

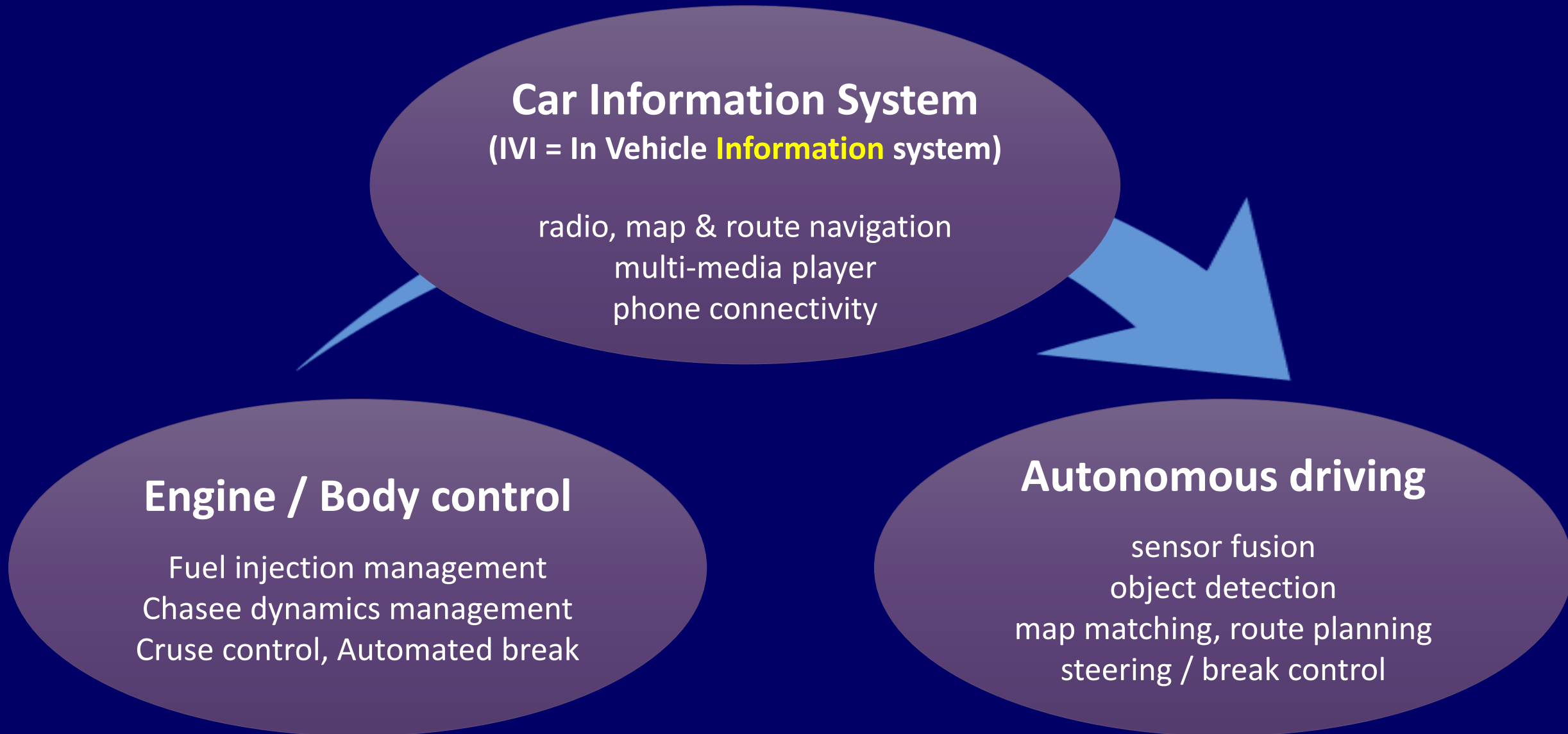
AGL aims for stress-less driving and vehicle safety

