

# 미래형 자동차 산업 생태계: 그 위기와 도전

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  - 가치 변화와 급변하는 생태계
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  - 국내 자동차산업의 구조 고도화 방향
- 결론

# 1. 개요 | 이동성이란 무엇인가

# 이동의 개요

## ▪ 위치(장소)의 변화

✓ Point-to-Point, Room-to-Room, Door-to-Door

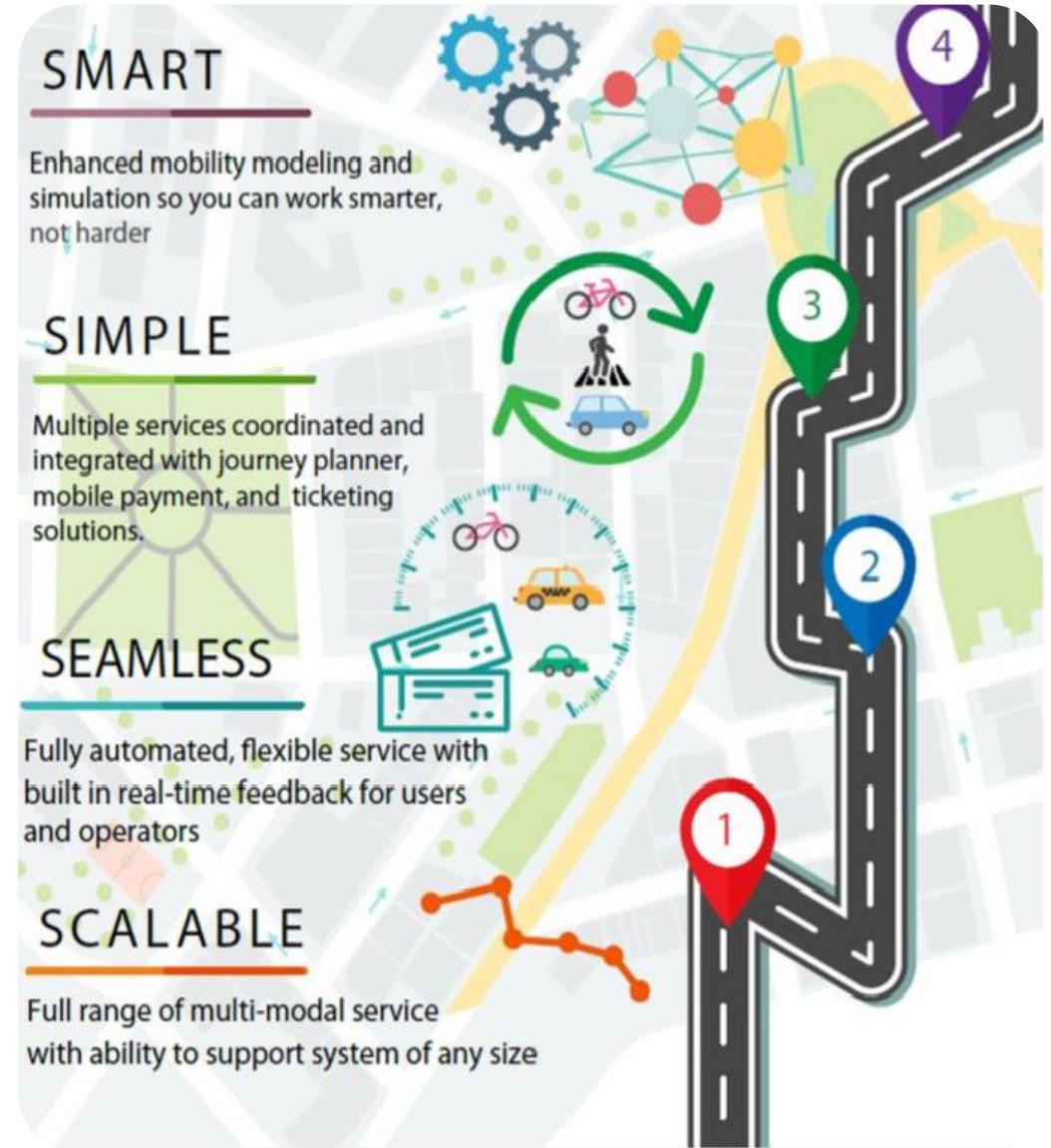
✓ 보행, 주행, 비행, 항행

✓ 복합, 연계, 공유(승차/차량)

## ▪ + Service

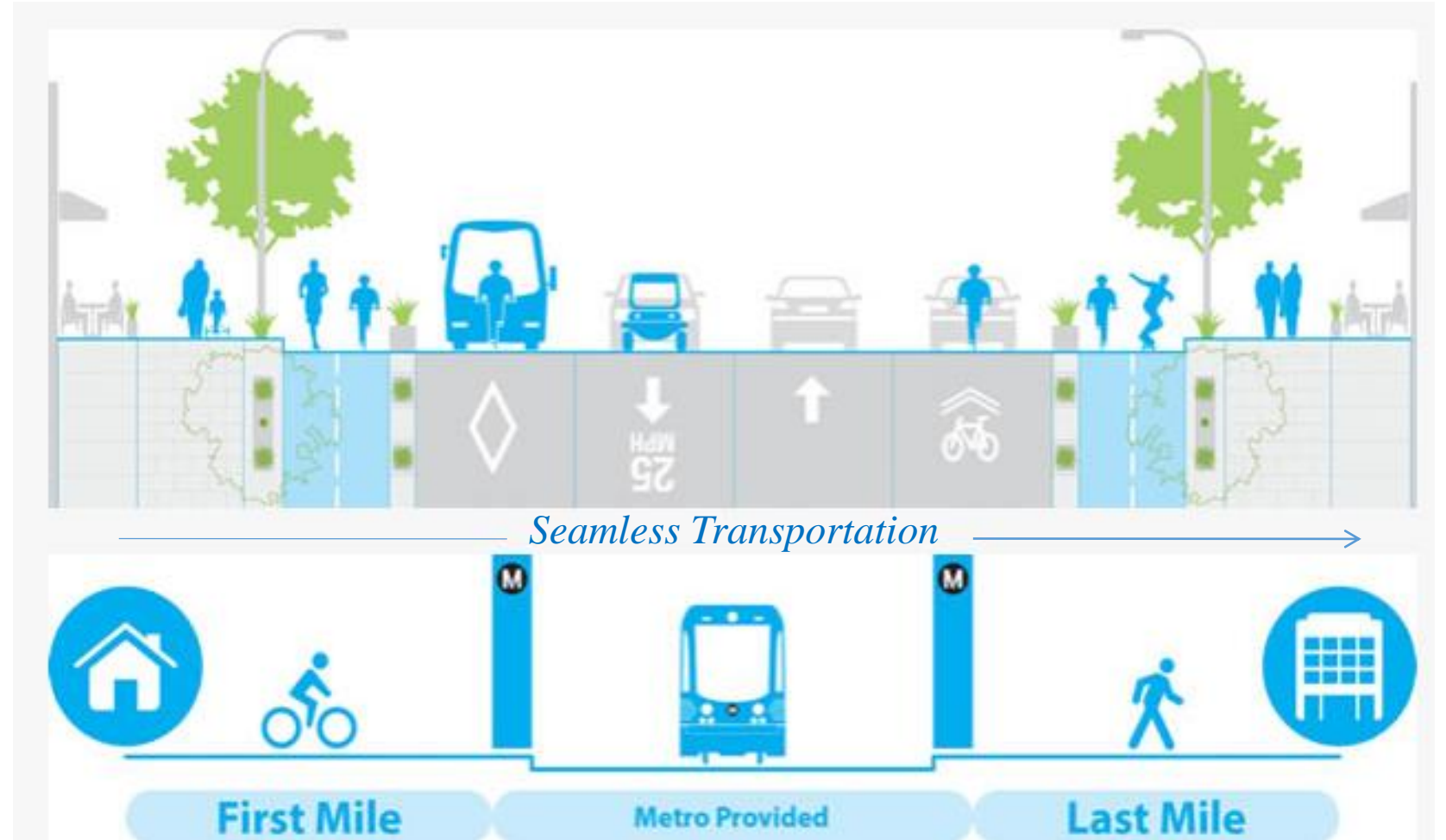
✓ 개인형, 공공형, 맞춤형(On-Demand, PPT)

✓ 물류배송(창고물류), 생활교통, 레저수단 등



# 이동플랫폼의 개요

- 이동수단 + 이동인프라 + 이동서비스 → MaaS(Mobility as a Service), E-MaaS, CASE





# 이동성의 변화

- 관점의 변화 : (대상) What → (서비스) How



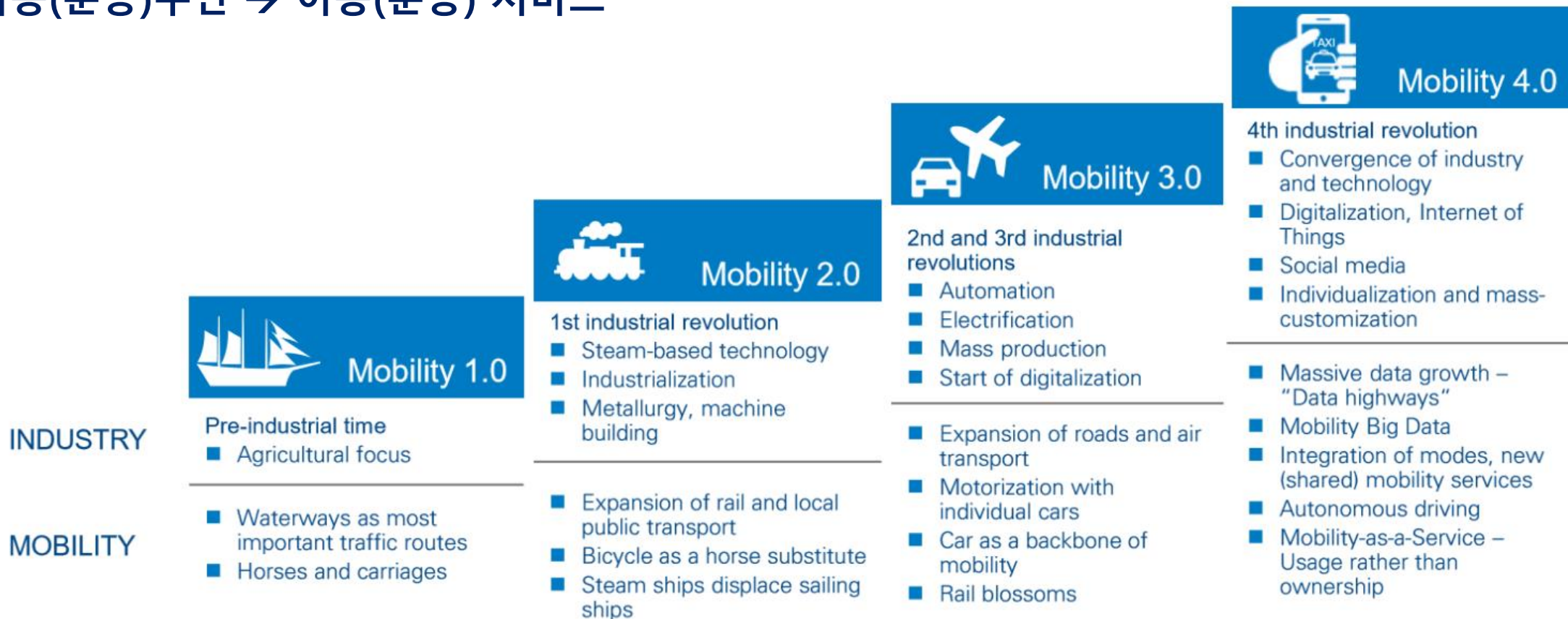
# 이동성의 역사 | 수레 → 전기자율차





# 산업환경의 변화

- 생산성 시대@~3rd → 창의력 시대@4th~
- 이동(운송)수단 → 이동(운송) 서비스





# 산업환경의 변화



✓ **Henry Ford starting his automotive business**

"If I'd asked people what they wanted, they would have asked for faster horses"

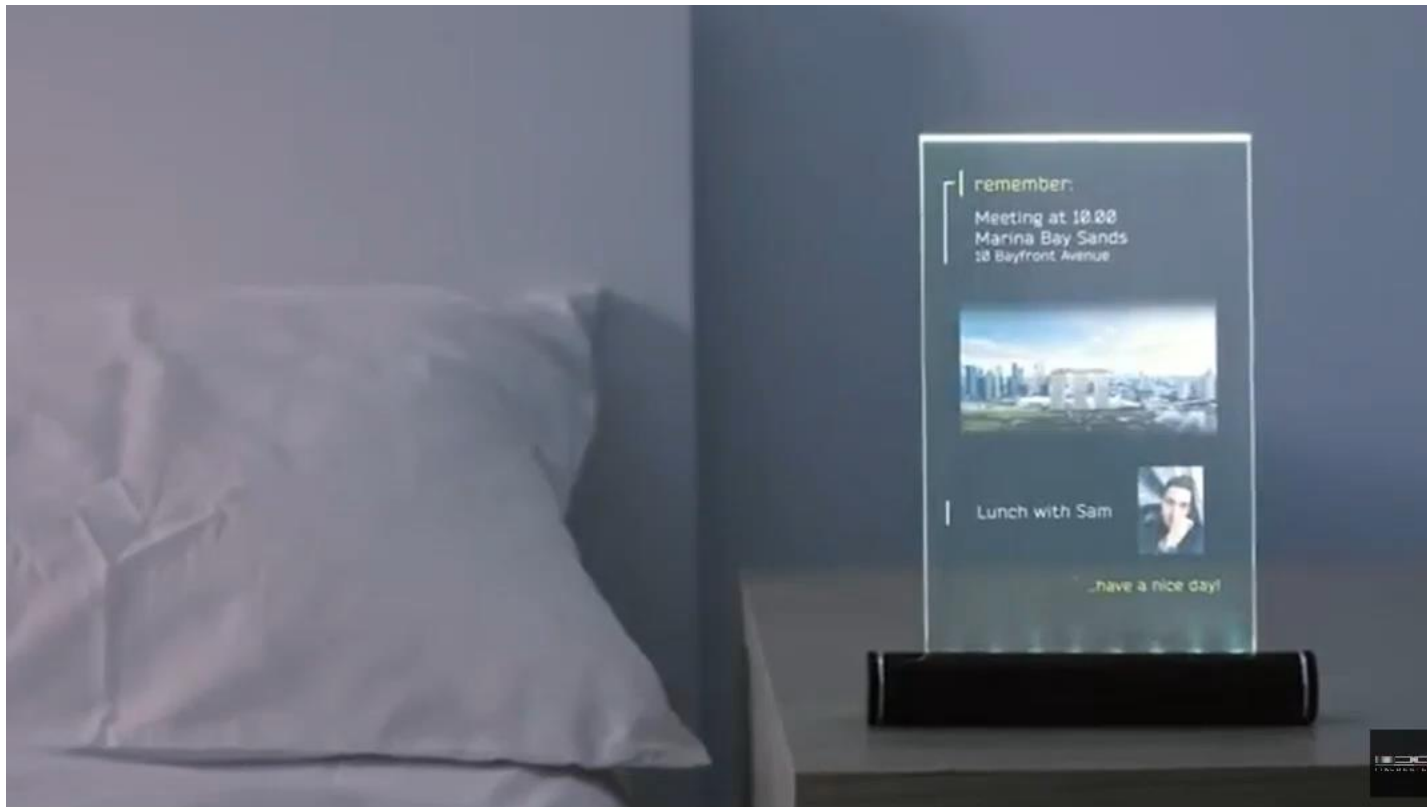
✓ **Peter Drucker**

"If you want something new, you have to stop doing something old"

## 2. 본론 | 새로운 가치, 급변하는 생태계

# CASE STUDY | 플라잉카, 싱가포르

- Flying Car by Airbus
- 주행 + 비행 etc.



