After COVID-19: What Will Drive the IoT Market through 2020?

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Dan Shey, *VP Enabling Platforms*

Michela Menting, *Research Director*
Jamie Moss, *Research Director*
Phil Sealy, *Research Director*
Adarsh Krishnan, *Principal Analyst*
Dimitrios Pavlakis, *Industry Analyst*
Kate Dubrova, *Research Analyst*

Post-COVID-19 Headlines and Key Themes

Headlines and Statistics:

- **American Association of Port Authorities sees 1Q volume decreased by at least 20%**
- **IATA expects cargo traffic to drop by more than 15% in 2020**
- **U.S. jobless claims surge to record 3.28 million as mass COVID-19 layoffs begin**
- **Instacart plans to hire an additional 300,000 "full-service" contractors**
- **Oil prices could soon turn negative as the world runs out of places to store crude, analysts warn**
- **Microsoft Azure traffic surges 775% amid COVID-19 Work from Home (WFH) shift**
- **World merchandise trade is set to plummet by between 13 and 32% in 2020 due to the COVID-19 pandemic**

Post-COVID-19: Key Themes for Enterprises

- Resilience
- Visibility
- Flexibility/Agility for Scalability
- Trust
- Speed/Accessibility

Sources for Headlines and Statistics:

- www.freightwaves.com/news/coronavirus-slashing-us-port-volumes
- www.aircargonews.net/airlines/iata-expects-cargo-traffic-to-drop-by-more-than-15-in-2020/
- www.reuters.com/article/us-health-coronavirus-usa-unemployment/u-s-weekly-jobless-claims-surge-to-record-3-28-million-idUSKBN21D1WJ
- www.engadget.com/2020-03-23-instacart-hiring-300-000-full-time-grocery-shoppers.html
- www.cnbc.com/2020/04/01/coronavirus-oil-prices-could-turn-negative-as-storage-nears-capacity.html
- www.pcmag.com/news/microsoft-azure-traffic-surges-775-percent-amid-coronavirus-wfh-shift
- www.wto.org/english/news_e/pres20_e/pr855_e.htm

