



***AUTOMOTIVE FLASH MEMORY GROWTH
AND THE PRODUCTION BOTTLENECK:
ACCELERATING THE TRANSITION FROM
eMMC TO 3D UFS IN
MANUFACTURING FOR THE CONNECTED CAR***

www.dataio.com

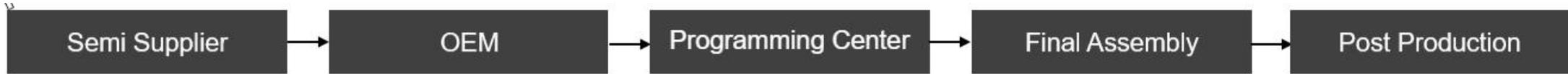
Abstract

Automotive electronics systems including powerful in-vehicle infotainment systems (IVI), detailed navigation maps and complex advanced driver assist systems for the connected cars are driving demand for high density Flash memory. Researchers estimate cars will require up to 2TB of data by 2022. To meet these demands semiconductor vendors are introducing new automotive grade flash technology with more storage (higher density) in a smaller size.

Designing the next generation of cars with the latest Flash technology is one challenge. Manufacturing and programming these systems without creating a bottleneck in production is another. Data for these applications are primarily programmed into the systems during manufacturing can have significant impacts on the production processes.

It is critical for automotive electronics manufacturers to understand the latest advancements in Flash memory and the impact on their manufacturing process. This session examines the transition from eMMC to 3D UFS (Universal Flash Memory) and the impact of this technology change and rapid content growth on the manufacturing processes. This session will also identify strategies and best practices automotive electronics manufacturers can integrate into their manufacturing processes today to manage large file sizes and ensure they have a highly flexible and cost-effective supply chain.

Who We Are & What We Do



Sample Customers

Automotive | IoT/Industrial/Consumer

Programming Centers and EMS



CHALLENGES MOVING TO UFS

Managing Extremely Large Files: >100GB for infotainment

- Job Creation across multiple regions with security and management
- High Performance Programming (Speed x Capacity) with new device interface
- Security / Encryption capability becoming a requirement

Controlling Manufacturing Costs

- Leveraging existing supply chain resources where possible
- Installed base of systems must be upgradable to newest technology
- Support for all leading UFS suppliers

Maintaining the Highest Reliability

- Integrating Best Practices for Reflow, XRAY and Security
- Programming, not duplication, required for automotive requirements

UNIVERSAL FLASH STORAGE (UFS) IS THE NEXT WAVE IN AUTOMOTIVE

2014/2015

UFS is introduced into the market targeting consumer applications

2017

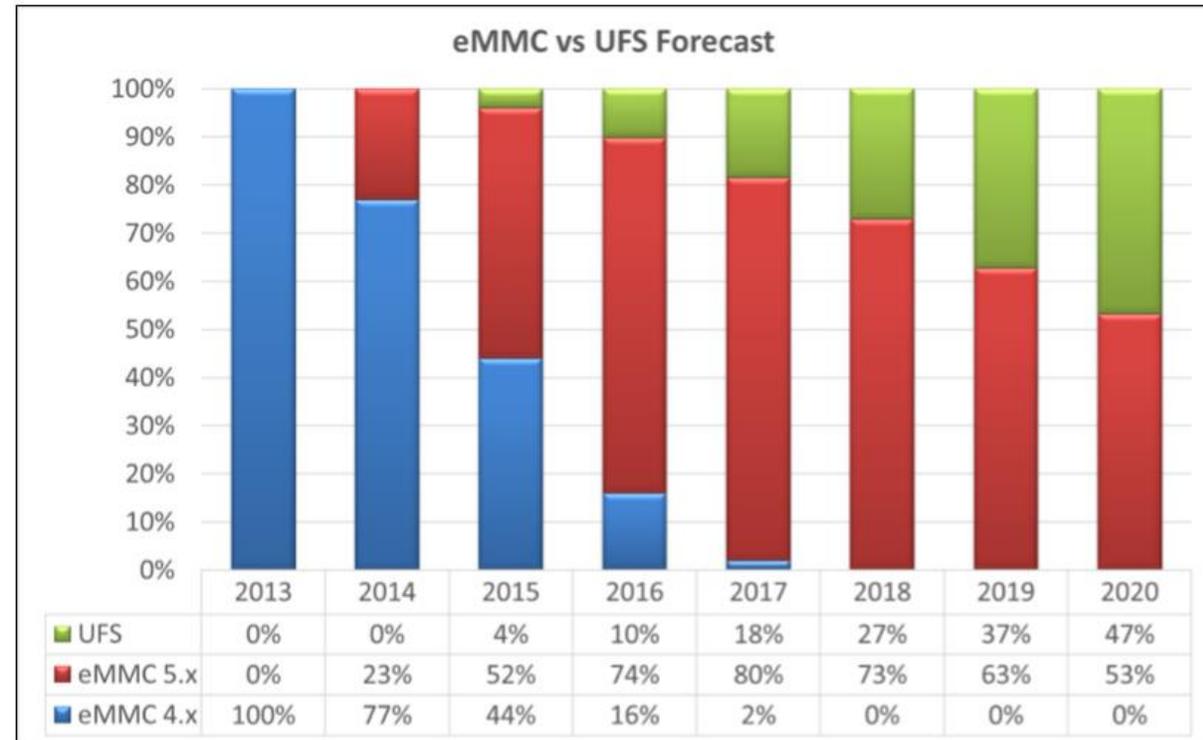
Data I/O introduced UFS support for automotive

