

# Industrial IoT Market by IIoT Technology (5G, APIs, Databases), Device (Sensors, RFID, Robots, Smart Meters), Software (Controls, Data Management, PLM), Application (3D Printing, Industrial Analytics, Process Automation, Smart Workplace, Teleoperation), Industry Vertical, and Geography

https://marketpublishers.com/r/I172D6AD7E9EN.html

Date: February 2017

Pages: 1414

Price: US\$ 3,995.00 (Single User License)

ID: I172D6AD7E9EN

# **Abstracts**

The Industrial Internet of Things (IIoT) is poised to significantly improve reliability, production, and customer satisfaction. Initially focusing on improving existing processes and augmented current infrastructure, IIoT will rely upon as well as integrate with certain key technologies, devices, software, and applications.

Unlike LTE /4G, the fifth generation (5G) of wireless will represent a purpose-built technology, designed and engineered to facilitate connected devices as well as automation systems. In many ways, 5G will be a facilitator and an accelerator of the next industrial revolution, often referred to as Industry 4.0. There is a need to look beyond smart factories, intelligent products and services towards enterprise as a whole and the unique benefits of high capacity urban wireless applications.

IoT APIs will support IoT Operations in many regards including interoperability between IoT Platforms, Devices, and Gateways. Moreover, IoT APIs will become a critical part of major IoT application and service developer programs. There is an emerging opportunity for IoT database infrastructure services to support inter-working and access to IoT related resources, most notably data associated with IoT events gathered from IoT Devices and sensors.

Sensors are used for detection of changes in the physical and/or logical relationship of



one object to another(s) and/or the environment. Physical changes may include temperature, light, pressure, sound, and motion. Logical changes include the presence/absence of an electronically traceable entity, location, and/or activity. Within an IoT context, physical and logical changes are equally important.

IoT will be a driver of substantial software development in infrastructure, platforms, devices, security, applications and services. Original Equipment Manufacturer (OEM) represents an important go-to-market aspect of IoT for early distribution and as a value-add to IoT product capabilities and/or service offerings. IoT also raises Importance of Value-added Resellers (VAR), Systems Integrators (SI), and Independent Software Vendors (ISV).

The convergence of Cloud, Data Management, IoT Platforms and Solutions is enabling the next evolution of data analytics in which enterprise will realize significant tangible and intangible benefits from IoT data.

3D Printing is transformative beyond the printing industry itself as it is poised to cause a huge shift in manufacturing, especially when coupled with Artificial Intelligence (AI) and advancements in Industrial Internet of Things (IIoT). In next five years, virtually every human will come into touch with 3D printed products. Mind Commerce sees 3D Printing as an essential building block, along with 5G, AI, and IIoT in forming the 4th industrial revolution, commonly referred to as Industry 4.0.

The Smart Workplace is a concept powered by IoT technologies and solutions and is composed of smart workforce, intelligent environments, and smart components. There are many factors to consider including service robots, ubiquitous connectivity and communication technology, building automation and management systems, sensor equipped energy management systems, cloud and edge enabled infrastructure, mobile device management, wearable networks, intelligent software application, and many more.

Teleoperation and Telerobotics plays a profound role in industrial automation and the rapidly evolving industrial Internet of Things (IIoT) arena. Robots and remote control systems enable various industries to control real machines/equipment by virtual object through master controlling interfaces.

This is by far the most comprehensive IIoT research available. With hard data, keen insights, detailed qualitative analysis, and forecasts, Industrial IoT Market by IIoT Technology (5G, APIs, Databases), Device (Sensors, RFID, Robots, Smart Meters),



Software (Controls, Data Management, PLM), Application (3D Printing, Industrial Analytics, Process Automation, Smart Workplace, Teleoperation), Industry Vertical, and Geography is must reading for anyone within the manufacturing, industrial, and/or enterprise IoT space. All purchases of Mind Commerce reports includes time with an expert analyst who will help you link key findings in the report to the business issues you're addressing. This needs to be used within three months of purchasing the report.

# **Target Audience:**

Robotics companies

Telecom service providers

Manufacturing companies

Embedded systems companies

Wireless device manufacturers

Systems integration companies

Sensors and actuators suppliers

IoT and industrial service providers

Telecom and IT infrastructure suppliers



# **Contents**

Industrial Internet of Things (IIoT) Technologies, Solutions, and Services

#### 1 INTRODUCTION

- 1.1 Scope of Research
- 1.2 Target Audience
- 1.3 Key Findings in Report
- 1.4 Companies in Report

#### **2 EXECUTIVE SUMMARY**

- 2.1 IIoT Markets by Region 2017 2022
- 2.2 IIoT Global Markets by Products 2017 2022

#### **3 OVERVIEW**

- 3.1 Defining Industrial Internet of Things
  - 3.1.1 People, Processes, and Technology
  - 3.1.2 IIoT and People
  - 3.1.3 IIoT and Processes
  - 3.1.4 IIoT and Technologies
- 3.2 Critical Focal Areas for IIoT Execution
- 3.3 IIoT Application Areas
  - 3.3.1 Process Optimization
  - 3.3.2 Enhance, Integrate and Scale existing Corporate IT Systems
  - 3.3.3 Leverage Potential of Existing Infrastructure
- 3.4 Forming a Foundation for IIoT
  - 3.4.1 Industrial Internet Consortium
  - 3.4.2 Industry Leading Companies set the Pace
  - 3.4.3 Industry Test Beds for IIoT
  - 3.4.4 Industrial Internet Reference Architecture
- 3.5 Evaluating the Future Potential of IIoT
  - 3.5.1 Cyber-security is a Critical Concern with IIoT
  - 3.5.2 IIoT is Facilitating a Drive in Industrial Automation
  - 3.5.3 Early IIoT Deployments to Benefit Existing Industries
  - 3.5.4 IIoT will work in Collaboration to achieve Success
  - 3.5.5 IIoT and the Fourth Industry Revolution



- 3.5.6 IIoT to Facilitate Transition to Smart Factories
- 3.5.7 Connected Factory: New Roles for Suppliers and Customers
- 3.5.8 IIoT and Product Transformation to an "as a Service" Economy
- 3.5.9 Intelligent Manufacturing: From Smart Factories to Smarter Factories
- 3.5.10 Teleoperation and Tele-robotics
- 3.5.11 IIoT and Fifth Generation (5G) Wireless

#### **4 IIOT TECHNOLOGIES**

- 4.1 Hardware Technologies
  - 4.1.1 Hardware Development Platforms
  - 4.1.2 Smart Sensors
- 4.2 Software Technologies
  - 4.2.1 Connectivity Platforms
  - 4.2.2 Data Storage Platforms
  - 4.2.3 Data Analytics and Visualization Platforms
  - 4.2.4 IoT Protocols
    - 4.2.4.1 ZigBee
    - 4.2.4.2 Message Queuing Telemetry Transport (MQTT)
    - 4.2.4.3 XMPP Accelerates IoT
    - 4.2.4.4 AMQP is Provides Rich Capabilities for Distributed Systems
    - 4.2.4.5 DDS enables Network Interoperability in IoT
    - 4.2.4.6 Thread
  - 4.2.5 Next Generation Real Time Operating Systems (RTOS)
- 4.3 IIoT and Manufacturing Execution Systems (MES)
  - 4.3.1 Role and Importance with IIoT
  - 4.3.2 MES and Cyber-Physical Systems
  - 4.3.3 MES in the Cloud and other Convergence
  - 4.3.4 Future of IIoT Enabled MES
- 4.4 Network Technologies in IIoT
  - 4.4.1 Wireless Local Area Network
  - 4.4.2 Wireless Personal Area Network
  - 4.4.3 Wireless Sensor Network