Key Topics

Using the IoT to De-Risk the Supply Chain and Critical Infrastructure

IoT Security and Blockchain: From Hardware to Life Cycle Management

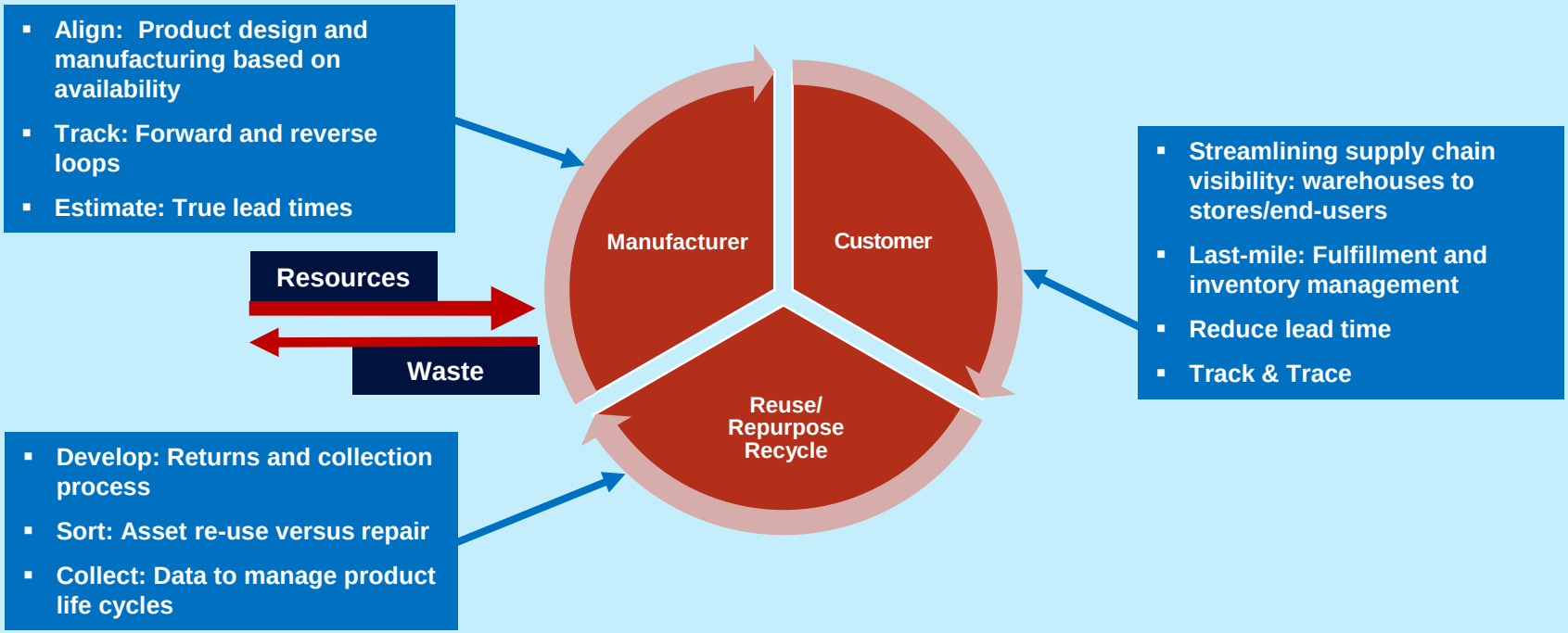
The Growing Importance of iSIM and eSIM

Contactless, Biometrics, and Surveillance

IoT Monetization Strategies

Using the IoT to De-Risk the Supply Chain and Critical Infrastructure

Leveraging the IoT to Enable Circular/Closed-Loop Supply Chains



Linear Supply Chain Cost-Based Approach

- Procurement function incentivized to reduce cost
- Supplier evaluation based on cost competitiveness
- Low investment in new production methods and process improvements
- Unidirectional flow of process: make and forget

Circular Supply Chain Value-Based Approach

- Procurement focused on reducing risk and improving overall value creation
- Supplier assessed based on value delivered to the business in flexibility, resilience, and efficiency.
- Sustainability in enterprise Supply Chain Management (SCM) strategic market differentiator and not limited to Corporate Social Responsibility (CSR) function.
- Continuous flow of insights across the supply chain to improve product and process efficiencies.

IoT in Asset Visibility Trends Past and Future

General

Before COVID-19	After COVID-19
▪ Trade war drives suppliers to diversify supply chain and avoid clustering suppliers in one region. ▪ Enterprises growing demand for asset visibility of high-value finished goods and large volume transportation assets used in reverse logistics. Early adoption in aeronautics, automotive, Third-Party Logistics (3PL) ▪ Monitoring of assets used in manufacturing mostly siloed from monitoring/tracking supply chain feed stock, subassemblies, and finished parts. ▪ Early adoption in large-scale enterprises to reduce operational costs. Enterprises developed customized IoT solutions in partnership with solution vendors and in-house resources.	▪ Supply chain diversification accelerates; enterprises seek technology to help establish trust and reliability from new partners and suppliers ▪ Supplier ecosystem will also need to digitize their operations to provide end-to-end visibility of the supply chain. Asset visibility across upward and downward supply chain flows. ▪ More integration of data from connected manufacturing assets with supply chain asset visibility. More focus on prioritizing manufacturing asset IoT projects that reduce end-to-end supply chain friction ▪ Small and Medium-Sized Enterprises (SME) will be hardest hit due to disruption; however, financial grants from government schemes will enable initiatives to digitize their operations to improve resilience. Will need more off-the-shelf solutions to address key pain points.

