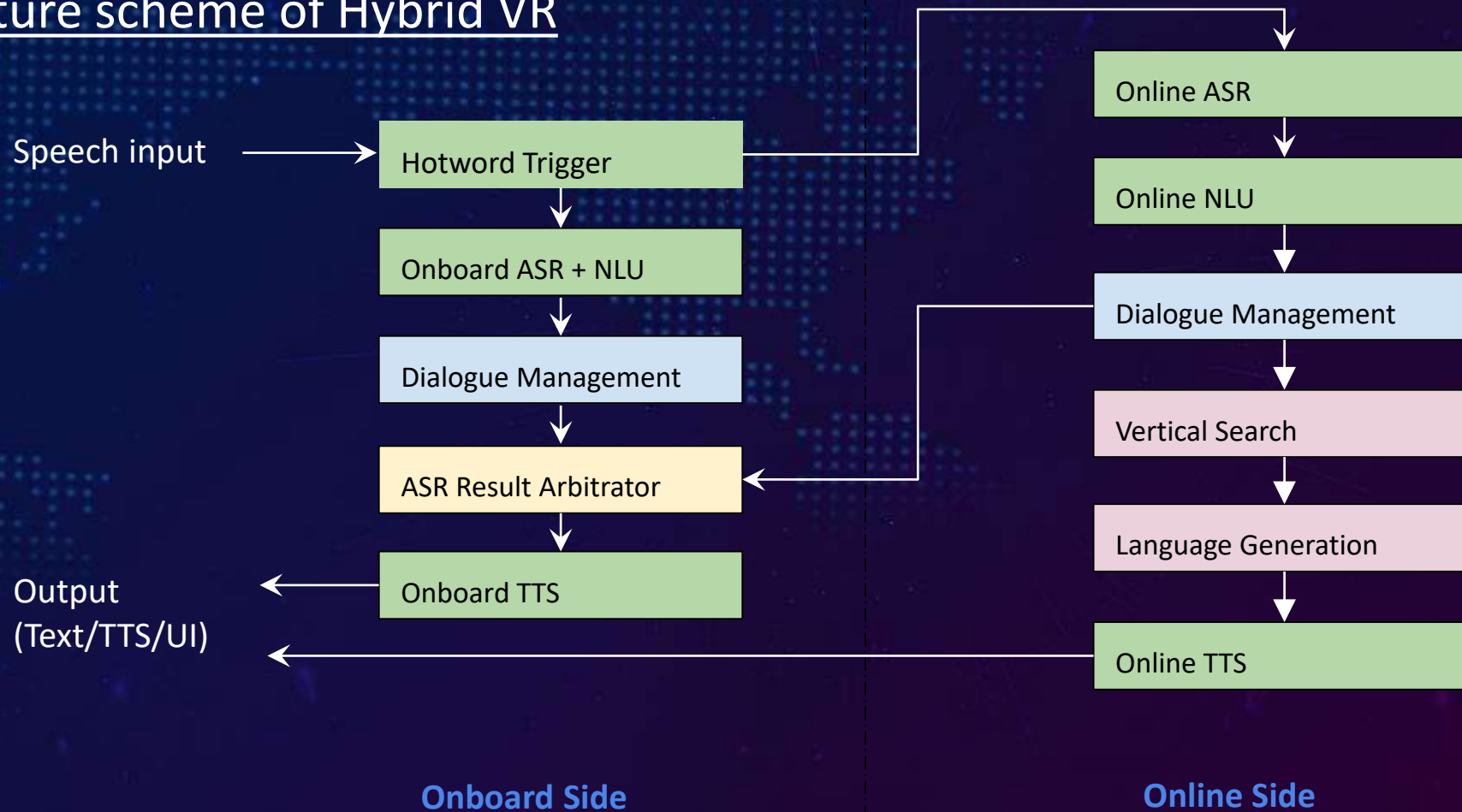
“晚上有什么好看的电影？”