#### 5 IIOT GLOBAL MARKET ANALYSIS AND FORECASTS 2017 - 2022

- 5.1 IIoT Markets by Region 2017 2022
- 5.2 IIoT Global Markets by Products Offered 2017 2022
  - 5.2.1 IIoT in Hardware in 2017 2022



- 5.2.1.1 Connectivity platforms
- 5.2.1.2 Sensor Infrastructures
- 5.2.1.3 Hardware Development Platforms
- 5.2.2 IIoT in Software in 2017 2022
- 5.2.2.1 Data Storage
- 5.2.2.2 Software Development Platforms and Apps
- 5.2.2.3 Data Analytics Platform
- 5.2.2.4 Cyber-security Solutions
- 5.2.3 IIoT in Services 2017 2022
  - 5.2.3.1 Cloud based Services
- 5.2.3.2 Management and Consulting Services
- 5.3 IIoT Global Markets by Industry Sector 2017 2022
- 5.3.1 IIoT Deployments in Manufacturing Sector 2017 2022
- 5.3.2 Healthcare in IIoT 2017 2022
- 5.3.3 Automotive Industry in IIoT 2017 2002
- 5.3.4 Retail Industry in IIoT 2017 2022
- 5.3.5 Oil and Gas Industry in IIoT 2017 2022
- 5.3.6 IIoT in Cargo and Logistic Sector 2017 2022
- 5.3.7 IIoT in Utilities Sector 2017 2022
- 5.3.8 IIoT in Hospitality Sector 2017 2022
- 5.4 Market for Teleoperation and Tele-robotics in IIoT 2016 2021
  - 5.4.1 IIoT Teleoperation and Tele-robotics Solutions by Segment 2016 2021
  - 5.4.2 IIoT Teleoperation and Tele-robotics Solutions by Region 2017 2022
  - 5.4.3 IIoT Teleoperation and Tele-robotics Solutions by Tech and App 2017 2022
  - 5.4.4 IIoT Teleoperation and Tele-robotics Solution by Industry Vertical 2017 2022
  - 5.4.5 Artificial Intelligence in IIoT Teleoperation and Tele-robotics Solutions

#### **6 COMPANY ANALYSIS**

- 6.1 AGT International
- 6.2 ARM Holdings
- 6.3 AT&T Inc.
  - 6.3.1 AT&T Machine to Machine Solutions
  - 6.3.2 AT&T M2X
- 6.4 B+B SmartWorx
- 6.5 Bayshore Networks
- 6.6 Bosch
  - 6.6.1 Bosch Connected Devices and Solutions GmbH
  - 6.6.2 Bosch Software Innovations: Bosch IoT Suite



- 6.7 Cisco System Inc.
  - 6.7.1 Cisco Industrial Networks
  - 6.7.2 Cisco Embedded Networks
  - 6.7.3 Management and Application Enablement
  - 6.7.4 Physical and Cyber Cyber-security
  - 6.7.5 Cisco IIoT Solutions
- 6.8 Contiki
- 6.9 Digi International
- 6.10 Echelon Corporation
- 6.10.1 Echelon's IzoT Platform
- 6.11 Elecsys Corporation
- 6.12 General Electric
  - 6.12.1 GE Predicitvity Solution
  - 6.12.2 GE Predix Platform
- 6.13 Jasper Technologies Inc. (Cisco)
- 6.14 Lynx Software Technologies, Inc.
- 6.15 Object Management Group (OMG)
  - 6.15.1 Data Distribution Service (DDS)
  - 6.15.2 Dependability Assurance Framework for Safety-Sensitive Consumer Devices
  - 6.15.3 Threat Modelling
  - 6.15.4 Structured Assurance Case Meta-model (SACM)
- 6.15.5 Unified Component Model for Distributed, Real-Time and Embedded Systems (UCM)
  - 6.15.6 Automated Source Code CWE-SANS Top 25-Based Cyber-security Measure
- 6.15.7 Oil and Gas Risk Management
- 6.16 OneM2M Partners
- 6.17 ParStream (Cisco)
- 6.18 RIOT
- 6.19 Real Time Innovation (RTI)
  - 6.19.1 RTI Connext DDS
  - 6.19.2 RTI Industrial IoT FastTrax Program
- 6.20 Sensata Technologies
- 6.21 Symantec
- 6.22 Unisys Corporation
- 6.23 Wind River
- 6.24 Worldsensing
- 6.25 Wovyn LLC.



# **List Of Figures**

#### **LIST OF FIGURES**

Figure 1	1: IIoT	Impact	on	Automation	and	<b>Processes</b>
----------	---------	--------	----	------------	-----	------------------

