March 26, 2019

APTIV

Autonomous Mobility Teach-In

APTIV

Today’s Discussion

10:00 AM

PRESENTATION

AUTOMATED DRIVING ON THE SPECTRUM OF ACTIVE SAFETY

Aptiv uniquely positioned for success across each phase of deployment

COMMERCIALIZING AUTOMATED MOBILITY ON DEMAND (AMOD)

Deep understanding of technology and commercial roadmaps to deploy at scale, while maximizing return on investment

11:00 AM

Q&A

11:30 AM

LUNCH & COMMAND CENTER DEMO

Lunch, continued Q&A and opportunity to interact with Aptiv Mobility Cloud interface

NOON

CONCLUDE

Forward Looking Statements

This presentation, as well as other statements made by Aptiv PLC (the “Company”), contain forward-looking statements that reflect, when made, the Company’s current views with respect to current events, certain investments and acquisitions and financial performance. Such forward-looking statements are subject to many risks, uncertainties and factors relating to the Company’s operations and business environment, which may cause the actual results of the Company to be materially different from any future results. All statements that address future operating, financial or business performance or the Company’s strategies or expectations are forward-looking statements. Factors that could cause actual results to differ materially from these forward-looking statements are discussed under the captions “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in the Company’s filings with the Securities and Exchange Commission. New risks and uncertainties arise from time to time, and it is impossible for us to predict these events or how they may affect the Company. It should be remembered that the price of the ordinary shares and any income from them can go down as well as up. The Company disclaims any intention or obligation to update or revise any forward-looking statements, whether as a result of new information, future events and/or otherwise, except as may be required by law.

We are a global technology company that develops **safer, greener** and **more connected** solutions, which enable the future of mobility.



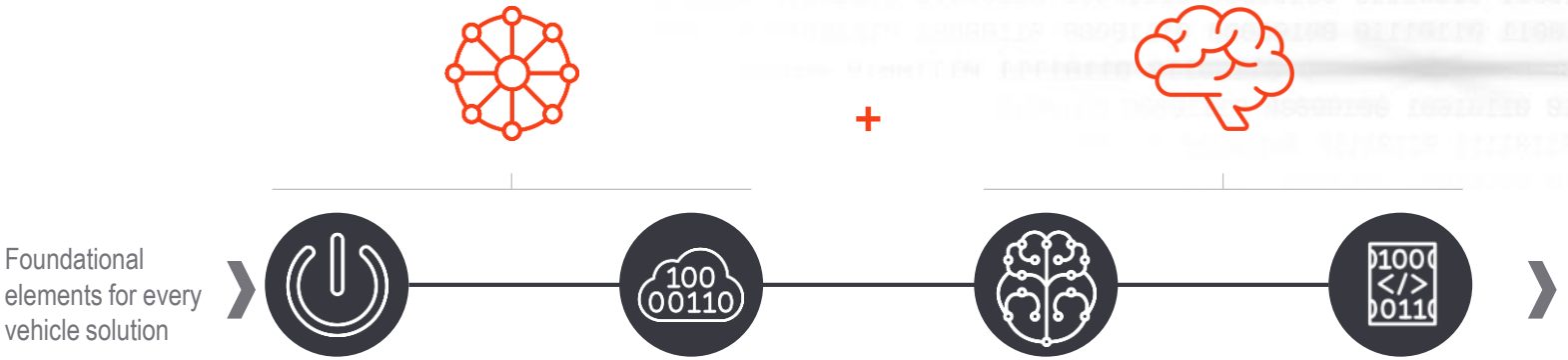
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Aptiv Addressing Mobility's Toughest Challenges

PROVIDING END-TO-END SOLUTIONS THAT ENABLE THE COMMERCIALIZATION OF NEW MOBILITY

Aptiv's advanced technologies and deep systems knowledge across the brain and nervous system of the vehicle…

…allows us to conceive, specify and deliver solutions for some of our customers' toughest challenges



ACTIVE SAFETY

Increasing levels of safety automation on the path to automated driving

HIGH VOLTAGE ELECTRIFICATION

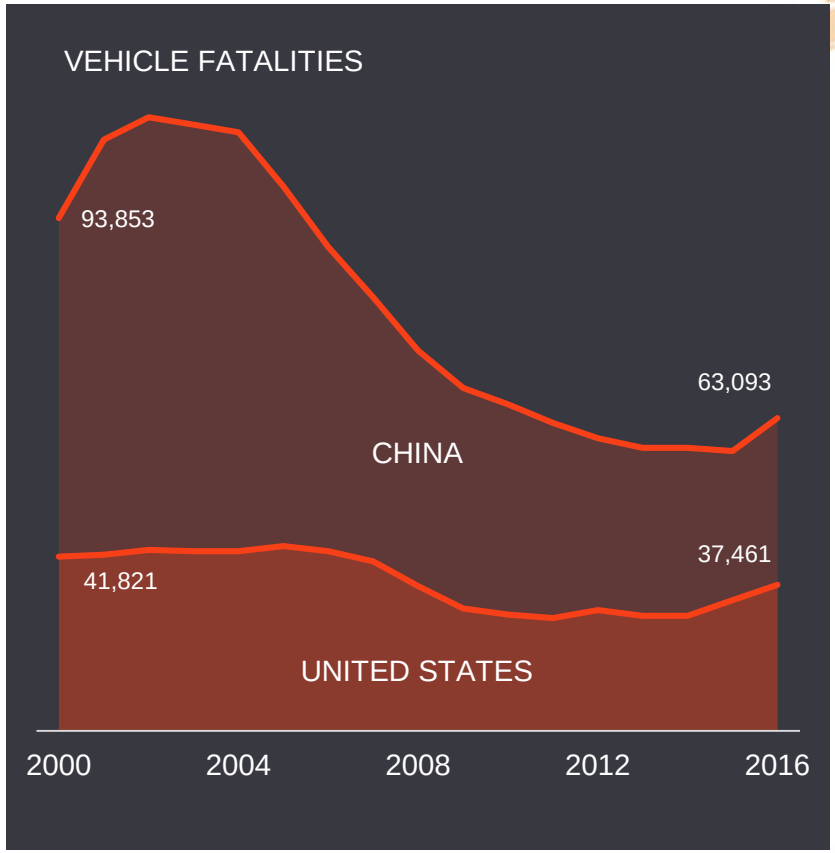
Greater vehicle electrification for propulsion and performance