(Source) AirBus & Italdesign, Flying Car

## Meet “Pop.Up Next” — latest hybrid car-copter

After debuting *Pop.Up* last year, Airbus is back at the 88th Geneva International Motor Show with a new version of its modular concept car

**GENEVA INTERNATIONAL MOTOR SHOW**

**POP.UP**

Aimed at megacities with high traffic congestion, passenger capsule can disconnect from ground module and be flown by air module. It can revert to road vehicle by coupling to another ground module

**SPECIFICATIONS**

**■ Air module**  
Propelled by eight counter-rotating 17kW rotors  
**Top speed:** 100km/h  
**Range (no payload):** 100km  
**Recharge time:** 15 mins  
**Max gross weight:** 600kg

**■ Passenger capsule**  
High-tech carbon-fibre monocoque carries two people

**■ Ground module**  
Powered by two rear wheel 30kW motors  
**Top speed:** 100km/h  
**Range:** 130km  
**Recharge time:** 15 mins

**4.4m**

**Zero emission electric propulsion**

**■ Coupling system**

**■ Battery packs**

*Artificial Intelligence manages complexities of travel in fully autonomous vehicle. Passengers communicate with Pop.Up via virtual reality interface. Could be integrated into rail transport systems or future hyperloops*

Sources: Airbus, Italdesign, Audi, The Verge      Pictures: Airbus/Italdesign      © GRAPHIC NEWS

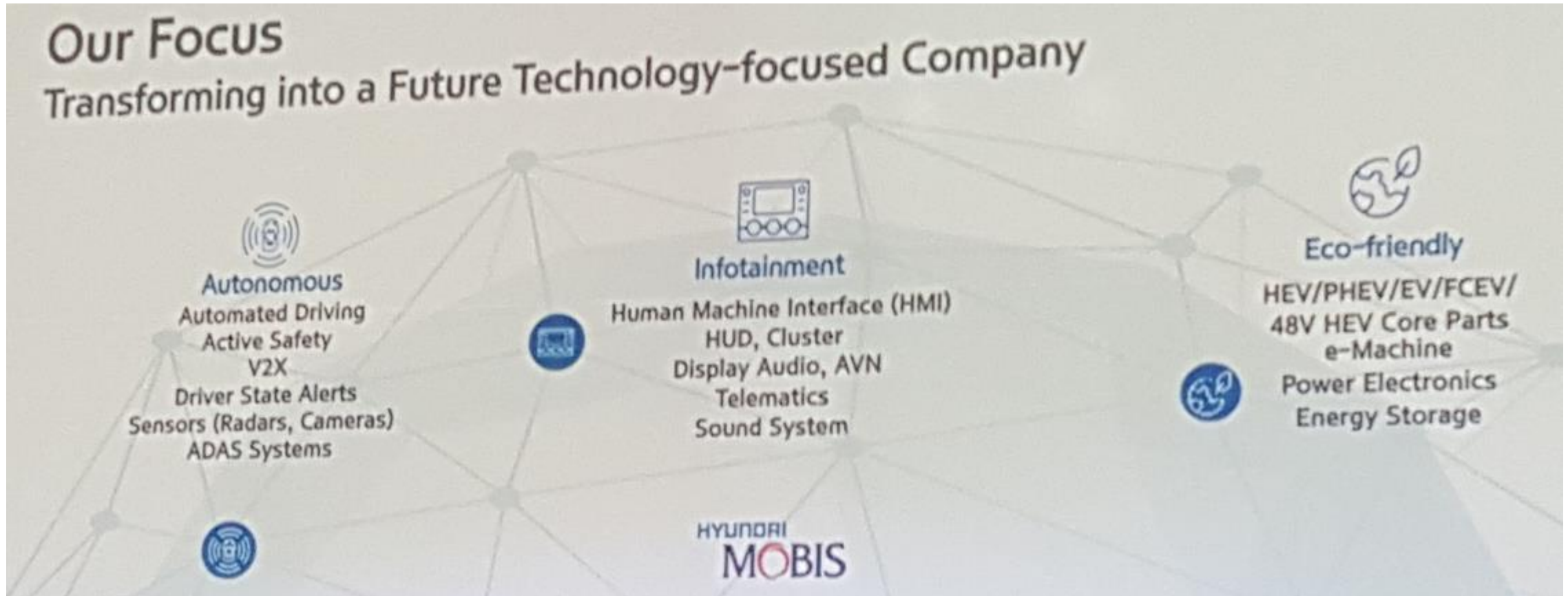
# 2010 SAE Convergence



“포드는 여전히 자동차를 생산하는 회사입니다. 그러나 자동차만 생산하는 회사가 아닙니다. 포드는 기술융합회사를 지향합니다”, Ford Motors, 2010 SAE Convergence 개막식



# 2018 DIFA 개막식



현대자동차그룹의 5대 미래혁신 성장분야: 차량 전동화, 스마트카(자율주행/커넥티드카), 로봇-인공지능, 미래 에너지, 스타트업 육성 (5년간 23조원 투자), 2018.9.19, 한국일보

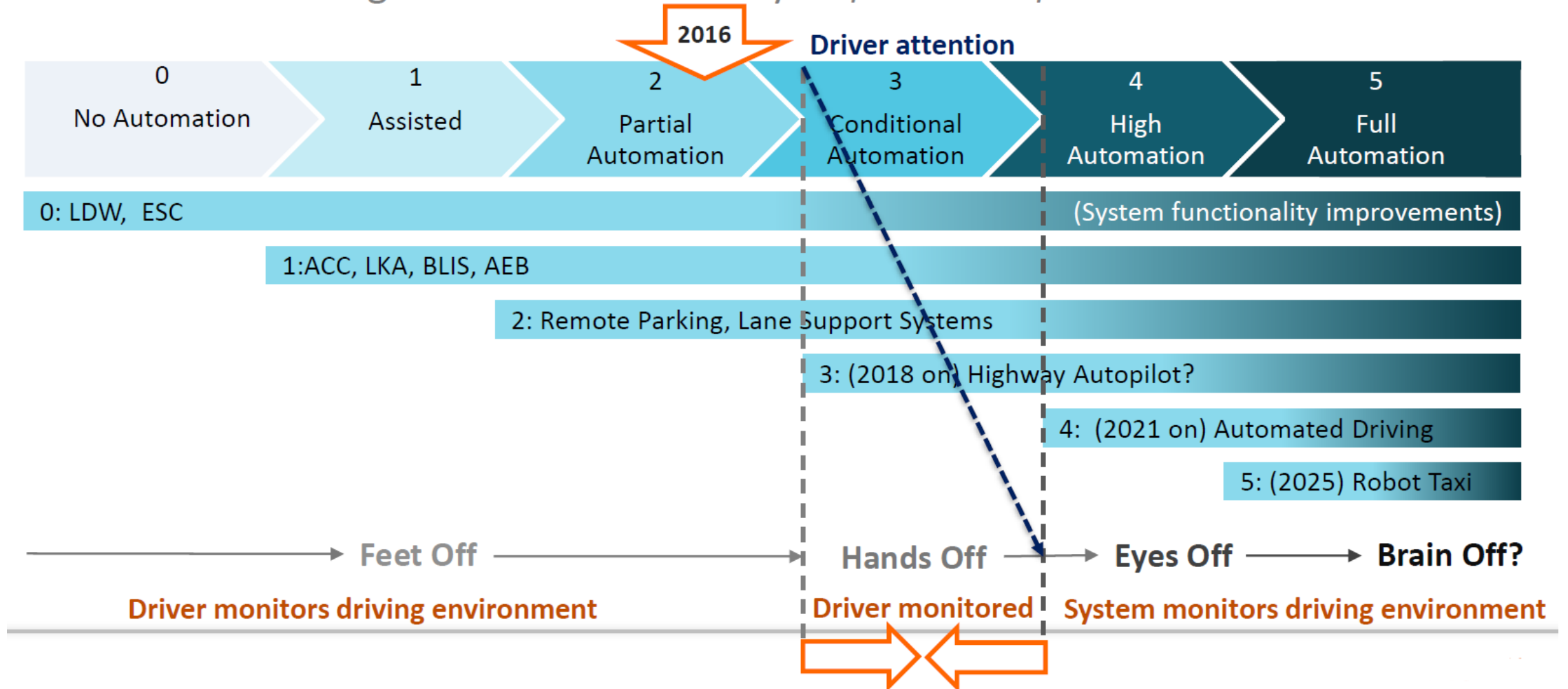
# Automated Driving – 미래의 게임 체인지 기술

Improved safety	Democratization of mobility	Higher fuel efficiency	Reduced congestion	Gain in productivity
→ Reduction in motor vehicle accident rates	→ allow all age ranges to be mobile	→ up to 39% improvement in highway fuel economy	→ 80% improvement in traffic throughput	→ 56 minutes per day freed up for other uses



# 자율주행자동차 시간표

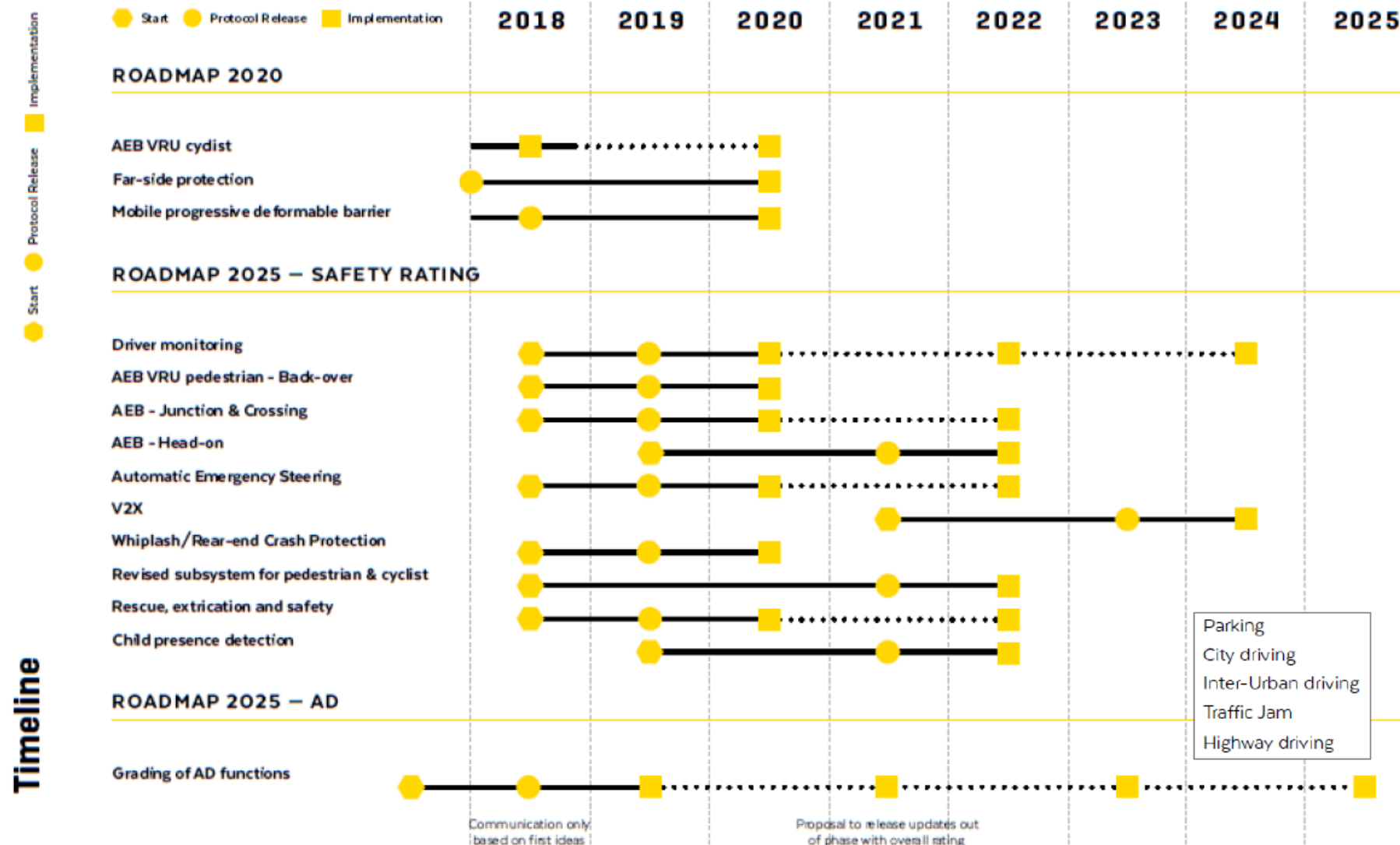
International Categorisation of Autonomy – *open to interpretation*