Vertical and Technology

Before COVID-19	After COVID-19
▪ Supply chain equipment pooling service providers were early adopters driven by the nature of business, dealing with high volume of assets with low margin per equipment; implement asset trackers to maximize the utilization of equipment and reduce loss of assets. ▪ Relatively higher maturity in the digitalization of warehouse operations and identifying the physical flow of processes. ▪ Asset tracking will be an entry-point for solution vendors to offer value-added sensor applications, including Condition-Based Monitoring (CBM). ▪ CBM early traction in monitoring downstream supply chain flows, *e.g.*, tracking finished goods to distributors/retailers. ▪ Asset Visibility-as-a-Services using shared public Wide Area Network (WAN) connectivity infrastructure and subscription model for hardware and software.	▪ Enterprises will rely more on equipment rental or pooling companies to reduce Capital Expenditure (CAPEX) and improve flexibility in Operational Expenditure (OPEX). ▪ Changes in consumer buying behavior and boost in e-commerce activity growth creates significant strain on transport and logistics operations. ▪ Growth in the use of data and analytics for demand planning and Inventory management. This will require collaborative environments with multi-stakeholder, supplier participation, and data sharing across the value chain. ▪ Adoption of CBM in upward supply chain flows in returnable packages/containers: auto-parts, industrial consumables, high-value electronic components. ▪ New business models: outcome-based services and pay-per-usage models (insurance), will drive IoT adoption of asset tacking and CBM for critical assets to improve security, availability, and uptime of equipment through predictive maintenance and other value-added services.

IoT Security and Blockchain: From Hardware to Life Cycle Management

Trends and Impacts

Trends Driving the IoT Security Market

- Democratization of **hardware security for IoT** applications due to growing demand by automotive, industrial, healthcare
- **Adaptation** of secure hardware **for embedded** and resource-constrained devices (Trusted Execution Environment (TEE), Trusted Platform Module (TPM)) by semis and OEMs
- Resulting in increasingly **secure Microcontroller Units (MCUs)/Microprocessor Units (MPUs)** for the IoT
- Bundling of **software development tools** with IP cores for easier and faster Go-To-Market (GTM)
- Includes tools **for provisioning and onboarding**, as well as Over-the-Air (**OTA) management** for updates/patching
- Supported by **partnerships with service providers**, *e.g.*, cloud, IoT, Mobile Network Operators (MNOs)
- Emergence of **end-to-end secure IoT device lifecycle management**, rooted in hardware, and continuing until End of Life (EOL)

Impacts on Current Trends

Short Term (COVID-19 impact):

- Supply chain impact for hardware manufacturing due to temporary closure of non-essential industrial activities will lead to longer lead times, especially for newer secure MCUs (no stock)
- Remote working and cut-back on industrial/business activities to drive adoption of secure IoT device management (cutting costs of on-premise management by staff)
- Surge in service provisioning for visibility and monitoring and extension of secure OTA management capabilities

Long Term:

- 5G rollout will drive greater demand for trust in the management of large-scale IoT deployments, with increasing focus on a secure Root of Trust
- Greater emphasis on automated and zero-touch provisioning and onboarding, with workload being done at the manufacturing level

IoT Security Ecosystem Challenges and Opportunities

	Silicon IP & Semiconductors	OEMs	Service Providers
Challenge	Creating hardware security modules that are low-cost and resource-efficient for a variety of IoT applications	Integrating hardware security into devices and ensuring device firmware/software can effectively leverage those features	Provide secure and resilient connectivity regardless of network, and data protection in transit and at rest
Opportunity	Existing hardware specifications are being adapted to IoT use cases (TPM, TEE, Secure Element (SE), MCU, MPU)	Use the Software Development Kits (SDKs) being offered by semis, create own SDKs and APIs to facilitate developer access and prototyping	Use OTA functionalities tied to HW Root of Trust to provide secure life cycle management: from provisioning and onboarding to EOL