INFOTAINMENT & USER EXP

Improved in cabin experiences for greater comfort and productivity

Traffic Fatalities Increasing After Years of Declines

ACTIVE SAFETY A CRITICAL NEXT STEP IN REDUCING VEHICLE FATALITIES



1.25M

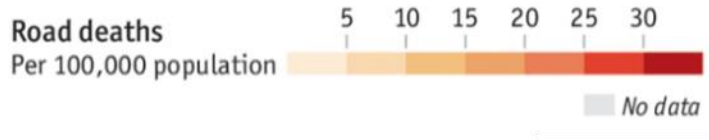
ROAD TRAFFIC DEATHS ANNUALLY

World Health Organization

94%

OF ALL ACCIDENTS CAUSED BY HUMAN ERROR

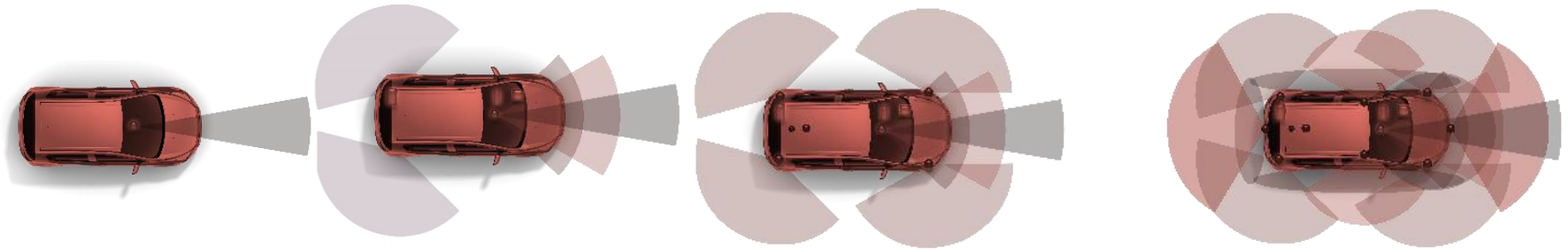
NHTSA
www.nhtsa.gov



Source: NHTSA, World Health Organization, The Economist

Safety Automation

MARKET EVOLVING AS A CONTINUUM, RATHER THAN DISCRETE LEVELS

	LEVEL 0/1	LEVEL 2	LEVEL 2+	LEVEL 3-	LEVEL 3+	LEVEL 4	LEVEL 5
HARDWARE CONFIGURATION							
	BASE	MID-RANGE	PREMIUM			AUTOMATED DRIVING	

EXAMPLE FUNCTIONALITY	• Adaptive Cruise
	• Blind Spot Detect
	• Forward Collision Warning
	• AEB
	  • Vehicles
	  • Pedestrians
		• Blind Spot Assist
		• Lane Departure
		• Lane Keep
		• Auto High Beams
		• Rear Exit Assist
		• Rear Collision Warn
		• Cross Traffic Warn
		• Traffic Sign Rec
		• AEB
		  • Bicycles
		  • Oncoming Traffic
		  • Rear / Backup
			• AEB Intersection
			• Auto Lane Change
			• Auto Park Assist
			• Surround View
			• Highway Assist
			• Front Cross Traffic Assist
			• Traffic Jam Assist
				• Auto Lane Change
				• Highway Assist
				• Traffic Jam Assist
					• Traffic Jam Pilot	• Highway Pilot
						• Traffic Pilot
						• Urban Pilot
						• Mobility on Demand	

Active Safety Leading To Automated Driving

INVESTMENTS IN SOFTWARE, SENSING AND COMPUTE DRIVE BENEFITS TODAY AND IN THE FUTURE

TODAY

DEMOCRATIZATION OF ACTIVE SAFETY

Base Active Safety functionality moving from premium vehicles to mass market platforms. Adoption driven by increased consumer awareness, scale-up improving affordability, and evidence of effectiveness driving rating agency and regulatory standards.

COMMERCIALIZATION OF AUTOMATED DRIVING

Mobility on Demand (AMoD) applications in geo-fenced areas represent initial deployments, helping provide more equitable access to mobility. Longer-term, convergence with OEM product and technology roadmap helps drive consumer introductions.

FUTURE

PERFORMANCE / COST SWEET SPOT

Maximizes the safety benefit while maintaining a system cost the customer can afford

$275 - 325

$450 - 550

$750 - 1,200

$1,750 - 2,200

$4000 - 5,000

L0	L1	L2	L2+	L3-	L3	L4/5
Base ADAS	Mid-Range ADAS	Premium ADAS	Highway / Traffic Jam Assist	Traffic Jam Pilot	Highway Pilot	Highway / Urban Pilot

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Automated Driving Investments

ACQUISITIONS OF AUTOMATED DRIVING SOFTWARE STACK PROVIDERS AND STRATEGIC INVESTMENTS IN SOLID STATE LiDAR COMPLEMENT EXISTING APTIV CAPABILITIES

SOFTWARE

STRATEGIC ACQUISITIONS OF AUTOMATED DRIVING SOFTWARE AND SUPPORTING TECHNOLOGY PROVIDERS

SOLID STATE LiDAR

STRATEGIC INVESTMENTS ENSURE ACCESS TO TECHNOLOGY WHILE ACCELERATING COMMERCIALIZATION

ottomatika™

CONTROLTEC

nuTonomy

:) Affectiva

QUANERGY™

INNOVIZ TECHNOLOGIES

LeddarTech®

Today's Presenters



Karl Iagnemma

President,
Aptiv Autonomous Mobility



Brandon Eldredge

Chief Financial Officer,
Mobility & Services Group

Urban Mobility CHALLENGES by 2050

+70%
Of Population

+40%
Freight

5x
Emissions

4x
Cost

3x
Travel time

Source: Arthur D. Little, World Economic Forum, Boston Consulting Group and Aptiv Estimates

