Flash Memory Summit

Auto Infotainment and Connectivity in the Age of Autonomous Vehicles

Impacts on Storage

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The autonomous future is… delayed

- The auto industry has moved back its launch dates for commercially available autonomous vehicles (e.g. Cruise)
- Many AV pilot programs exist, but they are limited and consumer interest in AV shuttles remains to be seen
- Infotainment and connectivity requirements for AVs are still in flux – the auto industry has not yet decided on AV form factors

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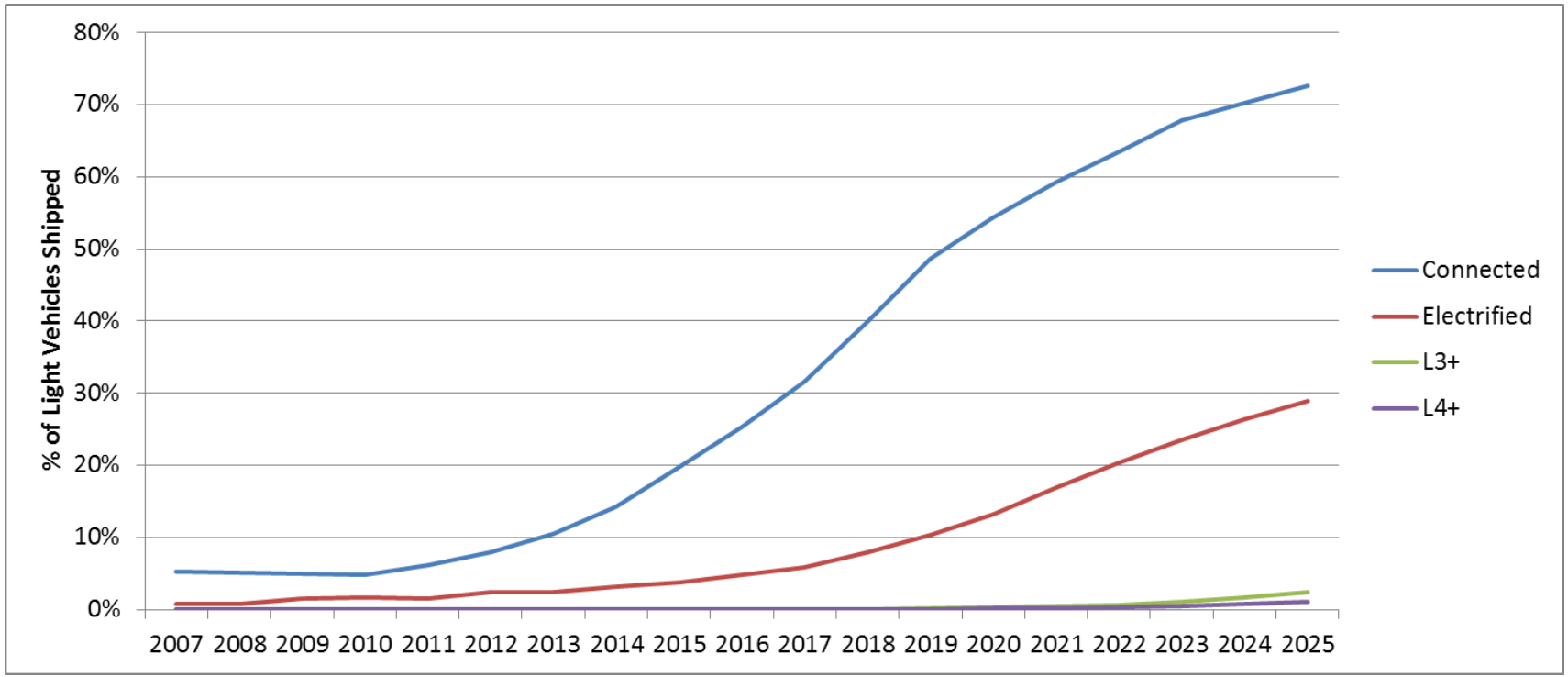
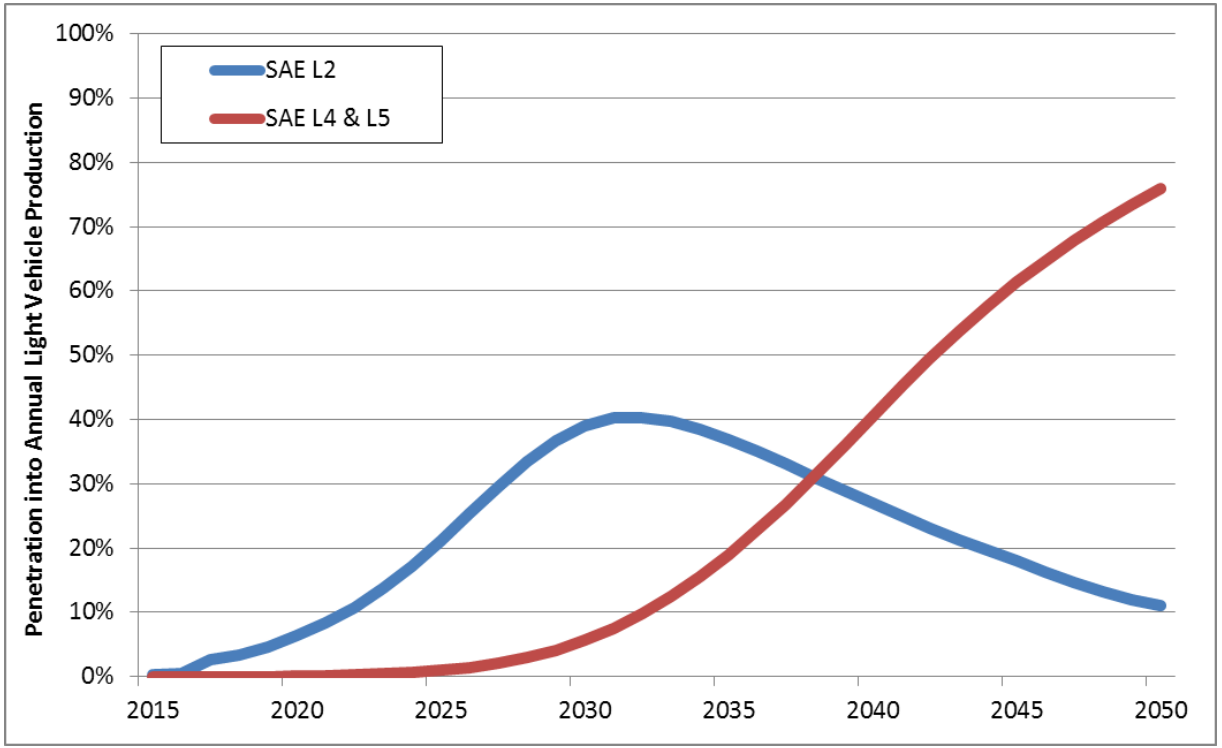
Different timescales for major technologies impacting the auto industry