Figure 2: Four Pillars of IIoT Execution

Figure 3: IoT Framework

Figure 4: 5G and IIoT

Figure 5: Requirements for Wireless IIoT Access Technology

Figure 6: Hardware Systems used in IIoT

Figure 7: Software Solutions used in IIoT

Figure 8: Smart Sensor Components

Figure 9: Smart Sensor Model

Figure 10: Smart Sensor Model with Functional Partitioning

Figure 11: IoT Data Processing Flow

Figure 12: Sensor Node Components

Figure 13: Wireless Sensor Network Topologies

Figure 14: Global IIoT Market 2017 – 2022

Figure 15: IIoT Regional Markets 2017 – 2022

Figure 16: IIoT Deployments in Manufacturing Sector 2017 – 2022

Figure 17: IIoT Deployments in Manufacturing Sector by Region2017 – 2022

Figure 18: IIoT Deployments in Healthcare Sector 2017 – 2022

Figure 19: IIoT Deployments in Healthcare Sector by Region 2017 – 2022

Figure 20: IIoT Deployments in Automotive Sector 2017 – 2022

Figure 21: IIoT Deployments in Automotive Sector by Regions 2017 – 2022

Figure 22: IIoT Deployments in Retail Sector 2017 – 2022

Figure 23: IIoT Deployments in Retail Sector by Region 2017 – 2022

Figure 24: IIoT Deployments in Oil and Gas Sector 2017 – 2022

Figure 25: IIoT Deployments in Oil and Gas Sector by Region 2017 – 2022

Figure 26: IIoT Deployments in Cargo and Logistics Sector 2017 – 2022

Figure 27: IIoT Deployments in Cargo and Logistics Sector by Region 2017 – 2022

Figure 28: IIoT in Utilities Sector 2017 – 2022

Figure 29: IIoT in Utility Sector by Region 2017 – 2022

Figure 30: IIoT in Hospitality Sector 2017 – 2022

Figure 31: IIoT in Hospitality Sector by Region 2017 – 2022

Figure 32: Embedded Systems and IIoT

Figure 33: Managing Devices, Processes, and End-users in IIoT

Figure 34: IIoT Management Platform: Cloud, Connectivity, and Devices

Figure 35: Fourth Generation Automation Software





# **List Of Tables**

#### LIST OF TABLES

- Table 1: Leading Proprietary RTOS in Embedded Systems
- Table 2: Global IIoT Market 2017 2022
- Table 3: IIoT Regional Markets 2017 2022
- Table 4: IIoT Markets by Product Segment 2017 2022
- Table 5: IIoT Regional Markets by Product Sub-segment 2017 2022
- Table 6: Connectivity Platforms by Industry Sector 2017 -2022
- Table 7: Connectivity Platforms by Regions 2017 -2022
- Table 8: Sensor Infrastructure by Industry Sector 2017 -2022
- Table 9: Sensor Infrastructure by Region 2017 -2022
- Table 10: Hardware Platforms by Industry Sector 2017 -2022
- Table 11: Hardware Platforms by Region 2017 -2022
- Table 12: Data Storage by Industry Sector 2017 -2022
- Table 13: Data Storage by Region 2017 -2022
- Table 14: Software Development Platforms and Apps by Industry Sector 2017 -2022
- Table 15: Software Development Platforms and Apps by Region 2017 -2022
- Table 16: Data Analytics platform by Industry Sector 2017 -2022
- Table 17: Data Analytics platform by Region 2017 -2022
- Table 18: Cyber-security Solutions by Industry Sector 2017 -2022
- Table 19: Cyber-security Solutions by Region 2017 -2022
- Table 20: Cloud based Services by Industry Sector 2017 -2022
- Table 21: Cloud based Services by Region 2017 -2022
- Table 22: Management and Consulting Services by Industry Sector 2017 -2022
- Table 23: Management and Consulting Services by Region 2017 -2022
- Table 24: IIoT Global Markets for Industry Sector 2017 2022
- Table 25: IIoT Deployments in Manufacturing Sector 2017 2022
- Table 26: IIoT Deployments in Manufacturing Sector by Region 2017 2022
- Table 27: IIoT Deployments in Manufacturing Sector by Product sub-segment 2017 2022
- Table 28: IIoT Deployments in Healthcare Sector 2016 2021
- Table 29: IIoT Deployments in Healthcare Sector by Region 2017 2022
- Table 30: IIoT Deployments in Healthcare Sector by Product sub-segments 2017 2022
- Table 31: IIoT Deployments in Automotive Sector 2017 2022
- Table 32: IIoT Deployments in Automotive Sector by Region 2017 2022
- Table 33: IIoT Deployments in Automotive Sector by Product Sub-segment 2017 2022



- Table 34: IIoT Deployments in Retail Sector 2017 2022
- Table 35: IIoT Deployments in Retail Sector by Region 2017 2022
- Table 36: IIoT Deployments in Retail Sector by Product Sub-segment 2017 2022
- Table 37: IIoT Deployments in Oil and Gas Sector 2017 2022
- Table 38: IIoT Deployments in Oil and Gas Sector by Region 2017 2022
- Table 39: IIoT Deployments in Oil and Gas by Product Sub-segment 2017 2022
- Table 40: IIoT Deployments in Cargo and Logistics Sector 2017 2022
- Table 41: IIoT Deployments in Cargo and Logistics Sector by Region 2017 2022
- Table 42: IIoT Deployments in Cargo and Logistics Sector by Product Sub-segment 2017 2022
- Table 43: IIoT in Utility Sector 2017 2022
- Table 44: IIoT in Utility Sector by Region 2017 2022
- Table 45: IIoT in Utility Sector by Product Sub-segment 2017 2022
- Table 46: IIoT in Hospitality Sector 2017 2022
- Table 47: IIoT in Hospitality Sector by Region 2017 2022
- Table 48: IIoT in Hospitality Sector by Product Sub-segment 2017 2022
- Table 49: Teleoperation and Tele-robotics Solution by Segment 2017 2022
- Table 50: Teleoperation and Tele-robotics Solution Market by Region 2017 2022
- Table 51: Teleoperation and Tele-robotics by Sector/Tech/App 2017 2022
- Table 52: Teleoperation and Tele-robotics Solution by Industry Vertical 2017 2022
- Table 53: Al in Teleoperation and Tele-robotics Software Market
- Industrial IoT and 5G: Emerging Technologies, Solutions, Market Outlook and Forecasts

#### 1 INTRODUCTION

- 1.1 Why Industrial IoT and 5G?
- 1.2 Industrial IoT Platforms
- 1.3 Relationship between Industrial IoT and 5G
- 1.4 Industrial IoT: A View into the Period 2016 to 2020
- 1.5 5G as Key Enabler for IIoT Initiatives
- 1.6 5G Responsiveness to IIoT
- 1.7 Potential Contribution of Proprietary Platform
- 1.8 5G and Industrial Automation
- 1.9 5G to Enable Wireless IIoT Automation
- 1.10 5G for Industrial Internet Components
- 1.11 Role of Industrial Internet in IIoT Automation
- 1.12 Role of Mobile Edge Computing in IIoT and 5G
- 1.13 Role of Smart Grid in IIoT and 5G



- 1.14 Role of LPWAN Technology to IIoT
- 1.15 5G to Create News Business Model for IIoT
- 1.16 IIoT Security
- 1.17 IIoT and 5G: Where is the Money?
- 1.18 Virtual Reality, IIoT, and 5G
- 1.19 IIoT 5G Stakeholder Analysis
  - 1.19.1 Equipment Manufacturer
  - 1.19.2 Connectivity Solution Providers
  - 1.19.3 Proprietary Platform and IIoT Application Providers
  - 1.19.4 Data Analytics Providers
  - 1.19.5 Professional Service Providers
  - 1.19.6 Enterprise
  - 1.19.7 End Users

#### **2 IIOT 5G APPLICATION SCENARIOS**

- 2.1 Maritime Use Case
  - 2.1.1 Optimizing Route
  - 2.1.2 Tracking Assets
  - 2.1.3 Monitoring Equipment Remotely and Saving Costs
- 2.2 Oil and Gas Sector
- 2.3 Manufacturing Use Case
- 2.4 Mobile Cloud Robotics
- 2.5 Precision Agriculture
  - 2.5.1 OnFarm Solution
  - 2.5.2 AT&T, Telefonica, and Verizon to Precision Agriculture
- 2.6 City Waste Management
  - 2.6.1 Urbiotica Case
  - 2.6.2 Enevo
- 2.7 Food Waste Management
  - 2.7.1 Maersk Line Remote Container Management
- 2.8 Smart Buildings
  - 2.8.1 Honeywell Intelligent System to Olympics Stadium
- 2.9 Road Congestion Management
- 2.10 Efficient Energy Management
- 2.11 Enterprise Asset Management
- 2.12 Healthcare Applications
- 2.13 Shipping Automation
- 2.14 Autonomous Driving



- 2.15 Water Management
- 2.16 Aviation Management

#### **3 IIOT 5G MARKET FORECASTS**

- 3.1 Global Forecasts 2020 2025
  - 3.1.1 IIoT 5G Automation Market Value
    - 3.1.1.1 Market by Segment
    - 3.1.1.1.1 Hardware & Equipment Market by Types of Device
    - 3.1.1.2 Market by Industry Verticals
    - 3.1.1.3 Market by Technology Application
  - 3.1.2 Wireless IIoT 5G Device Deployments
    - 3.1.2.1 Deployment by Device Type
  - 3.1.2.2 Deployment by Industry Vertical
- 3.2 Regional Forecasts 2020 2025
  - 3.2.1 Market Value by Region
  - 3.2.2 Market Value by Leading Countries
  - 3.2.3 Deployment by Region
  - 3.2.4 Deployment by Leading Countries
  - 3.2.5 Europe Market Forecasts
- 3.2.5.1 Market Value by Segment, Devices, Industry Vertical, & Technology Application
  - 3.2.5.2 Deployment Base by Devices & Industry Vertical
  - 3.2.6 North America Market Forecasts
- 3.2.6.1 Market Value by Segment, Devices, Industry Vertical & Technology Application
  - 3.2.6.2 Deployment Base by Devices & Industry Vertical
  - 3.2.7 APAC Market Forecasts
- 3.2.7.1 Market Value by Segment, Devices, Industry Vertical & Technology Application
  - 3.2.7.2 Deployment Base by Devices & Industry Vertical