Role of Blockchain

Medical and Healthcare Use Cases:

- Secure sharing of **patient records** across various stakeholders (hospitals, medical professionals, patient, insurers, government, *etc*.), while preserving privacy, including diagnostics and testing
- Secure sharing of **lab, medical, and healthcare data**
  - Testing and clinical trials for vaccine development
  - Availability of patents and other intellectual property (for creating vaccines, manufacturing medical equipment, *etc*.)
- Secure sharing of **health information and educational resources** related to the pandemic
  - Cataloging and making available metrics, statistics, best practices, guidelines, news sources, government announcements
  - Avoiding false or misleading information

Examples: WHO MiPasa initiative, Snark Health

Economic/Social Use Cases

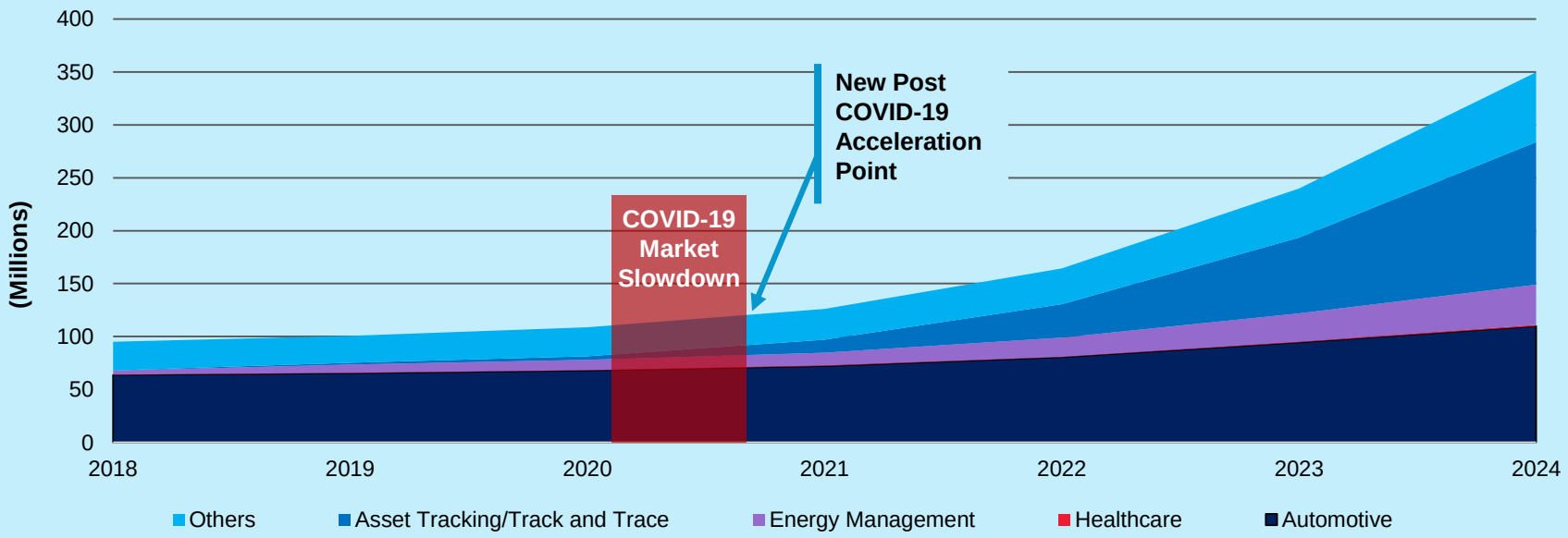
- **Track and Trace:**
  - Growth in eCommerce driving demand for information on location, movement, transit, etc.
- **Citizens**:
  - Payment of unemployment benefits, stimulus checks, sick pay, food assistance
- **Enterprise**:
  - Tax credits, relief business loans, postponement corporate rent/utilities bills

