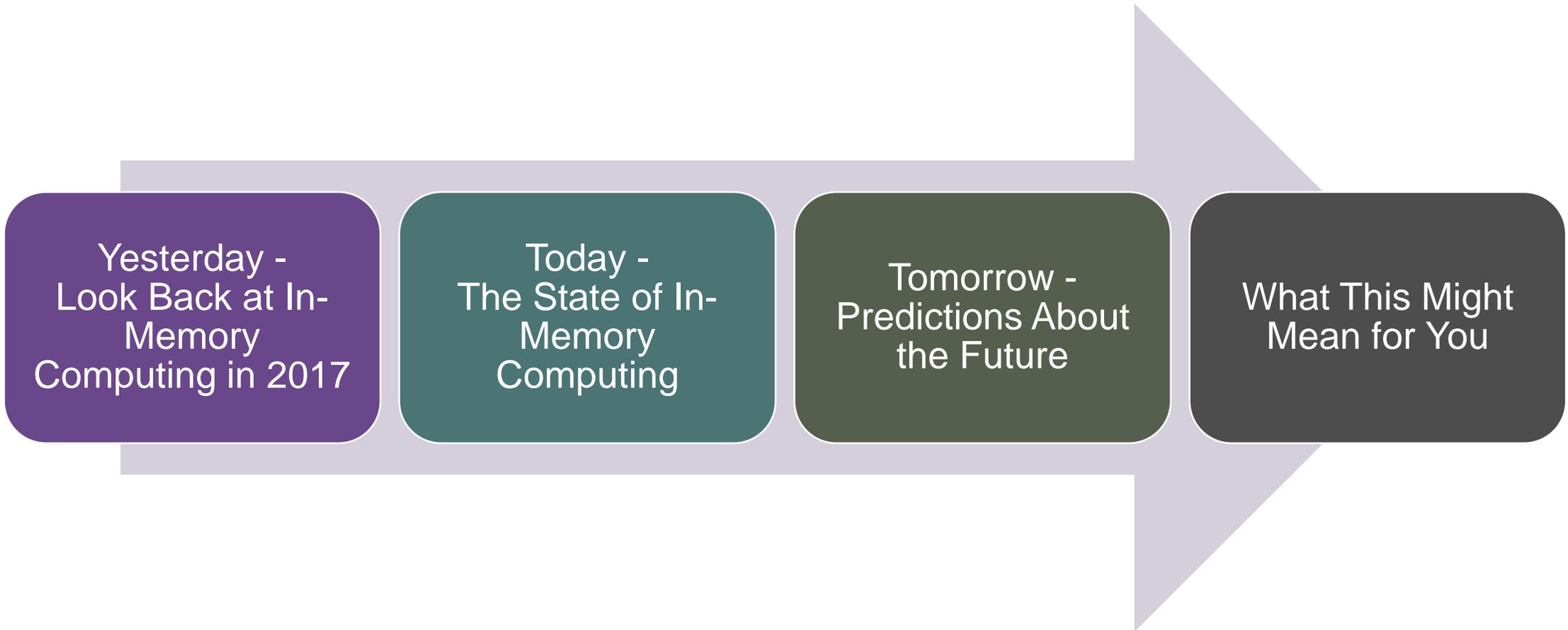# The Future of In-Memory Computing

Terry Erisman, EVP Marketing & Alliances
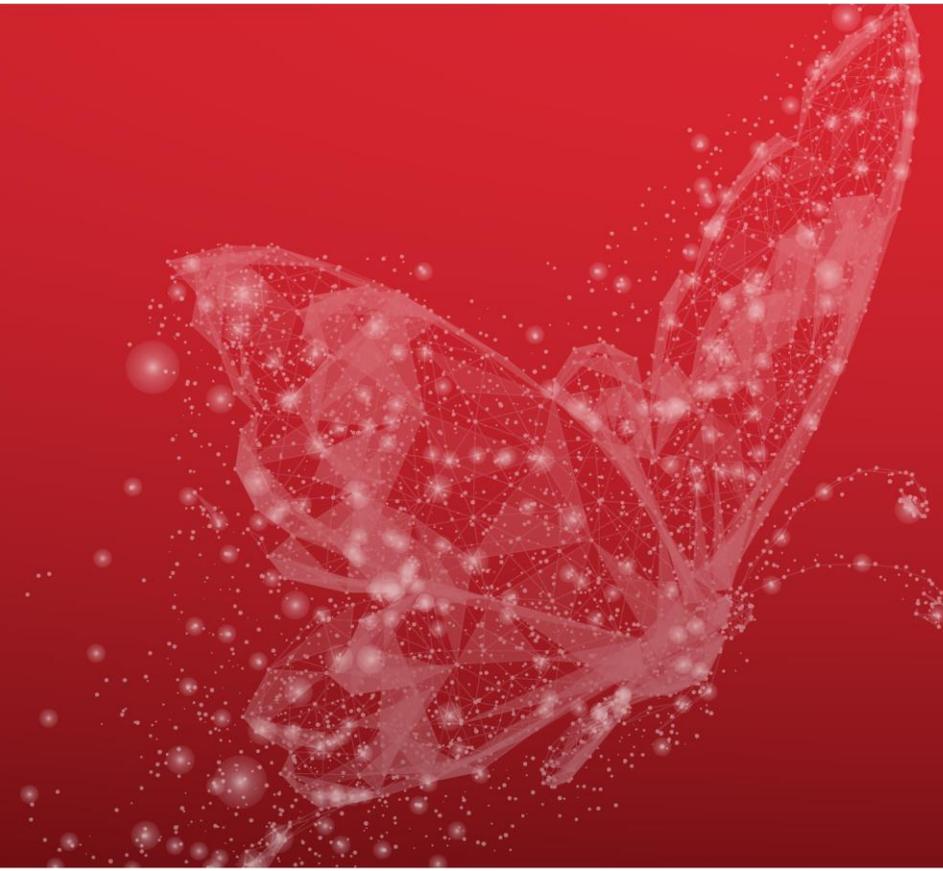
October 28, 2020