2018/2019

UFS Automotive SKUs are introduced; demand grows

2020 and beyond

Automotive UFS consumption ramps



AUTOMOTIVE TRANSITION: eMMC TO UFS

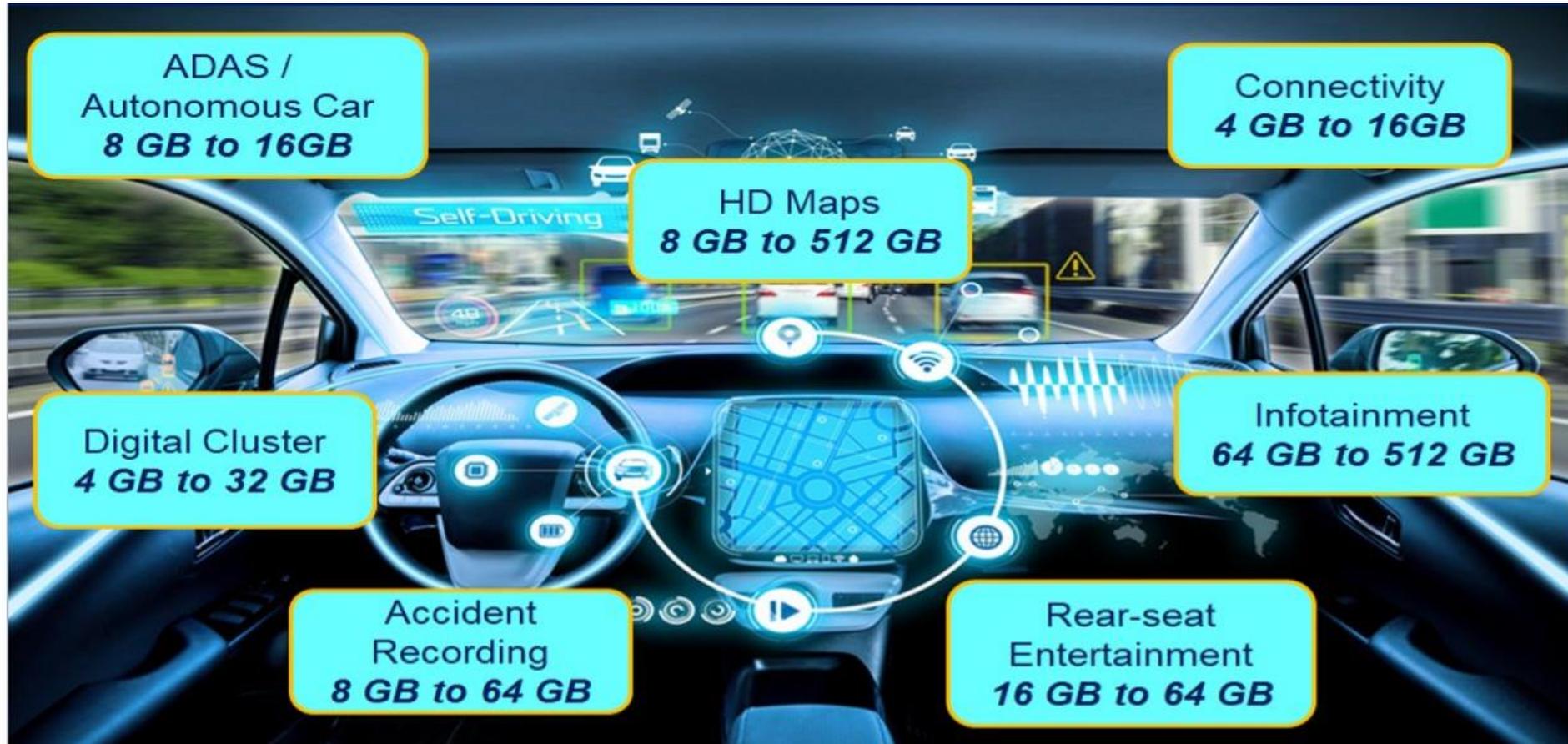
Memory Structure Trend in Automotive Systems