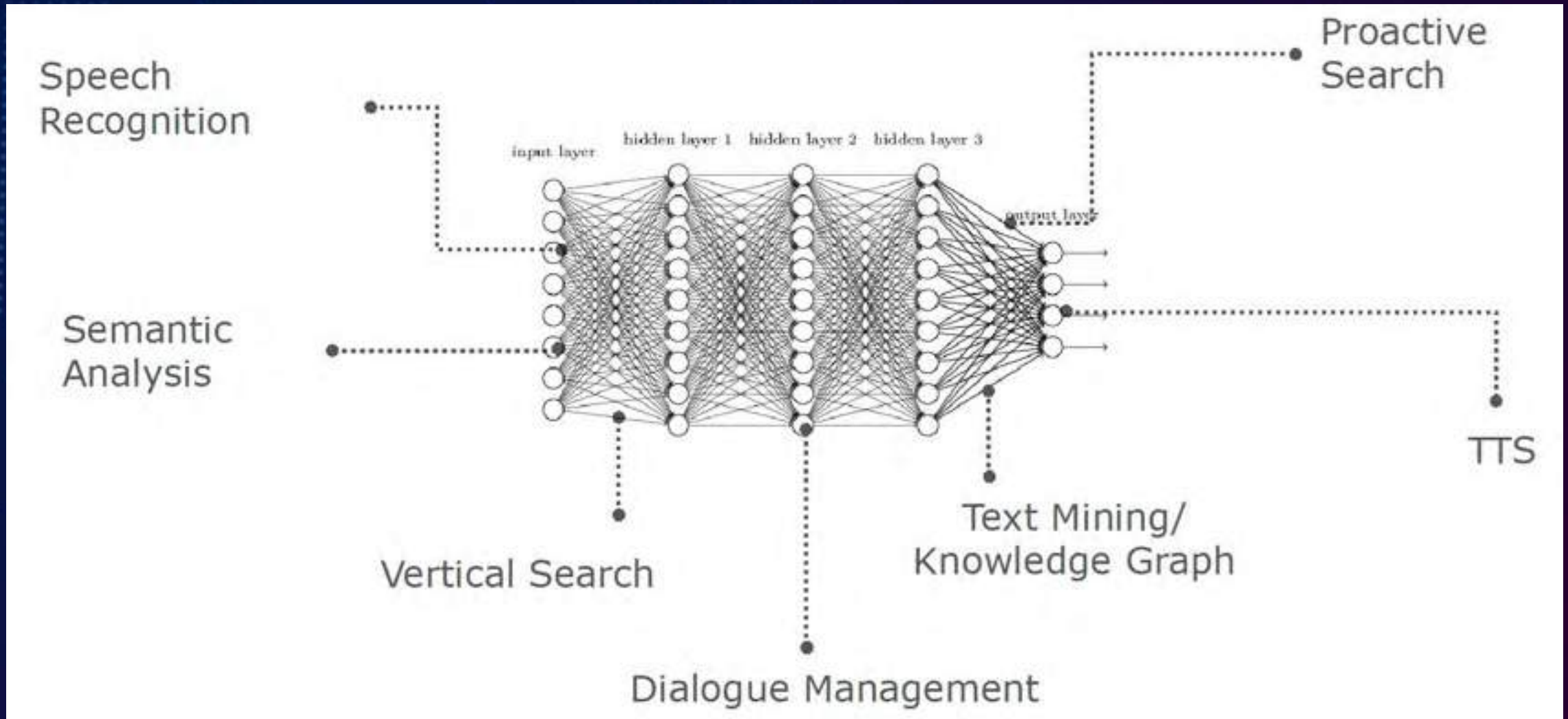
Movie

“海淀区的大众汽车4S店”