BENEFITS of smart mobility automation to cities

87%
Fewer Accidents

28%
Fewer Vehicles

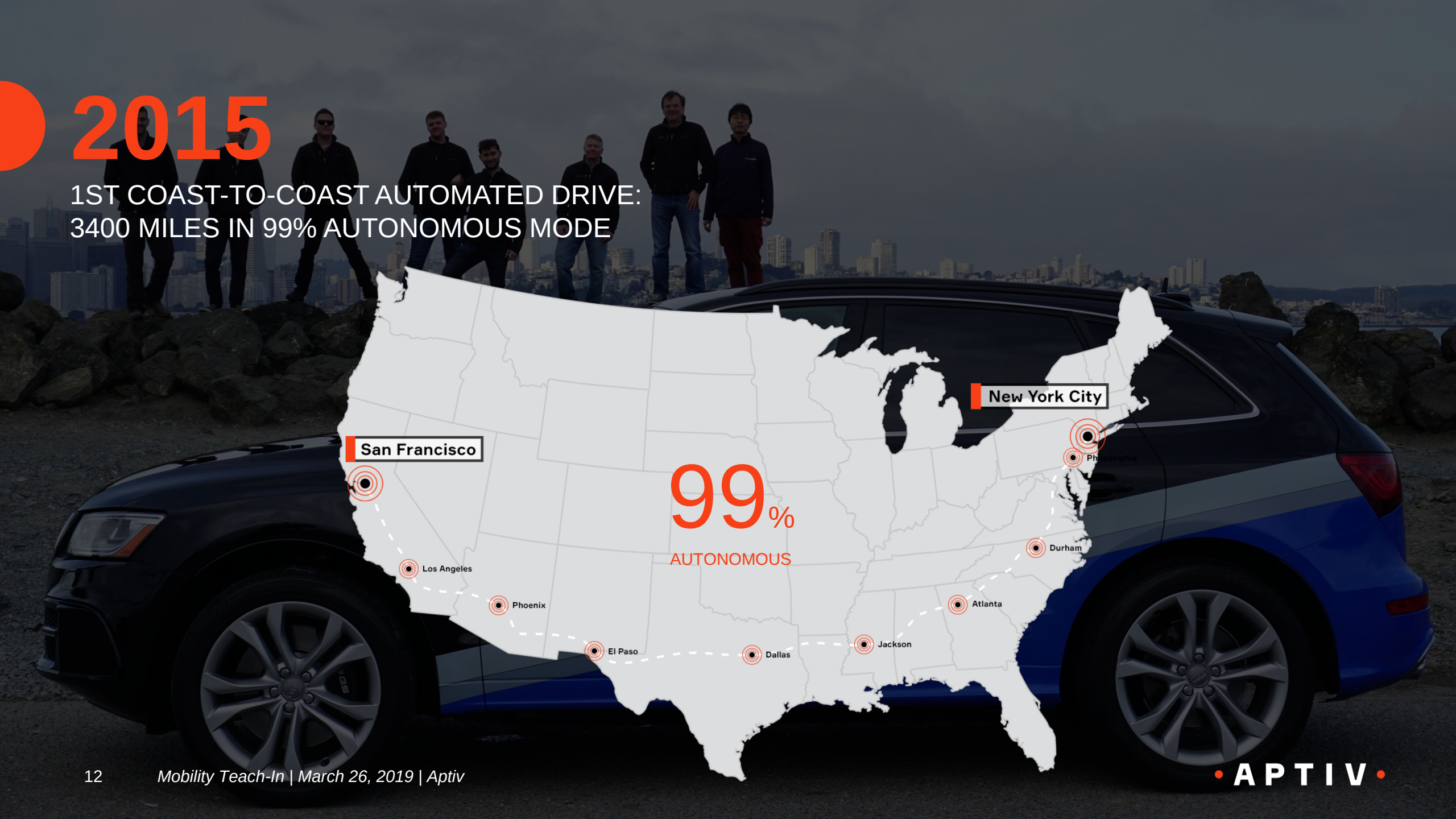
66%
Lower Emissions

44%
Fewer Parking Spaces

30%
Shorter Travel Time

2015

1ST COAST-TO-COAST AUTOMATED DRIVE:
3400 MILES IN 99% AUTONOMOUS MODE



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2016

APTIV AND NUTONOMY INDEPENDENTLY SELECTED FOR WORLD'S FIRST PUBLIC AMOD RIDE-HAILING TRIAL ON CITY ROADS

Land Transport Authority

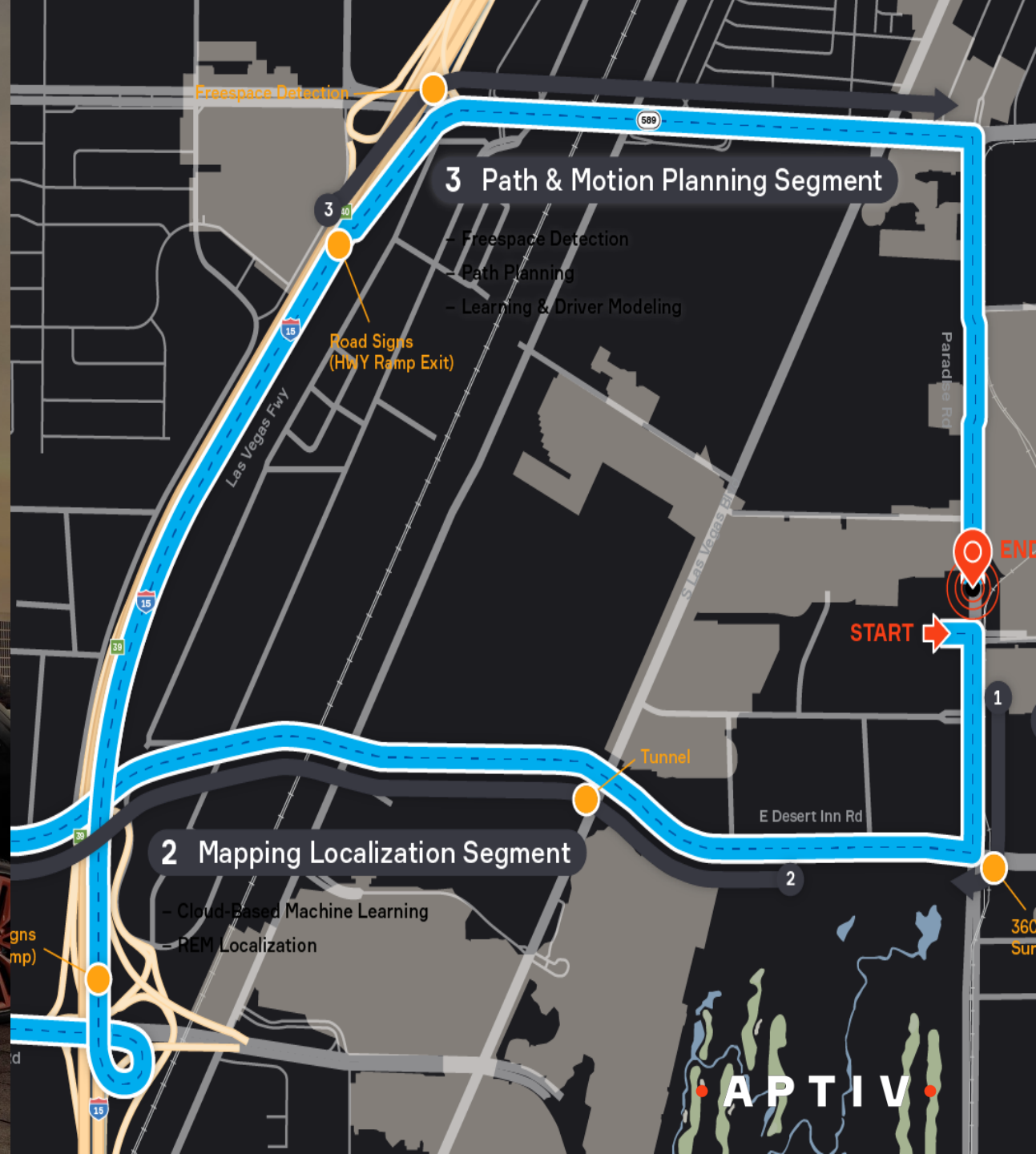




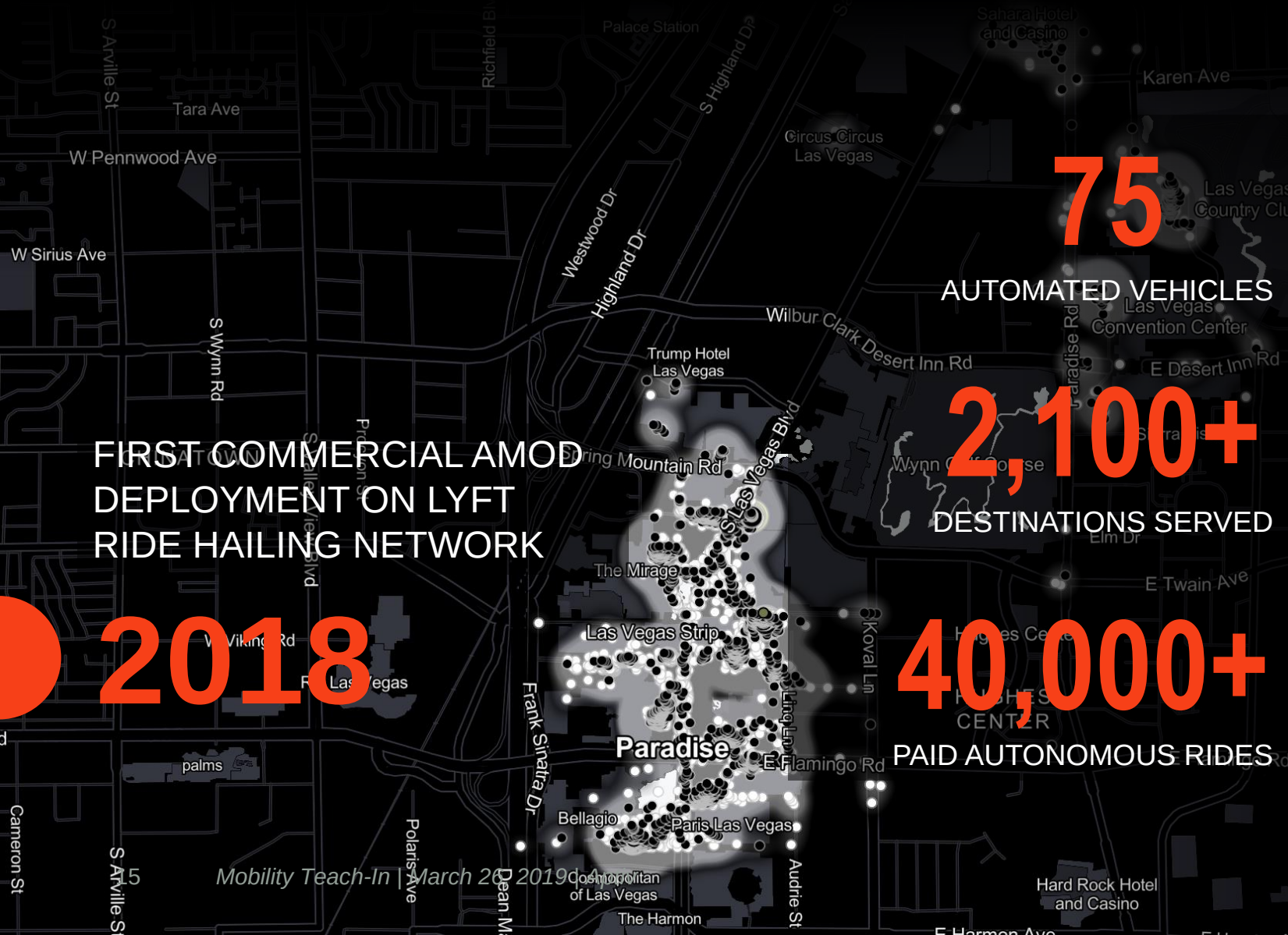
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2017