#### 4 INDUSTRIAL IOT 5G PLATFORMS, SOLUTIONS, AND INITIATIVES

- 4.1 Time Sensitive Networking
- 4.2 General Electric
  - 4.2.1 GE Predix
  - 4.2.2 GE Predictivity
  - 4.2.3 GE Partnership



- 4.2.3.1 Microsoft and GE
- 4.2.3.2 AT&T and GE
- 4.2.3.3 Cisco and GE Energy
- 4.2.3.4 Intel and GE
- 4.2.3.5 NTT DoCoMo and GE
- 4.2.3.6 HP and GE
- 4.2.3.7 BP and GE Oil & Gas
- 4.2.3.8 Paradigm and GE Oil & Gas
- 4.3 Qualcomm
  - 4.3.1 LTE IoT Connectivity Platform creating Path for 5G
  - 4.3.2 LTE Modem Solutions
- 4.4 Aware 360
  - 4.4.1 Real Time Monitoring Solution
- 4.4.2 Aware 360 with Gemalto for IIoT Connectivity & Analytics
- 4.5 KAA
- 4.6 XILINX
  - 4.6.1 Xilinx to Collaborate IIC for Common IIoT Framework
- 4.7 AT&T
  - 4.7.1 AT&T M2M Solution
    - 4.7.1.1 AT&T alliance with GE
  - 4.7.2 AT&T M2X Solution
  - 4.7.3 AT&T vEPC Network and Domain 2.
  - 4.7.4 AT&T 5G Trial and IIoT
- 4.8 Bosch
  - 4.8.1 Bosch IoT Suit
  - 4.8.2 Bosch IoT Cloud
  - 4.8.3 Bosch Connected Devices and Solutions GmbH (BCDS)
- 4.9 Cisco System
  - 4.9.1 Cisco IoT System
  - 4.9.2 Cisco Industrial Networking Solutions for IoT
  - 4.9.3 Cisco Embedded Networking Solution
  - 4.9.4 Cisco Security Solution
  - 4.9.5 Application Enablement Platform
  - 4.9.6 Cisco IoT Analytics
  - 4.9.7 Cisco Fog Computing
  - 4.9.8 Cisco's Acquisition of Jasper
- 4.10 Echelon Corporation
  - 4.10.1 Echelon IzoT Platform
  - 4.10.1.1 IzoT Enabled FT 6050 Chip



- 4.10.2 Industrial Control Networking Technologies
- 4.10.3 Xicato Demonstrate Intelligent Platform with Echelon
- 4.11 Object Management Group
  - 4.11.1 OMG Data Distribution Service
  - 4.11.2 Dependability Assurance Framework for Safety-Sensitive Consumer Devices
  - 4.11.3 Threat Modeling
  - 4.11.4 Structured Assurance Case Metamodel
  - 4.11.5 Unified Component Model for Distributed, Real-Time and Embedded Systems
  - 4.11.6 Automated Quality Characteristic Measures
  - 4.11.7 Interaction Flow Modeling Language
  - 4.11.8 OMG to Manage the Industrial Internet Consortium
  - 4.11.9 Automated Source Code Based Security Measure
  - 4.11.10 Oil and Gas Risk Management
- 4.12 Real Time Innovation
  - 4.12.1 RTI Connext DDS
  - 4.12.2 RTI IoT FastTrax Program
- 4.12.3 RTI to Support IIC Connected Care Testbed
- 4.12.4 RTI Alliance with National Instruments
- 4.13 Google
  - 4.13.1 Brillo and Weave
  - 4.13.2 Google Cloud Platform
  - 4.13.3 Google Glass in Telemedicine with CrowdOptic
- 4.14 Omron Corporation
- 4.15 BlackBerry
  - 4.15.1 BlackBerry IoT Platform
    - 4.15.1.1 QNX Software
- 4.16 Rockwell Automation
- 4.17 Honeywell International
  - 4.17.1 Honeywell Process Solution
  - 4.17.2 Honeywell Uniformance IIoT Suite
- 4.18 Fujitsu America
  - 4.18.1 GR AWARE Platform
  - 4.18.2 iMotion Edgeware Platform
  - 4.18.3 GYUHO SaaS
  - 4.18.4 UBIQUITOUSWARE Device
  - 4.18.5 CRATUS and Fujitsu
  - 4.18.6 Fujitsu Connected Enterprise Solution with SAP

### **5 CONCLUSIONS AND RECOMMENDATIONS**



- 5.1 Success Factors for IIoT in 5G
  - 5.1.1 Complex Ecosystem Management
  - 5.1.2 Accuracy in Analysis and Quantification
  - 5.1.3 Spectrum Management
  - 5.1.4 Building Data Trust

#### **LIST OF FIGURES**

- Figure 1: IIoT Platform Components
- Figure 2: IIoT 5G Requirements and Operational Diagram
- Figure 3: Requirements for Wireless IIoT Access Technology
- Figure 4: IIoT Technology to Optimize Route
- Figure 5: Mobile Cloud Robotics Functional Architecture
- Figure 6: Precision Agriculture Module to Monitor Water Flow
- Figure 7: OnFarm Dashboard for Precision Agriculture Analytics
- Figure 8: Honeywell Intelligent System for Building
- Figure 9: Vehicle to Everything (V2X) Framework for Autonomous Driving
- Figure 10: Global IIoT 5G Automation Market Value 2020 2025
- Figure 11: Global Wireless IIoT 5G Device Deployment Base 2020 2025
- Figure 12: KAA IIoT Middle Platform
- Figure 13: Bosch IoT Framework
- Figure 14: Bosch IoT Cloud Service Parameter and Modality
- Figure 15: Cisco IoT Service Portfolio
- Figure 16: Echelon FT 6050 Running on IzoT Platform
- Figure 17: OMG DDS Scalable Architecture: Edge to Fog to Cloud
- Figure 18: Google Cloud Platform Architecture
- Figure 19: Fujitsu Connected Enterprise Solution Phases

#### LIST OF TABLES

- Table 1: IIoT Platform Sub-Components
- Table 2: Global IIoT 5G Automation Market by Segment 2020 2025
- Table 3: Global IIoT 5G Hardware & Equipment Market by Types of Device 2020 2025
- Table 4: Global IIoT 5G Automation Market by Industry Vertical 2020 2025
- Table 5: Global IIoT 5G Automation Market by Technology Application 2020 2025
- Table 6: Global Wireless IIoT 5G Device Deployment by Types of Device 2020 2025
- Table 7: Global Wireless IIoT 5G Device Deployment by Industry Vertical 2020 2025
- Table 8: IIoT 5G Automation Market by Region 2020 2025