		Level 1 Driver Assistance		Level 2 Partial Driving Automation		Level 3 Conditional Driving Automation		Level 4-5 High/Full Driving Automation	
Application		~2015	NOW	2020	2025	~2015	NOW	2020	2025
ADAS	Recognition	NOR	e-MMC	e-MMC	UFS				
	Decision			UFS	UFS				
	Event Data Recorder			e-MMC	UFS				
Wireless	Gateway				UFS				
	V2X			e-MMC	UFS				
	Telematics				UFS				
Information	IVI	SD card							
		e-MMC		e-MMC	UFS				
		NOR							
	Cluster	NOR	e-MMC	e-MMC	UFS				
Total Density :		~64GB	~96GB	~1.5TB	~3TB				

Any information including data herein is prepared on a good-faith estimation basis and provided "as-is" with no warranty of any kind, express or implied, including but not limited to the warranties of fitness for a particular purpose, accuracy or otherwise.

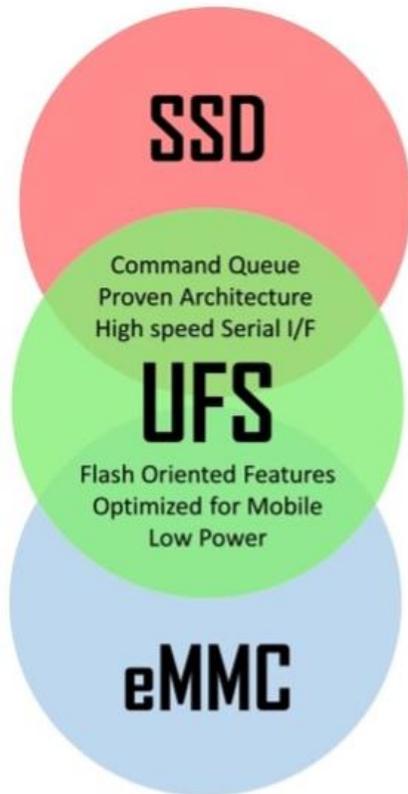
* Estimation by Toshiba Memory Corporation.

Exponential Growth in Data

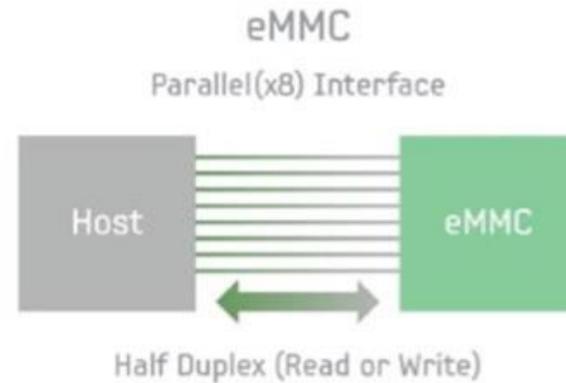


6 out of the top 9 automotive electronics manufacturers are transitioning from eMMC to UFS