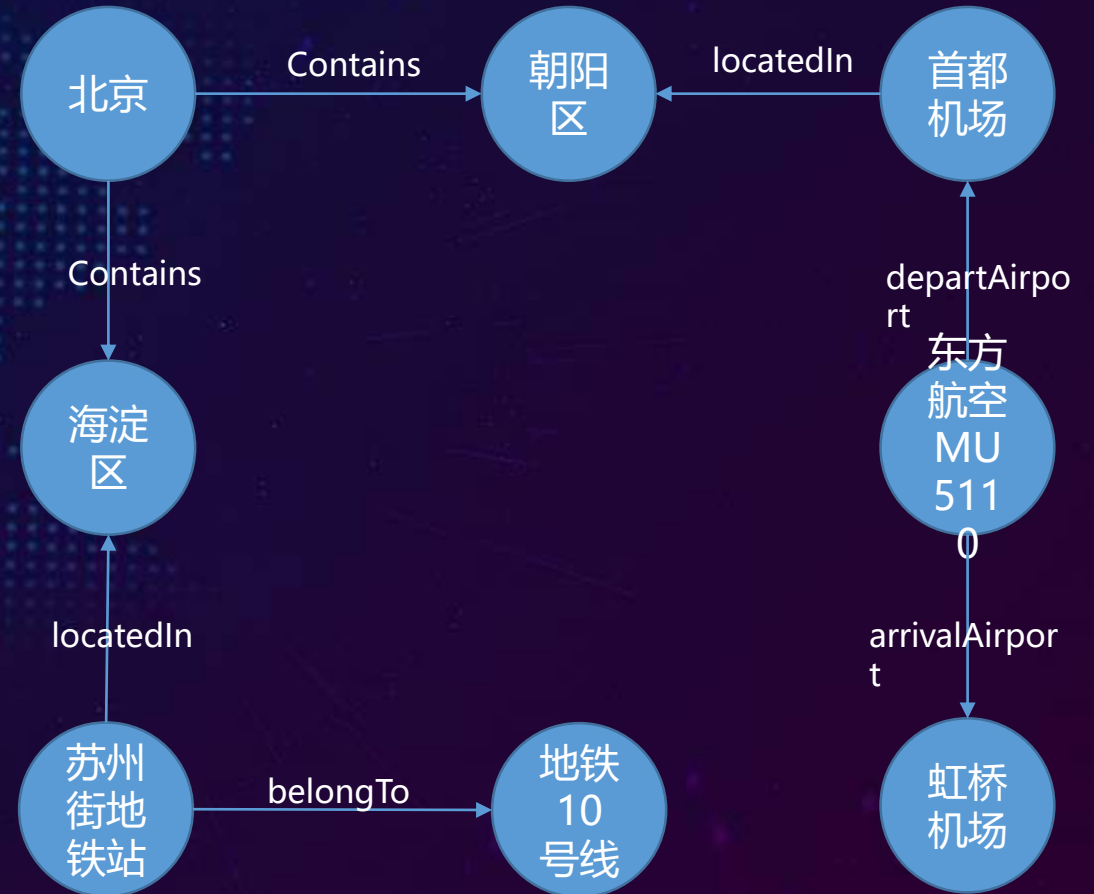
POI 4S dealer

Architecture scheme of Hybrid VR





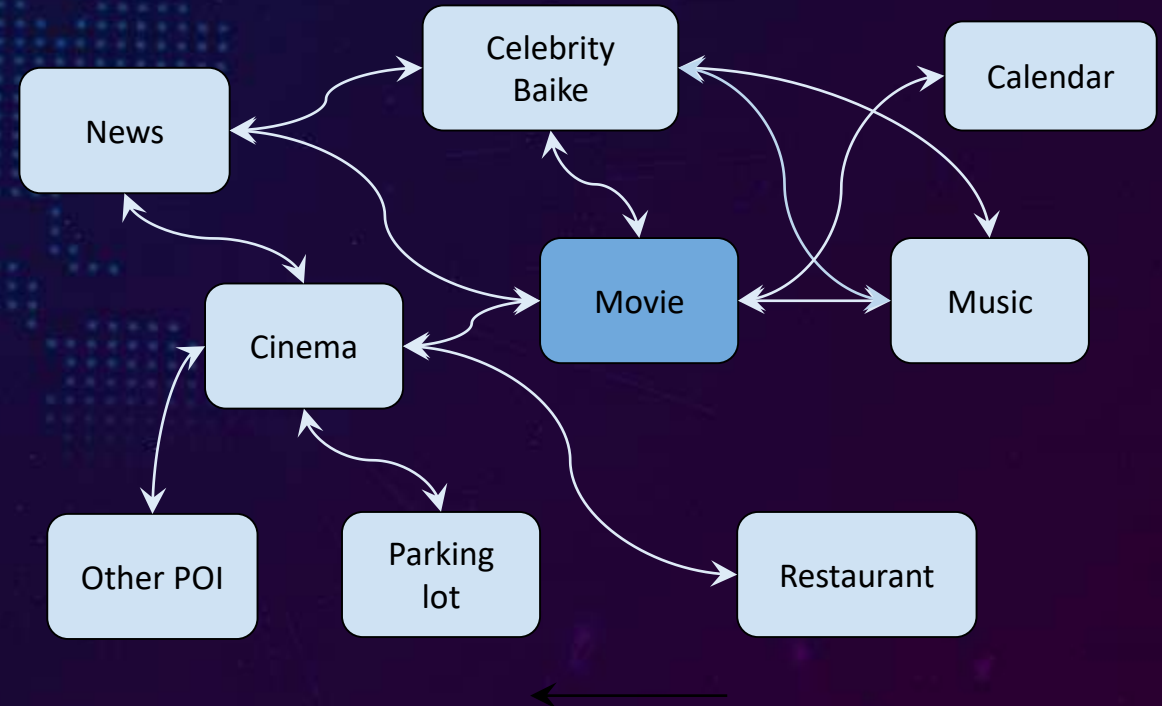
- Knowledge graph for in-domain data
 - About 40M entities of POI
 - Data organized in standard triplet structures
- Use of knowledge graph in learning systems
 - Entity detection and entity linking
 - Semantic tagging for queries
 - KG-based question answering
- Efficient web based user interface
 - Maintenance of knowledge graph
 - Training and test of models



Multiple domain-data are connected via Knowledge Graph(KG) and relevant search technique. Users can conduct dialogue around CPs/SPs without starting again.

Knowledge Graph/Relevant Search across CPs/SPs:

- Movies
- Actors in the movies
- Related music in the movies
- Director's or movie's baike
- Online cinema
- Related news



KG-Based QA Dialogues:

“Any good movies tonight?” / 今天的电影？

“Who’s the lead actor?” / 主演是谁？

“Find me relevant cinemas” / 最近的(上映)影院

“OK save to my To-Do” / 保存到我的待办

...