What I Will Discuss

Yesterday - Look Back at In-Memory Computing in 2017

Today - The State of In-Memory Computing

Tomorrow - Predictions About the Future

What This Might Mean for You

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Yesterday…

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In 2017, the Future Was Bright…

Technologies Projected to Hit the Mainstream

Figure 1. Hype Cycle for In-Memory Computing Technology, 2017
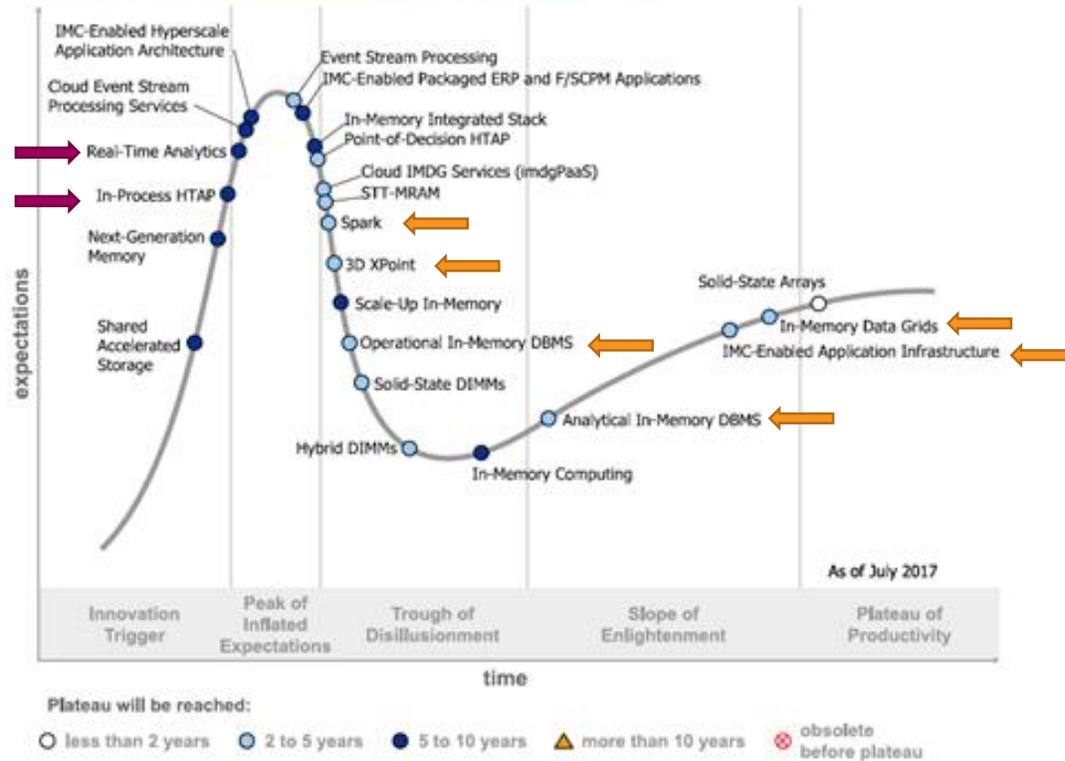
2-5 Years Out

- In-Memory Data Grids
- IMC-Enabled Application Infrastructure
- Analytical In-Memory DBMS
- Operational In-Memory DBMS
- 3D Xpoint
- Spark