Source: Thatcham Research, 2016



# EURO\_NCAP 2025





# OEM 상황

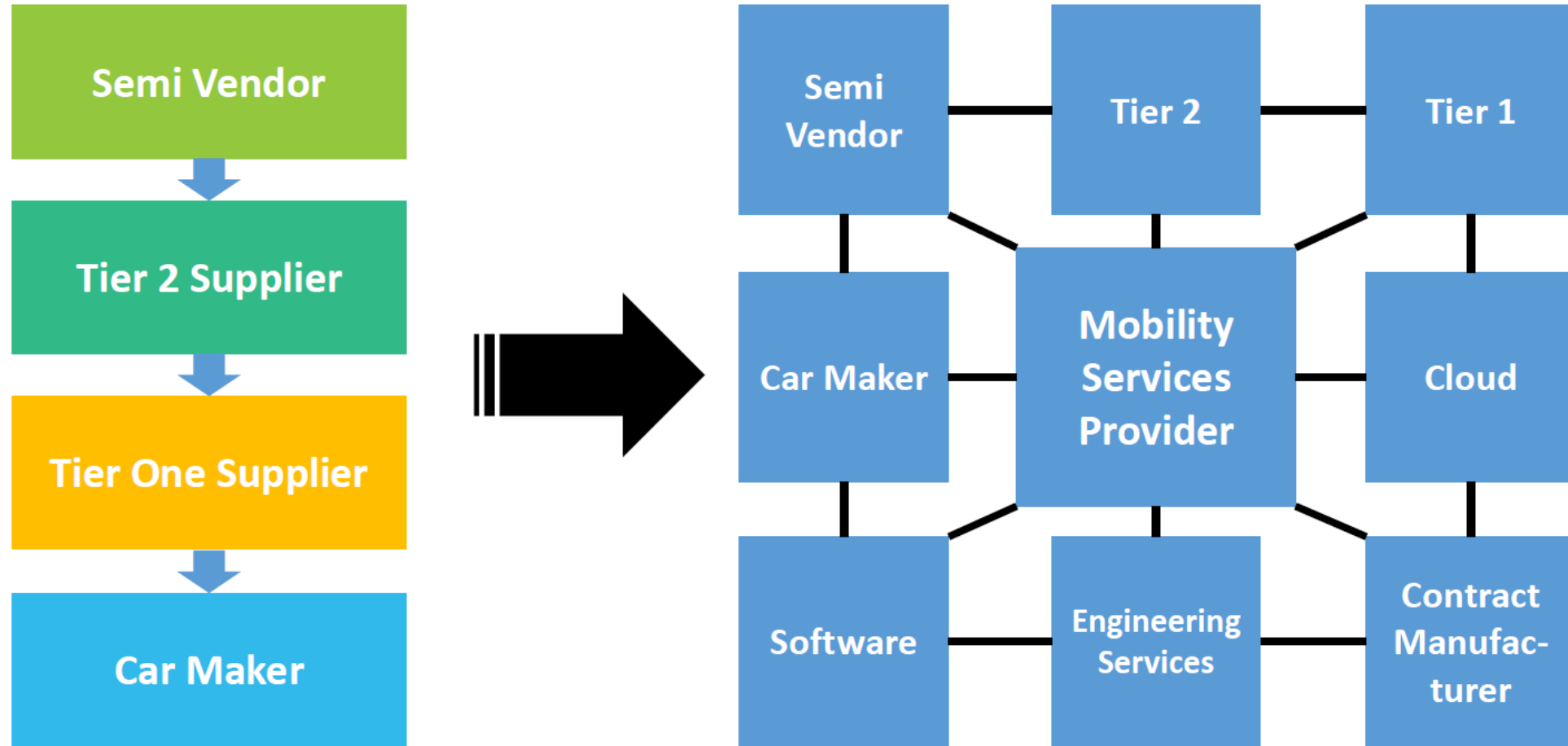
OEM	Currently Available		Future Offering				Supplier Tie-up
	Feature	SAE Level	Feature	SAE Level	Year	Models	
Audi	Traffic Jam Assist	Level 2	Traffic Assist, Piloted driving, and Piloted Parking	Level 3	2017 onwards	A8, A7 and Q8	Valeo, Mobileye, Continental, Bosch
BMW	Traffic Jam Assist, Assistive Parking	Level 2	Active Assist and Remote Valet Parking	Level 3	2018 onwards	7-Series and 5-Series	Continental & ZF Lenksysteme
Cadillac	AEB, ACC	Level 1	SuperCruise	Level 3	2020 onwards	CTS and Escalade	Mostly in-house, TRW, Laird Tech
Ford	Adaptive Cruise Control, AEB	Level 1	Active City Stop	Level 2	2017 onwards	Fusion and Escape	Continental, Velodyne, Bosch, In-house
Mercedes-Benz	Traffic Jam Assist	Level 2	DISTRONIC Plus with Steer Assist	Level 3	2019 onwards	S-Class and E-Class	Quanergy (For R&D)
Tesla	Autopilot	Level 2	Autopilot 2.0	Level 3	2019	Model S, X 3	Mobileye, Bosch, NVIDIA
Volvo	Pilot Assist	Level 2	City Safety	Level 3	2022 onwards	XC 90, S90	Continental, Autoliv

Source: Frost & Sullivan, 2017

# 급변하는 생태계

- End-user revenue from fully automated driving is **ZERO**
- This market of zero is **re-shaping** the value chain
- Biggest challenge is for **T1 suppliers**
  - Automakers are increasingly looking to **start-ups and non-traditional suppliers** for innovation, as well as developing their **own IP** and solutions
  - **Separation** of hardware and software. Integration of hardware and software no longer only done by T1 – but also by OEM and engineering services partners
  - How can a T1 **add value**? How can semi vendors enable them in this, while also advancing their competitive position?

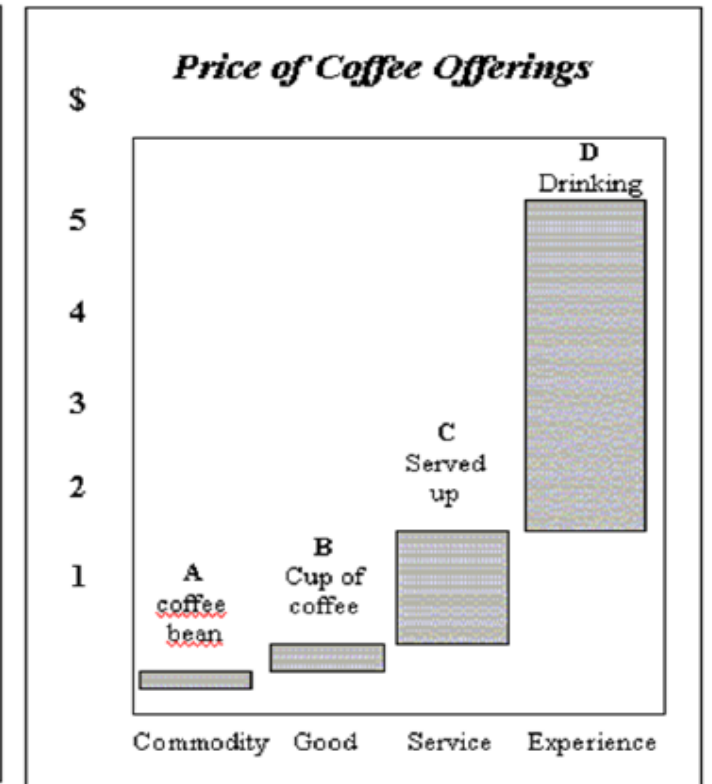
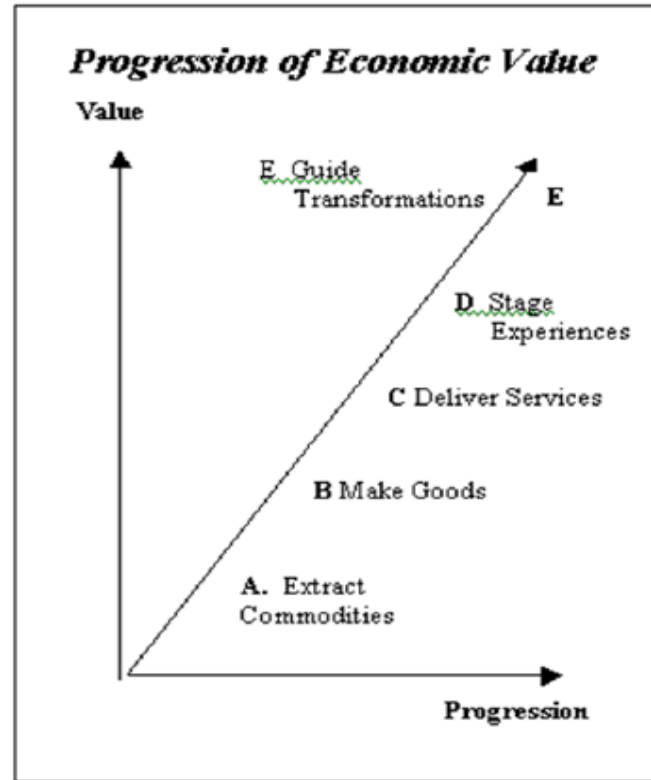
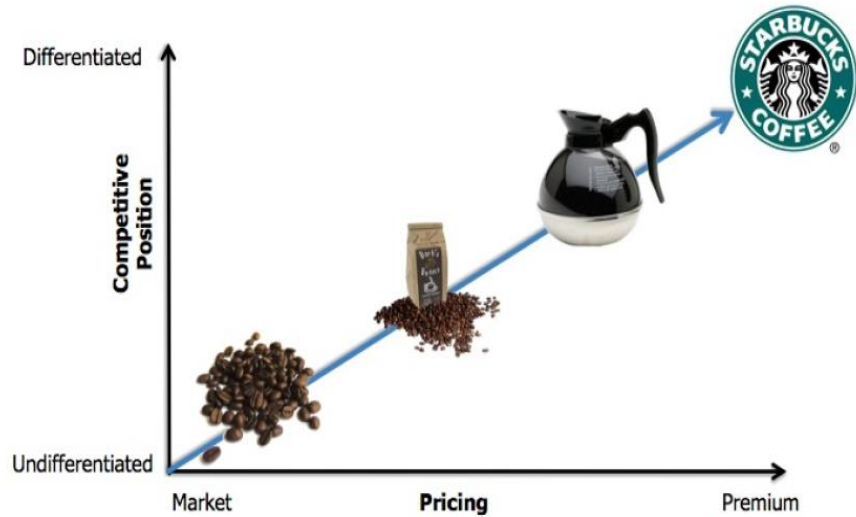
# 가치 네트워킹



The automotive value chain is evolving into a **value network**

- ALL players will need to identify and the secure their place in this network
- Your **customer** is becoming your **competitor**, and *vice versa*
- The true separation of hardware and software will bring huge change
- Ultimately we may see a **separation** of “innovation” and “manufacturing” focused automotive suppliers

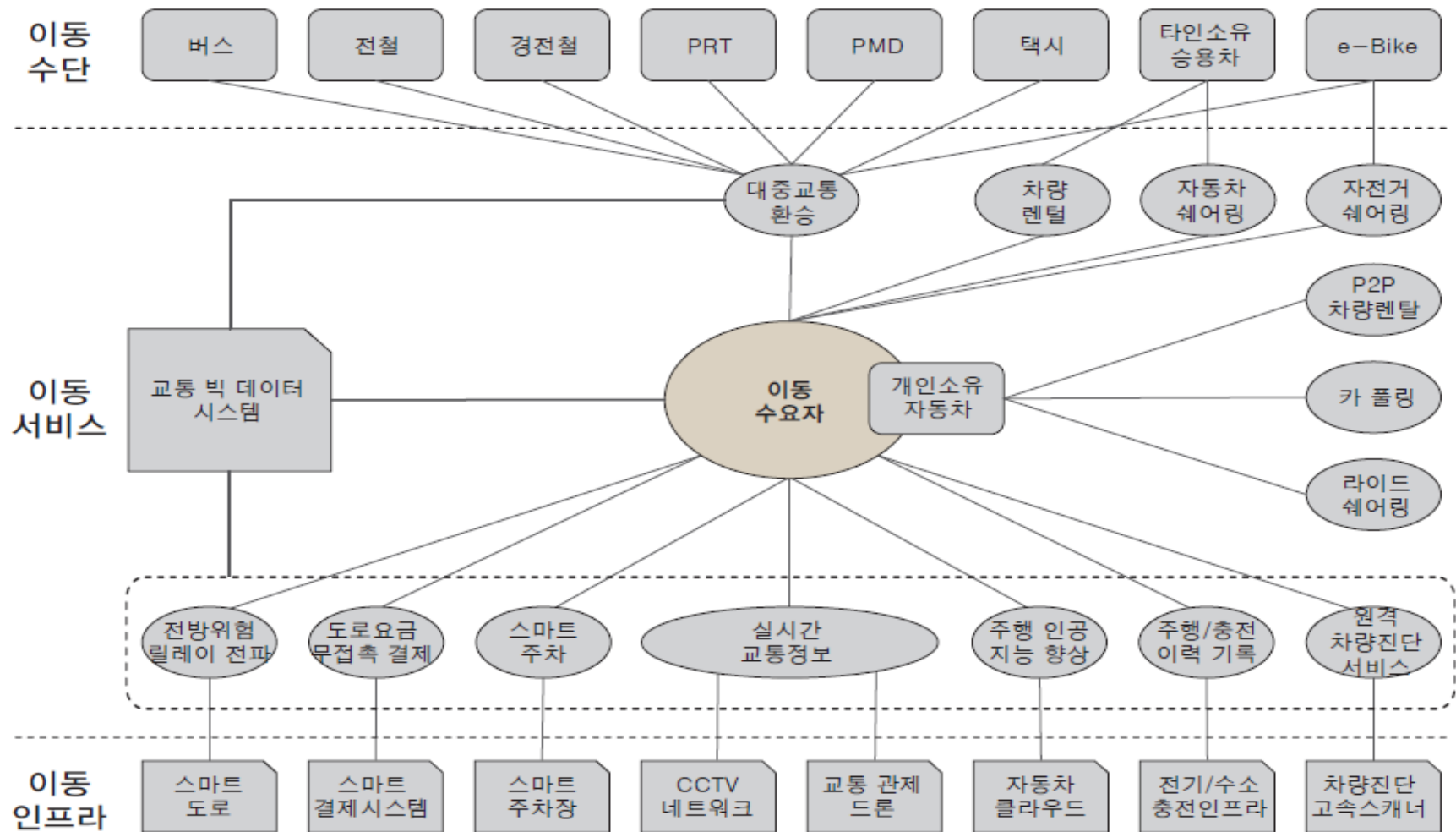
# 경험경제 (Experience Economy)