- 围绕用车的需求
 - 维修手册询问
 - 语音搜寻餐厅，充电桩，停车场
 - 娱乐媒体
 - 车辆控制温度，天窗，座椅
- 情感助手，深度个性化交流
 - 用户画像, 不断学习
 - 推荐

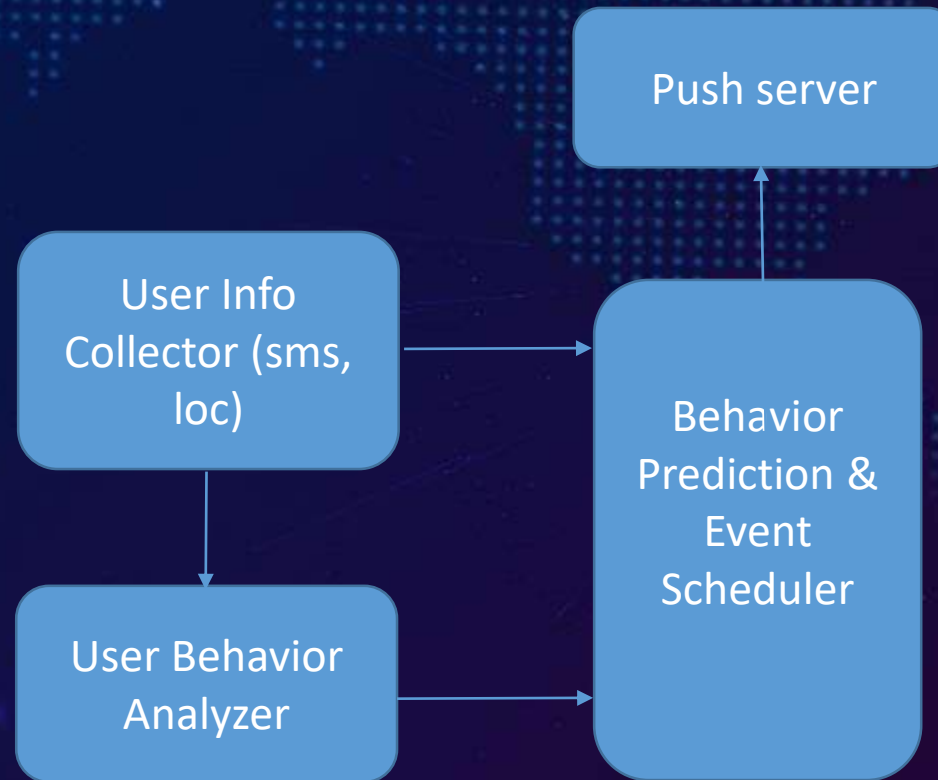
“AI Home Page” is the startpoint and endpoint of any operation.

Here at left part is the smart notification stream, which can provide proactive information at glance. The types of notification include:

- Predictive navigation
- Plate violation
- Road restriction
- Agenda/ToDo
- Vehicle Maintenance
- Parking meter
- Music recommendation
- OEM CRM events
-



Smart Home-Page: proactive information at glance based on deep learning and user preference



- 根据驾驶行为数据打分
- 用户驾车行驶习惯推荐user based insurance
- 总结驾驶行为波动情况，帮助改善驾驶行为
- 共享租车，打车保险

Computer Vision

Object Detection

- ▶ Deep neural network based detection of different object types, such as vehicle, traffic signs and pedestrian.

