THE SOFTWARE DEFINED VEHICLE FUTURE

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Introduction

The shift to Software Defined Vehicles presents challenges and opportunities to OEM and Supplier alike

Customers expect more capability from their devices, including their vehicles
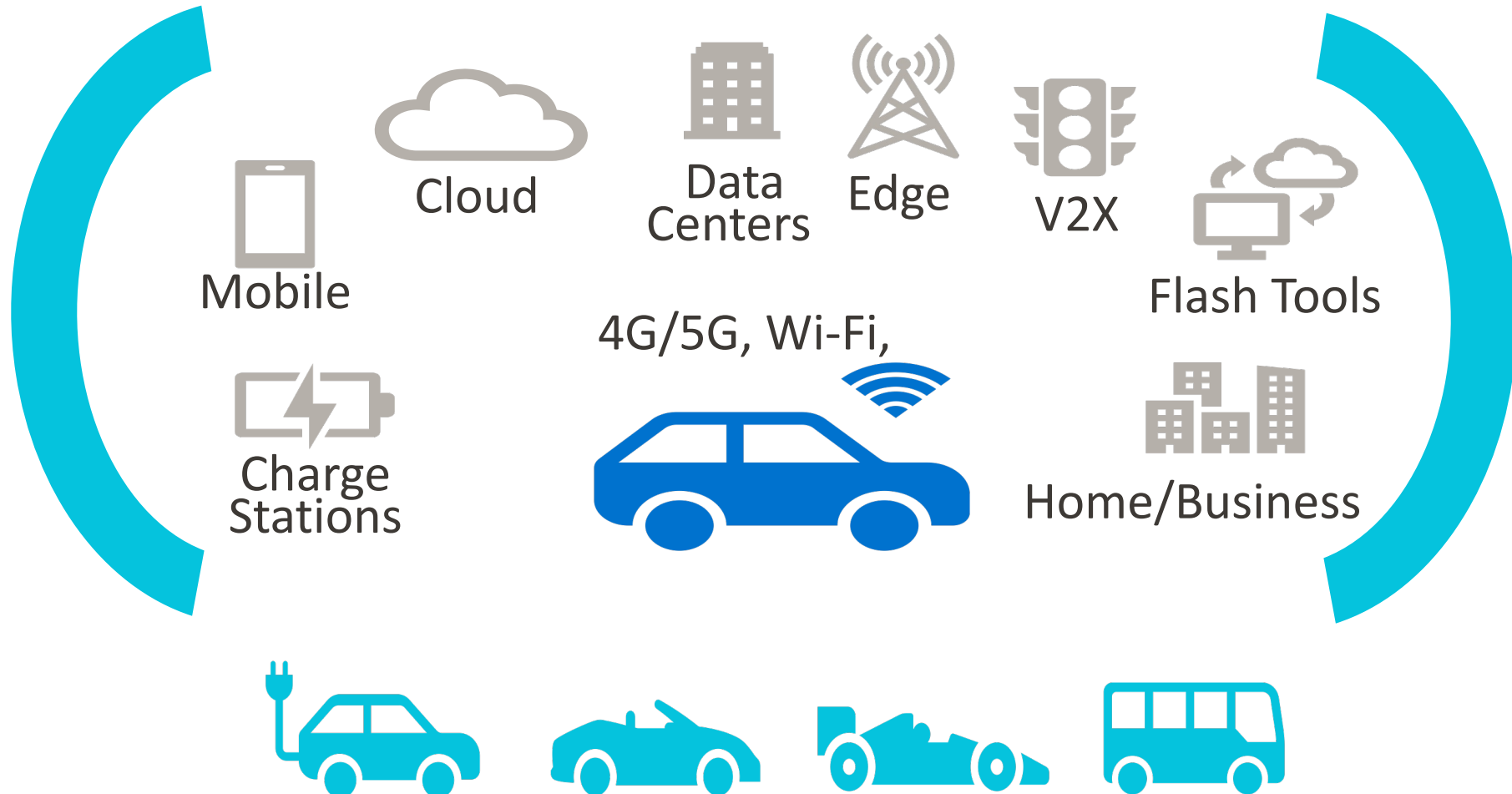
Collaboration is a key success factor
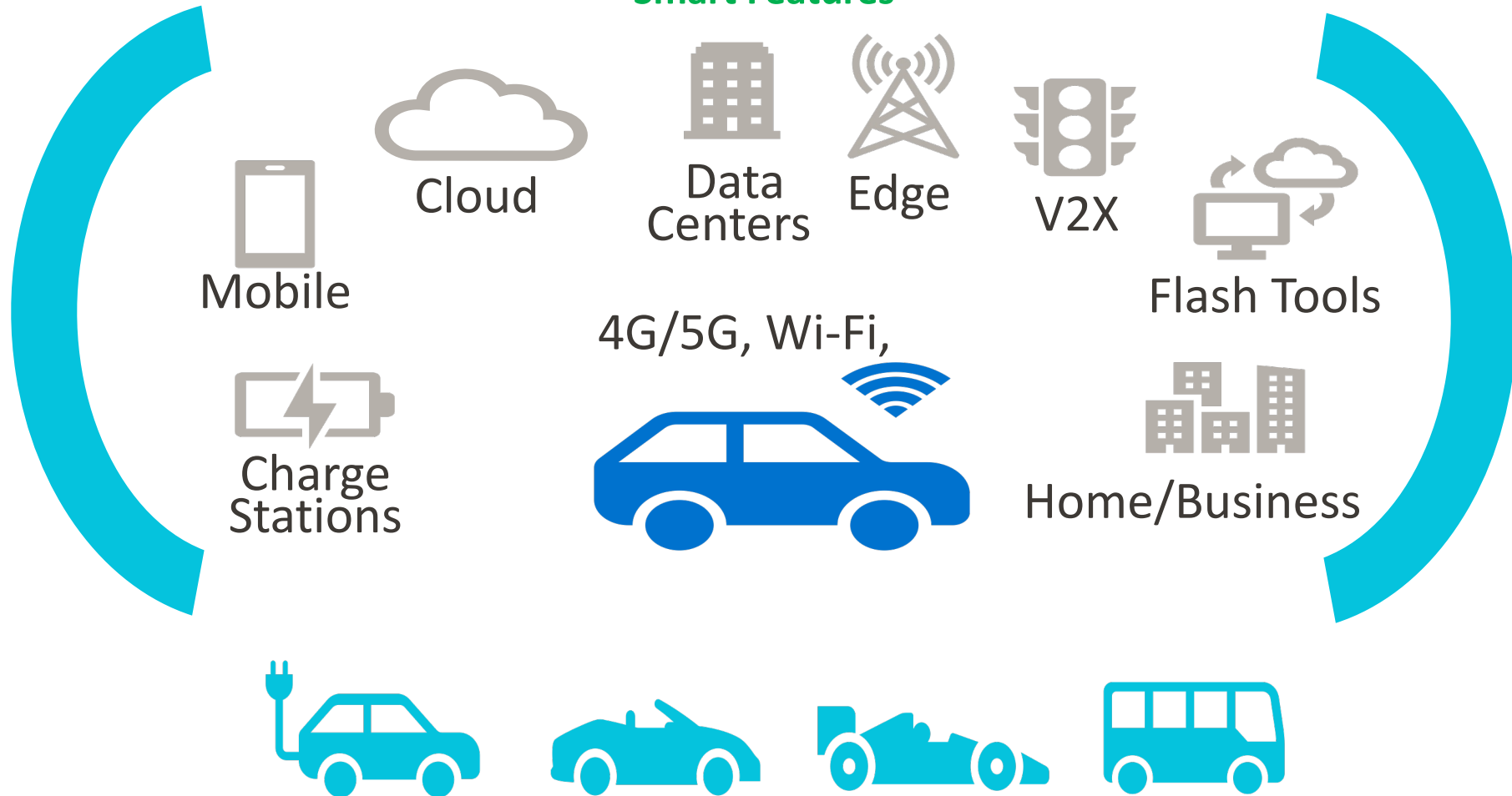
Challenges and Opportunities