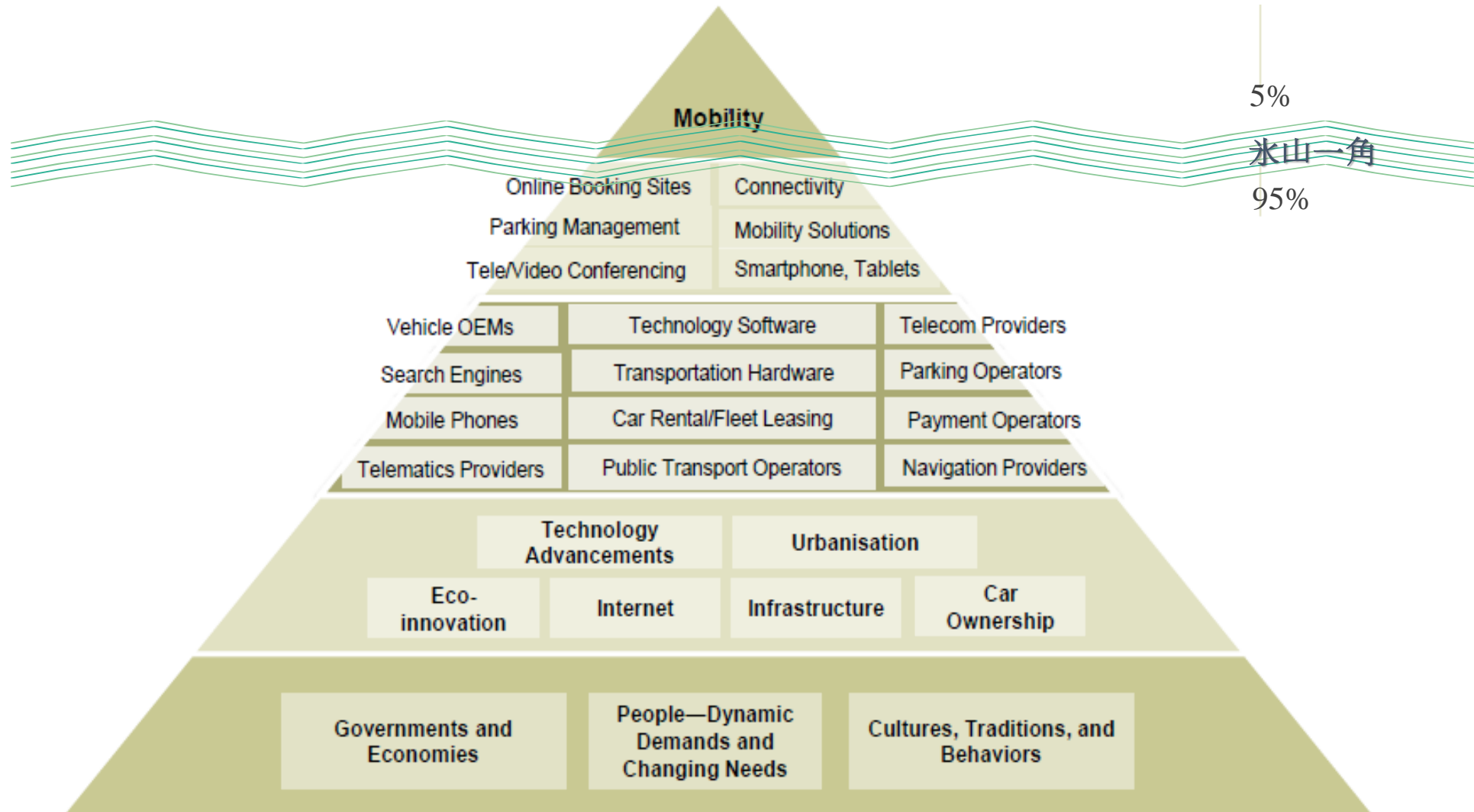
(관련문헌) 제임스 H. 길모어 "The Experience Economy" 1998



# 이동플랫폼 | 산업생태계

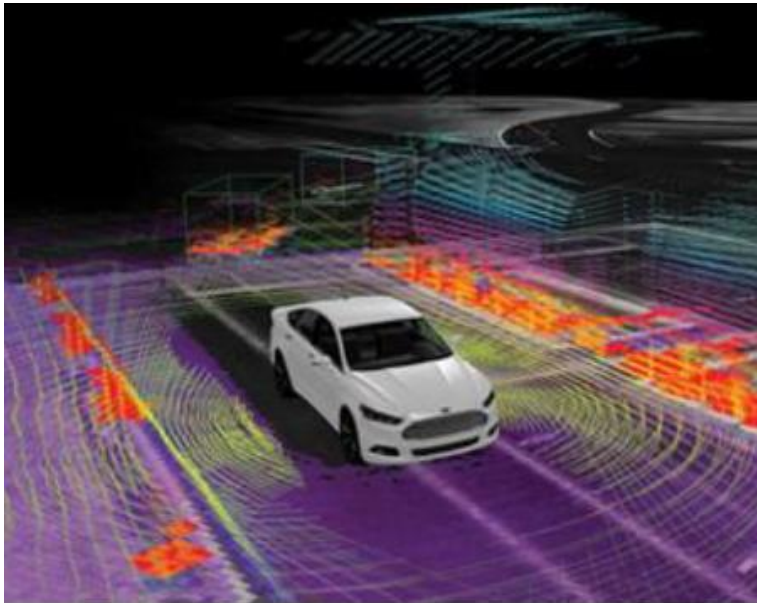


# 이동플랫폼 | 이동성(Mobility)의 BIG PICTURE



(편집인용) Source: Frost & Sullivan analysis.

# 도전적 과제들



## PROCESSING REQs

The ODDs scale from Lane Keeping to robo-taxis

Up to 100s of TOPs, 10s of TFLOPs,  
1000s of KDMIPs



## POWER, COST

Up to ...

1000s of Watts,  
10000s of \$

Cost of Software



### Driving to Safety

How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability?

#### Key findings

- Autonomous vehicles would have to be driven hundreds of millions of miles and sometimes hundreds of billions of miles to demonstrate their reliability in terms of fatalities and injuries.
- Under even aggressive testing assumptions, existing fleets would take tens and sometimes hundreds of years to drive these miles—an impossible proposition if the aim is to demonstrate their performance prior to releasing them on the roads for consumer use.
- Therefore, at least for fatalities and injuries, test-driving alone cannot provide sufficient evidence for demonstrating autonomous vehicle safety.

## TESTING, VALIDATION

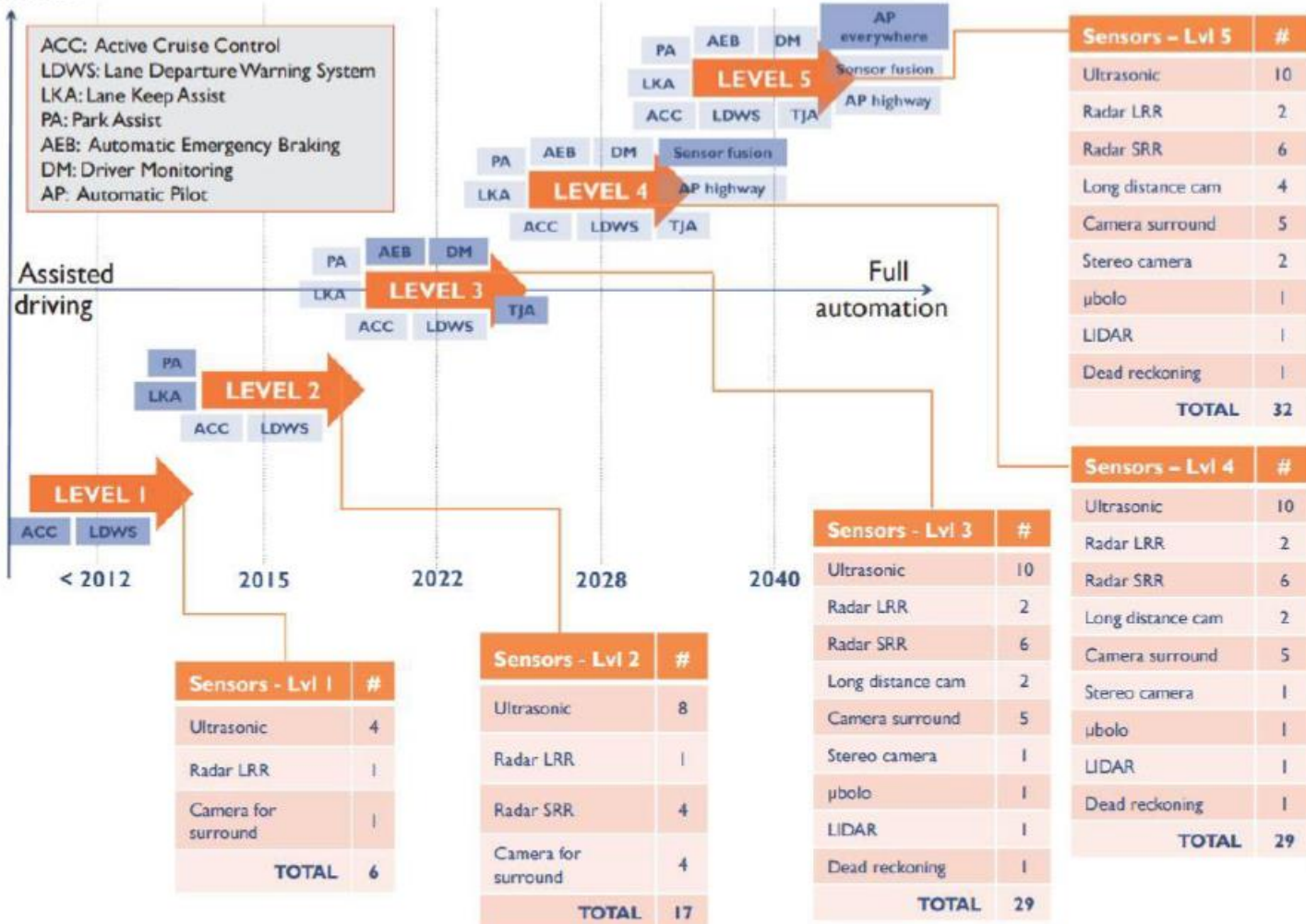
Up to ...