Example: H.R.6201 - Families First Coronavirus Response Act; n.b. as a bill, it contained a clause to implement a digital dollar to this effect, did not make it to the final Act

The Growing Importance of iSIM and eSIM

Total eSIM/iSIM Shipments by Application

World Markets, Forecast: 2018 to 2020



Immediate Market Impacts

- Initial short-term drop in demand
- Enterprise strategy shift
- Laying the foundation to future proof operations

Longer-Term Impacts

- Accelerated demand
- Enterprise move from mitigation to cure
- Connectivity and security convergence

Despite COVID-19

- Enterprise ambitions remain the same
- Borderless connectivity, automation & remote management capabilities key to unlocking enterprise ambitions
- eSIM/iSIM the enabling form factor

eSIM/iSIM Situation and Future Outlook

GSMA Releases Remote Provisioning Specification to Help Consumers Connect Mobile Devices

Where We Came From

- The GSMA took control against fears of disintermediation
- Platform-based carrier alliances emerged
- Promise of cross-border services at local rates only

Where We Are Now

- SIM-switching occurs as a last resort against roaming shock
- Used most where regulation forces use of local International Mobile Subscriber Identities (IMSIs)
- Enterprise market stifled, attention reverted to consumer

Despite COVID-19

- MCU+module+iSIM = next gen. integrated sensors
- Low-cost mass global environmental monitoring
- Local carrier eSIM opportunity for Remote SIM Provisioning (RSP) anytime-anywhere Wireless WAN (WWAN) connectivity

Contactless, Biometrics, and Surveillance

Contactless: Combating COVID-19 Spread and Improving Trust

Contactless limit in UK to be increased to £45

SUMMARY

The spending limit for contactless card payments will be increased from £30 to £45, with a national roll-out beginning from 1 April 2020, UK Finance has announced.

CCB police bust fake infrared forehead thermometers racket in Bengaluru

HM Chaitanya Swamy, DHNS, Bengaluru, APR 01 2020, 09:34 IST | UPDATED: APR 01 2020, 09:34 IST

Press Releases

Mastercard enables Contactless limit raise across 29 countries; and champions permanent increase

Important new move builds on the phenomenal growth in use of contactless with Mastercard enabling businesses and retailers to implement limit increases quickly and efficiently to help people everywhere benefit from the fastest and simplest way to pay

Mastercard enables higher contactless payments across Canada

This initiative comes in the wake of COVID-19 as health officials recommend social distancing and merchants encourage consumers to pay with contactless for a safer way to pay.

TORONTO, April 2, 2020 – Mastercard today announced it is enabling the increase of contactless payment limits across Canada, as people look for safer ways to pay in the wake of the COVID-19 (coronavirus) pandemic. The move follows similar announcements made by Mastercard recently to champion contactless limit raises around the world, as health officials recommend social distancing and a growing number of merchants encourage consumers to pay with contactless to minimize interaction.

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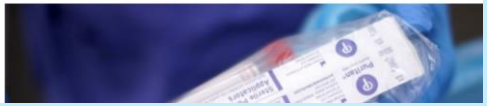
Coronavirus: Man in court over fake Covid-19 treatment kits

21 March 2020 Share

Coronavirus pandemic



COVID-19: Fake Masks, Sanitizers Surface in B'luru as Demand Rises

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SHARE, SAVE, COMMENT

Biometrics and Surveillance: Near-Term Trends Post-COVID-19

Trends	Secure network access and privilege management	Focus on contactless modalities: face and iris recognition	Consumer applications: biometrics and telemedicine	Forced evolution: further AI investments and improved algorithm design
Markets	Remote authentication: enterprise, healthcare, government, banking and finance	On-site logical and physical access control, civil and welfare, border control	Consumer, healthcare, government, immigration and border control	Deployments across major transportation hubs and border control
Supplier Insights	Threat surface increases, enabling new monetization options and subscription models for Multi-Factor Auth (MFA) vendors	New regulatory measures are expected to drive resilience into access control operations	Consumer electronics vendors must innovate implementing novel biometrics and COVID-19 symptom tracking applications	Software designers and hardware providers must leverage existing infrastructure with limited resources