Connecting Digital Lives

Challenge: Customers expect seamless connection to their digital lives

Cloud

Data Centers

Edge

V2X

Flash Tools

Mobile

4G/5G, Wi-Fi,

Charge Stations

Home/Business

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Connecting Digital Lives

Opportunity: SDV enables Over-the-Air Upgrades, Frequent New Content and Smart Features

Mobile

Cloud

Data Centers
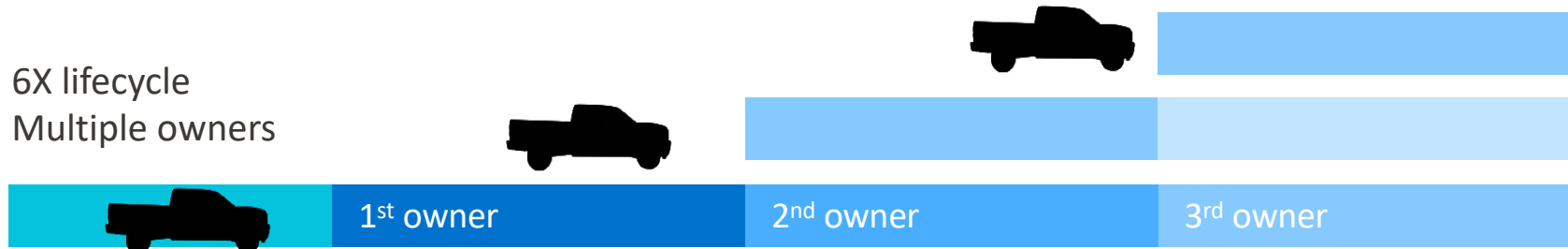
Edge

V2X

Flash Tools

Charge Stations

4G/5G, Wi-Fi,

Home/Business

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Addressable Lifecycle

Challenge: Customers expect continual upgrades

$800

4-6 HW upgrades

$50,000

6X lifecycle
Multiple owners

	Development
	Lifetime

1st owner   2nd owner   3rd owner

Years	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

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Addressable Lifecycle

Opportunity: SDV enables upgrades throughout the vehicle lifecycle

4-6 HW upgrades

$800

| Development |
| Lifetime |

6X lifecycle
Multiple owners

$50,000

1ˢᵗ owner   2ⁿᵈ owner   3ʳᵈ owner

Years | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19

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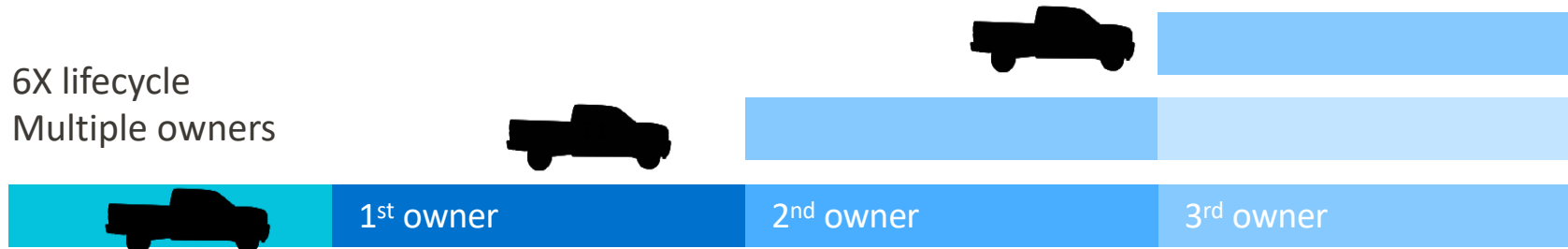
Apps and Developers

Challenge: Lack of commonality and standardization can lead to fragmented ecosystems

Opportunity: Utilize solutions with common APIs to enable:

- Critical mass for developing for a platform

- Off the shelf choices with common interfaces

- Solutions for areas beyond infotainment

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Optimization of Existing Software Assets

Challenge: OEM and SW Suppliers face pain points in procurement of automotive software

Full set of potential suppliers is not familiar to buyers	Lack of clarity around software offerings and capabilities	Sub-optimal make vs. buy decisions

Opportunity: A forum to help match buyers and sellers of automotive software assets

Our Vision

zero crashes

zero emissions

zero congestion

gm

Technology-Driven Transformation

Build a Digital Product Portfolio

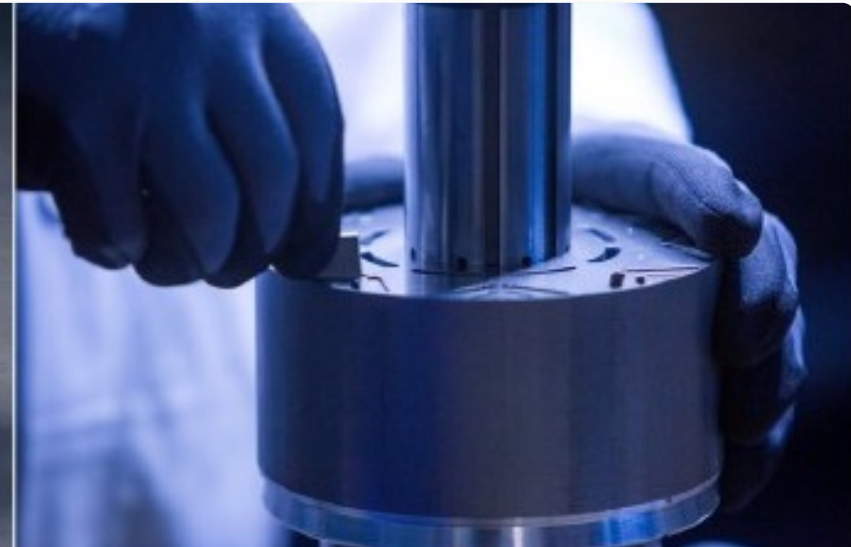**Build a Platform & Scalable Infrastructure**

Protect the Platform and Future Proof it For Innovation

Expand Our Go to Market Thinking

everybody in.