DEMONSTRATED ADVANCED
AUTOMATED DRIVING CAPABILITIES
AT CES AND SHANGHAI AUTO SHOWS



Las Vegas Commercial Deployment Progress



FIRST COMMERCIAL AMOD DEPLOYMENT ON LYFT RIDE HAILING NETWORK

2018

75
AUTOMATED VEHICLES

1,000,000+
AUTONOMOUS MILES TRAVELED

2,100+
DESTINATIONS SERVED

4.95 STAR USER RATING OUT OF 5

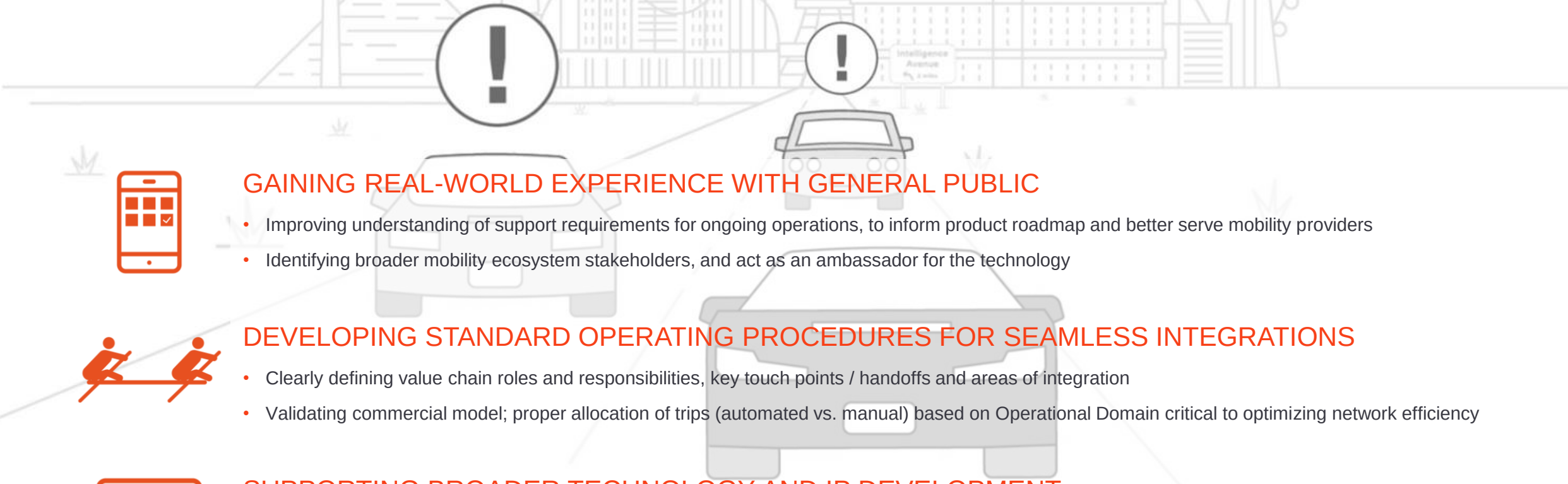
40,000+
PAID AUTONOMOUS RIDES

9 OUT OF **10** WOULD RIDE AGAIN

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Benefits Of Las Vegas Deployment

DEVELOPING APPROACH THAT ALLOWS APTIV TO QUICKLY AND EFFICIENTLY SCALE FUTURE DEPLOYMENTS



GAINING REAL-WORLD EXPERIENCE WITH GENERAL PUBLIC

- Improving understanding of support requirements for ongoing operations, to inform product roadmap and better serve mobility providers
- Identifying broader mobility ecosystem stakeholders, and act as an ambassador for the technology

DEVELOPING STANDARD OPERATING PROCEDURES FOR SEAMLESS INTEGRATIONS

- Clearly defining value chain roles and responsibilities, key touch points / handoffs and areas of integration
- Validating commercial model; proper allocation of trips (automated vs. manual) based on Operational Domain critical to optimizing network efficiency

SUPPORTING BROADER TECHNOLOGY AND IP DEVELOPMENT

- Command Center developing teleoperations capabilities which will be critical to deployment
- 30 vehicles on Lyft network, remaining fleet allows for testing and validation; ability to demonstrate application / first-use of IP in real-world deployment

2019 AD Milestones

CONTINUED PROGRESS TOWARDS COMMERCIAL DEPLOYMENT

NEXT GENERATION VEHICLE PLATFORM

Vehicle capable of driverless operation

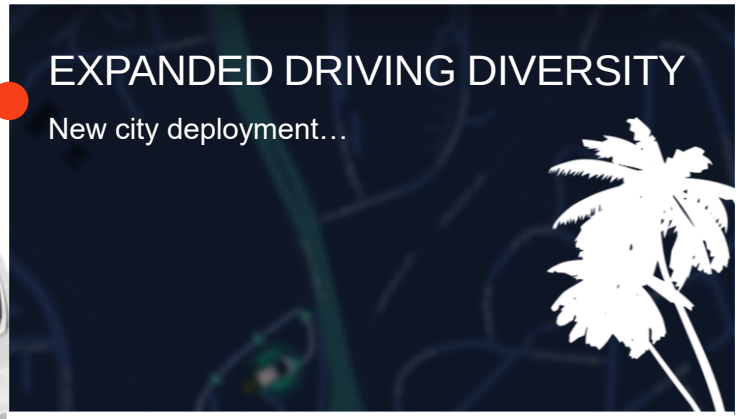
- Integrated Aptiv Software Stack (ottomatika + nuTonomy)
- Modular code structure
- Mobility Cloud integration

- Drive-by-wire interface
- Redundant power brakes and steering gears
- Self actuating doors
- Safety architecture with two redundant safety channels



EXPANDED DRIVING DIVERSITY

New city deployment…



… and a new region opened up for testing



Aptiv Mobility Cloud

ENABLING MOBILITY PROVIDERS TO DEPLOY, DISPATCH, MONITOR AND SUPPORT A FLEET OF APTIV AVs

Technical Capabilities

- STREAMING VIDEO
- COMMAND & CONTROL PIPING
- OTA
- NOTIFICATIONS
- AUTHORIZATION & AUTHENTICATION
- STREAMING TELEMATICS