5-10 Years Out

- Real-Time Analytics
- In-Process HTAP

Digital Transformation Became "A Thing"

> *"In business, **a fundamental change, a metamorphosis, in how companies generate value** for their owners and other stakeholders, **achieved by applying digital technologies** and ways of working to all aspects of the business"*
>
> - Boston Consulting Group Digital Transformation Definition

**Expectations for Real-Time, Seamless Customer Interactions Have Grown**

- Real-time business processes require real-time access to all data for a specific customer across the enterprise
- Monolithic, asynchronous/ETL-based applications and processes drawing from data silos presented a barrier

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Datastores Have Been Proliferating

The Most Data-Driven Companies Have the Most Data Silos*

*451 Research

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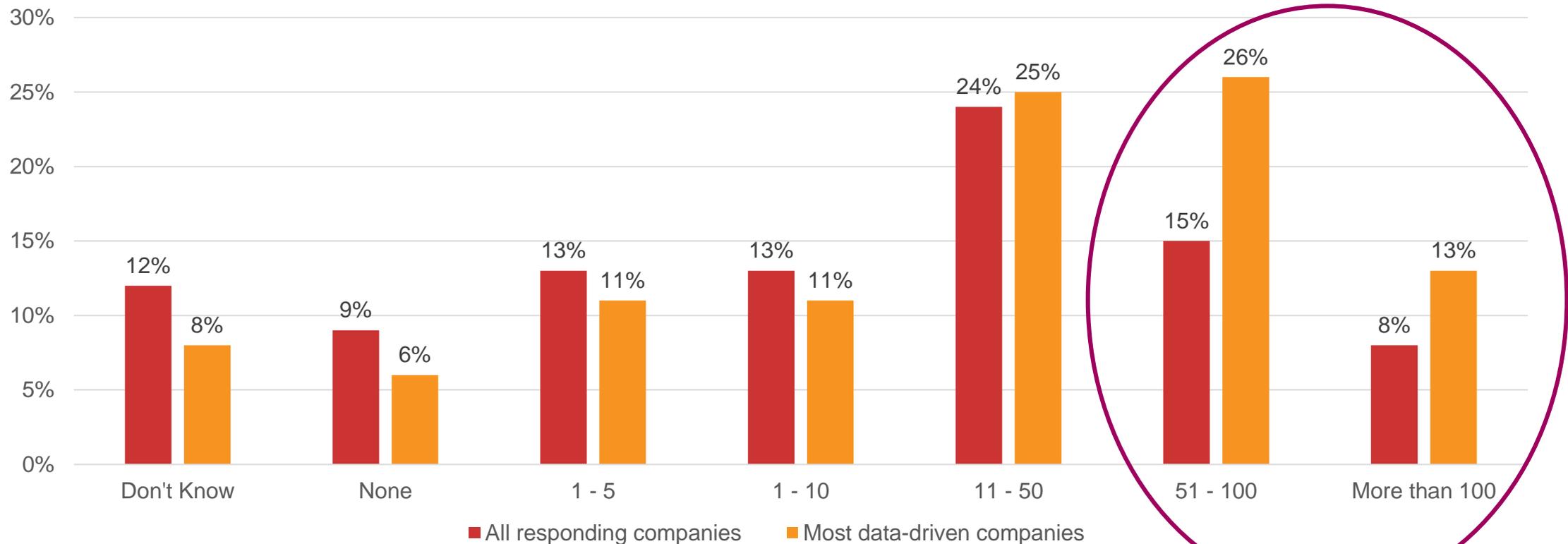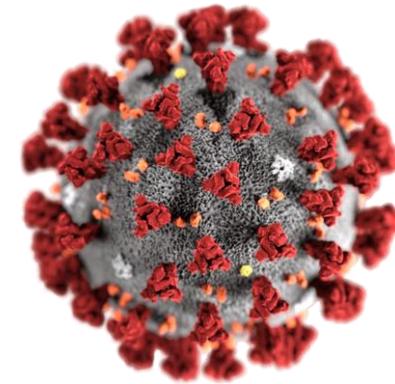
And Other Factors Emerged
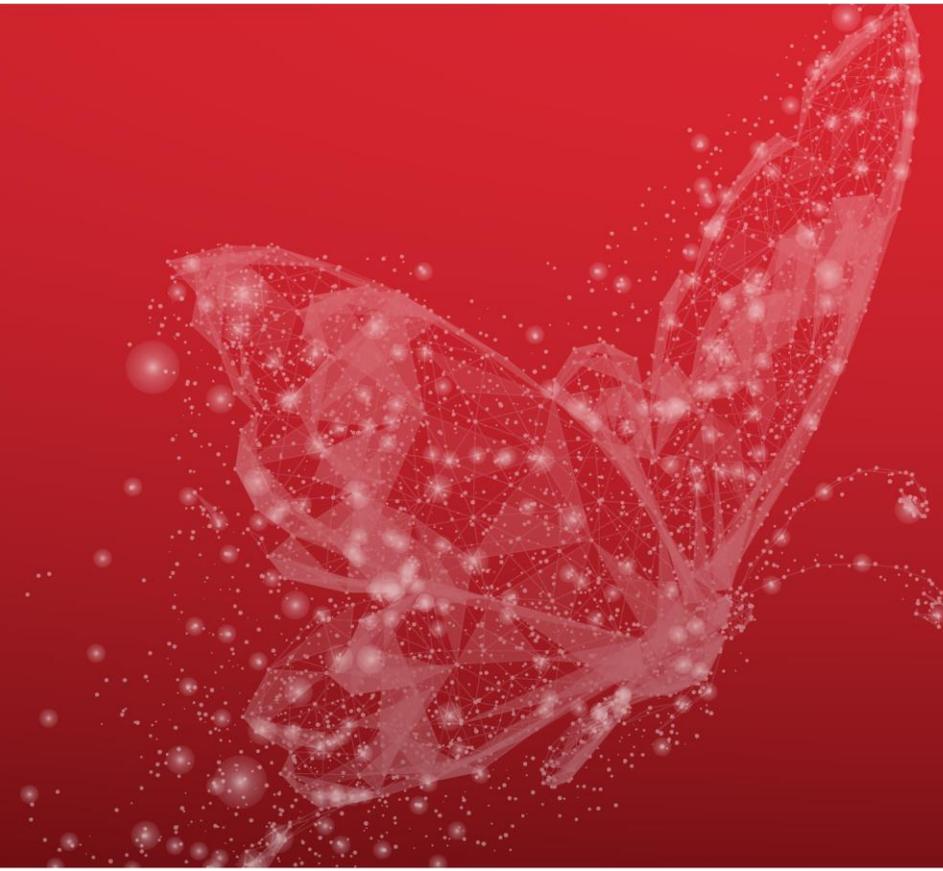
COVID-19 Drove Big Changes