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Ultium is the Heartbeat of our All-Electric Future

Ultifi is Our End-to-End Software Platform

Digital Products will be built using the Ultifi platform and services
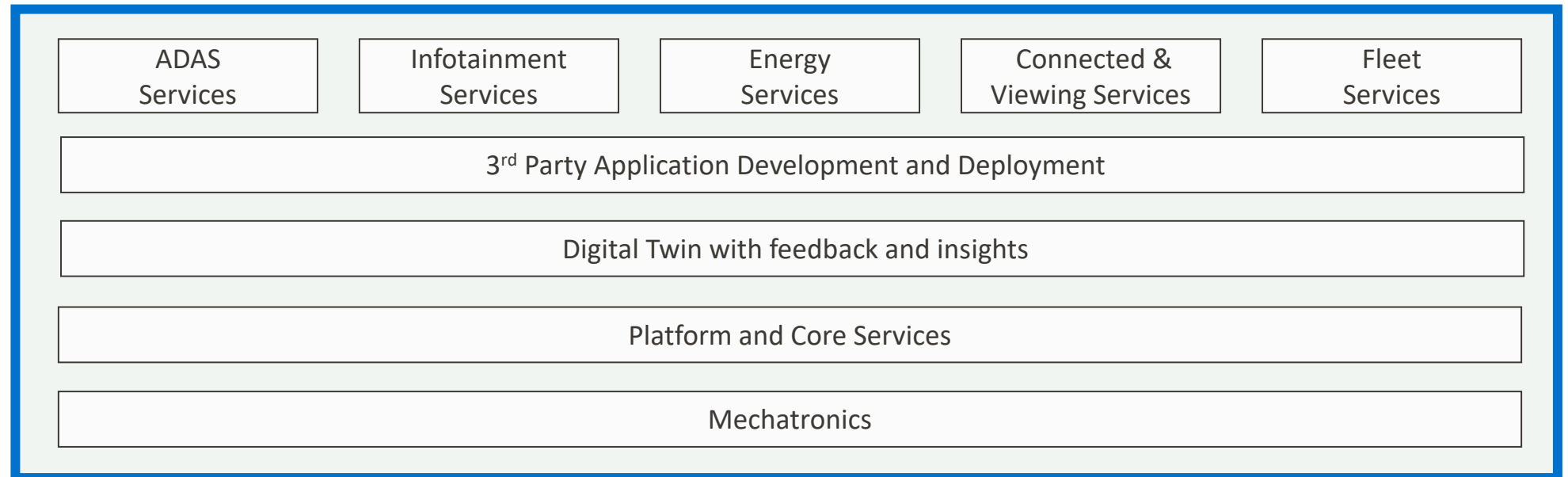
| Automated Driving | Infotainment | Energy Management | Connected Services | Fleet Management |

ultifi

| ADAS Services | Infotainment Services | Energy Services | Connected & Viewing Services | Fleet Services |

3rd Party Application Development and Deployment

Digital Twin with feedback and insights

Platform and Core Services

Mechatronics

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Collaboration

Customers will benefit from Software Standardization

Enablers:

- Open Source Software
- Commoditizing the Platform
- Consortia and Liaison Agreements

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uProtocol

Promoting collaboration on software solutions	• Contributed as Open Source in Eclipse Foundation
A starting point for standardization	• Builds on existing automotive and internet standards from the mechatronic layer to the cloud
Enabler for more efficient software development across multiple devices	• Allows distributed applications and services to communicate regardless of where they are running

uServices

We are contributing uServices as open source in COVESA

uServices Goals

| Communicating through uProtocol with vehicle features | Standard API to abstract vehicle services | Enhancing collaboration | Enabling developer access for applications |

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What Else from GM Today

Schedule of events with GM participation

9:00-9:45: Alternative to Push Notifications Working Session

9:45-10:30: AOSP App Framework Standardization Expert Group Status

- **Richard Fernandes:** GM Connectivity Standards Engineer
- Technical Session

11:30-12:15: uServices – A Step towards standardized vehicle interfaces for SDV

- **Halim Ragab:** GM Software Architect – Ultifi SDV Platform
- Technical Session

4:45-5:30: A Fragment of Your Imagination - Ending AOSP App Framework Fragmentation for Automotive

- **Michael Wahlstrom:** GM Executive Director SDV Product Engineering
- Panel Session

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Key Takeaways

Software Defined Vehicles are a seismic shift in what cars can do for customers

We're bolstering industry collaboration by contributing:

- **uProtocol** as open source within Eclipse Foundation's Software Defined Vehicles Group
- **uServices** as open source within COVESA's Data Expert workgroup

Cooperation within organizations like COVESA are a key to success for customers

We intend be a leader in the future of mobility by beautifully designing and engineering Software Defined Vehicles for our customers

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Thank You.