- Table 9: IIoT 5G Automation Market by Leading Countries 2020 2025
- Table 10: Wireless IIoT 5G Device Deployment by Region 2020 2025
- Table 11: Wireless IIoT 5G Device Deployment by Leading Countries 2020 2025
- Table 12: Europe IIoT 5G Automation Market by Segment 2020 2025
- Table 13: Europe IIoT 5G Hardware & Equipment Market by Types of Device 2020 2025
- Table 14: Europe IIoT 5G Automation Market by Industry Vertical 2020 2025
- Table 15: Europe IIoT 5G Automation Market by Technology Application 2020 2025
- Table 16: Europe Wireless IIoT 5G Deployment by Device Type 2020 2025
- Table 17: Europe Wireless IIoT 5G Device Deployment by Industry Vertical 2020 2025
- Table 18: North America IIoT 5G Automation Market by Segment 2020 2025
- Table 19: North America IIoT 5G Hardware & Equipment Market by Types of Device 2020 2025
- Table 20: North America IIoT 5G Automation Market by Industry Vertical 2020 2025
- Table 21: North America IIoT 5G Automation Market by Technology Application 2020 2025
- Table 22: North America Wireless IIoT 5G Deployment by Device Type 2020 2025
- Table 23: North America Wireless IIoT 5G Device Deployment by Industry Vertical 2020 2025
- Table 24: APAC IIoT 5G Automation Market by Segment 2020 2025
- Table 25: APAC IIoT 5G Hardware & Equipment Market by Device Type 2020 2025
- Table 26: APAC IIoT 5G Automation Market by Industry Vertical 2020 2025
- Table 27: APAC IIoT 5G Automation Market by Technology Application 2020 2025
- Table 28: APAC Wireless IIoT 5G Device Deployment by Device Type 2020 2025
- Table 29: APAC Wireless IIoT 5G Device Deployment by Industry Vertical 2020 2025
- Internet of Things API Marketplace: IoT API Use Cases, Solutions, Market Outlook

#### 1 EXECUTIVE SUMMARY

- 1.1 Importance of IoT APIs
- 1.2 Market Outlook in Brief

#### **2 API MANAGEMENT**

- 3.1 API Management Platform Components
  - 3.1.1 API Gateway
  - 3.1.2 API Developer Portal
  - 3.1.3 API Analytics
  - 3.1.4 API Monetization



- 3.2 API Management Considerations
  - 3.2.1 Core Capabilities
  - 3.2.2 Quality of Service Attributes
  - 3.2.3 Vendor Assessment
  - 3.2.4 People Criteria
- 2.2 IoT API Management Challenges
  - 2.2.1 Wide Range of Protocols
  - 2.2.2 Security Risks
  - 2.2.3 Mobility Issues
  - 2.2.4 Reliability Requirements
  - 2.2.5 Scalability Needs
  - 2.2.6 Interoperability Needs

#### 3 API MANAGEMENT TOOL PROVIDERS AND SOLUTIONS

- 3.1 3Scale
- 3.2 Akana
- 3.3 Alcatel-Lucent
- 3.4 API Axle
- 3.5 Apiary
- 3.6 Apify
- 3.7 Apigee
- 3.8 APIphany
- 3.9 Atmosphere
- 3.10 Axway
- 3.11 CA API Management
- 3.12 Cloud Elements
- 3.13 Cumula
- 3.14 Deployd
- 3.15 DreamFactory
- 3.16 Emergent One
- 3.17 Kasabi
- 3.18 Kong
- 3.19 Layer 7 Technologies
- 3.20 Mashape
- 3.21 Mashery
- 3.22 Nevatech Sentinet
- 3.23 REST United
- 3.24 Restlet



- 3.25 Socrata
- 3.26 StrongLoop
- 3.27 Swagger
- 3.28 Tyk
- 3.29 Vordel
- 3.30 WebServius
- 3.31 WSO2

#### **4 IOT API MARKET DRIVERS**

- 4.1 Access to IoT Platforms, Devices, Gateways, and More
- 4.2 IoT and Data as a Service (IoTDaaS)
  - 4.2.1 Data as a Service (DaaS)
  - 4.2.2 DaaS Federation
  - 4.2.3 DaaS and IoT
- 4.3 IoT Mediation
  - 4.3.1 IoT Platform to Platform Mediation
  - 4.3.2 IoT Platform to Device Mediation
  - 4.3.3 IoT Device to Device Mediation

#### **5 MONETIZING IOT APIS**

- 5.1 IoT API Business Models
  - 5.1.1 Peer Support of Platforms, Devices, and Gateways
  - 5.1.2 Supporting the API Developer Community
  - 5.1.3 Data and Database Transactions
- 5.2 IoT APIs and Data
  - 5.2.1 IoT API support in Data Management
    - 5.2.1.1 IoT Data Ownership
    - 5.2.1.2 IoT Data Care of Custody
    - 5.2.1.3 IoT APIs support Unstructured Data Challenges
- 5.3 IoT APIs Monetized through IoT Mediation
  - 5.3.1 IoT APIs support Identity
  - 5.3.2 IoT APIs support Permission
  - 5.3.3 IoT APIs support Device Discovery

# **6 IOT API FORECASTS 2017 - 2022**

6.1 Global IoT API Revenue 2017 - 2022



- 6.1.1 IoT API Revenue
- 6.1.2 IoT API Revenue by Types of IoT APIs
- 6.1.3 IoT API Revenue by Application Sectors
- 6.1.4 IoT API Revenue by API Category
- 6.1.5 IoT API Revenue by Industry Vertical
- 6.1.5.1 Automotive Services IoT API Revenue
- 6.1.5.2 Smart City Services IoT API Revenue
- 6.1.5.3 Healthcare Services IoT API Revenue
- 6.1.5.4 Industrial Services IoT API Revenue
- 6.1.5.5 Consumer Services IoT API Revenue
- 6.1.5.6 Military and Aerospace Services IoT API Revenue
- 6.2 Regional IoT API Revenue 2017 2022
  - 6.2.1 IoT API Revenue in Region
- 6.2.2 North America Revenue: IoT API Type, App, Category, Industry Vertical, and Country
  - 6.2.3 APAC Revenue: IoT API Type, App, Category, Industry Vertical, and Country
  - 6.2.4 Europe Revenue: IoT API Type, App, Category, Industry Vertical, and Country
- 6.2.5 Latin America Revenue: IoT API Type, App, Category, Industry Vertical, and Country
- 6.2.6 MEA Revenue Forecast: IoT API Type, App, Category, Industry Vertical, and Country

#### 7 CONCLUSIONS AND RECOMMENDATIONS

#### **8 APPENDIX**

- 8.1 IoT Protocols and Standards
  - 8.1.1 Infrastructure
    - 8.1.1.1 IPv6
    - 8.1.1.2 6LoWPAN
    - 8.1.1.3 6TiSCH
    - 8.1.1.4 6Lo
  - 8.1.1.5 IPv6 over G.9959
  - 8.1.1.6 IPv6 over Bluetooth Low Energy
  - 8.1.1.7 UDP
  - 8.1.1.8 QUIC
  - 8.1.1.9 Aeron
  - 8.1.1.10 uIP (Micro-IP)
  - 8.1.1.11 DTLS