- Increases in eCommerce
- New logistics challenges
- Rapid growth in remote workers

The 5G Rollout Began

- New opportunities for telcos
- Empowers IoT, digital twins and edge computing

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Today…

In-Memory Computing Has Crossed the Chasm

Early Majority is Fueling Growth

- Business needs are driving widespread adoption
- Demand has grown for deployment-ready solutions

Used by Most Data-Driven Industries

- Financial services and fintech lead the market
- Transportation and logistics, eCommerce and retail, telecom, online business services, and more have followed in large numbers

Powering a Vast Range of Use Cases

- IBOR, fraud detection, upsell/cross sell, security, call management, route planning, recommendation engines, IoT platforms and many more

EARLY MARKET   THE CHASM   MAINSTREAM MARKET

PRAGMATISTS   CONSERVATIVES

TECH ENTHUSIASTS

VISIONARIES

SKEPTICS

INNOVATORS
2.5%

EARLY
ADOPTERS
13.5%

EARLY
MAJORITY
34%

LATE
MAJORITY
34%

LAGGARDS
16%

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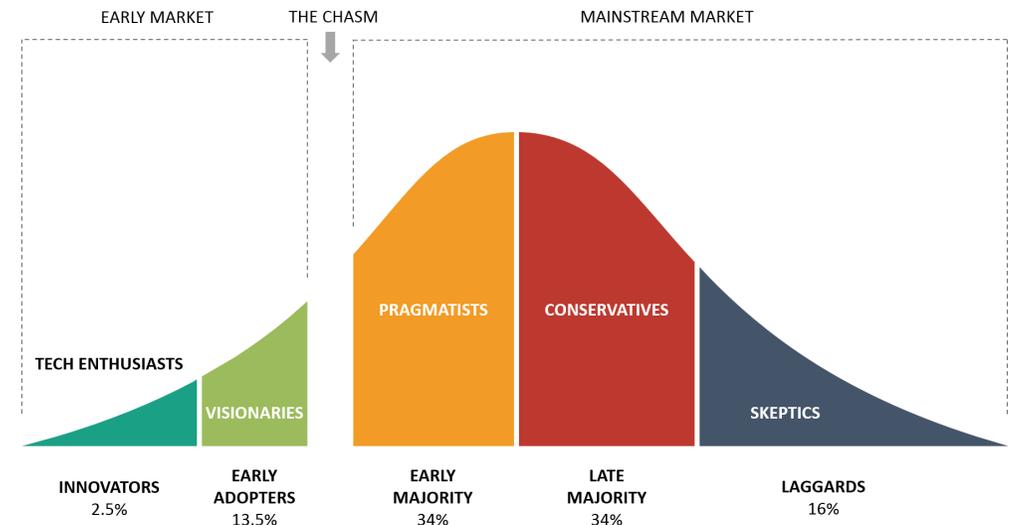
In-Memory Computing Has Gone Mainstream