NEW FLASH INTERFACES REQUIRE STATE-OF-THE-ART PROGRAMMING

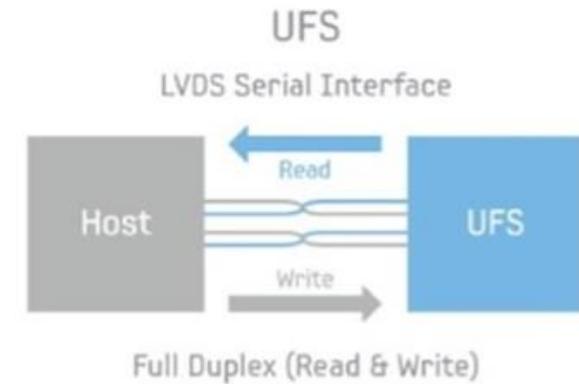


From



- ✓ Parallel interface supporting Read or Write
- ✓ Up to 256GB density for automotive

To



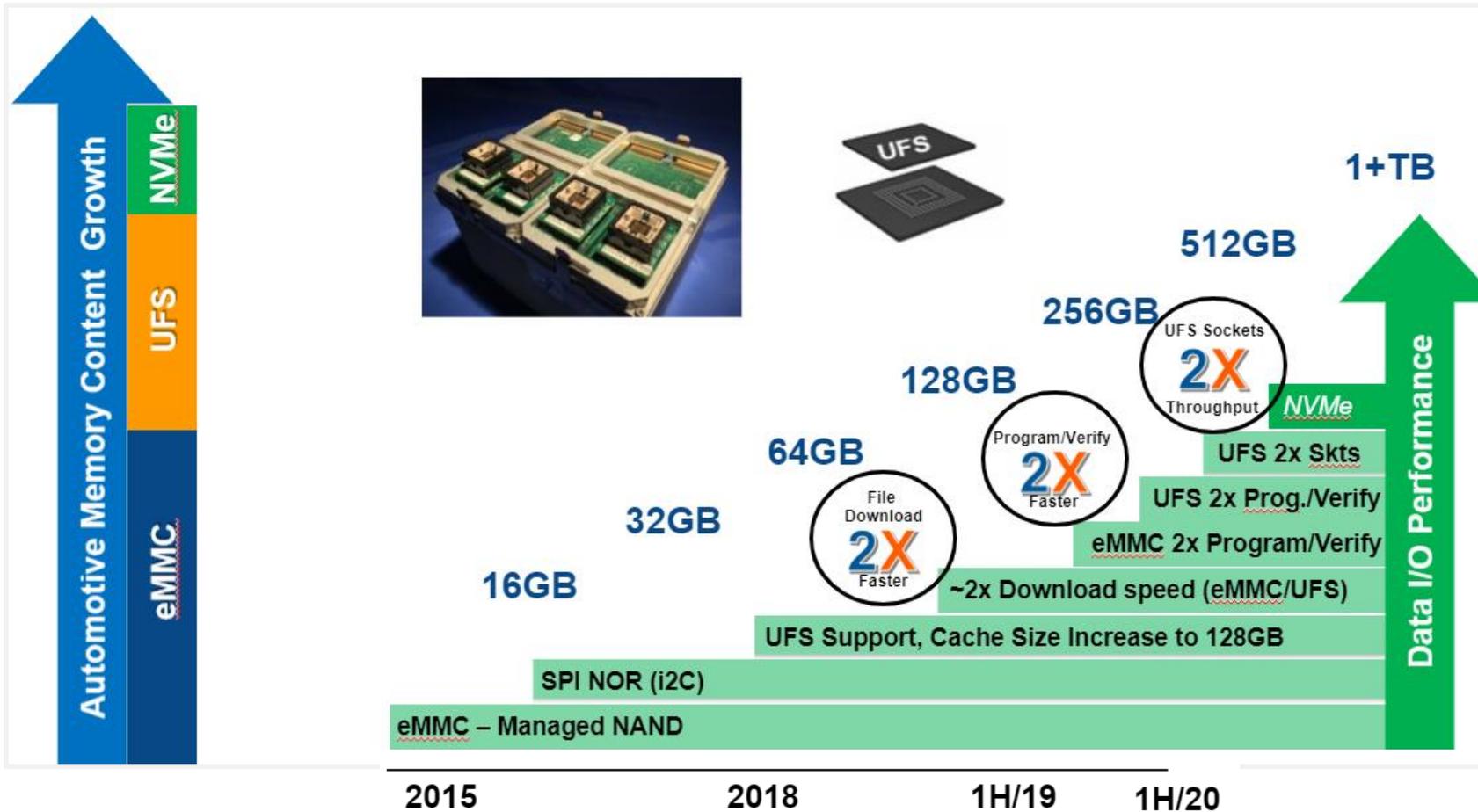
- ✓ High speed serial interface for simultaneous read and write
- ✓ Automotive grade devices from 32GB up to 512GB
- ✓ Unique settings and special features