Hisao Munakata

Automotive Grade Linux, Advisory board member

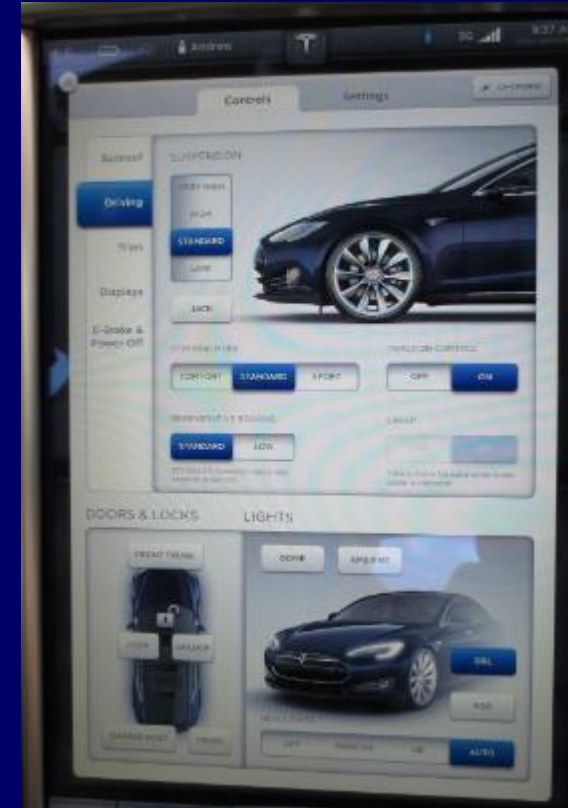
Renesas Electronics Corp.

3 major software territories for vehicle management



Smartphone inspires car information system today

- User interface innovation
 - Sophisticated graphical interface (large LCD display)
 - touch operation (flick, swipe, smooth scroll)
- Live database
 - map / POI live update
 - smartphone as a music server
- Connectivity
 - BT and USB interface
 - smartphone as a modem
 - IVI as a smartphone display (projection mode)



Car information system starts **pushing various data to the driver**, however ...

Are you completely happy with your IVI system?

Today, I introduce my troubled experience, especially experience of rental car
(Rental car experience may predict future experience of shared car)

Rental car experience (1/5) : hard to operate

- After 16 hours flight including 2 connections, I arrived at Nantes airport, France at 22:00. Then, I rented a car that new to me.
- Initially I tried to set the destination to the car navigation system.
- As I am new to the rented car, it takes sometime to operate that system.
- Especially, finding a **LANGUAGE SETING** was the first challenge.



Need to have a **simple & intuitive operation** that does not require experience

Rental car experience (2/5) : inaccurate map data

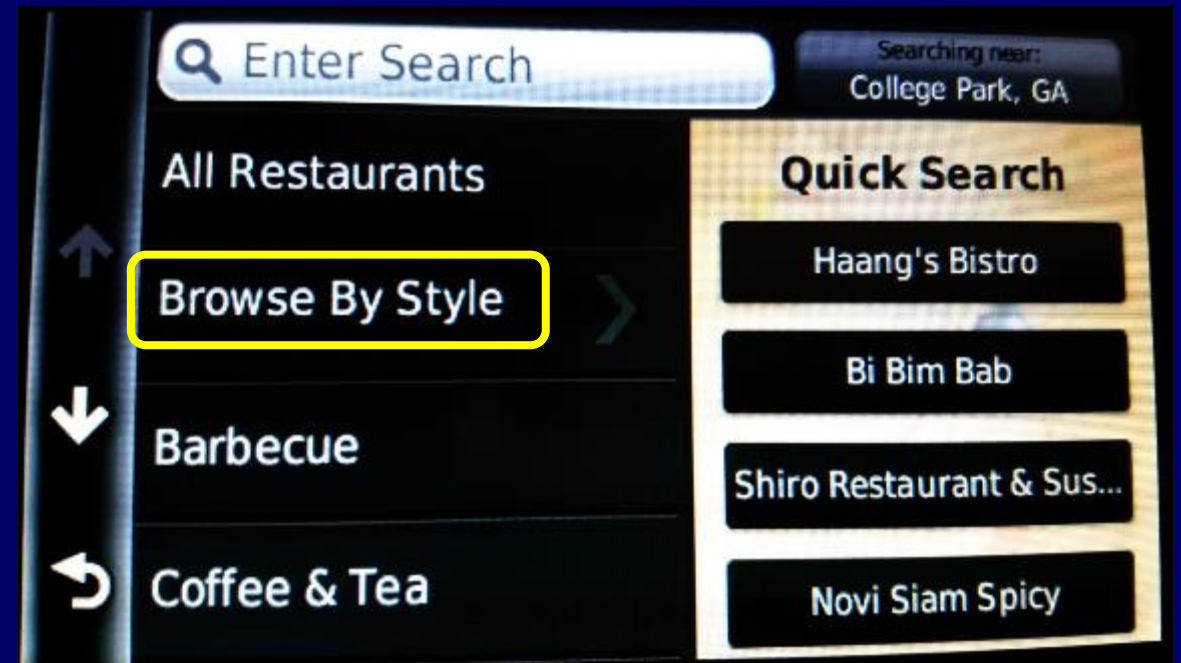
- Finally I could set the destination and start driving by the route guidance.
- Then, I found that guided **route closed due to the construction.**
- I could not manage car navigation to tell me an alternative available route.
- Route planning software does not consider occasional road conditions.