Key Functionality

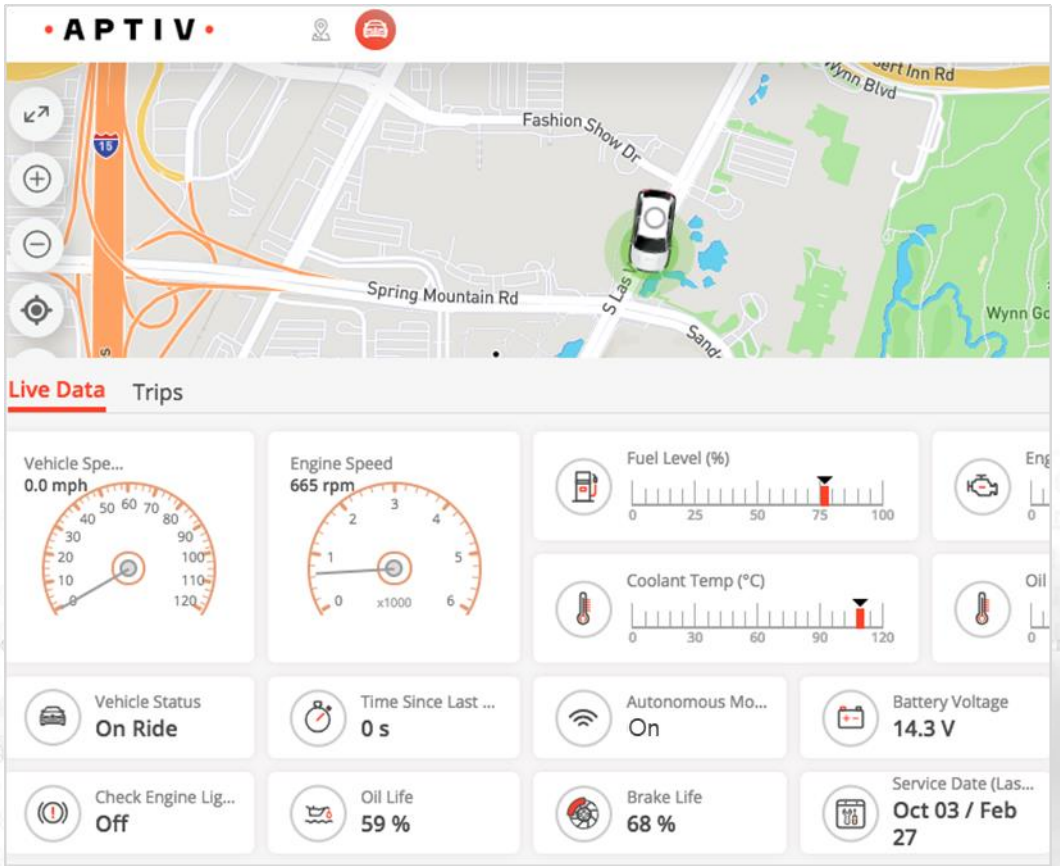
DEPLOY
- Map resource updates
- AD software version control
- Launch workflow and fleet readiness

DISPATCH
- Vehicle dispatch and real-time routing
- Micro-dispatch (aka teleoperation)
- Optimization algorithms (demand, maintenance, etc.)

MONITOR
- Historical fleet analytics (incl. utilization)
- Real-time monitoring & diagnostics (AV and vehicle)
- Safety driver/operator monitoring

UX SUPPORT
- Automated rider HMI updates
- Cabin monitoring & video conferencing
- User profiles (music, entertainment etc.)

Example Interface



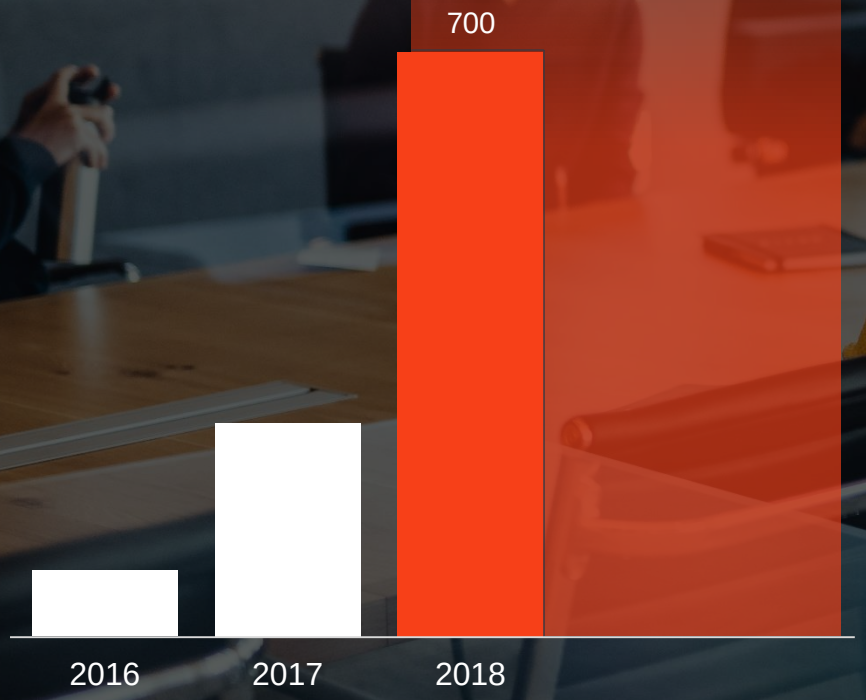
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Organizational Capabilities

INVESTMENTS INCREASING CAPABILITIES WHILE GENERATING SUBSTANTIAL INTELLECTUAL PROPERTY

HEADCOUNT

+ LEVERAGING GLOBAL ACTIVE SAFETY CAPABILITIES



PATENTS

Issued and Pending



- PLANNING
- PERCEPTION
- LOCALIZATION
- VEHICLE CONTROL
- OTA / DATA MANAGEMENT
- VEHICLE BUILD
- OTHER

APTIV

Flexible And Scalable Approach To Software

LEVERAGING FULL APTIV CAPABILITIES



MODULAR APPROACH

Flexible software design allows tailored solution

nuTonomy

ottomatika

ROBUST POLICY & PLANNING CAPABILITIES

Combined DNA from two full-stack automated driving teams



LEVEL 1
to
LEVEL 5

SCALABLE PLATFORM

Seamless scalability from Active Safety to Automated Driving

Structured AI Approach

COMBINING THE BEST OF RULES BASED AND AI APPROACHES TO AUTOMATED DRIVING SOFTWARE DEVELOPMENT

EXPLAINABLE

AUDITABLE



START WITH RULES OF THE ROAD

- Rules organized hierarchically with some rules more important than others
- Potential rule violation quantified / weighted with regard to same priority rule

AI FILLS IN CORNER CASES

- Unique situations / cultural norms addressed through applied machine learning
- Avoids exhaustive description of rule combinations / region specific rewrites