- 6.1.1 RPL
  - 8.1.1.12 NanolP
  - 8.1.1.13 Content-Centric Networking
  - 8.1.1.14 TSMP
- 8.1.2 Discovery
  - 8.1.2.1 mDNS
  - 8.1.2.2 HyperCat
  - 8.1.2.3 UPnP
- 8.1.3 Data Protocols
  - 8.1.3.1 MQTT
  - 8.1.3.2 MQTT-SN
  - 8.1.3.3 CoAP
  - 8.1.3.4 SMCP
  - 8.1.3.5 STOMP
  - 8.1.3.6 XMPP
  - 8.1.3.7 Mihini/M3DA
  - 8.1.3.8 AMQP
  - 8.1.3.9 DDS
  - 8.1.3.10 JMS
  - 8.1.3.11 LLAP
  - 8.1.3.12 LWM2M
  - 8.1.3.13 Reactive Streams
  - 8.1.3.14 SSI
  - 8.1.3.15 REST
  - 8.1.3.16 HTTP/2
  - 8.1.3.17 SOAP
  - 8.1.3.18 JSON
  - 8.1.3.19 WebHooks
  - 8.1.3.20 Jelastic
  - 8.1.3.21 MongoDB
  - 8.1.3.22 Websocket
  - 8.1.3.23 OPC
- 8.1.4 Communication / Transport Layer
  - 8.1.4.1 Ethernet
  - 8.1.4.2 DigiMesh
  - 8.1.4.3 ISA100.11a
  - 8.1.4.4 IEEE 802.15.4
  - 8.1.4.5 WirelessHART
  - 8.1.4.6 NFC



- 8.1.4.7 ANT
- 8.1.4.8 Bluetooth
- 8.1.4.9 Bluetooth Low Energy
- 8.1.4.10 Eddystone
- 8.1.4.11 ZigBee
- 8.1.4.12 Zigbee Smart Energy
- 8.1.4.13 DASH7
- 8.1.4.14 Z-Wave
- 8.1.4.15 HomePlug
- 8.1.4.16 G.9959
- 8.1.4.17 LTE-A
- 8.1.4.18 EnOcean
- 8.1.4.19 WiFi
- 8.1.4.20 IEEE 802.11 AH
- 8.1.4.21 WiMAX
- 8.1.4.22 Non-Cellular LPWAN
- 8.1.4.23 NB-IoT
- 6.1.2 LTE-MTC
  - 8.1.4.24 EC-GSM-IoT
  - 8.1.4.25 DECT/ULE
  - 8.1.4.26 RPMA
- 8.1.5 Semantic
  - 8.1.5.1 IOTDB
  - 8.1.5.2 SensorML
  - 8.1.5.3 Semantic Sensor Net Ontology W3C
  - 8.1.5.4 Wolfram Language Connected Devices
  - 8.1.5.5 RAML
  - 8.1.5.6 SENML
  - 8.1.5.7 LsDL
- 8.1.6 Multi-layer Frameworks
- 6.1.3 Alljoyn
  - 8.1.6.1 IoTivity
  - 8.1.6.2 IEEE P2413
  - 8.1.6.3 Thread
  - 8.1.6.4 IPSO Application Framework
  - 8.1.6.5 Weave
  - 8.1.6.6 OMA LightweightM2M v1.
  - 8.1.6.7 Telehash
- 8.1.7 Security



- 8.1.7.1 Open Trust Protocol
- 8.1.7.2 X.509
- 8.1.7.3 MAC 802.15.4
- 8.1.7.4 RPL
- 8.1.7.5 Application Layer
- 8.1.8 Vertical Specific Standards
  - 8.1.8.1 IEEE 1451
  - 8.1.8.2 IEEE 1888.3-2013
  - 8.1.8.3 IEEE 1905.1-2013
  - 8.1.8.4 IEEE 802.16p-2012
  - 8.1.8.5 IEEE P1828
  - 8.1.8.6 IEEE P1856
- 8.1.9 IoT Management
  - 8.1.9.1 IEEE 1905.1
- 8.1.9.2 Smart Transducer Interface
- 8.2 IoT API Solutions
  - 8.2.1 AT&T M2X Keys API
  - 8.2.2 Interpair API
  - 8.2.3 Kaa Admin API
  - 8.2.4 Meshblu API
  - 8.2.5 Particle API
  - 8.2.6 SenseloT API
  - 8.2.7 Weaver API
  - 8.2.8 Sensorberg API
  - 8.2.9 IOStash IoT PaaS API
  - 8.2.10 Mnubo API
  - 8.2.11 DeviceHub API
  - 8.2.12 Predix Time Series API
  - 8.2.13 Wia API
  - 8.2.14 Meeti API
  - 8.2.15 Omega Ricochet API
  - 8.2.16 Paraimpu API
  - 8.2.17 Temboo API
  - 8.2.18 Netbeast API
  - 8.2.19 Google Weave API
  - 8.2.20 URX App Search API
  - 8.2.21 Amazon Alexa Voice Service API
  - 8.2.22 Bt.tn API
  - 8.2.23 thingk.me API



- 8.2.24 Mojio API
- 8.2.25 PSA Group Connected Car API
- 8.2.26 Muzzley API
- 8.2.27 Amazon Alexa Smart Home Skills API
- 8.2.28 Telematic REST API
- 8.2.29 Beebotte API
- 8.2.30 scriptr.io API
- 8.2.31 The Beacon Registry API
- 8.2.32 Predix Traffic Planning API
- 8.2.33 the Things. IO REST API
- 8.2.34 littleBits Cloud API
- 8.2.35 Konekt API
- 8.2.36 CloudRail API
- 8.2.37 Predix Asset Data API
- 8.2.38 ClearBlade API
- 8.2.39 Samsung ARTIK Cloud API
- 8.2.40 Beagle Sense API
- 8.2.41 CubeSensors API
- 8.2.42 GardenKit API
- 8.2.43 Thinking Things API
- 8.2.44 Arrow Intelligent Services API
- 8.2.45 Pinoccio API
- 8.2.46 VIMOC Technologies API
- 8.2.47 Scio API
- 8.2.48 Nest API
- 8.2.49 Neura API
- 8.2.50 Space Bunny API
- 8.2.51 Netatmo API
- 8.2.52 Angus.ai API
- 8.2.53 Sense Tecnic WoTkit API
- 8.2.54 OGC SensorThings API
- 8.2.55 OpenSensors API
- 8.2.56 Brivo Labs SAM API
- 8.2.57 Carvoyant API
- 8.2.58 Illiri API
- 8.2.59 ThingPark API
- 8.3 IoT APIs in Industry Verticals and Functional Areas
  - 8.3.1 3D
  - 6.1.4 Body Labs BodyKit Instant API



- 8.3.2 Advertising
  - 8.3.2.1 Roq.ad Cross-Device User Identification API
- 8.3.3 Analytics
  - 8.3.3.1 MoBagel API
- 8.3.4 API Management
  - 8.3.4.1 APIBond API
- 8.3.5 Application Development
  - 8.3.5.1 Zatar API
  - 8.3.5.2 Telepat API
  - 8.3.5.3 Relayr API
  - 8.3.5.4 AT&T M2X Distribution API
  - 8.3.5.5 AT&T M2X MQTT API
- 8.3.6 Audio
  - 8.3.6.1 W3C Web MIDI API
- 8.3.7 Augmented Reality
- 8.3.7.1 Thalmic Myo API
- 8.3.8 Auto
  - 8.3.8.1 Caruma API
  - 8.3.8.2 Automile API
  - 8.3.8.3 Autodata Motorcycle API
  - 8.3.8.4 Dash Chassis API
  - 8.3.8.5 Unofficial Tesla Model S API
  - 8.3.8.6 Dash Mobile API
  - 8.3.8.7 Vinli API
- 8.3.9 Automation
  - 8.3.9.1 SNAP PAC REST API
  - 8.3.9.2 IJENKO IoE<sup>2</sup> IoT API
  - 8.3.9.3 SmartThings API
  - 8.3.9.4 Ubidots API
- 8.3.10 Backend
  - 8.3.10.1 Kuzzle API
  - 8.3.10.2 Sidecar Event API
  - 8.3.10.3 Xively API
  - 8.3.10.4 THIL API
- 8.3.11 Unstructured Data
  - 8.3.11.1 Orange Datavenue API
- 8.3.12 Business
  - 8.3.12.1 xMatters API
- 8.3.13 Cameras