Autonomous driving definitely needs to know **occasional road condition change**

Rental car experience (3/5) : restaurant was closed

- My Garmin navigation can show me the restaurant list by the cousin type.
- This helps a lot at, especially I drive at unfamiliar location.
however ...
- No **price range** information
- No **ranking (grading)** information
- No **opening time** information



Restaurant name and type are **not enough to choose** appropriate eating place

Rental car experience (4/5) : phonebook privacy

- You can connect your phone using BT connection to activate hands free call.
- At the pairing, system **downloads phonebook information** from your phone.
- You need to delete such privacy information when you return the car
- However, some IVI system does not provide clear delete saved data.
- Previous **guide history, route history** also remains in the IVI system.



Previous user's phonebook information is still remaining in the navigation system



Privacy data management is not fully implemented to the current IVI system

Rental car experience (5/5) : phone call-in problem

- As you wanted to use hands free call, you paired your phone with IVI system.
- Once configured, IVI system automatically detect your phone and connect.
- This is very convenient feature when you drive a car alone, however,...
- When you get **call-in from anyone you do not want to answer** at the moment, IVI system display the caller name to the display.
- This **might cause a severe (catastrophic) problem** if you are with
 - Your customer
 - Your family
- To avoid the risk, you may need to disable BT phone connection

IVI system should understand **driver's circumstances** better and smarter

Cause of my rental-car “stress”

- Human machine interaction design problem
 - Lack of “Perceived Affordance”
 - = Requires some getting used to the system
(It is completely acceptable for the private car)
- Data accuracy problem
 - Integrity of reference data (= partially updated)
 - Hard to synchronize with the real-world status
- Context understanding problem
 - Current system does not aware who is driving
 - Need to improve use-case based setting option