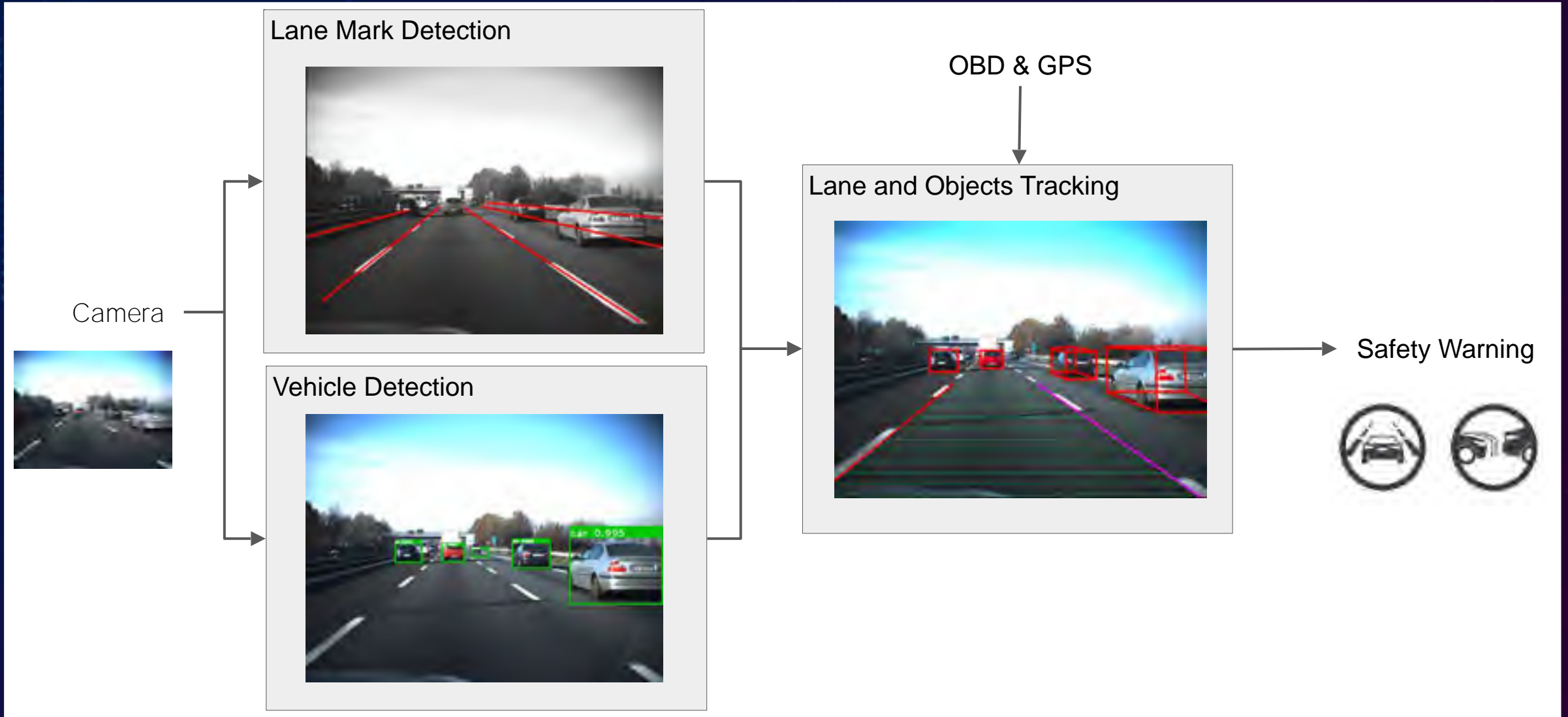
Face Analysis

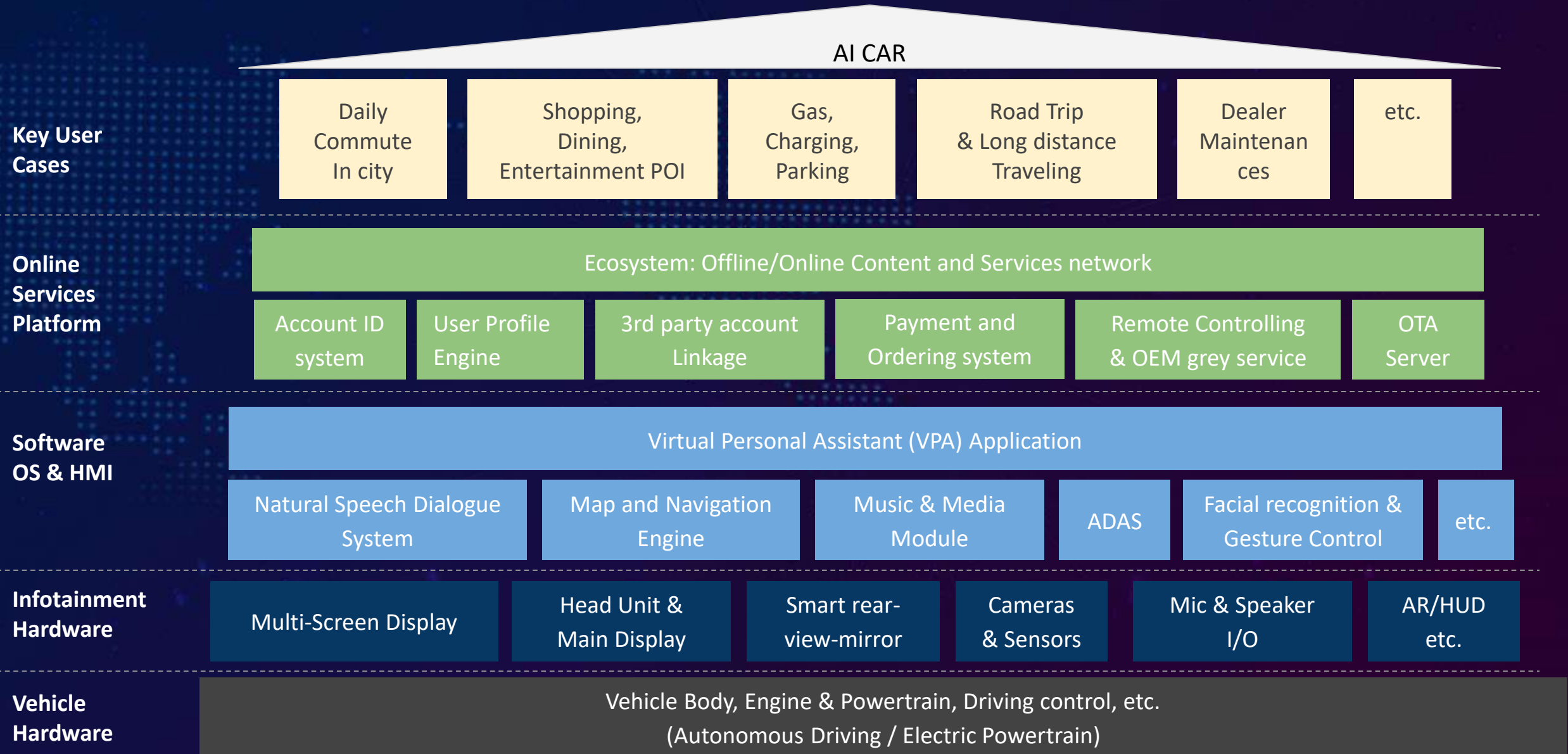
- ▶ Face detection, face recognition, eye tracking. Can be used in driver alertness monitoring system.