Daily Impact on People's Lives

- Powers many everyday consumer interactions

IMC Interest and Users Have Soared

- More than a 10x increase in In-Memory Computing Summit registrants since 2014
- Large software and services vendors now active

Massive Open Source Usage

- Millions of monthly downloads
- Over a billion cumulative Docker pulls
- Apache Ignite is a top ten Apache Software Foundation project

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Another Major Use Case Emerged

Application Acceleration

- Speeding up and massively scaling applications
- In-memory data grids, in-memory databases

Digital Integration Hubs

- Also known as Smart Data Hubs, Real-Time Operational Datastores, and API Platforms
- Real-time access to disparate data across the enterprise
- In-memory data grids, in-memory data caches

The Digital Integration Hub Architecture

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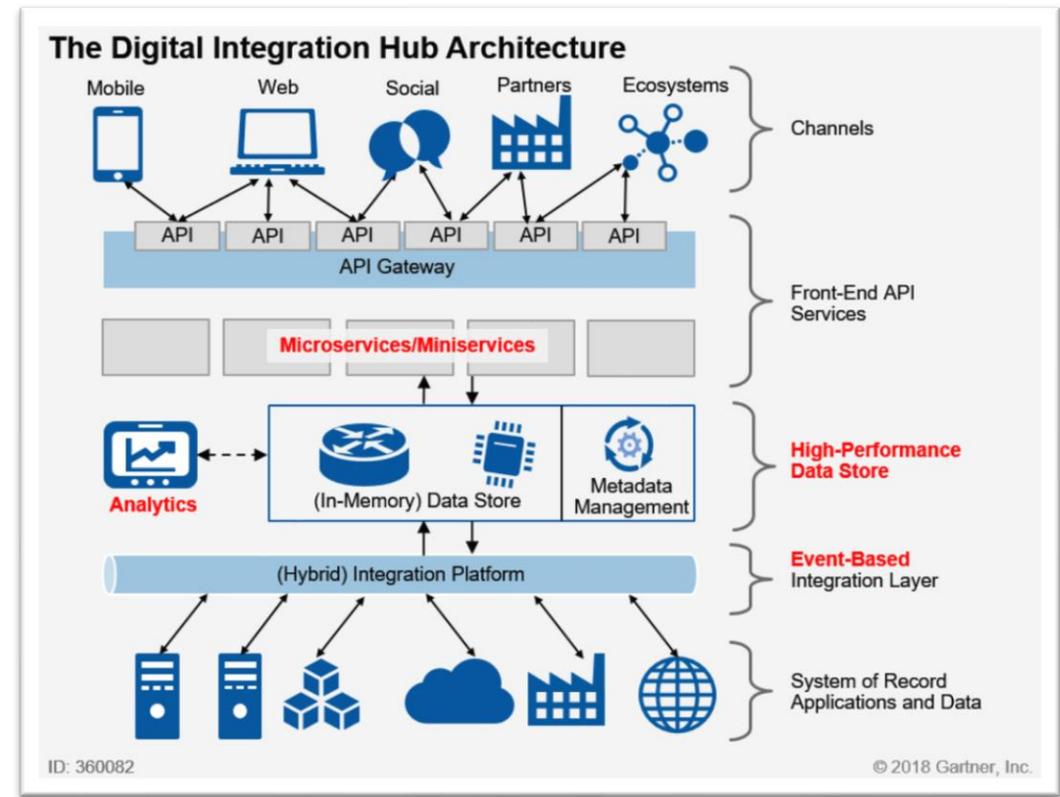
Tools and Talent Have Become Critical

Production and Development Tools

- Developer tools increase productivity and reduce skills requirements
- Managing mission-critical deployments requires production MMA tools