Pre-programming technology must evolve to support UFS

PROGRAMMERS VS. DUPLICATORS PROGRAMMERS MEET AUTOMOTIVE INDUSTRY STRICT QUALITY STANDARDS

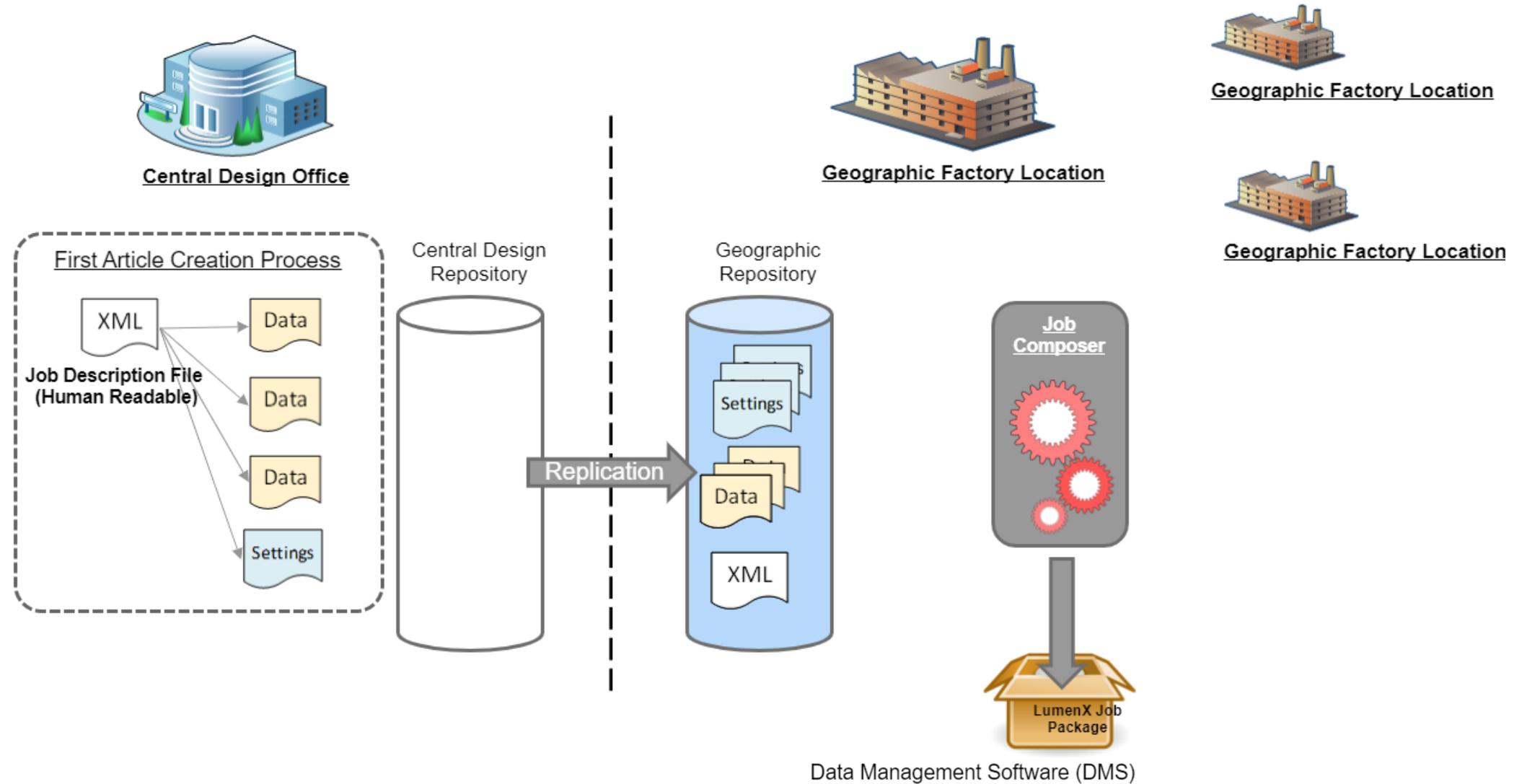
Programmers	Duplicators
IP (Data Files) Stored on a Secure Network	IP (Data Files) Stored on “Master” Devices - Prone to Intellectual Property Theft
Job Changeovers Secured and Managed	Job Changeovers are Prone to Human Error
Supports multivendor UFS Devices - Adjusts critical timing features of unique UFS devices	Generic UFS Interface - May not be suitable for all UFS vendors
UFS Devices Individually Tested	UFS Devices, not Individually Tested
UFS 3.0 Standard Supported - Uses different programming voltages than UFS 2.x	Support for UFS 3.0 may requires Hardware Redesign
Supports Dynamic Data, Serial Numbers	Cannot Serialize IC’s
Supports Bare NAND - Hundreds of Bad Block Schemes	Cannot Support Bare NAND - No controller for Back Block Management (BBM)
Supports RPMB - Replay Protected Memory Block Feature	Does Not Support RPMB - Replay Protected Memory Block Feature
Supports Security Provisioning - Asymmetric Keys and Certificates	No Provisioning Support
Supports Full Device Traceability and Reporting	No Unique Device Statistics