Not ready to rely entirely upon IVI guidance, still requires driver's evaluation

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Perceived Affordance



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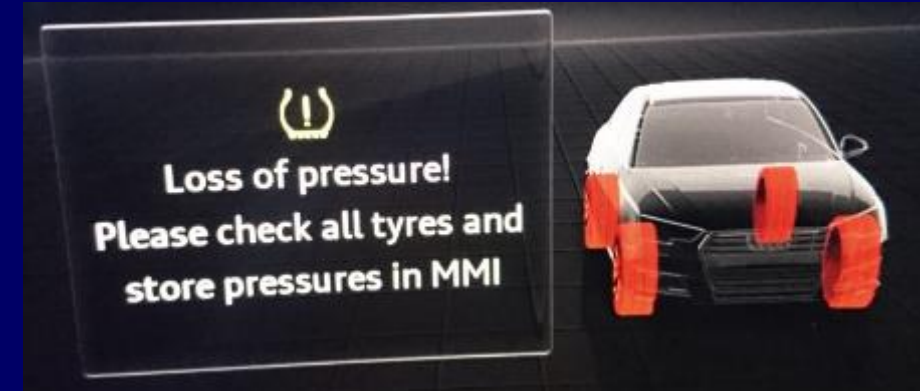
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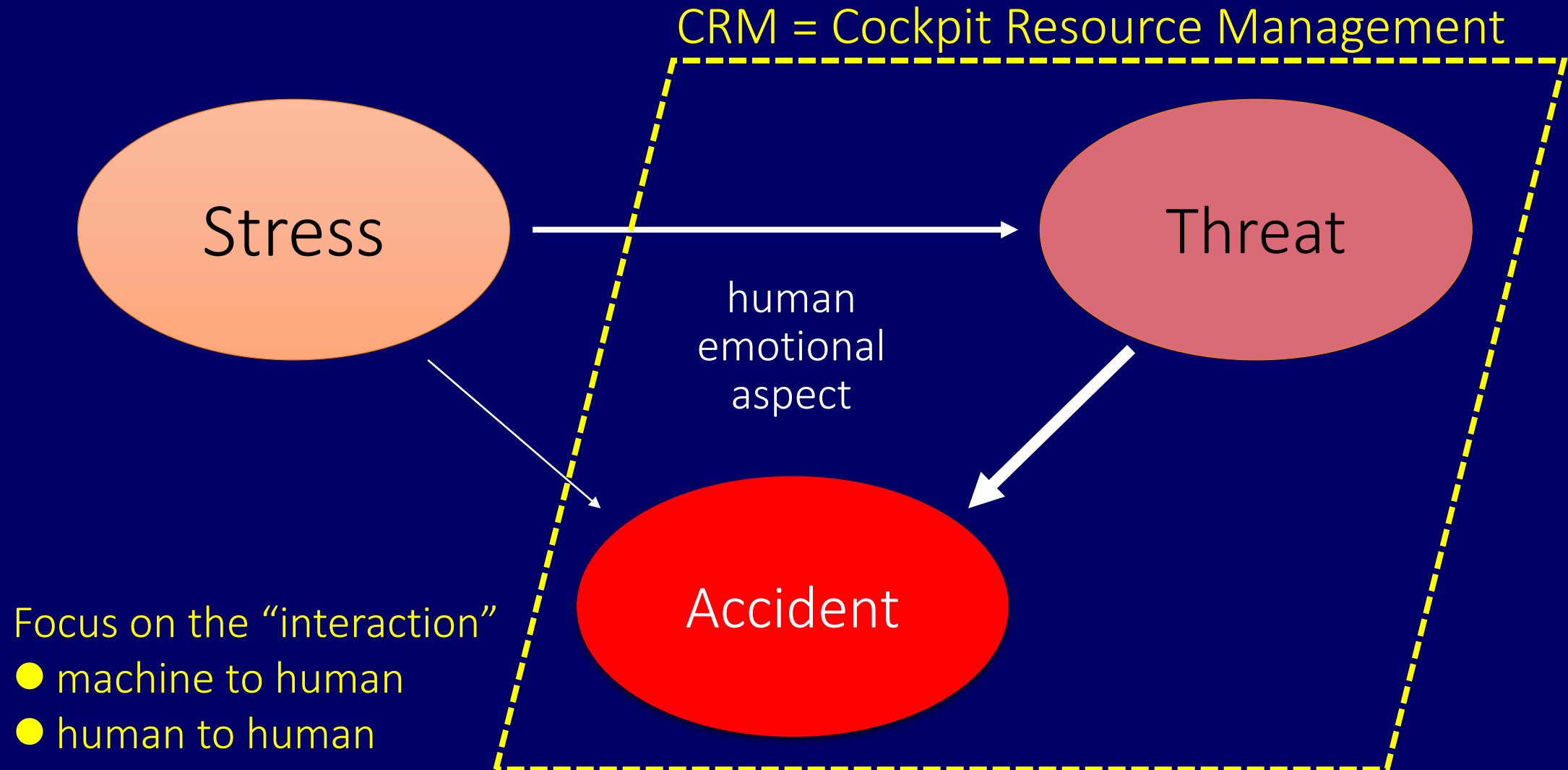
Driver's circumstances might contain “threat” factor

- Car accident is highly related to the **unusual driver's circumstances**
 - Driving in haste (to catch up on the delay)
 - Unfamiliar place (confusing intersection, unclear road sign)
 - Unexpected traffic (temporary road close, accident, GPS connection lost)
 - Terrible natural condition (snow, ice, heavy rain, darkness)
 - Physically tired (long drive, sleepy, sick)
 - Pressurized by the following car
 - Family problem (e.g. rush to the hospital)
 - Low fuel, engine trouble
 - False alarm (warning) —————→



Car information system **can proactively contribute to driver's risk reduction**

Stress and Threat can trigger an Accident



CRM focus on the interaction and decision process

- Newly developed method to analyze the human error risk of airplane operation.
- Focused on teamwork between pilot and co-pilot when they face the **threat**.