Talent Demands Have Skyrocketed

- Implementation rather than experimentation
- Distributed, in-memory computing skills are in short supply
- Training is critical
- IMCPaaS and MSOs available
- Large SIs are debuting IMC-centric services
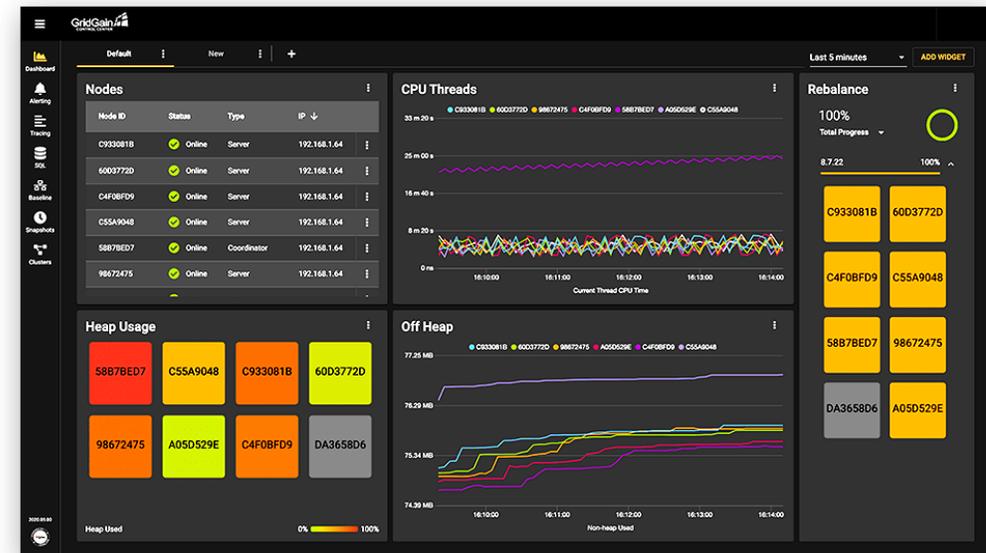
Related Technologies Dovetailing with IMC Software Solutions

Persistent Memory Has Blossomed

- Now generally available
- Interest in byte-addressable memory usage growing
- Solutions to make PMEM easier to fully utilize are emerging

Integrations with Key Software Solutions Now Common

- Kafka/Confluent for streaming data
- Spark for unified analytics
- Debezium for CDC

Latency (ns) — In Human Observable Terms

MEMORY / STORAGE

- CPU 10^0
- DRAM / NVDIMM-N 10^1 — NVDIMM-N = DRAM! — Seconds
- NVDIMM-P 10^2-10^3 — PM Fills the Gap — Minutes
- Performance SSD 10^4 — Hours
- Capacity SSD 10^5 — Days
- HDD 10^6 — Weeks

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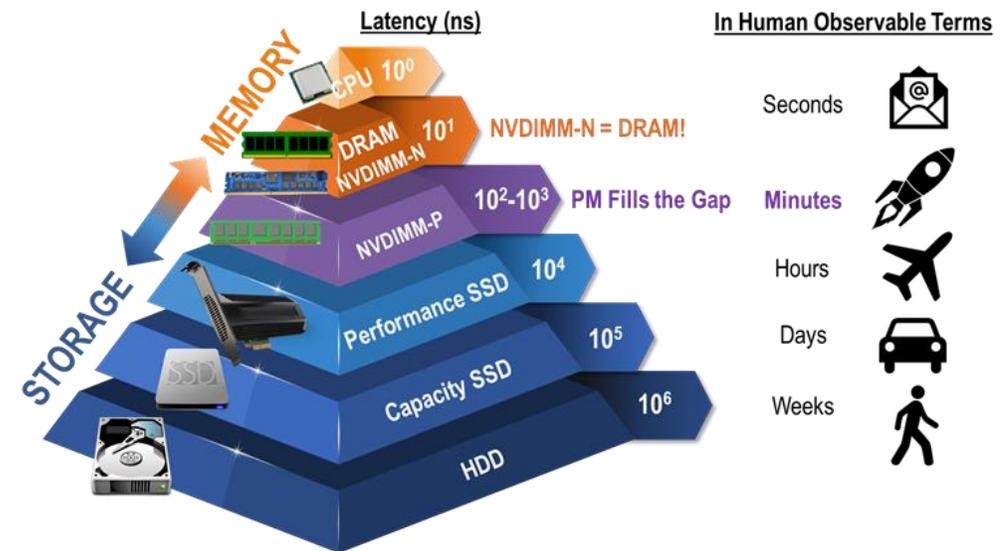
Data Management Technologies Converging