100s of billions of driving miles,  
100s of years

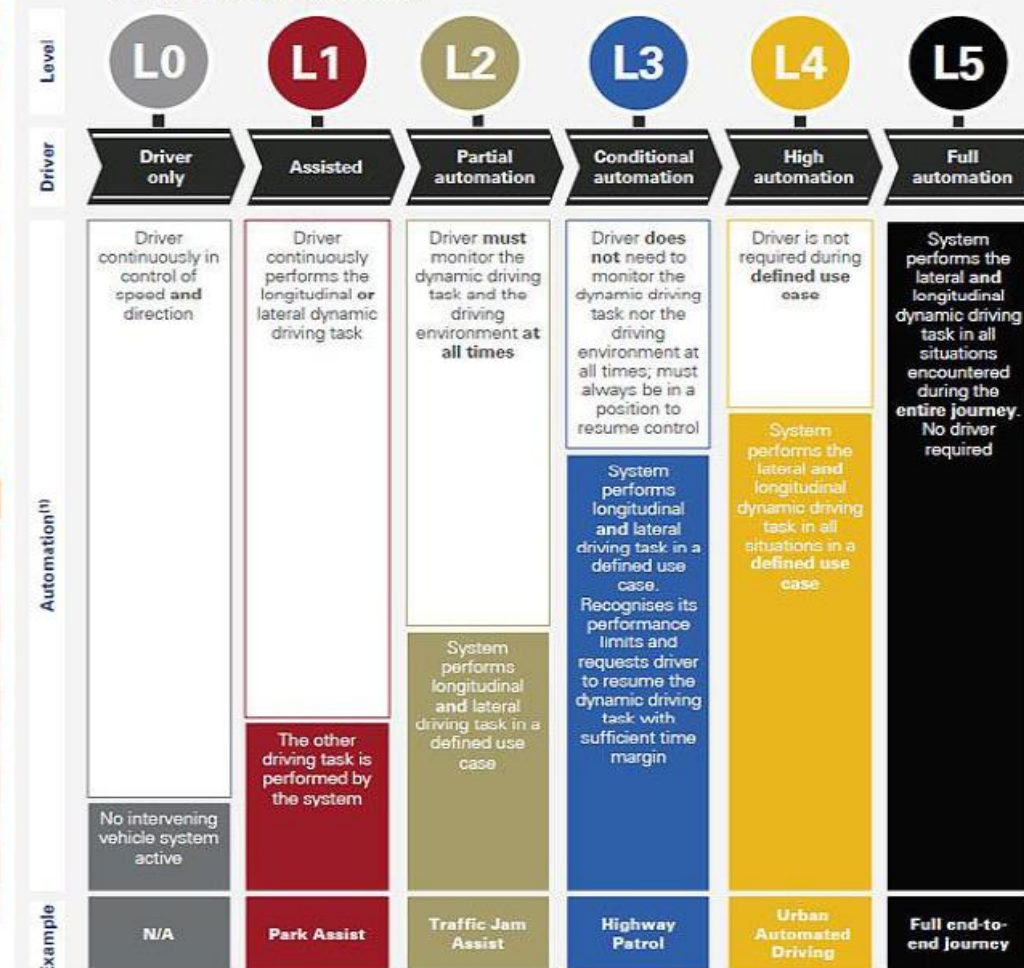


# 자율주행을 구현하는 실제적 센서기술

## Functionalities

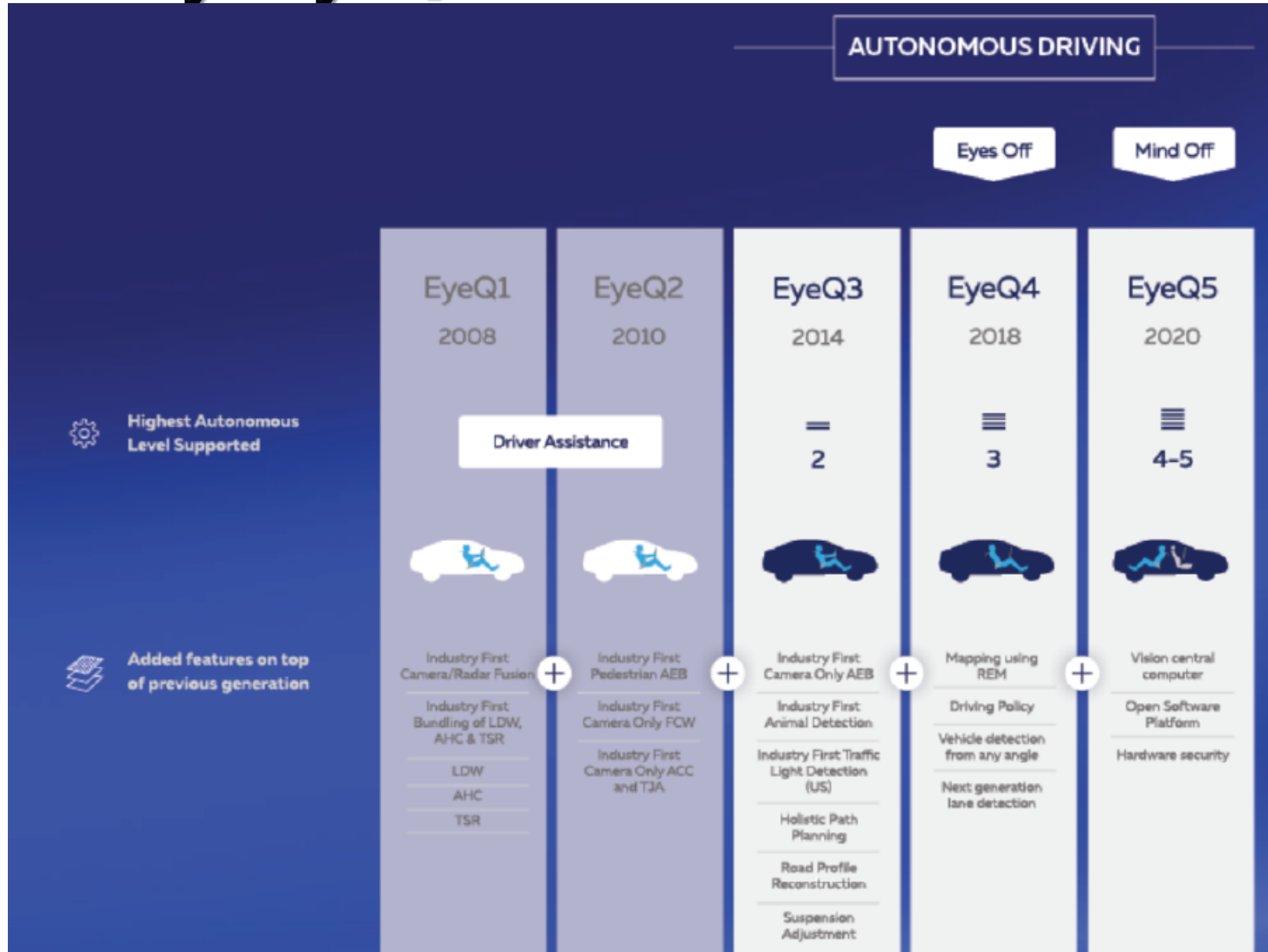


## Defined levels of automation











# Mobileye EyeQ

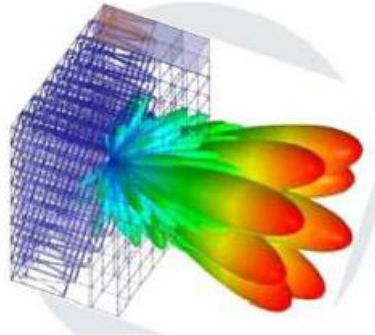


# 라이다 기술

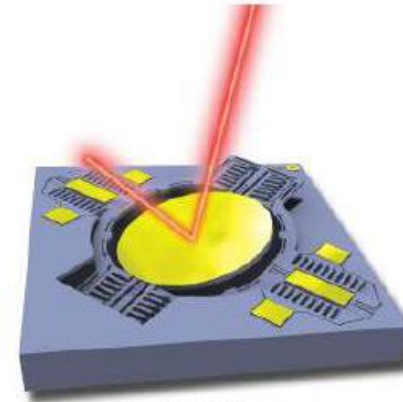
## ➤ Solid State Lidar 기술 동향

- OPA → MEMS Mirror로 주도 기술 전환 추세

업체	Innoluce	LeddarTech	Innoviz	Velodyne	Pioneer	Cepton
형상						
방식	MEMS Mirror	MEMS Mirror	MEMS Mirror	?	MEMS Mirror	?
거리/FoV	150m/30°	60m/100° 215m/20°	250m/120°	200m/120°	33m/180°	200m/60°

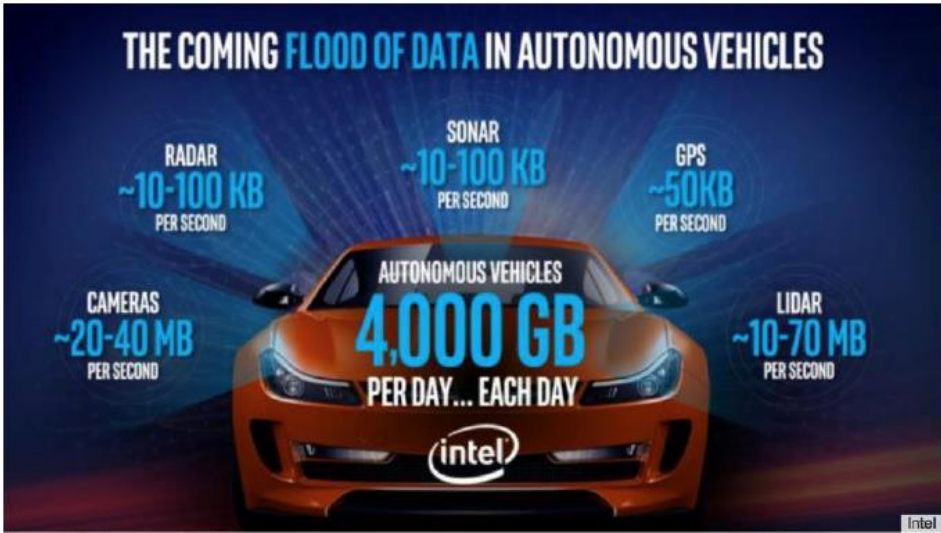


Optical Phase Array



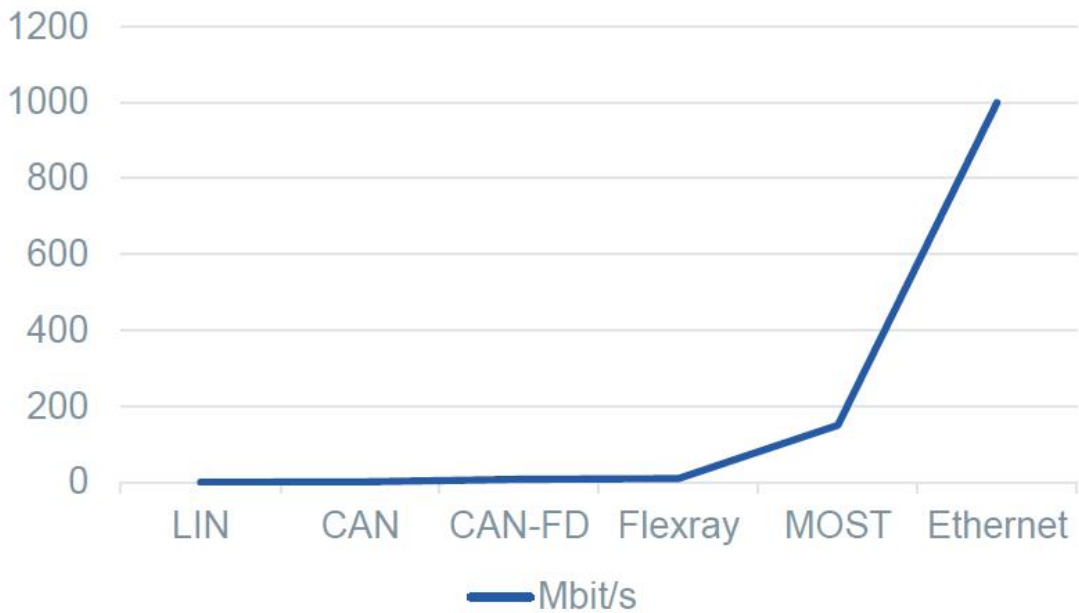
MEMS Mirror

# IVN 통신



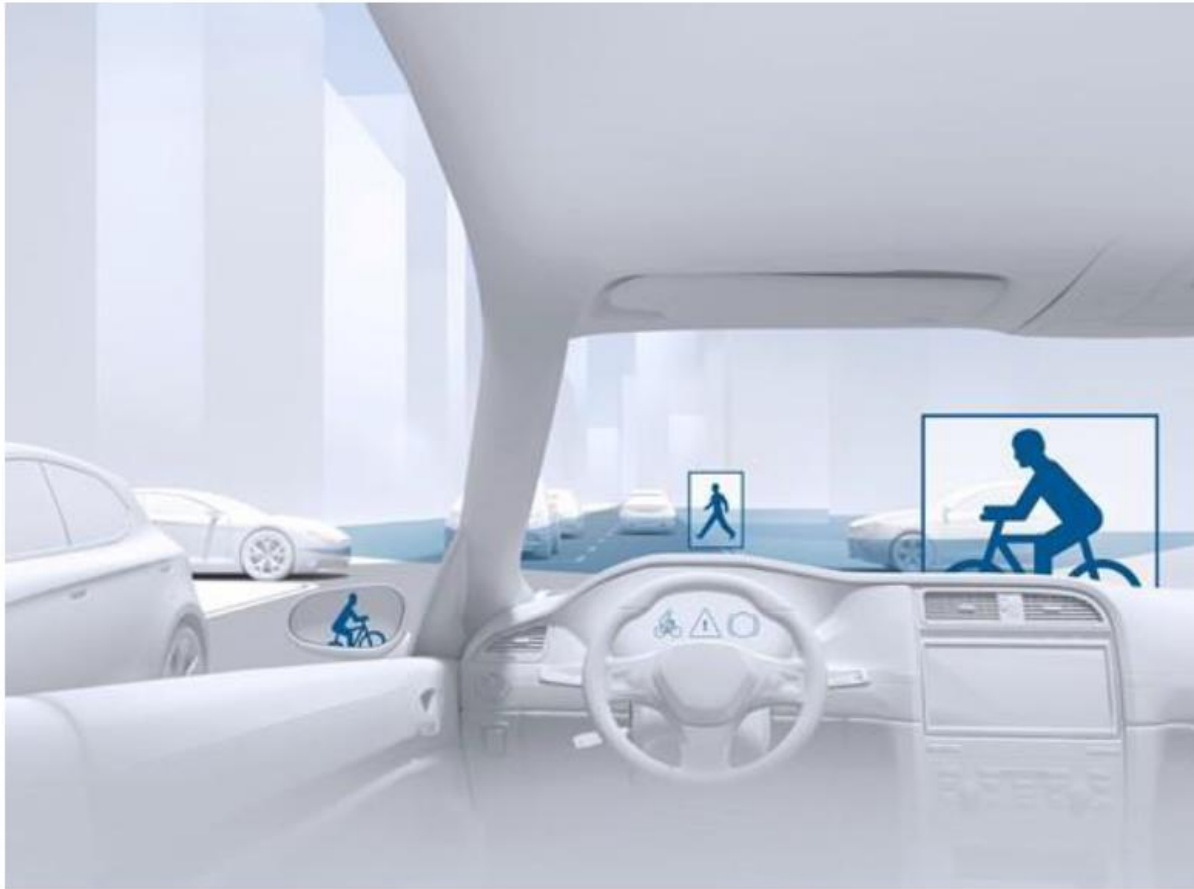
- Standard Ethernet is “best effort” based
- No synchronization between devices
- No Redundancy

Bandwidth capacity



Technol ogy	LIN	CAN	CAN-FD	Flexray	MOST	Ethernet
Speed	19.2 kbit/s	1 Mbit/s	8 Mbit/s	10 Mbit/s	150 Mbit/s	1 Gbit/s (2 Gbit/s)

# 도심 자율 주행 시험



- ▶ Mileage derived from safety goals is beyond practicability:  $\sim 10^9$  h of driving  $\sim 10^{10}$  k  
(1.1 million years, about 33 times from earth to sun and back)
- ▶ However, “the vehicle must be able to deal with all situations it would reasonably be expected to encounter” )\* =>
  - ▶ Knowledge of expectable situations necessary
  - ▶ Behavior of ego vehicle in these situations incl. system degradation