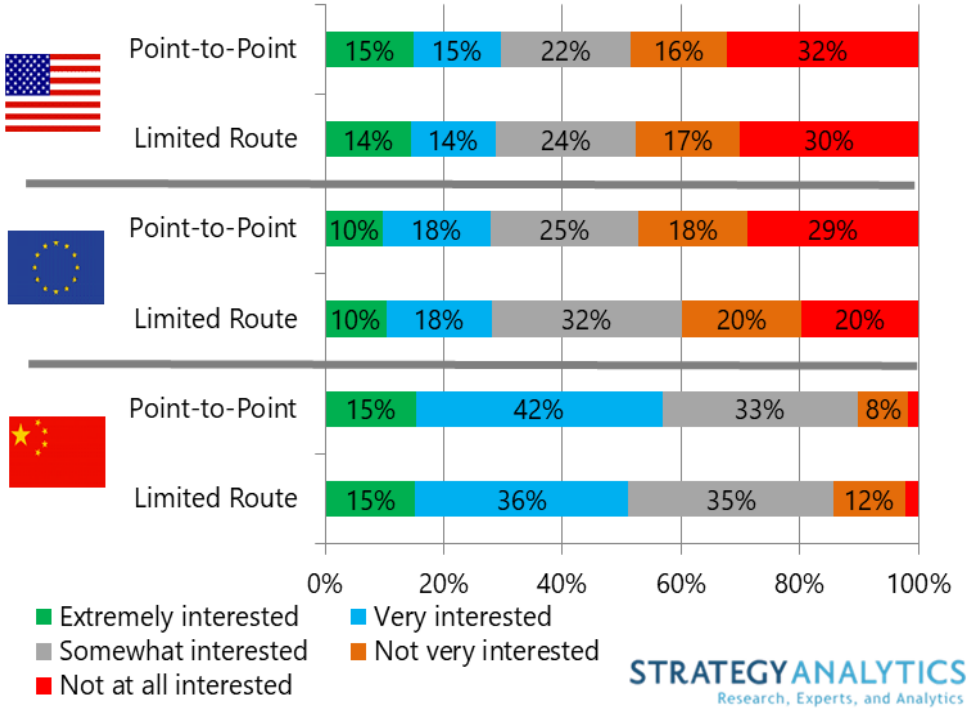


What is a realistic autonomous deployment scenario ?



- Mass-market L4+ driving likely a 2030+ opportunity
- Will see introductions starting soon – but with very limited availability and on city-by-city basis

Consumers skeptical of autonomous shuttles



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Consumer interest in automated taxi or bus services is extremely low, and confined to specific demographics.

- No more than 15% in any region showed “extreme” interest in any self-driving mobility service.
- Consumers in the U.S. are most wary, with almost one third showing no interest at all in automated point-to-point taxi services.
- Those skeptical say their primary rationale for their lack of interest is that they don’t trust autonomous vehicle systems.
- Consumers in China show concern about the quality of the vehicles used for such services.

Any automated taxi/bus service must be usable and practical for local use cases. And consumers’ skepticism toward automated transport in general remains unresolved.

CES 2019: Autonomous Pod Concepts Proliferate

Source: Strategy Analytics

AEV Robotics' autonomous EV pod concept: Features multiple cabins that can be swapped out as needed. Infotainment features will vary based on vehicle requirement.

Source: Strategy Analytics

Continental's Cube concept: It features fairly basic infotainment features, such as a single display along one interior wall (facing the entrance) and a tablet for interacting with the vehicle. It is designed for passenger transport and not much else.

Source: Rinspeed

Pod cabin concept, where cabin can be switched out depending on use case. Features a cockpit designed for enertaining passengers.

L3+ Autonomy Infotainment Systems

Source: BMW

Source: Rinspeed

Source: Bosch

Source: Byton

(Top left) From BMW's iNEXT concept, this cabin featured infotainment for three modes, Boost (human-driven), Ease (autonomous-driven), and Executive (office lounge).

(Top right) Bosch's Autonomous shuttle concept: Individual seats feature flip-up displays rather than any centralized displays.

(Lower right) Rinspeed's swappable pod concept features multiple displays that users can engage with.

(Lower left) Byton's M3 is designed to be L3+ capable in terms of autonomous driving.