CRM skills

- CRM is concerned not so much with the technical skills but rather with the **cognitive and interpersonal skills** needed to manage the flight.

```
graph LR; A[CRM skills] --> B[Cognitive]; A --> C[Interpersonal];
```

- **Cognitive** skills are defined as the **mental processes** used for gaining and maintaining **situational awareness**, for **problem solving** and **decision making**.
- **Interpersonal** skills are regarded as **communications** and a range of behavioral activities in the **teamwork**

4

Presented by Mohd Amirul for AMC

<http://slideplayer.com/slide/841283>

コミュニケーション	2way communication	適切な意思疎通
	Assertion/Inquiry	安全への主張/質問
	Briefing	計画と認識の共有
意思決定	Use of resources	リソースの有効活用
	Decision	適切な意思決定
	Critique	決定と行動の振り返り
チームビルディング	Climate	チームの雰囲気作り
	Leadership	リーダーシップ/フォロワーシップの発揮
	Conflict Resolution	建設的な対立の解消
状況認識	Vigilance	警戒心の維持
	Monitor	状況のモニターと共有
	Anticipation	状況からの予測
ワークロードの管理	Prioritize	優先順位付け
	Distribute	業務の割り振り
	Stress Management	個人とチームのストレス管理

<http://www.medsafe.net/specialist/5jas.html>

CAR CRM defines driver and IVI teamwork interaction



"Check a hotel booking confirmation in my mailbox and guide me to the hotel, please"

stress-less
ordering

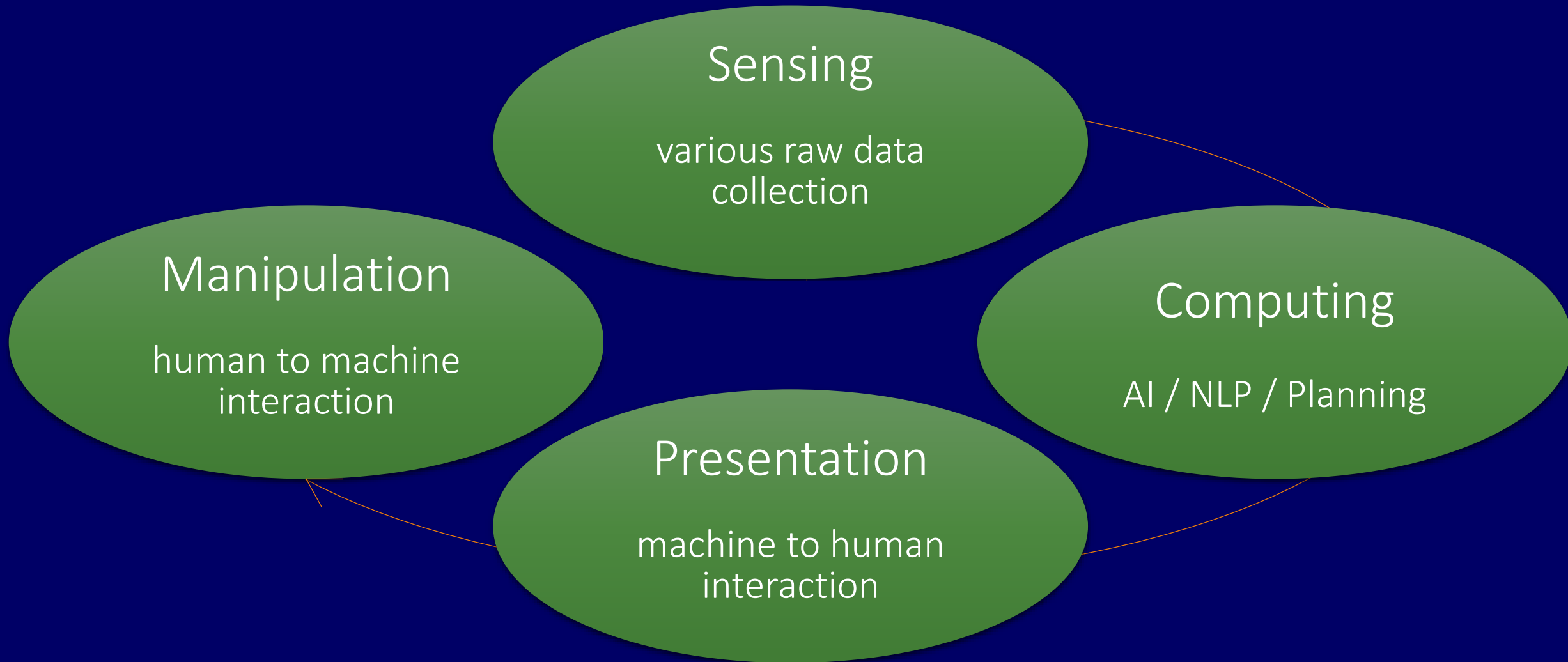
CRM

runtime
threat fix

"Hmm, guided road looks temporary unavailable now. Please guide me an alternative. It must be a safe route"