- 8.3.13.1 Google Open Spherical Camera API
- 8.3.14 Classification
- 8.3.14.1 MyTagList API
- 8.3.15 Cloud
  - 8.3.15.1 MODE API
  - 8.3.15.2 SIGFOX API
- 8.3.16 Data
  - 8.3.16.1 Chain API
  - 8.3.16.2 HPE Haven OnDem and Retrieve Config API
  - 8.3.16.3 Sierra Wireless AirVantage API
- 8.3.17 Data-as-a-Service
  - 8.3.17.1 Fencer API
  - 8.3.17.2 myCloudData API
- 8.3.18 Demographics
  - 8.3.18.1 Cara API
- 8.3.19 eCommerce
  - 8.3.19.1 Estimote API
- 8.3.20 Energy
  - 8.3.20.1 Know Watt API
- 8.3.21 Enterprise
  - 8.3.21.1 GroveStreams API
  - 8.3.21.2 Scout API
  - 8.3.21.3 Smart Citizen API
- 8.3.22 Environment
  - 8.3.22.1 Safecast API
- 8.3.23 Fax
  - 8.3.23.1 Telecoms Cloud API
- 8.3.24 Home Automation
  - 8.3.24.1 MicroBees API
  - 8.3.24.2 Lelylan API
  - 8.3.24.3 Myfox API
  - 8.3.24.4 Sensorist API
  - 8.3.24.5 Dog Gateway API
  - 8.3.24.6 Insteon API
  - 8.3.24.7 Istabai API
- 8.3.24.8 Loggamera Heatpump API
- 8.3.24.9 Pimatic REST API
- 8.3.24.10 Wink App API
- 8.3.24.11 Indigo Domotics API



- 8.3.24.12 Apple HomeKit API
- 8.3.24.13 Lockitron API
- 8.3.24.14 Okidokeys API
- 8.3.25 Lists
  - 8.3.25.1 Amazon List Skills API
- 8.3.26 Location
  - 8.3.26.1 Garmin Communicator Plugin API
  - 8.3.26.2 LotaData API
  - 8.3.26.3 Kontakt.io API
  - 8.3.26.4 BeaconsInSpace API
- 8.3.27 Machine-to-Machine
  - 8.3.27.1 DeviceHive API
  - 8.3.27.2 CoSwitched API
- 8.3.28 Management
  - 8.3.28.1 InstaUnite API
- 8.3.29 Marketing
  - 8.3.29.1 Poken API
- 8.3.30 Marketplace
  - 8.3.30.1 OpenChannel Marketplace API
- 8.3.31 Medical
  - 8.3.31.1 Withings API
- 8.3.32 Messaging
  - 8.3.32.1 UnificationEngine API
- 8.3.33 Messaging
  - 8.3.33.1 Matrix API
- 8.3.34 Monitoring
  - 8.3.34.1 Pulseway REST API
  - 8.3.34.2 energyhive API
- 8.3.35 Motion
  - 8.3.35.1 Motion Shadow API
  - 8.3.35.2 Sense360 API
- 8.3.36 Music
- 6.1.5 ickStream API
  - 8.3.36.1 Livio Connect API
- 6.1.6 Sonos Music API
- 8.3.37 NoSQL
  - 8.3.37.1 Couchbase API
- 8.3.38 Notifications
- 8.3.38.1 Mojio Push API



- 8.3.39 Optimization
  - 8.3.39.1 Minme API
- 8.3.40 Other
  - 8.3.40.1 Pebble API
  - 8.3.40.2 yetu API
  - 8.3.40.3 TalkBack API
  - 8.3.40.4 BITalino API
  - 8.3.40.5 electric imp API
  - 8.3.40.6 ThingSpeak API
  - 8.3.40.7 Pachube API
- 8.3.41 Pets
  - 8.3.41.1 FitBark API
- 8.3.42 Robots
  - 8.3.42.1 NAOqi Sensors API
- 8.3.43 Science
  - 8.3.43.1 ThinkEco API
- 8.3.44 Search
  - 8.3.44.1 Reposify API
  - 8.3.44.2 Shodan API
- 8.3.45 Security
  - 8.3.45.1 ncryptify API
  - 8.3.45.2 SecureDB accounts API
  - 8.3.45.3 Miracl API
  - 8.3.45.4 Codeproof MDM API
  - 8.3.45.5 Nymi API
- 8.3.46 Storage
- 8.3.46.1 Verizon Personal Cloud Storage API
- 8.3.47 Telephony
  - 8.3.47.1 DeviceIdentifier API
  - 8.3.47.2 Tweakker API
  - 8.3.47.3 PushBug API
- 8.3.48 Tools
  - 8.3.48.1 Craft.ai API
  - 8.3.48.2 Solutecia API
  - 8.3.48.3 METAQRCODE API
  - 8.3.48.4 Instacount API
  - 8.3.48.5 ecobee API
  - 8.3.48.6 ioBridge API
  - 8.3.48.7 Spark Devices API



- 8.3.48.8 Miri Device Description API
- 8.3.48.9 SwiftKey API
- 8.3.48.10 Arrayent API
- 8.3.48.11 W3C Generic Sensor API
- 8.3.49 Transportation
  - 8.3.49.1 PlugShare Station API
- 8.3.49.2 CarmaLink GPS API
- 8.3.50 Voice
  - 8.3.50.1 Houndify API
- 8.3.51 Wearable
- 8.3.51.1 Myle API
- 8.3.51.2 Garmin Connect API
- 8.3.51.3 Misfit API
- 8.3.51.4 Sony Lifelog API
- 8.3.52 Weather
  - 8.3.52.1 PressureNet.io API
  - 8.3.52.2 Planet OS API
  - 8.3.52.3 BloomSky API
- 8.4 IoT API Standardization Efforts
  - 8.4.1 GSMA
  - 8.4.2 Open Alliance for IoT Standard
  - 8.4.3 oneM2M
  - 8.4.4 Others
  - 8.4.5 Important Considerations

#### **LIST OF FIGURES**

- Figure 1: The IoT Stack
- Figure 2: Distributed Computing in IoT
- Figure 3: Artificial Intelligence in IoT Edge Computing
- Figure 4: APIs Enable Data Access and Exchange
- Figure 5: IoT Data Exchange Marketplace
- Figure 6: IoT Platform Functionality
- Figure 7: IoT Device Management Platforms
- Figure 8: Global IoT Data as a Service (IoTDaaS) Revenue
- Figure 9: IoTDaaS Topology
- Figure 10: IoTDaaS Data Flow
- Figure 11: Data as a Service Functions
- Figure 12: Mediation between Cloud and Telephony



- Figure 13: Mediation of Location Information
- Figure 14: Mediation between Telecom and Enterprise
- Figure 15: Leveraging APIs for IoT Mediation
- Figure 16: IoT APIs and Mediation with Smart Grid
- Figure 17: IoT API support of Platform to Platform
- Figure 18: IoT API support of Platform to Device
- Figure 19: IoT API support of Device to Device
- Figure 20: Phase One: Limited IoT Data Sharing without Formalized Mediation
- Figure 21: Phase Two: IoT Data Sharing between Limited Industries
- Figure 22: Phase Three: Broadly shared IoT Data across Industries and between
- Figure 23: Direct and Indirect IoT API Monetization
- Figure 24: APIs support Physical to Cyber World Communications
- Figure 25: IoT API supports Data Care of Custody
- Figure 26: IoT API supports BDaaS/IoTDaaS
- Figure 27: Need for Authority Data and Mediation in IoT
- Figure 28: IoT API support of Identity Management
- Figure 29: IoT API support of Permission Mediation
- Figure 30: IoT APIs facilitates Permissions Hierarchy
- Figure 31: IoT APIs facilitate Device Discovery
- Figure 32: Global IoT API Revenue 2017 2022