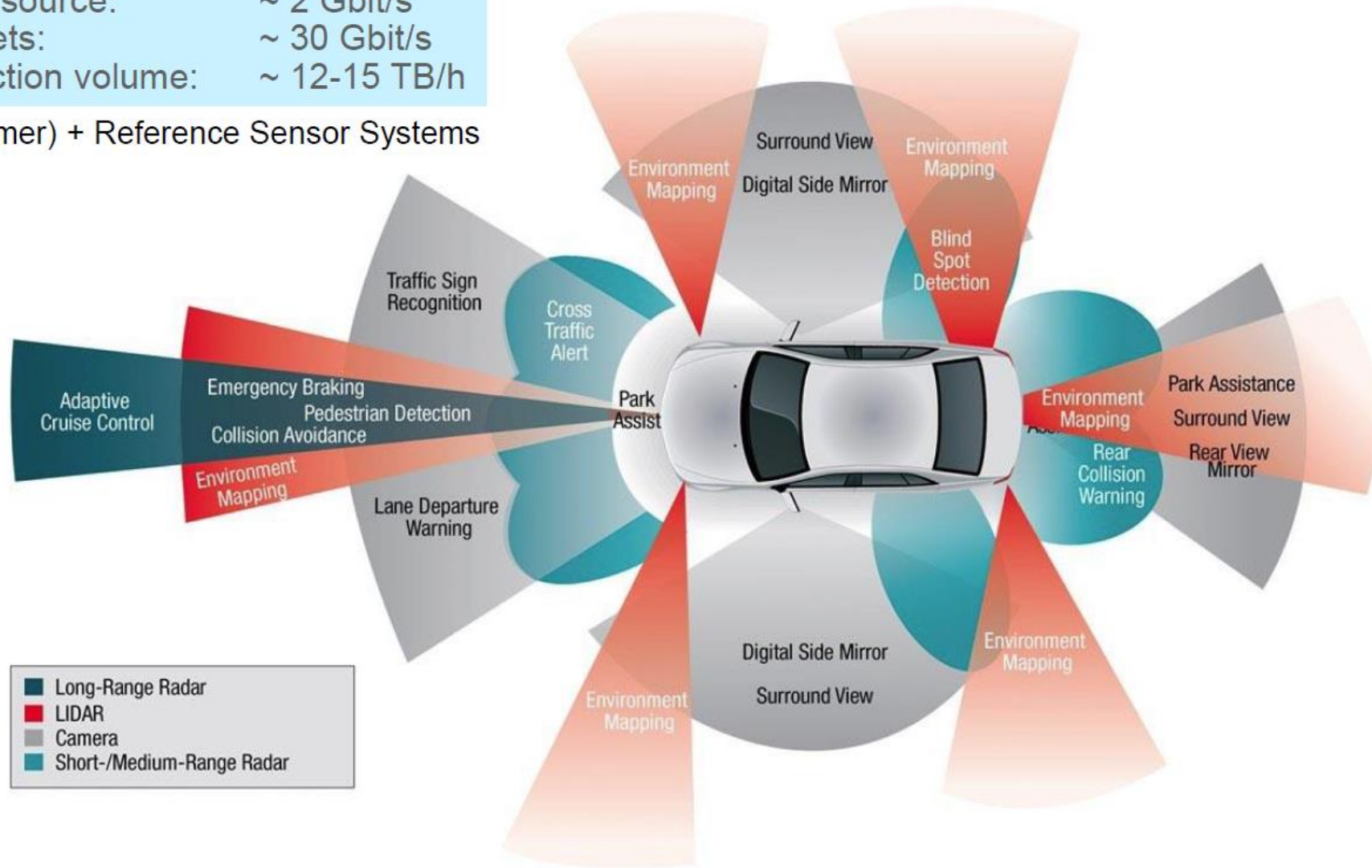
Source: Bosch, AVT&DS 2018  
Thatcham Research; IEDAS  
2017



## ▪ Key Player를 향한 도전 : 빅 데이터

Each data source: ~ 2 Gbit/s  
Sensors sets: ~ 30 Gbit/s  
Data collection volume: ~ 12-15 TB/h

Car (Consumer) + Reference Sensor Systems





# Challenging Data Management

## Test Drives

- Europe
- USA
- China
- Japan
- Asia
- Africa



## R&D Labs: tagging



## R&D Labs: developing & testing & (re-)simulation & AI training

**>5PB / car model (project)**



Source: IBM, 2018

# IBM 솔루션

1. How to implement & operate an efficient storage, workflow and management system?

„The Foundation“

2. How to distribute data globally within an enterprise and partners?

3. How to preserve digital data for decades with optimized costs?

4. How to analyze sensor and video data with fast analytics and modern BigData tools?

5. How to run Machine Learning (ML) and AI training with Nvidia GPU technology at scale?

6. How to do efficient IT workload and resource scheduling?

7. How to embed analytics/data management into R&D Environment?

8. How to run massive workloads on large topology Clusters with data centric workloads?



**IBM Spectrum Scale**  
Cloud Object Storage



IBM AREMA

**IBM High-Speed File Transfer**  
IBM Aspera / Mass Data Migration



**IBM Archiving**  
IBM Spectrum Protect



**IBM Analytics**  
Hortonworks HDP, DSX, Spark,...



**IBM Enterprise-Class AI**  
TensorFlow, AC922, Nvidia V100, PowerAI



**IBM Spectrum Computing**



**IBM ALM & PLM Solutions**  
IBM Continuous Engineering



**IBM Cloud Platform (Public)**  
Performance, scalability and costs.



Source: IBM, 2018



# DELL 솔루션

## Legislation, Liability and Insurance : More Uncertainty...

Self-driving cars could make jaywalking legal

*CNN Tech, Nov 3, 2017*

Rules for self-driving cars are stuck in park

*Federal regulations for automation are voluntary*

*ABC15, Nov 6, 2017*

Should Your Car Be Willing To Kill You? You Might Have To Decide

*IFL Science, Oct 16, 2017*

Humanising AI: Driverless cars to be trained on morality to make life and death decisions

*International Business Times, Oct 17, 2017*

Insurance industry calls on Government to clearly define autonomous cars

*Auto Express, Nov 6, 2017*

Australian Commission Wants To Allow Intoxicated People To Use Driverless Cars

*The Drive, Oct 8, 2017*

New CA laws permit self-driving tests without a human in the driver seat

*Digital Trends, Oct 16, 2017*

Lawyers, not ethicists, will solve the robocar "Trolley Problem"

*Wired, May 28, 2017*

### Example: Sensor Data Retention

Current Consensus: 30+ years (life of the vehicle)

**Next Challenge:**

**1-7 day OEM Service Level Agreements (SLAs)**

<http://money.cnn.com/2017/11/03/technology/culture/autonomous-vehicles-jaywalking/index.html>

<http://www.iflscience.com/technology/driverless-cars-could-give-passengers-power-over-who-lives-and-dies-in-a-crash/>

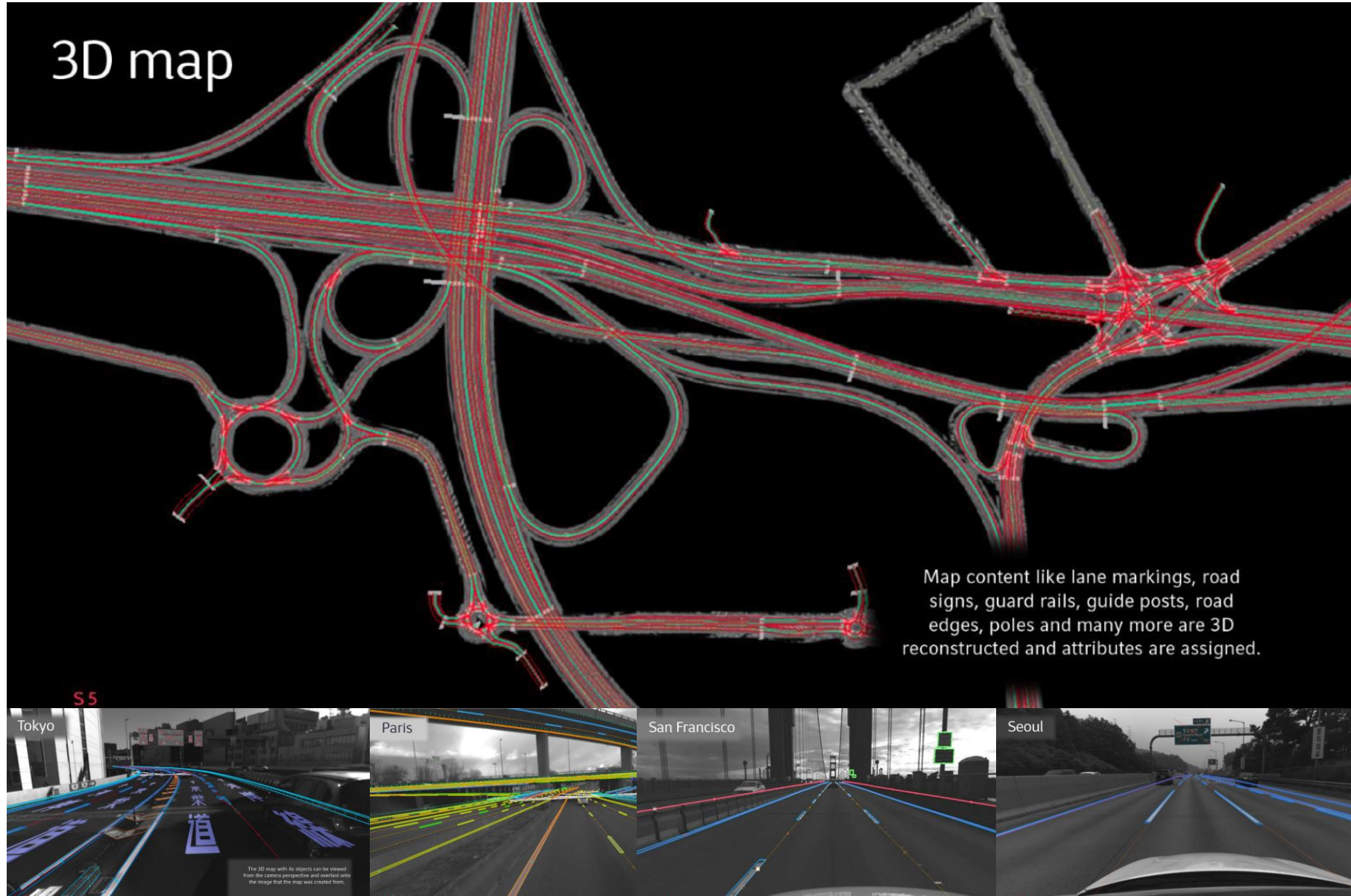
<http://www.autoexpress.co.uk/car-news/101600/insurance-industry-calls-on-government-to-clearly-define-autonomous-cars>

<https://www.abc15.com/news/national/rules-for-self-driving-cars-are-stuck-in-park>

<https://www.ibtimes.co.uk/humanising-ai-driverless-cars-be-trained-morality-make-life-death-decisions-1643447>

<http://www.thedrive.com/sheetmetal/14956/australian-commission-wants-to-allow-intoxicated-people-to-use->

## ■ Key Player를 향한 도전 : 3D 맵





# Map data at scale from street-level imagery

Images from all over the world processed with computer vision.

Create account

Explore imagery and data

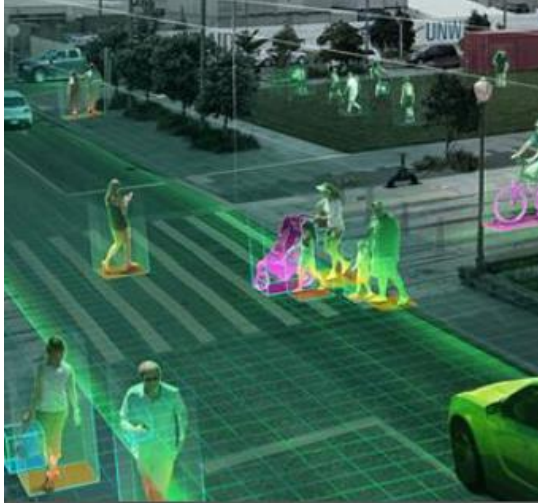
279.6 million images, 4.4 million kilometers

<https://www.mapillary.com/>



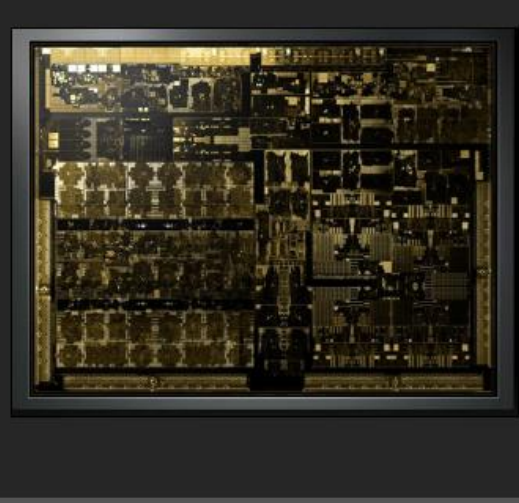


# Key Strategies, Game Changers



## AI

The Computing Model  
for AV



## One-Architecture

Xavier - Pegasus - Orin  
From L2 to L5



## DRIVE END-TO-END SYSTEM

Collect Data  
Train Models  
Simulate  
Drive



## OPEN PLATFORM

370+ Partner  
Ecosystem

# 소프트웨어 비즈니스



*"Our thesis is ... the entire experience of being in the car will be defined by software."*