Traditionally Disk-Based Databases

- Developing in-memory features

In-Memory Computing Platforms

- Developing multi-tiered computing capabilities

In-Memory Databases

- Enhancing disk-based features and integrations
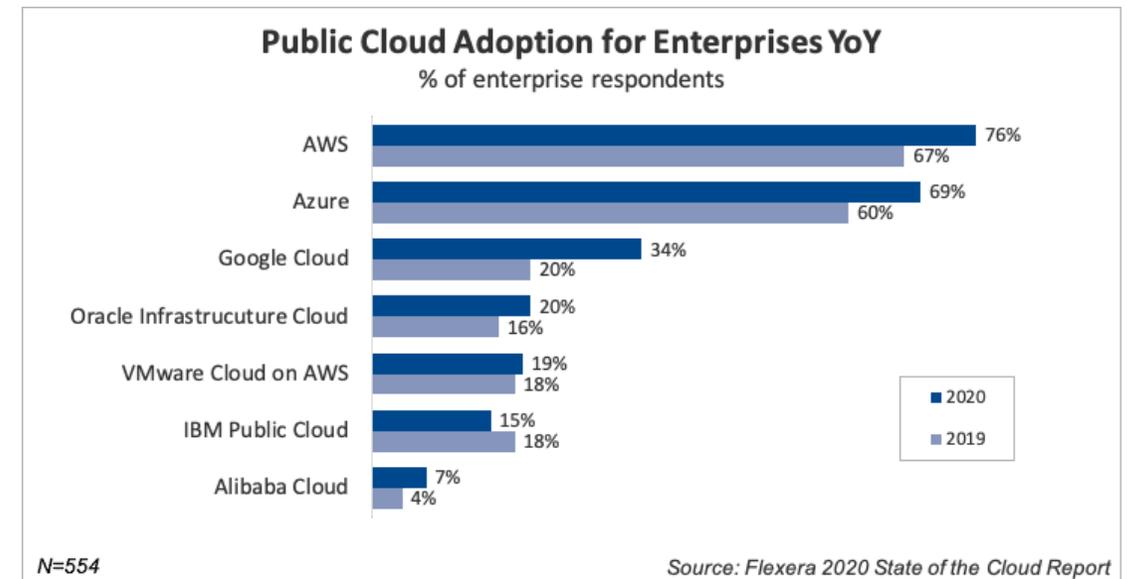
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Cloud Continues to Grow in Importance
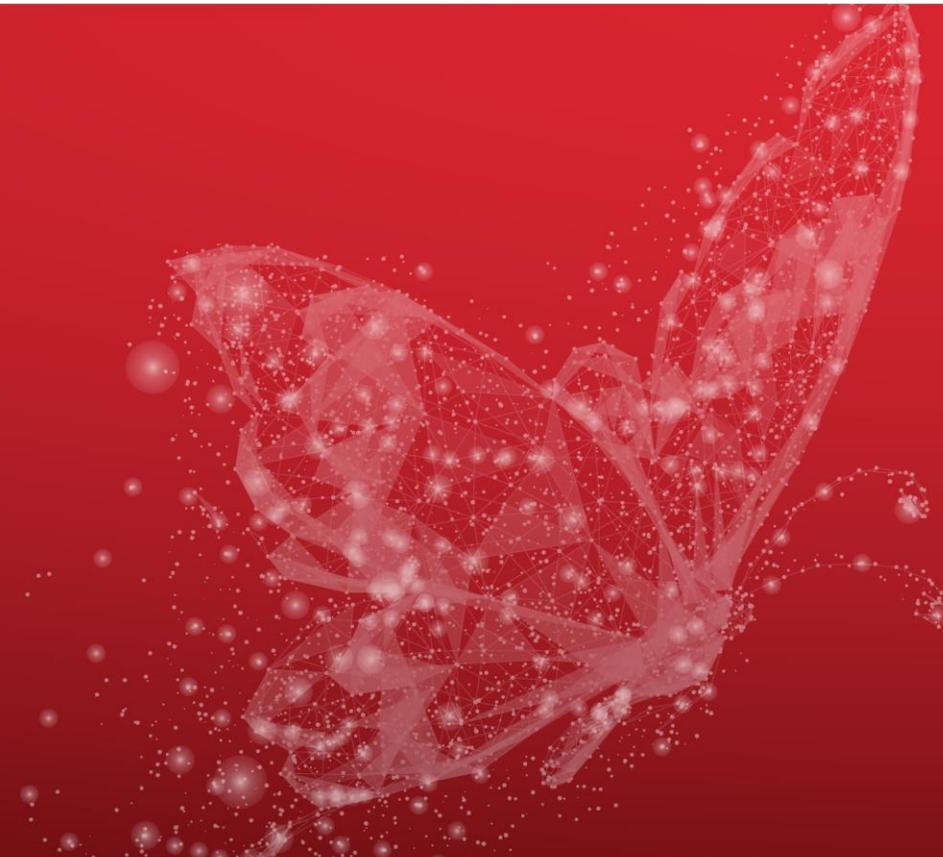
Cloud Presents Challenges

- A lack of resources and expertise
- Managing multi-cloud deployments
- Migrating to the cloud

IMC Deployment Options Cross Boundaries

- Support for on-premises, public and private cloud, and hybrid environments
- Cross-datacenter backups and operations crucial
- Cloud-friendly solutions that leverage Kubernetes, Docker, OpenShift and more are rapidly growing in popularity