Car IVI system must become **driver's companion** that works in a team setting

Key technologies to realize a driver's companion device



Expected innovation for the future IVI : sensing

- Car sensing : to detect driver's status
 - fluctuation of speed (smoothness of acceleration and breaking)
 - fluctuation of direction (steering accuracy)
- Cloud data sensing
 - Connected car (distributed and collaborative approach)
 - Data read-ahead and smart caching
- Human sensing
 - psychological status sensing
 - mental status sensing



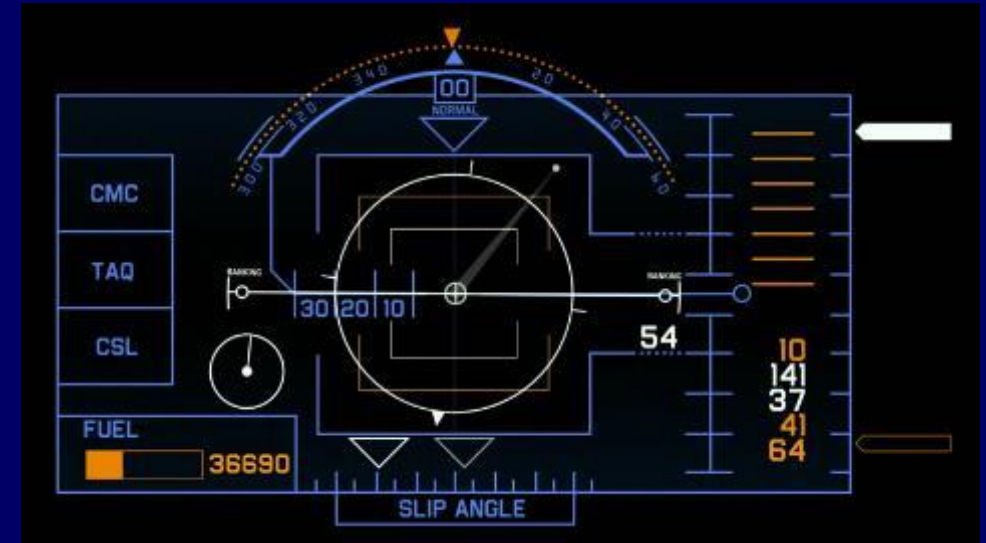
Expected innovation for the future IVI : computing

- Context understanding
 - Location based service
 - PIM data matching (scheduler, e-mail,...)
 - Environment evaluation (weather, time, traffic,..)
- Data mining and personalized recommendation
 - Preference assessment (route choice, driving characteristics)
- Emotion process
 - Human emotion understanding (like stress level)
 - Emotional response (speech speed, vocabulary choice, frequency)



Expected innovation for the future IVI : presentation

- Visual presentation
 - HUD utilization
 - Large / Vertical display
 - Augmented Reality (AR) overlay
- Audible presentation
 - Speech interface (text to speech and human voice recognition)
 - Sound routing and priority management
- Other presentation
 - Motion feedback (haptic touch, steering/pedal shaker)



Expected innovation for the future IVI : manipulation

- Finger operation ---- touch operation is not a good way while driving
 - Steering SW
 - Jog dial
 - Multi-function soft SW
- Voice operation
 - Simple word based voice control
 - Natural language operation (like Siri)
- Other operation
 - Eye tracking
 - Gesture control
 - Auto configure (destination, speed..)



Driver's companion might be more like a Humanoid

- AI (Artificial Intelligence) and NLP (natural language processing) is key
- Expert system that correct human operational error



NAO : <http://www.robotlab.com/>



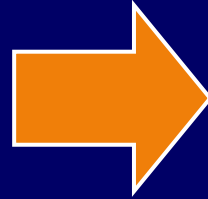
Pepper : <http://www.softbank.jp/robot/consumer/>

Humanoid robot might be the **model of future driver's companion** system

NAOqi API provides various programming methods

Choregraphe

allows you to create applications containing Dialogs, services and powerful behaviors, such as interaction with people, dance, e-mails sending, without writing a single line of code.