LUMENX PROGRAMMER DELIVERS PERFORMANCE GAINS TO MEET AUTOMOTIVE DEMAND



- ✓ Extensible performance with > 100 sockets per PSV7000 Platform
- ✓ Future proof technology with UFS 3.0 support today, NVMe planned
- ✓ 160MB/sec read/write programming performance
- ✓ Minimized risk of human error
- ✓ Proven reliability with XRAY, reflow processes

Job Composer: Management System for Large Files



Reliability Summary

The rapid growth in NAND automotive flash memory content and **the impact of data retention through X-ray inspection and oven reflow** has become a topic of discussion among automotive electronic suppliers, semiconductor vendors and programming vendors.

Data I/O partnered with industry leaders to study the impact of x-ray and oven reflow on Managed NAND devices

X-ray test performed with Managed NAND flash in 15nm and 20nm lithography's from multiple semiconductor vendors. Our study found that **processing Managed NAND flash through X-ray inspection is safe when following best practices**, with filtering having the biggest impact.

Oven reflow test was performed using automotive grade 3D TLC UFS devices from multiple semiconductor vendors. Our study found that **pre-programming is safe** and full device performance is maintained with a post reflow data refresh

Summary

Connected and Autonomous Cars are Driving Changes in Design & Manufacture of Electronics systems, and moving to UFS based designs

- **40-80% per year**¹ growth in programmable content drives design change from eMMC to UFS managed NAND
- *Changes in programming performance AND support for UFS required*

Electronic Systems Suppliers and OEMs must maximize production capability & minimize costs, leveraging existing installed base wherever possible

- Upgrade existing investment in capital equipment to UFS wherever possible
- 60-70% Lower costs than new equipment purchase

Manage software code variants systematically and securely worldwide with Job Composer

Data I/O, the world leader in automotive NAND **FLASH** programming, addresses industry trends with a **10X price/performance** gain & extensible LumenX architecture

¹ (source: Mercedes Benz) to 1-2TB per vehicle

RECIPE FOR NEXT GENERATION OF AUTOMOTIVE PROGRAMMING

PS V5000
Data iO

PS V7000
Data iO

LUMEN X
with **TurboBoost**

Lowest Total Cost of Ownership

Data iO

Thanks!