Public Cloud Adoption for Enterprises YoY
% of enterprise respondents

	2020	2019
AWS	76%	67%
Azure	69%	60%
Google Cloud	34%	20%
Oracle Infrastructure Cloud	20%	16%
VMware Cloud on AWS	19%	18%
IBM Public Cloud	15%	18%
Alibaba Cloud	7%	4%

N=554

Source: Flexera 2020 State of the Cloud Report

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Tomorrow…

Present Trends Will Continue

IMC Growth In an Expanding List of Industries

- Adoption by more and smaller companies
- Technology will become easier to use
- Expansion in pool of knowledgeable IMC practitioners

Digital Integration Hubs Will Become Mainstream

- Digital Transformation will be an overwhelming force
- Real-time business processes based on 360-degree customer views will become a requirement for business success
- Easier-to-implement, commercial DIH solutions will emerge
- Ecosystems will emerge around specific DIH architectures

Adoption of Persistent Memory Will Grow

- Exploration of byte-addressable PMEM will evolve into adoption
- PMEM prices will fall, reducing barriers to adoption
- Technologies that enable PMEM usage will advance

THE FUTURE IS OURS TO CREATE.
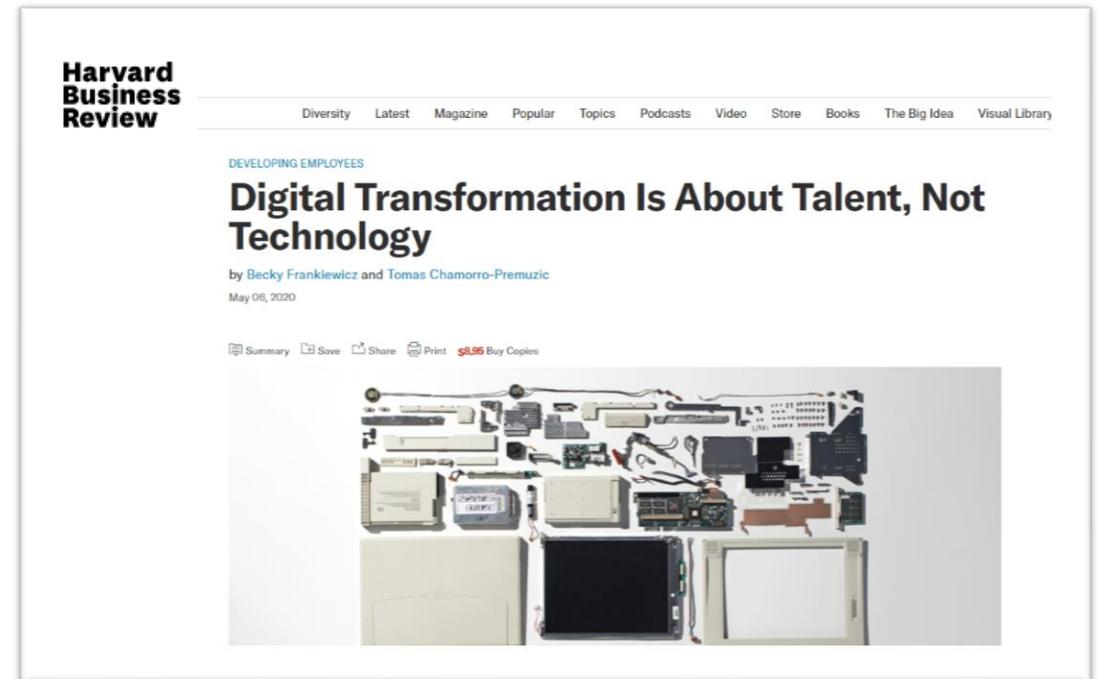
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What Does This Mean for You?

- ## Digital Transformation is About People, Not Technology

"…one of the most obvious consequences of the current Covid-19 pandemic will be "the infusion of data-enabled services into ever more aspects of life." *We expect digital transformation to be an even bigger imperative for organizations in the short-term…*

Contrary to popular belief, *digital transformation is less about technology and more about people*. You can pretty much buy any technology, but your ability to adapt to an even more digital future depends on developing the next generation of skills, closing the gap between talent supply and demand, and future-proofing your own and others' potential."

Harvard Business Review

Diversity Latest Magazine Popular Topics Podcasts Video Store Books The Big Idea Visual Library

DEVELOPING EMPLOYEES

Digital Transformation Is About Talent, Not Technology

by Becky Frankiewicz and Tomas Chamorro-Premuzic

May 06, 2020

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- ## Expanding Your IMC Knowledge and Skills is a Great First Step

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Thank You

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