SLAM (Simultaneous Localization and Mapping)

- ▶ Real-time camera based 3D visual SLAM.







- 车驾驶的智能
- 车交流的智能

分级	SAE	定义	驾驶操作	周边控制	支援	系统作用域
0	无自动化	人类驾驶者全权操作汽车，行驶过程中得到警告和保护系统的辅助	人类驾驶者	人类驾驶者	人类驾驶者	无
1	驾驶支援	通过驾驶环境对方向盘加减速中的一项操作提供驾驶支援，其他的驾驶动作由人类驾驶员操作	人类驾驶者 系统			部分
2	部分自动化	通过驾驶环境对方向盘加减速中的一项操作提供驾驶支援，其他的驾驶动作由人类驾驶员操作	系统	系统	系统	全部
3	有条件自动化	由无人驾驶系统完成所有的驾驶操作，根据系统请求，人类驾驶者提供适当的应答				
4	高度自动化	由无人驾驶系统完成所有的驾驶操作，根据系统请求，人类驾驶者不一定需要对所有的系统请求作出应答，限定道路和环境条件等				
5	完全自动化	由无人驾驶系统完成所有的驾驶操作，人类驾驶者在可能的情况下接管。在所有的道路和驾驶环境下驾驶。				

UBER ATG

51CTO

Top mounted lidar units provide a 360° 3-dimensional scan of the environment

Side and rear facing cameras work in collaboration to construct a continuous view of the vehicle's surroundings

Forward facing camera array focus both close and far field, watching for braking vehicles, crossing pedestrians, traffic lights, and signage

Roof mounted antennae provide GPS positioning and wireless data capabilities



Custom designed compute and storage allow for real-time processing of data while a fully integrated cooling solution keeps components running optimally