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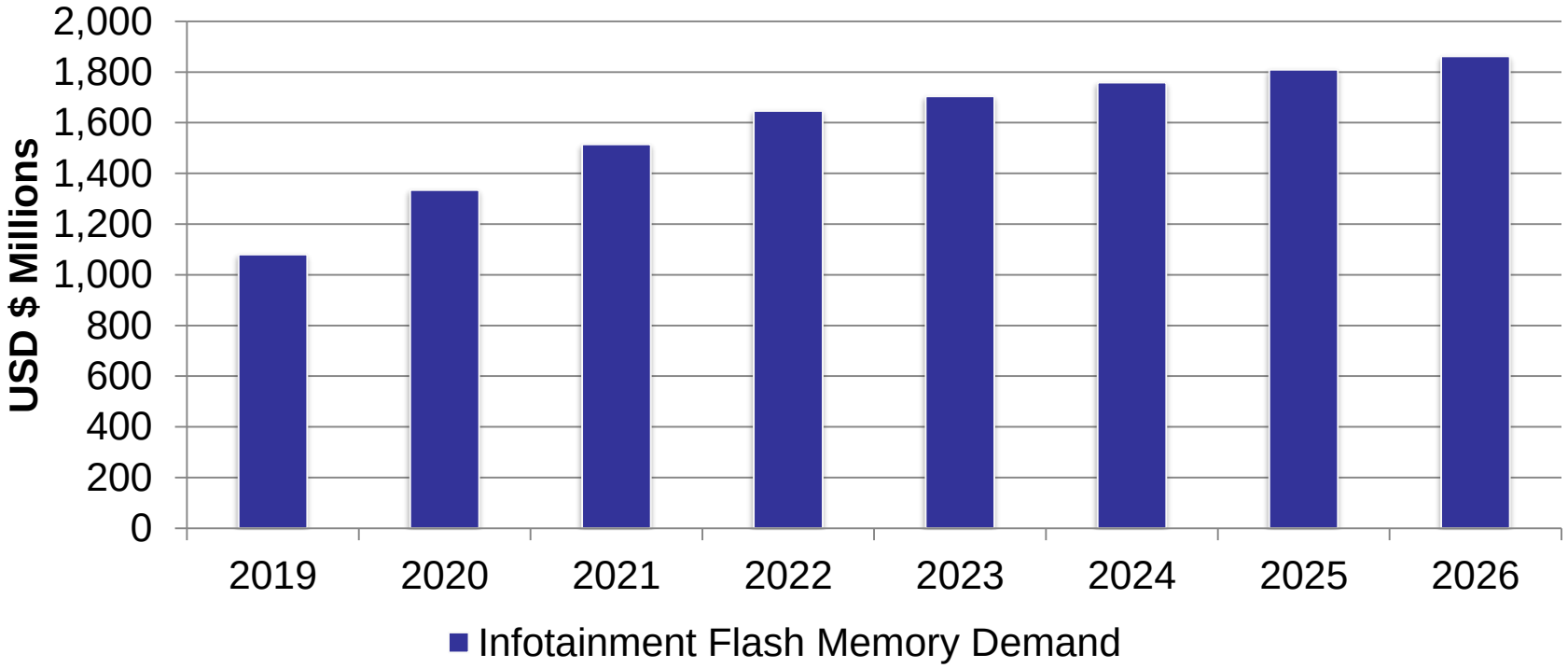
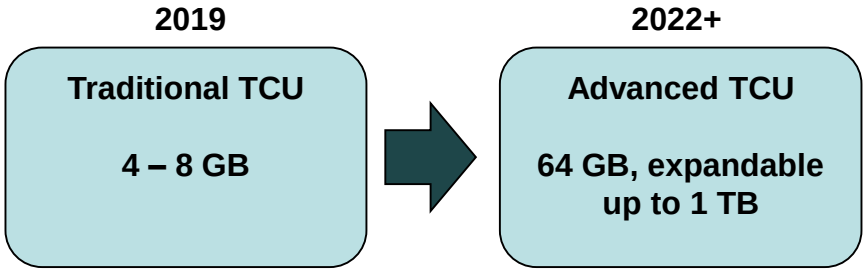
Infotainment Flash Memory Market Demand



Infotainment and Telematics ECU Storage Requirements

ECU	Current	Near Future (2022+)
Headunit/Cockpit Domain Controller	32 GB – 64 GB (mid-range or premium vehicle)	64 GB – 128 GB (mid-range vehicle) 128 GB – 512 GB (premium vehicle)
Connectivity (i.e. Telematics) ECU or Connectivity Gateway	4 – 8 GB	64 GB, expandable (some specs say expandable up to 1 TB)



- Embedded cellular (3G or LTE)
- Wi-Fi
- Supports typical telematics features (remote door lock/unlock, remote start, automatic crash notification, etc.)

- Supports analytics software
- Supports OTA updates
- Provides security (firewall, possibly IDPS, etc.)
- Vehicle data logging
- Can support telematics features
- Wi-Fi
- Embedded cellular (LTE or 5G)

Tier 1 vendors are positioning wireless connectivity ECUs – commonly called “telematics ECUs” (abbreviated as TCUs) as “edge compute” and analysis devices, for delivering OTA udpates, for security, and for gateway (e.g. protocol translation) use cases. They are becoming multi-functional devices rather than single-function devices.

Thank you!