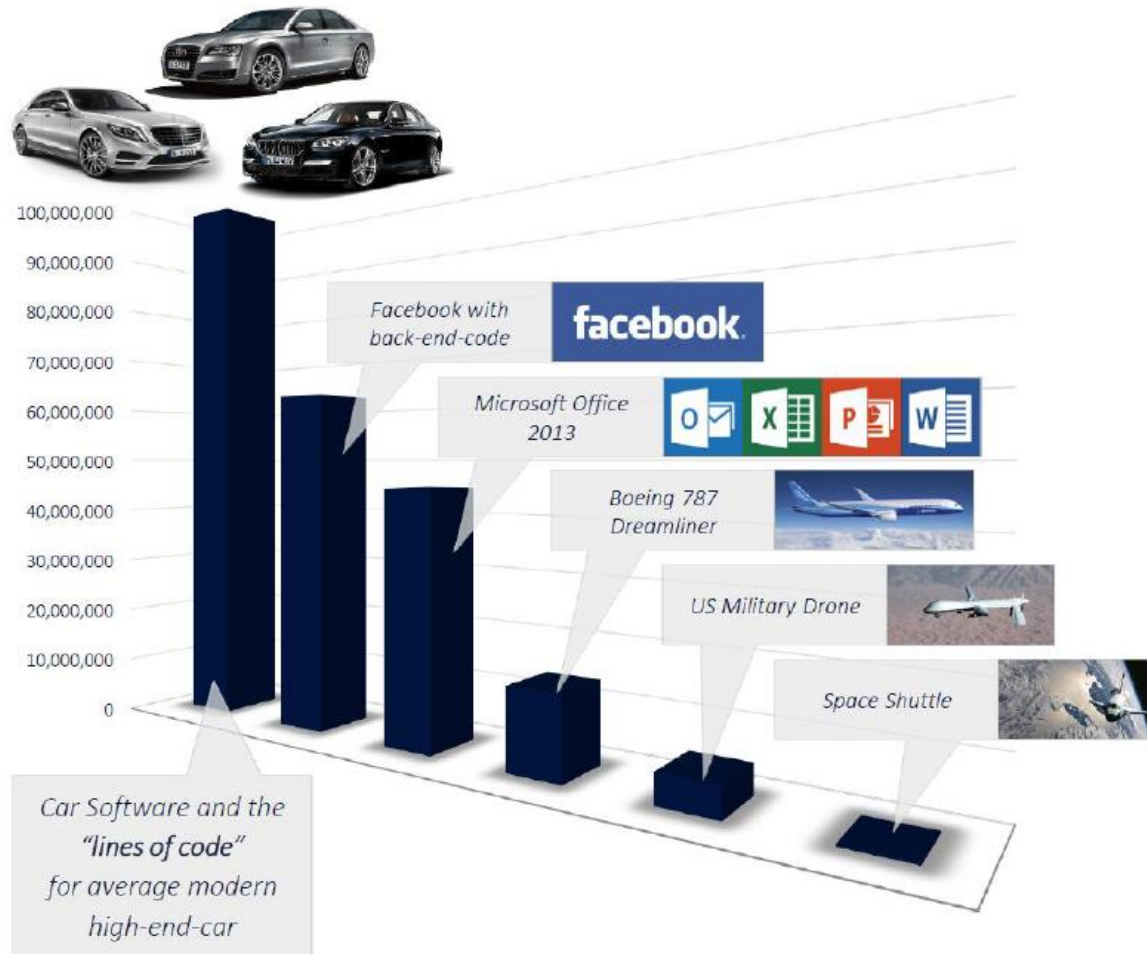
– Marc Andreessen, Silicon Valley Investor,  
CNBC Interview, May 22<sup>nd</sup>, 2017

**Collaborating to build the car of the future through rapid innovation.**

Source: LINUX, 2018; <http://AutomotiveLinux.org>



# "CAR" > 1억 라인 코드



Source: Prime Research, 2015

Nearly **one-third** of new vehicles sold in 2015 had internet connectivity.

By 2020 more than **three-quarters** of new vehicles will have such connectivity.

VDC Research

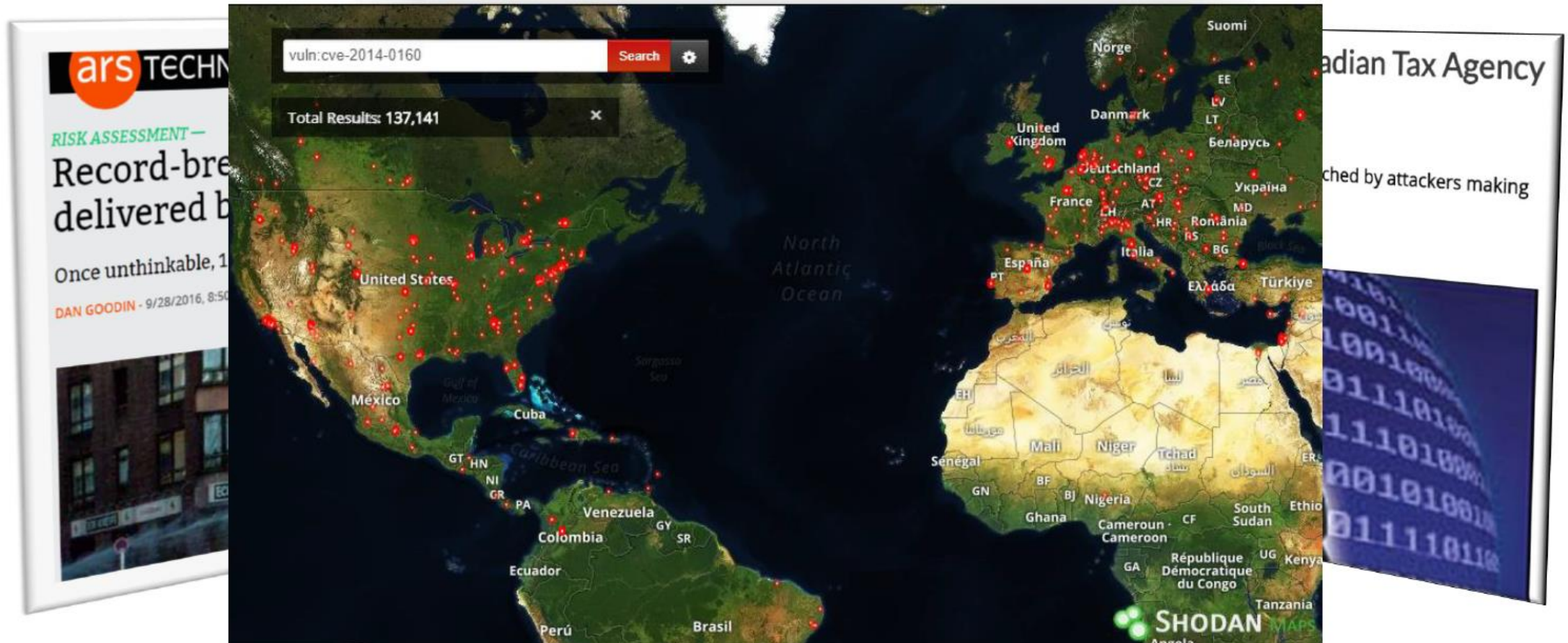
# 소프트웨어 “버그”

- ▶ “80% of embedded systems are delivered late” (\*)
- ▶ “New code generally has 50 to 100 bugs per thousand lines” (\*)



(\* Jack Ganssle, embedded systems commentator

# 해커는 영리하다





# 새로운 보험 상품

## Autonomous Driving Ecosystem



### Adjusted motor insurance

Motor insurance for autonomous driving mode

Motor insurance for manual driving mode



### Personal on-demand coverage

Mobility lateness protection

Coverage for lost and stolen personal items



### Protection for companies

Product liability for product defect and recall

Failure protection for operators of AVs



### Assistance services

Assistance for autonomous vehicles

Emergency call and telehealth service



### Comfort services

Offering individual interconnected mobility services

Concierge service (e.g. info for points of interest)



### Cyber protection passenger / car

Protection of personal data and Identity (Cyber Shield)

Protection against cyber attacks and manipulation of the vehicle

Source: Allianz, AVT&DS 2018

# 국내 자동차산업 대응현황

## ■ 우리는 ... : 국내 자동차산업 대응현황

### ● [핵심 요소] KSAEP – 사고의 전환

- Knowledge/Sharing/Autonomous/Electrification
- Digitization : Land ⇒ Steel ➞ Data : 공유!
- Internal investment, Strategic alliance, M&A

### ● [신기술] 새로운 융합기술이 기존 기술의 75%를 대체할 전망

[모델] 고효율내연기관/  
전기동력/커넥티드(자율주행)

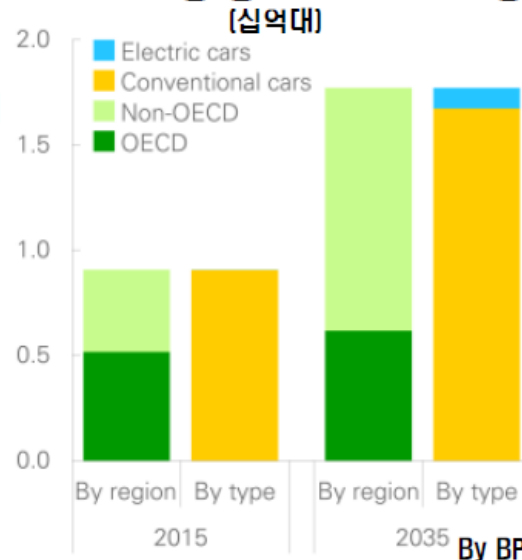
[판매] 온 라인

[유지 보수] 신규 인력 – 판매 결정 요인

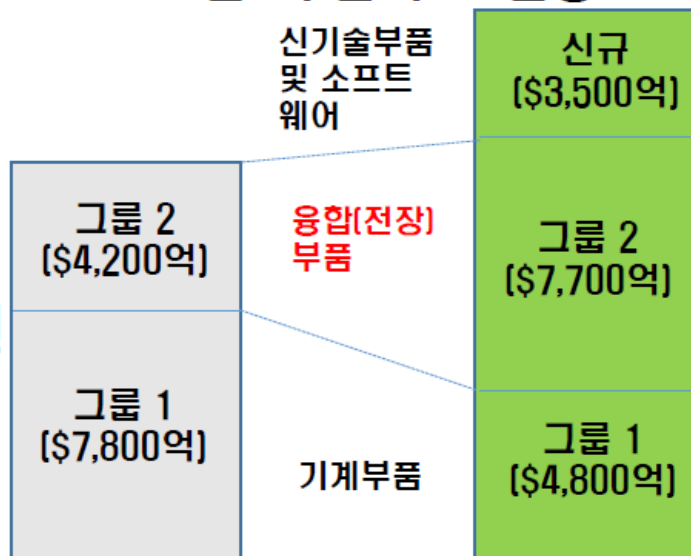
[서비스] 새로운 사업 분야

출처: 대구 자율차, 산업연구원 이항구, 2017

### <그림> 승용차 보급 전망



### <그림> 부품 수요 전망



# 국내 자동차산업 대응현황

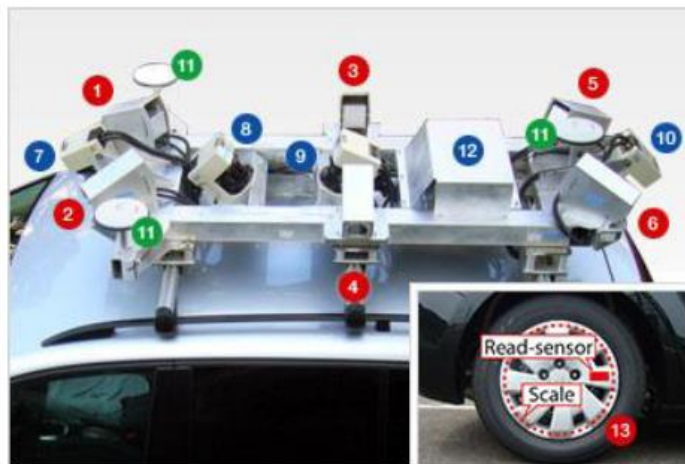
## ● 기술 패러다임 변화는 3500억 달러의 새로운 시장 창출(IHS)

- 연비 향상과 경량화 : 대당 원가 744달러 상승
- 편의성 제고와 자율화 : 360달러 : 자율은 75달러 상승
- 파워트레인 효율성 제고와 전기동력화로 원가 37% 상승

## ● 그룹 1 : 차체, 새시, 파워트레인 관련 기존 기계부품군

그룹 2 : 정보통신기술(ICT) 및 신소재와 융합해 성능, 연비, 편의, 안전성 향상에 기여하는 융합부품군

그룹 3 : 기존 기술을 대체하는 구동용 모터/인버터, 배기시스템 등 신기술 부품이나 소프트웨어 등



- 1 Camera(front;right)
- 2 Camera(front;left)
- 3 Camera(side;right)
- 4 Camera(side;left)
- 5 Camera(rear;right)
- 6 Camera(rear;left)
- 7 Laser scanner (front;downward)
- 8 Laser scanner (rear;upward)
- 9 Laser scanner (front;upward)
- 10 Laser scanner (rear;downward)
- 11 GPS antenna
- 12 IMU
- 13 In-wheel odometer

## Carbon Fiber Composite Subframe Concepts

Compression molded composite and UD laminates

Supplier partner : Cosma International and Magna Exteriors



Steel front subframe



Steel rear subframe



CF front subframe



CF and Al rear subframe



# 국내 자동차산업 대응현황

## ● 국내 자동차산업 현황과 역량에 대한 정보 부족

- [경쟁력] 부품업체의 경쟁력이 완성차업체의 경쟁력?

⇒ 양극화

- [기본 역량] 부품업체의 고임금, 저효율 및 혁신성 부족?

☞ 사실이라면 그 원인은 어디에 있는가?