Biometrics and Surveillance: Long-Term Trends Post-COVID-19

Trends	Innovative biometric technologies enter the fray: temperature detection, fever screening, behavioral analytics	Increased investments in surveillance tools to control and manage citizen activities for adherence to gov't safety orders	Smart city technology investments; increased use of biometric AI and real-time data analytics	Data sharing collides with data privacy regulations to find common ground for citizen safety and security
Markets	Deployments across major transportation hubs, border control, law enforcement, consumer, telemedicine and healthcare	City, state, and federal governments	City, state, and federal governments, regional and geographical alliances	Open-source initiatives, healthcare, science and epidemiology, government and law enforcement
Supplier Insights	Software designers and hardware providers must leverage existing infrastructure with limited resources	Suppliers should expect more gov't regulations that can both hinder & hasten deployments, pushing the boundaries of technological capabilities	AI and ML algorithm designers should drive innovation across the IoT ecosystem: real-time infection rate monitoring, population safety, outbreak prediction	Expect more open-source data and fewer monetization options; however, post-crisis followed by privacy concerns, de-siloing options, & a data-sharing ecosystem

IoT Monetization Strategies

IoT Monetization Strategies: Market Response from COVID-19

	Enterprise	Supplier
Monetization Approaches ▪ Value chain stacking ▪ Outcome-based pricing ▪ Data monetization	Location-based services find more value, asset visibility	Greater collaboration and partnerships to drive value creation More flexibility in pricing and offer models
Packaging/Offers ▪ Subscription ▪ Software sales ▪ Hardware sales	Hardware packaged with services Seeking ease in onboarding and life cycle management, particularly with security features As-a-Service business models: requires proper software enablement	Greater collaboration and partnerships among hardware OEMs Greater push for standardization around onboarding; security features become more prominent to verify hardware integrity
Data Monetization Options ▪ Advanced Analytics ▪ Real-time streaming & data management services ▪ Data exchange (Data-as-a-Service, DaaS)	Faster time-to-value of data from OT things Seek industry collaboration to address need for cross-industry data; may see government regulations to force industry data sharing	Vertical data sharing approaches will persist, but with greater emphasis on desiloing particularly for civic and gov't IoT
Solution Enablement and Support ▪ Custom *versus* Platform services *versus* packaged solutions ▪ Professional services ▪ IoT managed services	Adding trust and security to solutions requires greater technology and supplier awareness, hence, consultation on best approach, particularly for global enterprises	Packaged offerings needed more than ever to drive resilience and visibility into the supply chain

Real-Time Streaming and Data Management Services

What is real-time streaming and data management?

Software and services designed to process data in real time to make it more immediately consumable by applications or for integration into other systems and databases. Core functions include parsing, filtering, transformation, aggregation, and enrichment.