Self Driving Uber sensor suite

7 Cameras
1 Laser
Inertial Measurement Units

Custom compute and data storage
360° radar coverage

Advanced
Technologies
Group

UBER

UBER ATG

51CTO

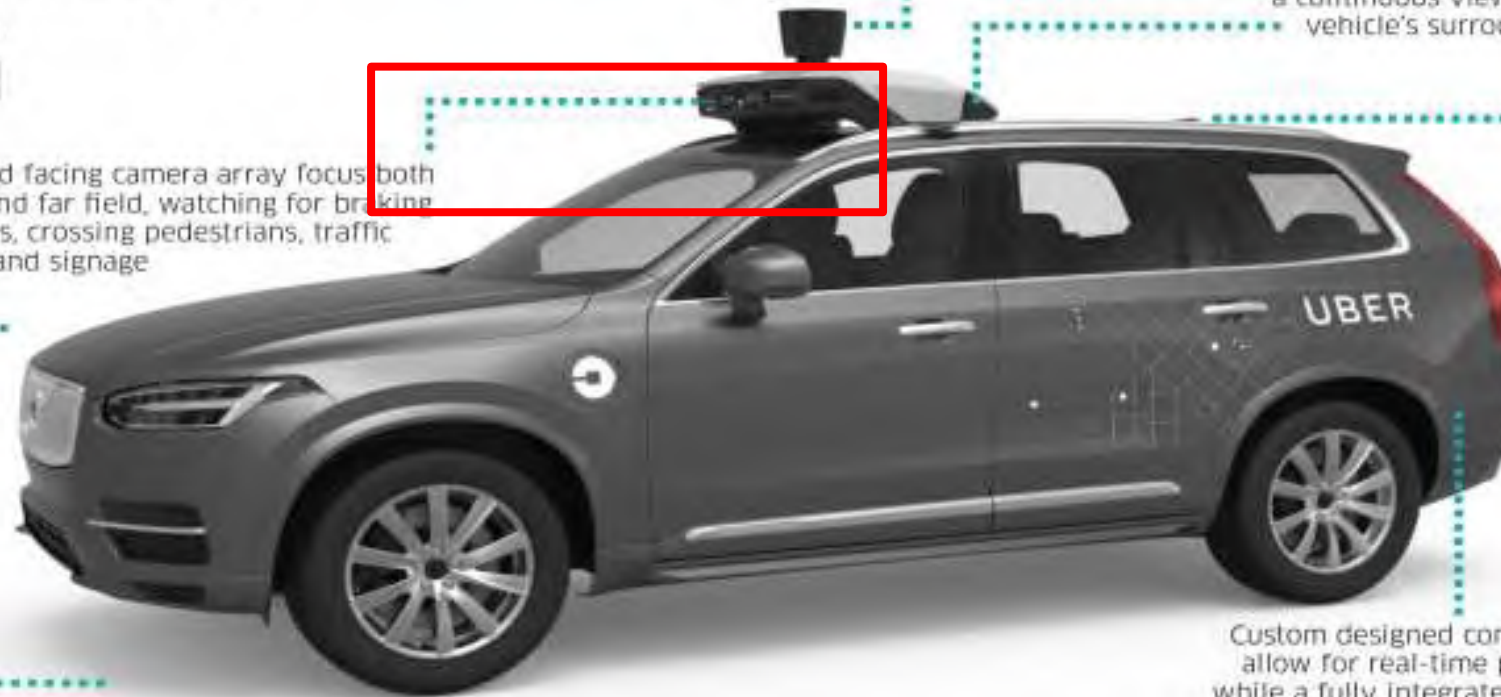
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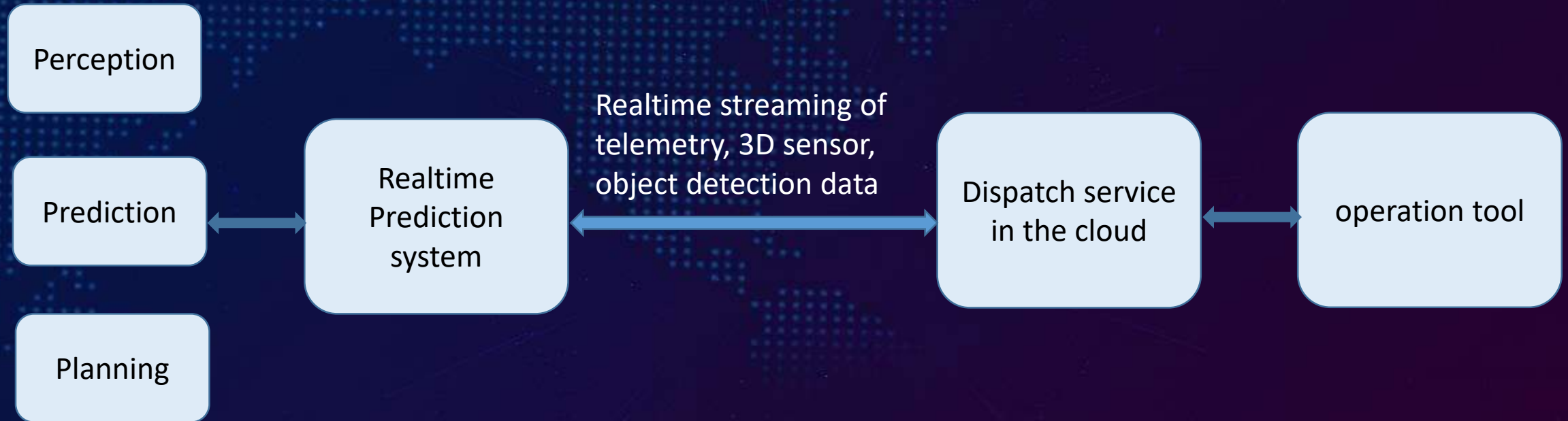
51CTO







- 1m Miles Per intervention
- Simulation, regression test
- Labeling automation
- Map automation
- Intervention classification