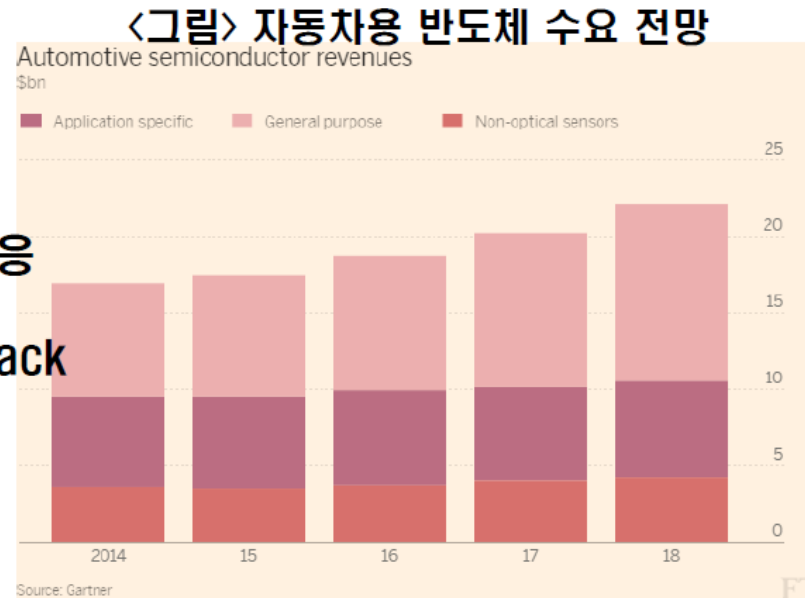
⇒ 전속거래

- [빠른 추격자에서 선도자로]

⇒ 패러다임 변화에 수동적 대응

- [융합] 대상을 찾기 어렵고 Slack도 부족

☞ 아래로부터의 위기





# 혁신은 '개똥'이다

■ 우리는 ... : 유니콘기업

**International unicorn club: 106 private companies outside the US**  
valued at \$1B+ as of 9/18/2017



“지금은 혁신적인 기술이나 아이디어가 과잉인 세상이다 ... 개똥처럼 흔한 혁신을  
황금으로 바꾸는 연금술은 **기업가정신**이라는 촉매가 있을 때만 가능하다 ...  
중국에서는 일주일에 2개꼴로 유니콘기업이 탄생한다. 이에 비해 한국은 2015년 이후  
지금까지 단 한 곳도 나오지 않았다”, 천광암, 2018.10.29, 동아일보

● 대구, 업체 수 기준 전국 4위 (경남, 경북, 충남)

〈표〉 국내 자동차산업 현황

구분	자동차용엔진 및 자동차 제조업		자동차 차체 및 트레일러 제조업		자동차 부품(전장) 부품 제조업		자동차 재제조 부품 제조업		자동차산업 소계	
	생산액 (억원)	비중 (%)	생산액 (억원)	비중 (%)	생산액 (억원)	비중 (%)	생산액 (억원)	비중 (%)	생산액 (억원)	비중 (%)
전국	669,424	100.00	21,689	100.00	786,514	100.00	1,208	100.00	1,478,834	100
부산	56,353	8.42	211	0.97	31,701	4.03	177	14.66	88,442	5.98
대구	-	-	24	0.11	61,637	7.84	34	2.84	61,695	4.17
인천	76,440	11.42	505	2.33	35,424	4.50	170	14.08	112,540	7.61
광주	99,075	14.80	2,946	13.58	33,476	4.26	7	0.59	135,508	9.16
대전	-	-	124	0.57	11,038	1.40	93	7.68	11,254	0.76
울산	304,156	45.44	743	3.43	84,075	10.69	-	0.00	388,974	26.3
세종	-	-	818	3.77	4,516	0.57	-	0.00	5,335	0.36
강원	-	-	96	0.44	13,929	1.77	32	2.67	14,057	0.95
충북	58	0.01	2,876	13.26	48,170	6.12	26	2.13	51,130	3.46
충남	65,870	9.84	1,648	7.60	161,221	20.50	77	6.38	228,816	15.47
전북	50,319	7.52	5,149	23.74	29,565	3.76	150	12.44	85,183	5.76
전남	-	-	486	2.24	2,091	0.27	-	0.00	2,577	0.17
경북	-	-	825	3.80	132,358	16.83	40	3.34	133,224	9.01
경남	17,153	2.56	5,237	24.15	137,314	17.46	401	33.21	160,105	10.83
제주	-	-	-	-	-	-	-	-	-	-

자료 : 통계청, 광업·제조업조사(생산액), 10차개정, 2017년도 자동차산업 관련 산업분류코드(C30) 기준

- 고용 규모로는 전국 5위  
- 과제는 인력구조 개편

〈표〉 국내 자동차산업 현황

구분	사업체수(개사)				종사자수(백명)				생산액(억원)			
	2013년	2015년	2017년	CAGR	2013년	2015년	2017년	CAGR	2013년	2015년	2017년	CAGR
전국	3462	3843	3726	363	201,788	220,438	218,112	267	1,419,033	1,515,298	1,478,834	1.73
부산	265	264	235	-154	10,204	10,048	10,224	200	53,862	71,741	88,442	8.61
대구	295	297	285	-109	19,083	18,690	16,941	027	61,010	62,201	61,695	3.94
인천	235	240	212	-127	11,808	13,460	12,051	1.18	113,588	105,067	112,540	-0.06
광주	132	158	152	271	15,374	15,586	15,222	122	123,241	140,740	135,503	3.09
대전	35	35	34	186	2,256	2,546	2,421	535	8,113	13,683	11,254	16.57
울산	270	295	282	195	16,327	19,173	19,587	295	377,940	396,490	388,974	0.99
세종	19	23	22	796	1,228	1,553	1,207	306	4,990	5,546	5,335	8.25
강원	53	52	46	502	4,125	4,383	3,581	-1.14	17,933	18,130	14,057	-3.24
충북	151	192	206	1105	9,663	11,018	11,779	648	47,186	46,265	51,130	3.63
충남	501	575	588	612	36,503	38,905	38,193	1.81	222,464	235,847	228,816	1.52
전북	241	240	231	154	11,851	11,708	11,129	-743	116,467	112,404	85,183	-6.52
전남	21	29	25	259	319	576	598	485	1,666	2,415	2,577	9.88
경북	502	634	632	899	31,702	35,847	36,702	639	122,245	137,548	133,224	4.51
경남	742	809	776	332	31,345	36,945	38,477	614	148,327	167,221	160,105	2.71
제주	-	-	-	-	-	-	-	-	-	-	-	-

자료 : 통계청, 광업·제조업 조사(사업체수, 종사자수, 생산액), 10차 개정, 각 년도 기준

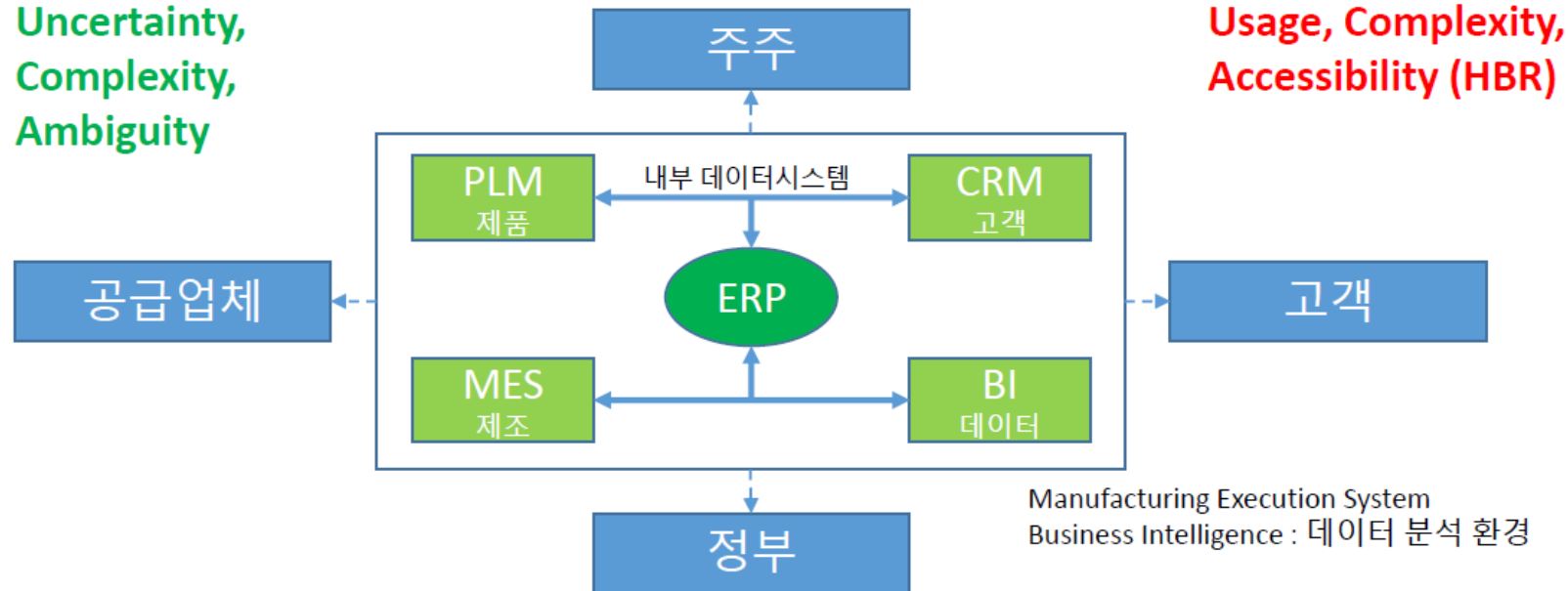
# 자동차부품산업의 고도화 방향

## ● 혁신 : 데이터 기반

- 제품 혁신 : 전기동력 자율주행화 – 부품 수 감소와 작업 공정의 단순화
- 공정 혁신 : Industry 4.0 – 자동화와 디지털화 – 효율성 제고, 원가 절감
  - \* 새로운 장비의 도입 : 데이터 분석과 활용 – 새로운 기능 요구
- 서비스와 비즈니스 모델 혁신 : 전환 배치
  - \* CAR, 2019년 120개 부품업체 대상 조사에서 8%만이 사내 데이터 통합 중

VUCA : Volatility,  
Uncertainty,  
Complexity,  
Ambiguity

〈 그림 〉 제조 데이터 생태계



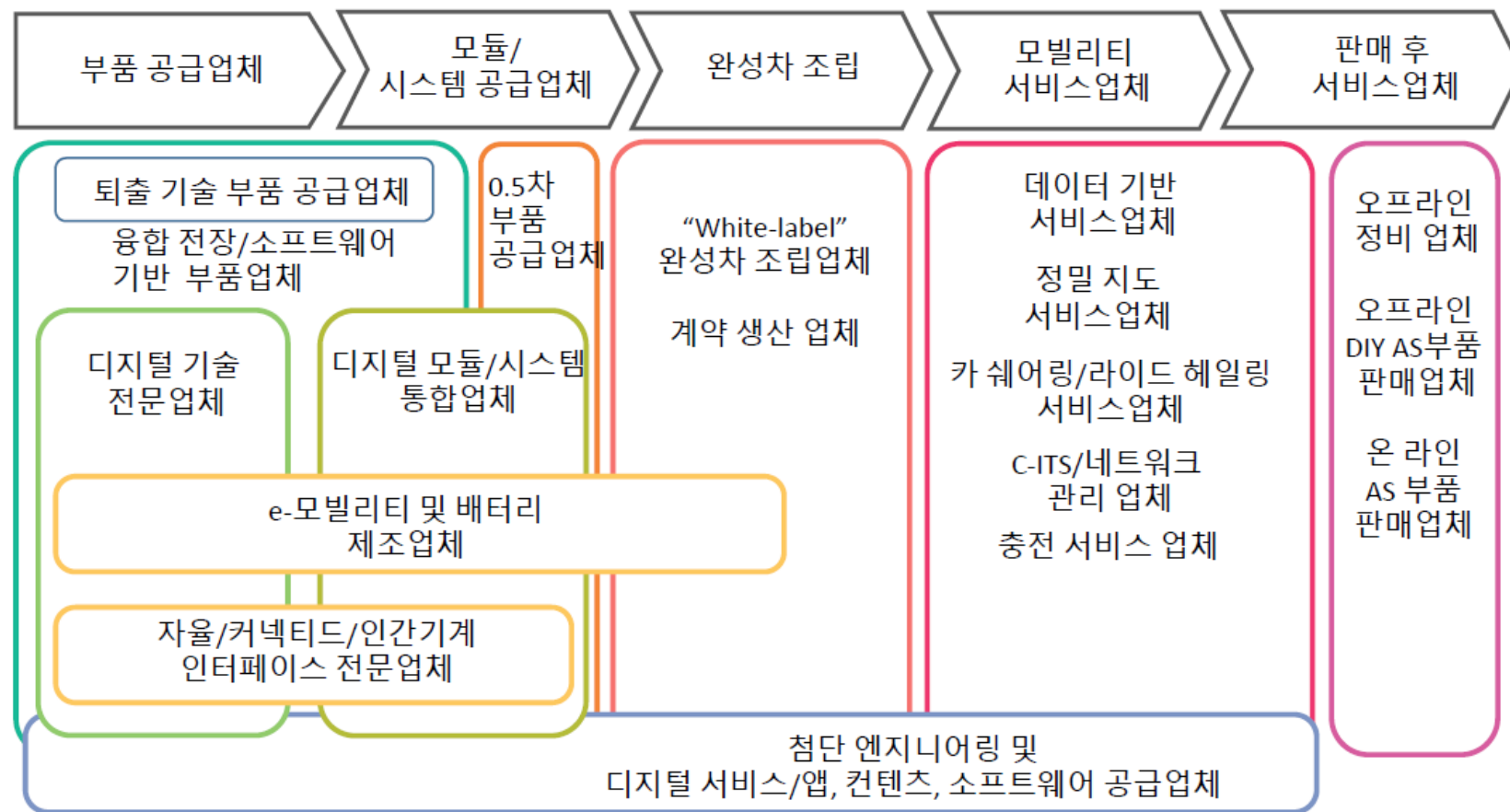


# 자동차부품산업의 고도화 방향

## ● 모빌리티 생태계 조성

- 제조와 조립 생태계
- 부품산업 생태계 강화
- 질병, 보호무역주의, 중국의 홍색 공급망 – 교역과 투자 구조 변화

### < 미래차 가치사슬 >



## 4. 맺음말

## 모빌리티의 미래



# ARE YOU READY?



"The electric light did not come from the continuous improvement of candles."



# Thank you very much

▪ **Contact: Prof. Jae-Cheon Lee, Ph.D**

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**Keimyung University, S. Korea**

**Email: [LJCDS@kmu.ac.kr](mailto:LJCDS@kmu.ac.kr)**

**Tel: +82-(0)53-580-6720**