Regulation Not Holding Back AV Deployment

OVERWHELMING SUPPORT FOR SAFE DEVELOPMENT AND DEPLOYMENT AT SCALE; PROACTIVE ENGAGEMENT HELPS ENSURE SMOOTH EXECUTION

UNDERSTAND KEY STAKEHOLDER REQUIREMENTS, AND MOBILITY CHALLENGES

STAKEHOLDERS

Engagement prior to city selection helps establish support

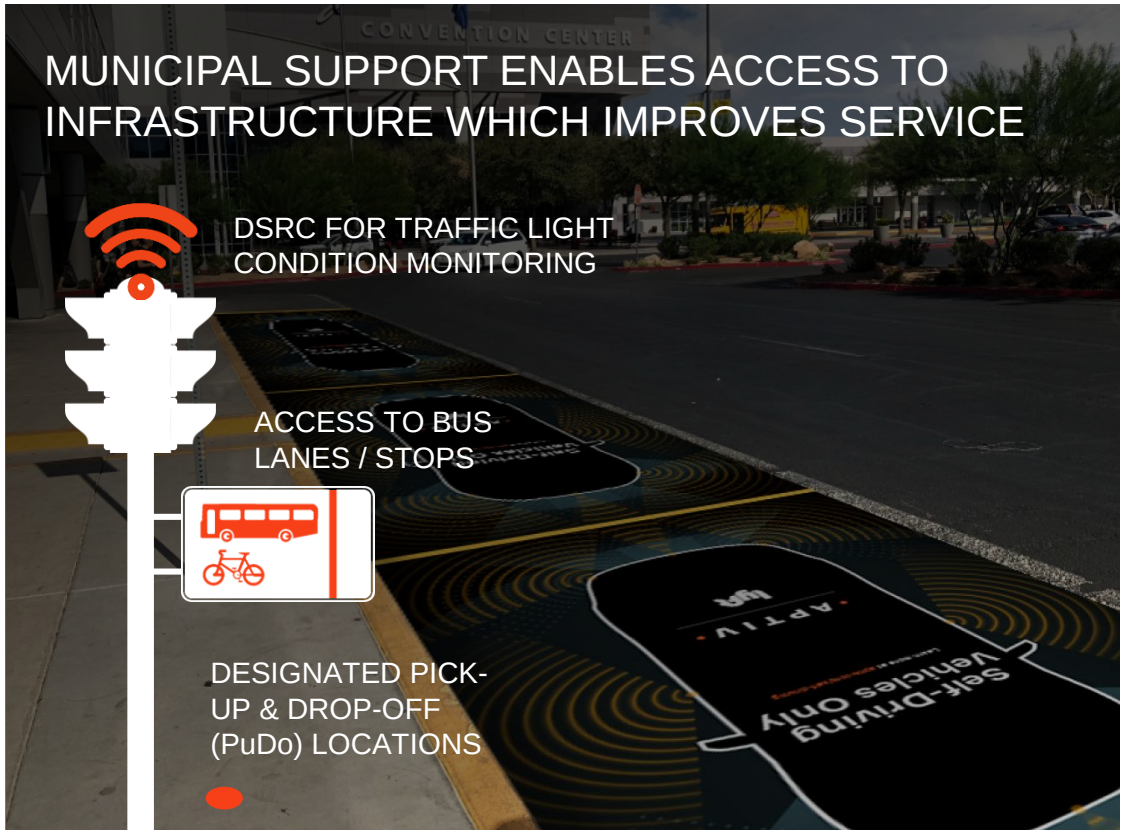
- Municipal and State Transit Authorities
- TNC Regulators
- High Interest Location Owners
- State and Municipal Legislators
- Law Enforcement

OPPORTUNITIES

Address market-specific transportation challenges

- First Mile / Last Mile
- Public Transit Gaps
- Underserved Areas
- City / State Initiatives
- High Congestion Areas

Examples only, not an exhaustive list



Smart City Selection

DEPLOYMENTS EXECUTED ON A SELECTIVE CITY BY CITY BASIS TO MAXIMIZE RETURN ON INVESTMENT

MARKET SELECTION CRITERIA

DEMOGRAPHIC

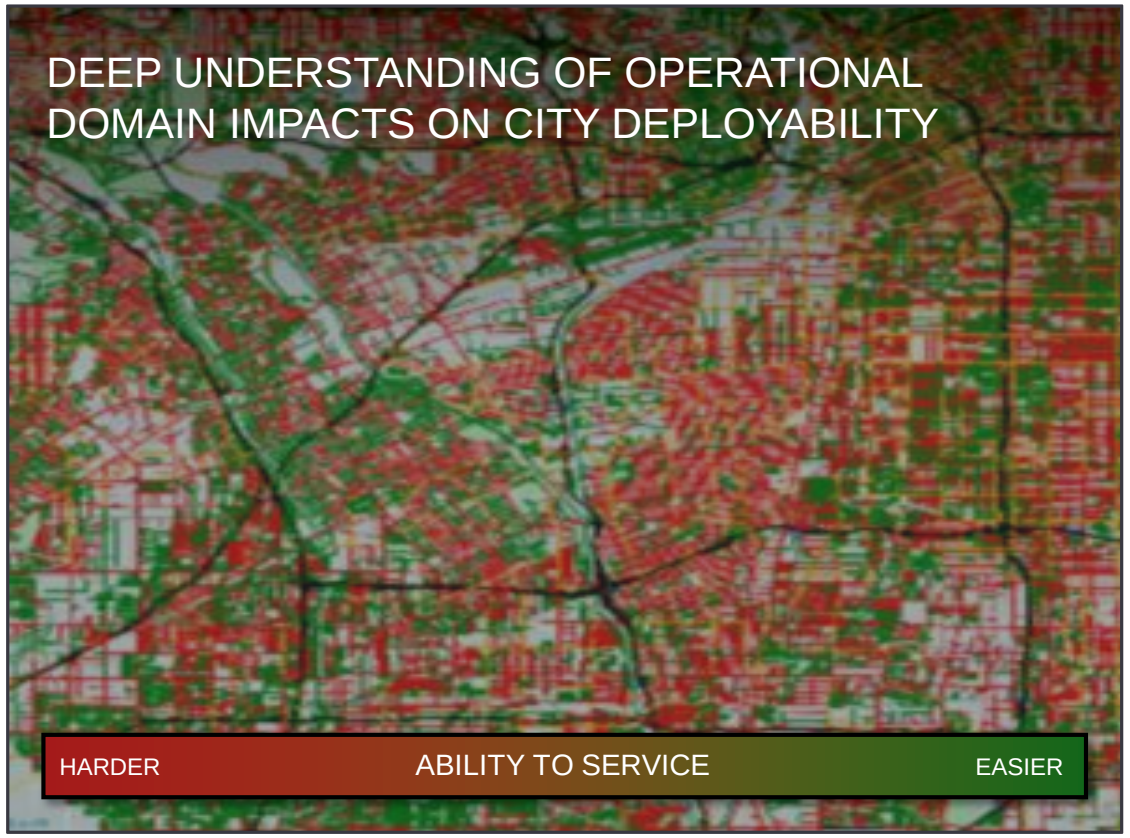
- Ride Hailing Penetration And Driver Income
- Population Density
- Climate / Weather

OPERATIONAL DOMAIN

- Number Of Vehicles Required
- Traffic Speed, Corner Cases Encountered
- Similarities To Other Deployed Cities

INTANGIBLES

- Market Need / Opportunity To Address Transit Issues
- Alignment To City Strategy / Municipal Buy-In