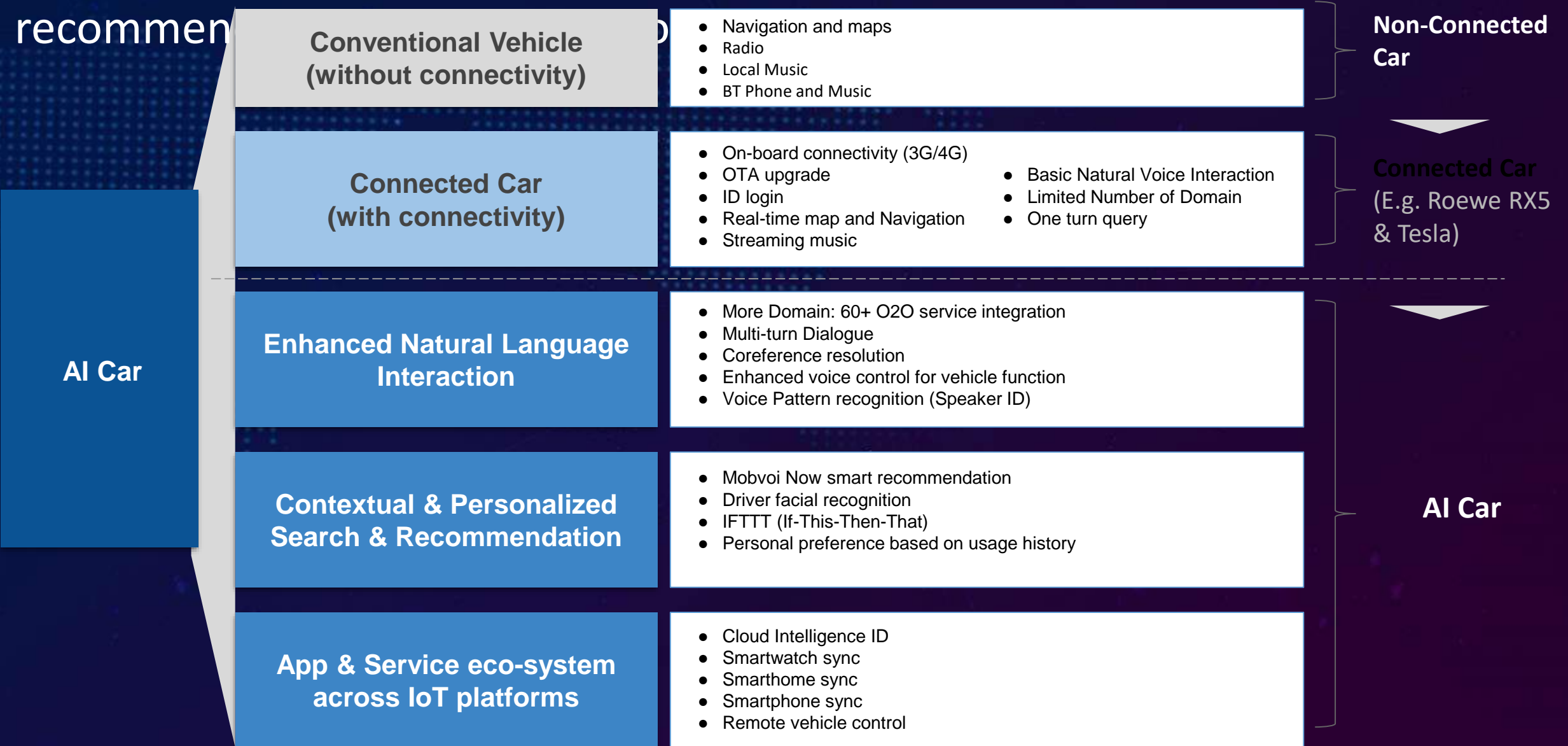
未来

- 乘车体验
 - 更丰富的场景
 - 语音交互陪伴
 - 周围环境提醒，危险和风景等
 - 预测障碍求助
- 共享车
 - 刷脸上车
 - 上车自动调节座椅
 - 声纹识别支付
 - 计算机视觉提醒遗落物品

Self
driving



AI Car is the evolution of Connected-Car with enhanced HMI, contextual recommendation



An AI Car can interact with the human-driver via natural HMI and keep evolving via OTA after SOP

Capabilities

<u>Ears and Mouth</u> Listening and Speaking	<u>Eyes and Touch</u> Seeing the sensing	<u>Brain intelligence</u> Thinking and Learning	<u>Organic Growth</u> IoT and OTA
<ul style="list-style-type: none"> •Speech recognition •Natural language processing •Text-to-speech(TTS) •Multi-turn dialogue •Speaker identity verification 	<ul style="list-style-type: none"> •Camera Sensors •360 degree view •ADAS •Pedestrian detection 	<ul style="list-style-type: none"> •Always online 7x24 •User Profiling and proactive recommendation •connecting 60+ growing vertical domain of information and services 	<ul style="list-style-type: none"> •Regular OTA update •Cross-platform interaction <ul style="list-style-type: none"> •Wearable •Home •Phone •Vehicle

Comments & Analogies



Your 24x7 proactive co-pilot

Connects with all your smart devices and always standby

Reactive and Proactive interaction via advanced HMI technology

The more you use it, the more smart it gets

Similar as raising a pet dog that grows with you and getting better at understand you

SOP is just the beginning of Software iteration

Multi-screen interaction with Natural Voice HMI is the trend for next wave of product innovation

When Human-Driving

- Reduce Driver distraction
- Focus on safety
- Hands-free HMI

When Autonomous Driving

- Focus on consuming content and entertainments
- Heavy HMI on various tasks



Hardware Devices

- Head Unit
- Cluster Display
- HUD on Windshield
- Smart-rear-view mirror
- SmartWatch, Mobile Phone, etc.

Key Technologies

- Natural Speech Dialogue System
 - ASR(Automatic Speech Recognition)
 - NLU(Natural Language Understanding)
 - Vertical Search
 - TTS (Text-to-Speech) etc.
- Computer Vision Control
 - Facial Recognition
 - Gesture Controlling
 - Eyeball tracking, etc.
- AR(Augmented Reality) and HUD
- ADAS(Advanced-Driving-Assistant-System)
 - FCW
 - LDW
 - FVSW, etc.

Thank you!