SDK want more complicated thing

Python

qi API

matlab

.net

C++ native coding

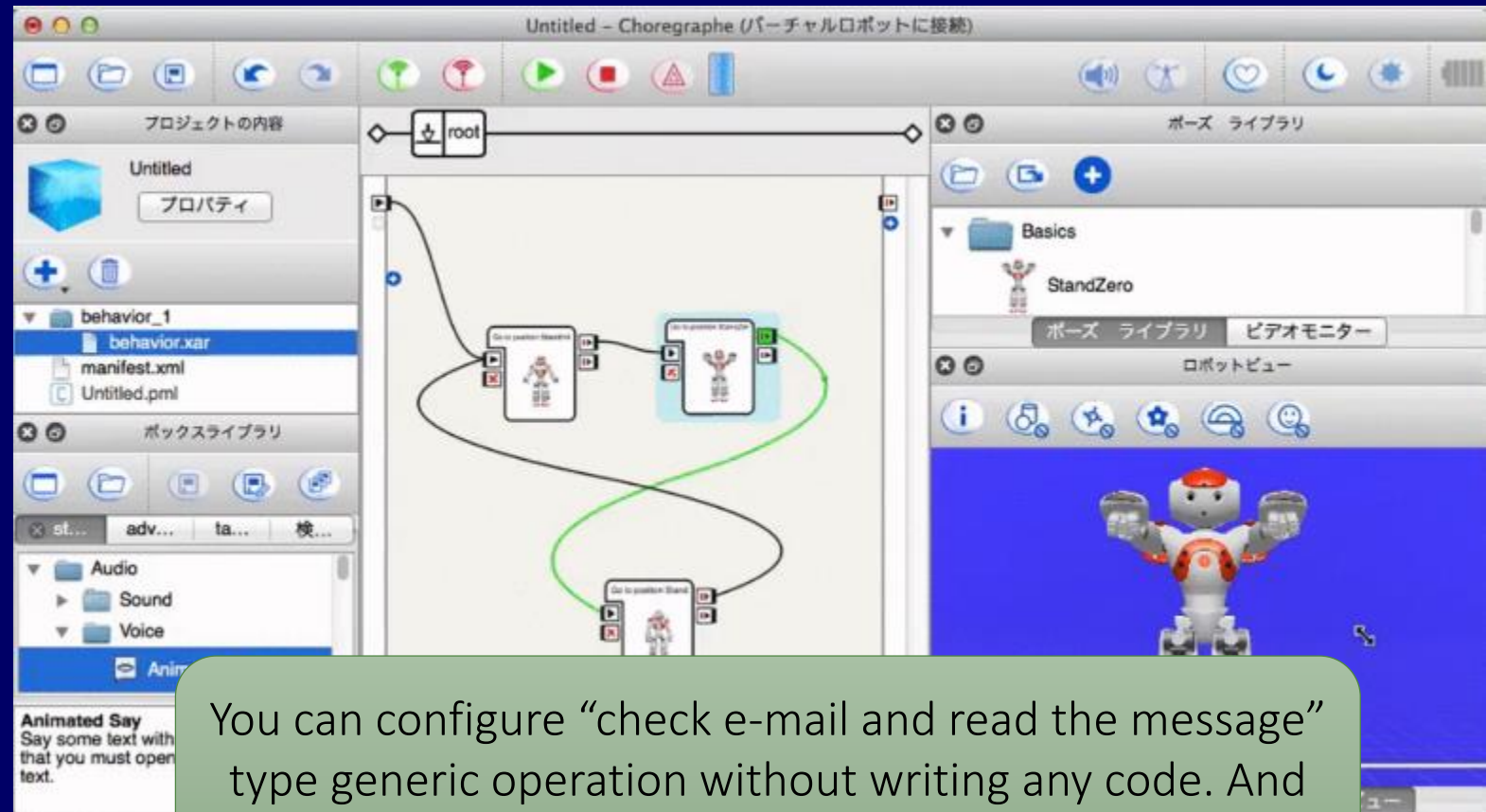
qi API

native code

NAOqi OS

Gentoo embedded Linux based

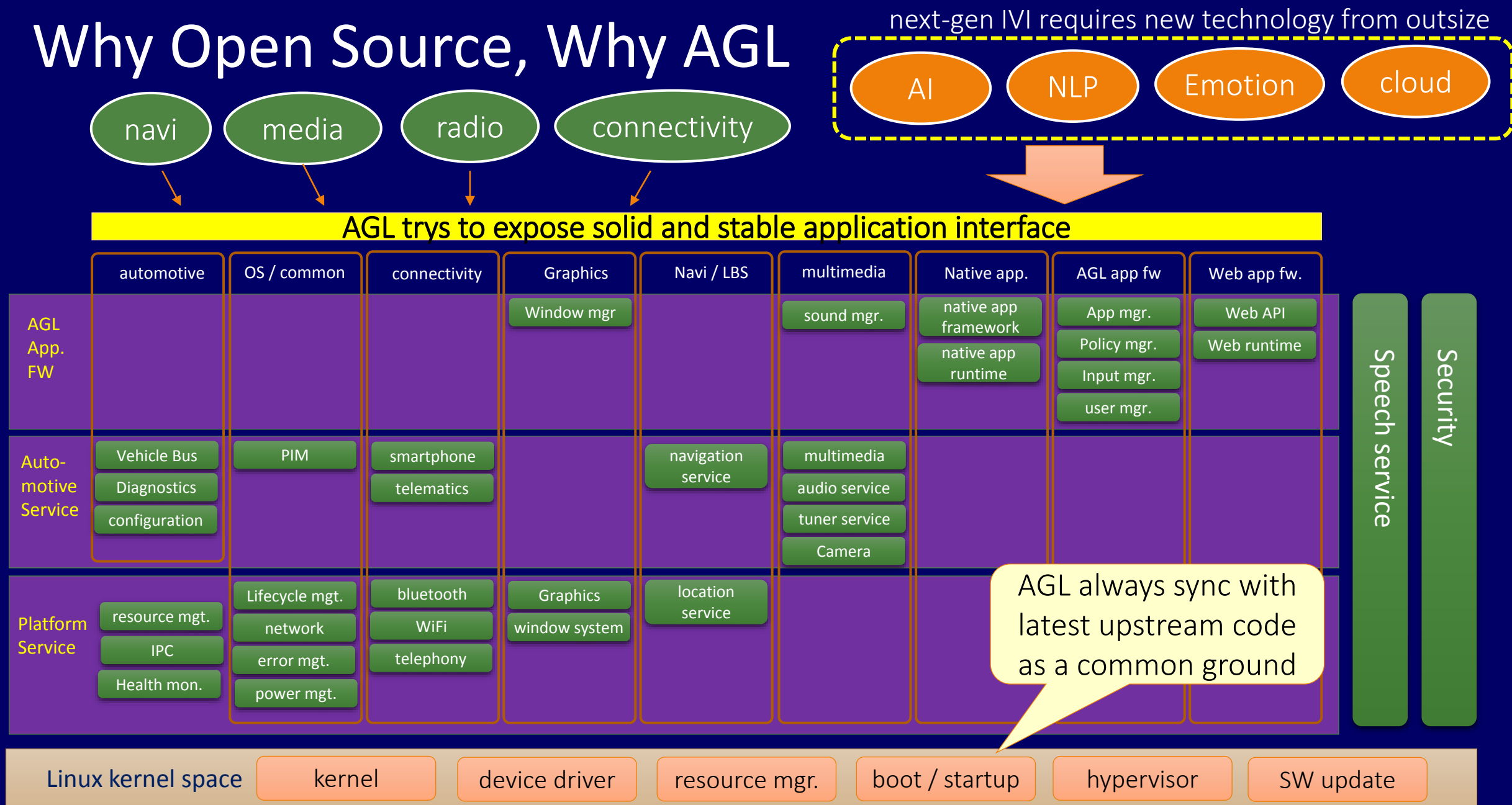
<http://doc.aldebaran.com/2-1/dev/naoqi/index.html#naoqi-framework-overview>



You can configure “check e-mail and read the message” type generic operation without writing any code. And you can define further task utilizing NAOqi SDK.

We need sophisticated tools for advanced IVI / human interaction design

Why Open Source, Why AGL



Conclusion . . . We still need to improve IVI and AGL realize it
switch over depending on the driving situation



next-gen IVI (=In Vehicle **Information) system**

- Aims to be a true driver's companion device (AI, NLP)
 - Various context understanding
 - Emotion Process