Commercializing Automated Driving

APPLYING DECADES OF EXPERIENCE IN AUTOMOTIVE GRADE SAFETY SOLUTIONS TO ADVANCE THE FUTURE OF MOBILITY

FOUNDATION

DEEP VEHICLE SYSTEMS KNOWLEDGE

CERTIFICATION AND TESTING EXPERTISE

30 YEARS OF SAFETY EXPERIENCE



DEVELOPMENT & TESTING

OPTIMIZED, FAIL-SAFE ARCHITECTURE

MODULAR, FAIL-SAFE SOFTWARE

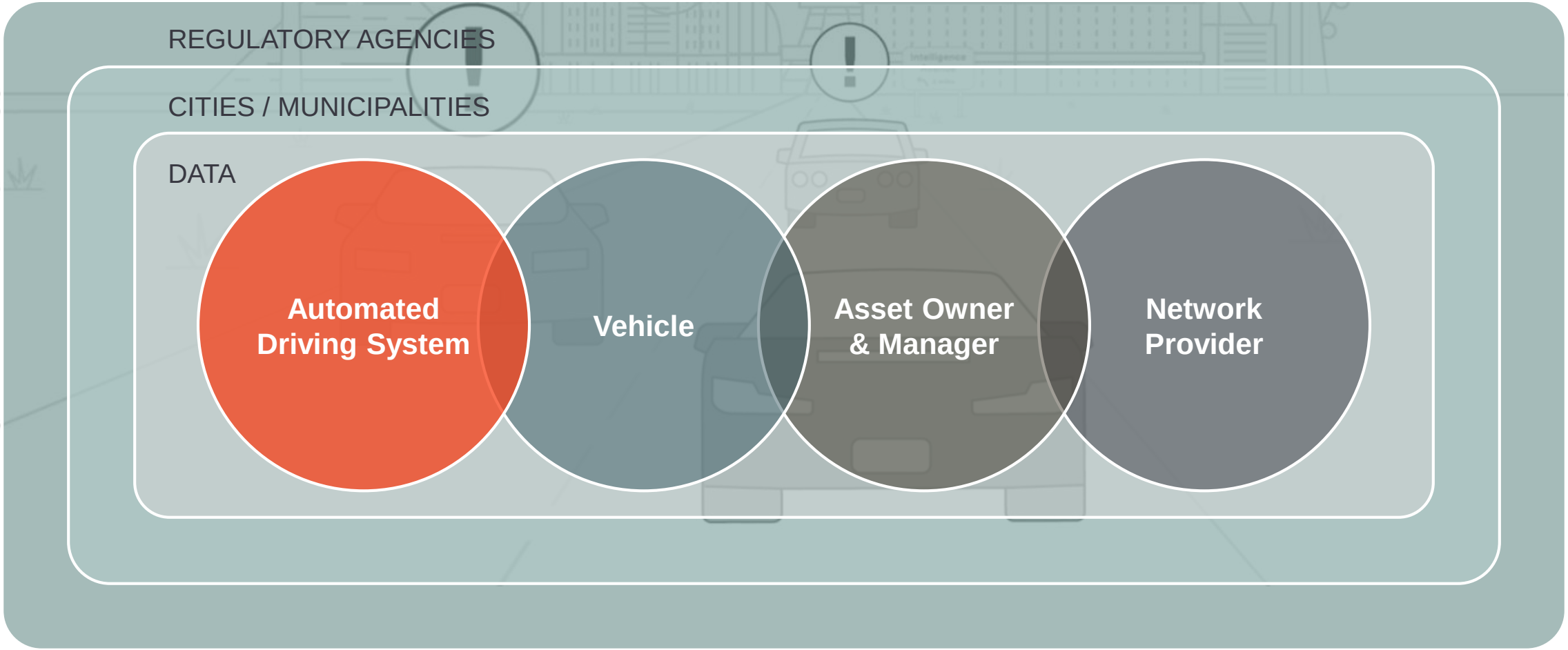
1+ MILLION AUTOMATED MILES TRAVELED

COMMERCIALIZATION

L1 to L5 MULTIPLE PATHS TO MONETIZING INVESTMENTS

COLLABORATIVE APPROACH TO ENABLING MOBILITY

Mobility Ecosystem



AMoD Requires Four Primary Roles

MOBILITY PROVIDERS NEED APTIV AUTOMATED DRIVING SOLUTIONS

AUTOMATED DRIVING SYSTEM

- Software
- Sensors
- Compute platform
- Mobility cloud

Las Vegas Example

APTIV

VEHICLE

- Vehicle development
- Vehicle production
- Automated driving system integration

Las Vegas Example

BMW — NEXT-GEN VEHICLE (future)

ASSET OWNER & MANAGER

- Vehicle ownership
- Vehicle financing
- Fleet management
  Cleaning, repair, charging, parking, insurance, etc.

Las Vegas Example

Hertz DONLEN — LEASING COMPANY (future)

NETWORK PROVIDER

- Consumer interface
- Demand fulfilment

Las Vegas Example

Lyft — OTHER MOBILITY PROVIDERS (future)

BROADER ECOSYSTEM

APTIV (DATA MONETIZATION)

LAS VEGAS CASINOS (DATA CONSUMERS)

RTC, City of Las Vegas Nevada, Great Seal of the State of Nevada, LVPD (LAS VEGAS STAKEHOLDERS AND REGULATORY BODIES)

How Aptiv Makes Money

BUSINESS MODEL DRIVES HIGH MARGIN RECURRING REVENUE

TECHNOLOGY SALE

One-time sale of enabling tech into the vehicle such as sensors, and compute

Customers



Sales Type



SOFTWARE LICENSING

Autonomous driving stack including upgrades to performance and operational design domain





FLEET MONITORING

Support network operators through AV fleet performance analytic and teleoperations





DATA MONETIZATION

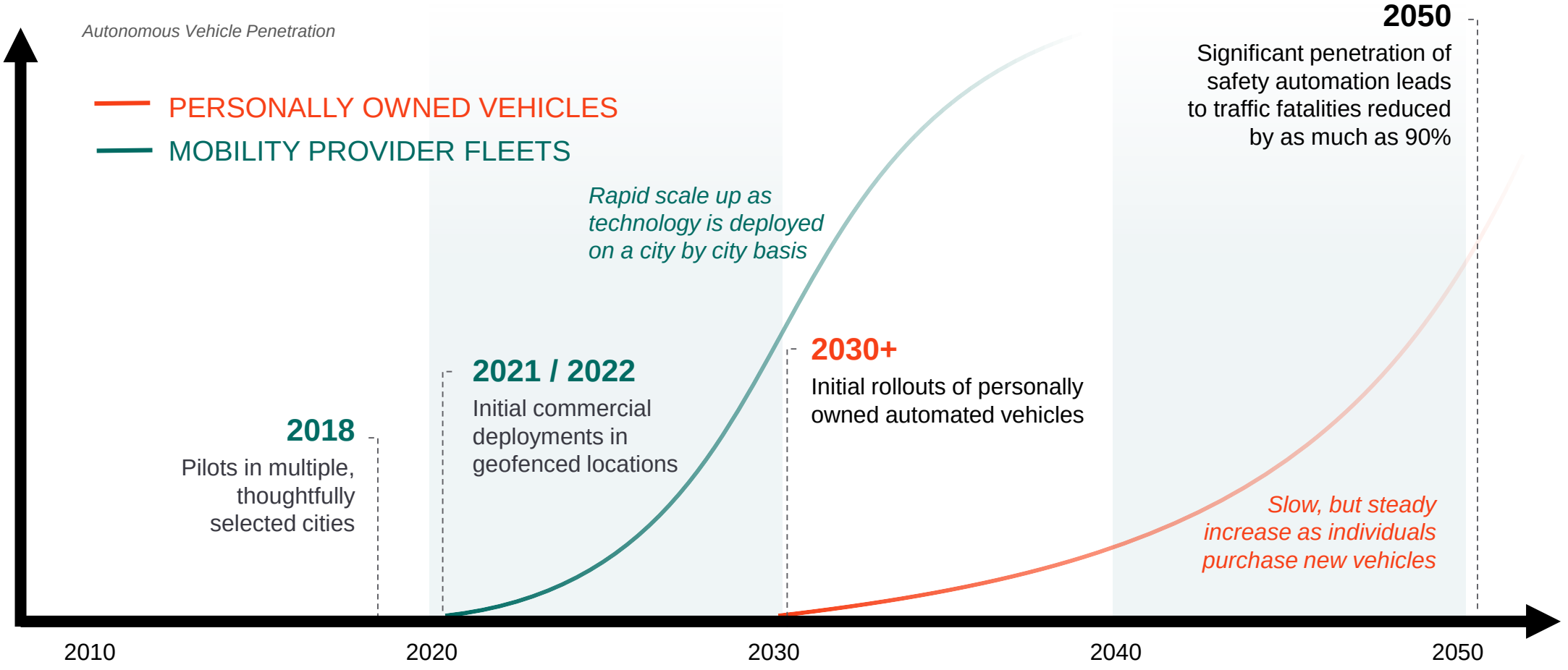
Enable data acquisition and monetization through edge processing and OTA





When Will Autonomous Vehicles Arrive?