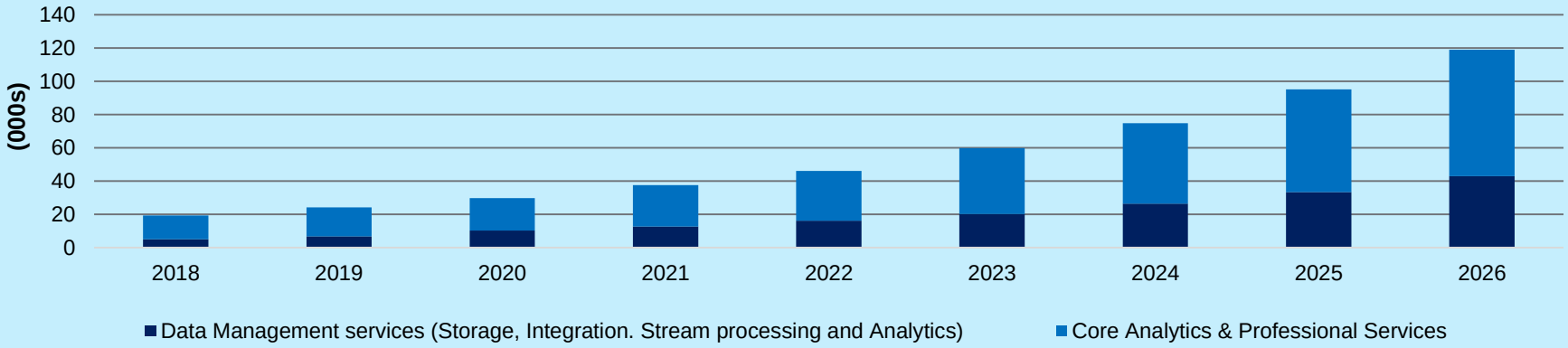
Drivers and Trends

- "Hot data" are real-time operation data value
- Expansion of edge, 5G and AI enhances opportunities for real-time streaming services

- Wider use of ML and AI applications
- Big data increases cost for storage

- Trend for self-service and data flow management
- Cloud with horizontal platforms *versus* specialized platforms/ software

IoT DATA MANAGEMENT MARKET FORECASTS



How Real-Time Streaming and Data Management Services Are Addressing COVID-19 Challenges

Scalability and Visibility

Streaming and Data Management Insights

- Data value is still an issue for enterprises worldwide driven by a lack of tools to inexpensively and automatically process a wide variety of data from multiple sources
- Real-time streaming services have started to become available to enable both data accessibility and visibility
- Suppliers offering streaming technology are divided over the perspective on “best approach”:
  - Cloud-Centric Approach: TIBCO, Informatica AWS, and Azure
  - Edge-Centric Approach: SWIM.ai, Crosser, Cisco
- Analytics on streaming data are still primarily descriptive with some suppliers offering pattern matching functions
  - AI and ML tools still in development

Streaming and Data Management Applications

- Real-time data collection at scale, which could then be used by AI and deep learning systems to understand healthcare trends, model risk associations, and predict outcomes
- Real-time tracking map for following cases of COVID-19 across the world
- Tracking Intensive Care Unit (ICU) equipment availability
- Real-time streaming combined with digital twins offer faster assessment and response of critical systems and situations

Summary and Recommendations

- COVID-19 is exposing the fragility of the supply chain. Enterprises of all sizes need to invest in asset visibility solutions to more quickly respond to disruptions.
- Enterprise's requirements for asset visibility are varied and will, therefore, cover multiple technologies and platforms. More off-the-shelf solutions are needed to address resource constrained organizations.
- Hardware and network innovation needs to accelerate to expand and speed asset visibility solution access.
  - Sigfox and LoRa could be an early beneficiaries from more a mature device ecosystem.
  - Multi-radio technologies will find interest for seamless indoor/outdoor coverage.
- CSPs and SIs are strongly positioned to develop an ecosystem of hardware OEMs and software platforms vendors to develop turnkey solutions and become a valuable distribution channel to global enterprises.
- IoT security will continue as a critical need bolstered by availability of secure hardware and scalable device life cycle management solutions.
- eSIM/iSIM becomes an even more important enabler, but requires greater cooperation among the CSP community to achieve its benefits.
- Contactless and biometrics technologies need greater consideration as a component of IoT solutions, particularly for healthcare, retail, transportation, and government sectors.
  - Data privacy laws may need amending to address societal health/safety needs.
- IoT monetization options will expand from business model innovation and technology advancements.
  - As-a-Service business models, particularly for connectivity hardware.
  - Data exchange/DaaS will expand contextual awareness/
  - Real-time streaming and data management make data from multiple sources available faster and in near real time.

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