CONSISTENT, REALISTIC EXPECTATIONS FOR DEPLOYMENT – APTIV TIMELINE REMAINS UNCHANGED



Sources: Company and OEM Estimates, Boston Consulting Group, McKinsey & Company

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Automated Mobility Deployment Phases

APTIV UNIQUELY POSITIONED FOR SUCCESS ACROSS EACH PHASE OF AD MATURITY

	TODAY	2022	2025	2030
PHASE	TECHNOLOGY DEMONSTRATION	GREENFIELD LAUNCHES	BROADER ADOPTION	OEM CONVERGENCE
SOFTWARE MATURITY	**LIMITED CAPABILITIES** Manual interventions required for corner cases, necessitates a safety driver	**SMALL, BUT VIABLE** Viable without a driver in limited geofenced areas, under strict operating conditions	**RAPID OD EXPANSION** Significant decrease in limitations increases operational domain.	**ROBUST** Able to handle enough corner cases to make it viable for personal vehicle applications
HARDWARE MATURITY	**NOT FAIL-SAFE** Safety driver acts as the back-up in the event of a hardware failure	**EXPENSIVE FAIL-SAFE** Leveraging industrial PC hardware, but sufficient to start driving launches, and beginning to scale	**AUTO GRADE** ASIL-D purpose built hardware is ready for deployment at scale	**OEM STANDARD** OEM vehicles come off the assembly line fully configured for automated driving
COMPETITIVE LANDSCAPE	**RESEARCH** Many players dabble, but limited real world deployments. Compete for talent and capital, but little else.	**INITIAL DEPLOYMENTS** Greenfield on a city-by-city basis. Compete based on smart deployment SOPs	**MOBILITY SCALE-UP** Significant ramp-up in scale / speed of deployments. Compete based on robustness of operational domain.	**CONVERGING WITH OEMs** OEM AD availability pushes point of AD systems competition earlier in the value chain

Automated Mobility Growth Plan

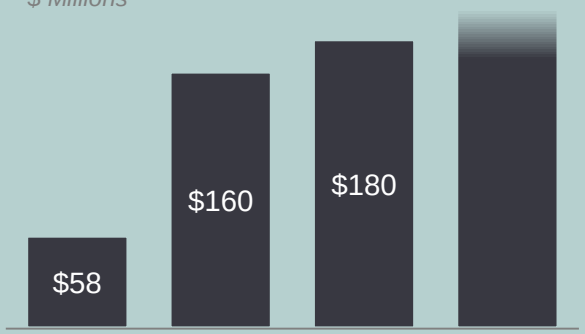
ON TRACK TO 2025 REVENUE TARGET

TODAY 2022 2025 2030

INVESTMENT

Strategically investing to establish leading position in automated mobility on demand; spend highly applicable to longer term Active Safety / AD OEM position

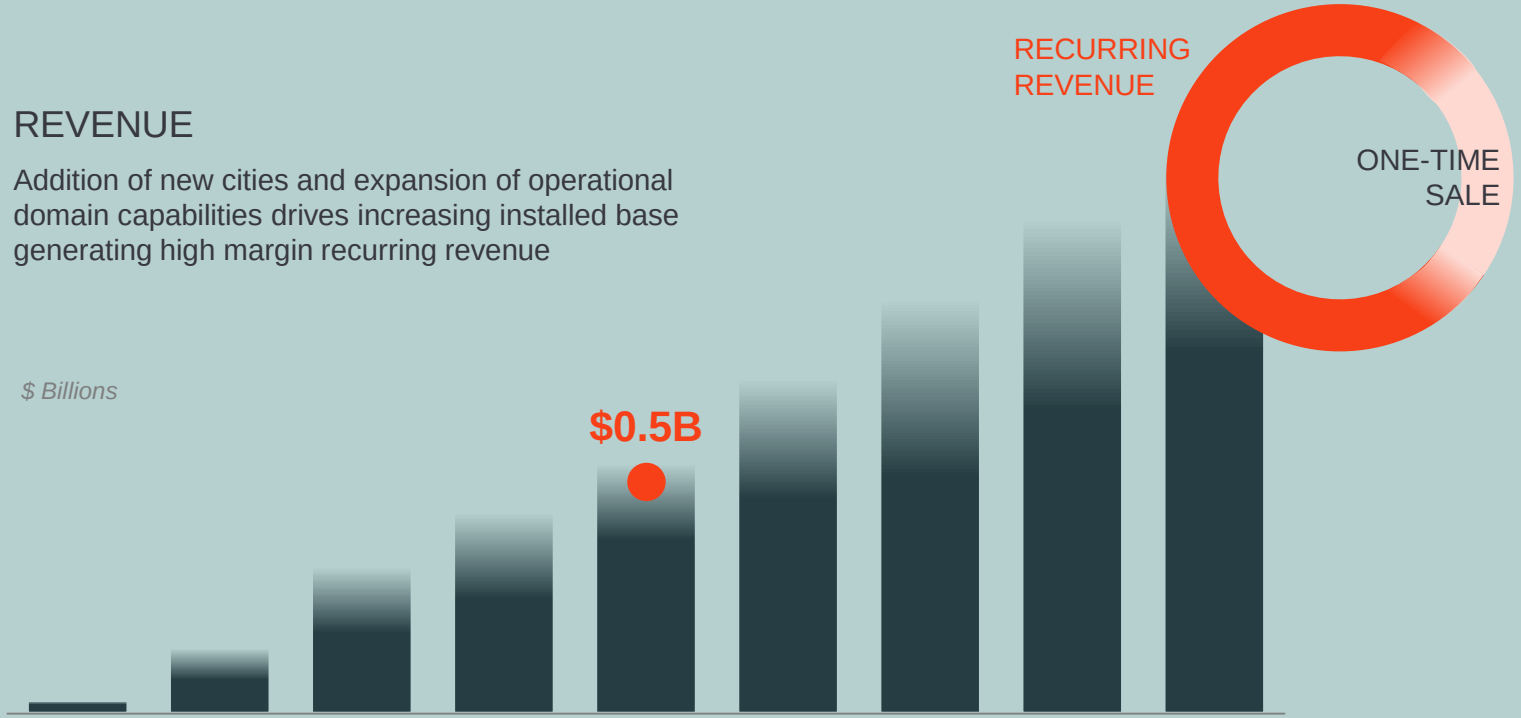
$ Millions



REVENUE

Addition of new cities and expansion of operational domain capabilities drives increasing installed base generating high margin recurring revenue

$ Billions



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Summary

AUTOMATED MOBILITY ON TRACK TO 2025 TARGETS

- Clear strategy for commercialization drives efficient capital deployment, avoids channel conflict
- Deep understanding of operational and regulatory impacts ensures smooth deployments

TECHNOLOGY CAPABILITIES DEVELOPING AS EXPECTED

- 2021 / 2022: Initial launches with mobility providers in geofenced locations
- 2025 - 2030: Improved capabilities, and scale-up of purpose built hardware drives OEM viability

LONGER TERM ROADMAP FOR CONVERGENCE WITH OEMs

- Automated Driving on the spectrum of Active Safety; investments today drive future benefits
- Aptiv's end-to-end solutions enable the commercialization of new mobility



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