#### LIST OF TABLES

- Table 1: Global IoT API Revenue by Types of APIs 2017 2022
- Table 2: Global IoT API Revenue by Application Sector 2017 2022
- Table 3: Global IoT API Revenue by API Category 2017 2022
- Table 4: Global IoT API Revenue by Industry Vertical 2017 2022
- Table 5: Global IoT API Revenue by Automotive Services 2017 2022
- Table 6: Global IoT API Revenue by Smart City Services 2017 2022
- Table 7: Global IoT API Revenue by Healthcare Services 2017 2022
- Table 8: Global IoT API Revenue by Industrial Services 2017 2022
- Table 9: Global IoT API Revenue by Consumer Services 2017 2022
- Table 10: Global IoT API Revenue by Military & Aerospace Services 2017 2022
- Table 11: IoT API Revenue in Region 2017 2022
- Table 12: North America IoT API Revenue by Types of APIs 2017 2022
- Table 13: North America IoT API Revenue by Application Sector 2017 2022
- Table 14: North America IoT API Revenue by API Category 2017 2022
- Table 15: North America IoT API Revenue by Industry Vertical 2017 2022
- Table 16: North America IoT API Revenue by Automotive Services 2017 2022



- Table 17: North America IoT API Revenue by Smart City Services 2017 2022
- Table 18: North America IoT API Revenue by Healthcare Services 2017 2022
- Table 19: North America IoT API Revenue by Industrial Services 2017 2022
- Table 20: North America IoT API Revenue by Consumer Services 2017 2022
- Table 21: North America IoT API Revenue by Military & Aerospace Services 2017 2022
- Table 22: North America IoT API Revenue by Country 2017 2022
- Table 23: APAC IoT API Revenue by Types of APIs 2017 2022
- Table 24: APAC IoT API Revenue by Application Sector 2017 2022
- Table 25: APAC IoT API Revenue by API Category 2017 2022
- Table 26: APAC IoT API Revenue by Industry Vertical 2017 2022
- Table 27: APAC IoT API Revenue by Automotive Services 2017 2022
- Table 28: APAC IoT API Revenue by Smart City Services 2017 2022
- Table 29: APAC IoT API Revenue by Healthcare Services 2017 2022
- Table 30: APAC IoT API Revenue by Industrial Services 2017 2022
- Table 31: APAC IoT API Revenue by Consumer Services 2017 2022
- Table 32: APAC IoT API Revenue by Military & Aerospace Services 2017 2022
- Table 33: APAC IoT API Revenue by Country 2017 2022
- Table 34: Europe IoT API Revenue by Types of APIs 2017 2022
- Table 35: Europe IoT API Revenue by Application Sector 2017 2022
- Table 36: Europe IoT API Revenue by API Category 2017 2022
- Table 37: Europe IoT API Revenue by Industry Vertical 2017 2022
- Table 38: Europe IoT API Revenue by Automotive Services 2017 2022
- Table 39: Europe IoT API Revenue by Smart City Services 2017 2022
- Table 40: Europe IoT API Revenue by Healthcare Services 2017 2022
- Table 41: Europe IoT API Revenue by Industrial Services 2017 2022
- Table 42: Europe IoT API Revenue by Consumer Services 2017 2022
- Table 43: Europe IoT API Revenue by Military & Aerospace Services 2017 2022
- Table 44: Europe IoT API Revenue by Country 2017 2022
- Table 45: Latin America IoT API Revenue by Types of APIs 2017 2022
- Table 46: Latin America IoT API Revenue by Application Sector 2017 2022
- Table 47: Latin America IoT API Revenue by API Category 2017 2022
- Table 48: Latin America IoT API Revenue by Industry Vertical 2017 2022
- Table 49: Latin America IoT API Revenue by Automotive Services 2017 2022
- Table 50: Latin America IoT API Revenue by Smart City Services 2017 2022
- Table 51: Latin America IoT API Revenue by Healthcare Services 2017 2022
- Table 52: Latin America IoT API Revenue by Industrial Services 2017 2022
- Table 53: Latin America IoT API Revenue by Consumer Services 2017 2022
- Table 54: Latin America IoT API Revenue by Military & Aerospace Services 2017 –



#### 2022

Table 55: Latin America IoT API Revenue by Country 2017 – 2022

Table 56: MEA IoT API Revenue by Types of APIs 2017 – 2022

Table 57: MEA IoT API Revenue by Application Sector 2017 – 2022

Table 58: MEA IoT API Revenue by API Category 2017 – 2022

Table 59: MEA IoT API Revenue by Industry Vertical 2017 - 2022

Table 60: MEA IoT API Revenue by Automotive Services 2017 – 2022

Table 61: MEA IoT API Revenue by Smart City Services 2017 – 2022

Table 62: MEA IoT API Revenue by Healthcare Services 2017 – 2022

Table 63: MEA IoT API Revenue by Industrial Services 2017 – 2022

Table 64: MEA IoT API Revenue by Consumer Services 2017 - 2022

Table 65: MEA IoT API Revenue by Military & Aerospace Services 2017 - 2022

Table 66: MEA IoT API Revenue by Country 2017 – 2022

IoT Database Infrastructure and DB Services

# **1 EXECUTIVE SUMMARY**

#### 2 IOT DATABASE INFRASTRUCTURE AND DB SERVICES

- 2.1 IoT Database Infrastructure
  - 2.1.1 IoT Identity Management Database
  - 2.1.2 IoT Permissions Database
  - 2.1.3 IoT Discovery Database
- 2.2 DB Support of IoT Orchestration and Mediation
- 2.3 DB Support of IoT AAA Services
  - 2.3.1 IoT Authentication
    - 2.3.1.1 Methods and Procedures
    - 2.3.1.2 Establishing and Maintaining Trust
  - 2.3.2 IoT Authorization
  - 2.3.3 IoT Accounting
- 2.4 IoT DB Support of IoT Identity Management
  - 2.4.1 Identify Network Elements
  - 2.4.2 Identify Consumer, Enterprise, and Industrial Devices
  - 2.4.3 Identify Actors: Consumer, Producer, Service Provider
  - 2.4.4 Identify Data, Data Users, and Data Uses
  - 2.4.5 IoT Identity Management and AAA as a Service
- 2.5 IoT DB Support of IoT Data Management and Analytics
  - 2.5.1 IoT Data Management Requirements
  - 2.5.2 IoT Data Market



- 2.5.3 IoT Data as a Service
- 2.5.4 IoT Analytics as a Service
- 2.5.5 IoT Decisions as a Service
- 2.6 IoT DB Registry and Transaction Services
  - 2.6.1 Identity Registry and IDoT as a Service
  - 2.6.2 IoT Authentication DB Services
  - 2.6.3 IoT Authorization DB Services
  - 2.6.4 IoT Accounting DB Services
  - 2.6.5 IoT Data and Analytics DB Services
  - 2.6.6 IoT Device Registry and DB Services
  - 2.6.7 IoT Device Registry and IoT Identity Registry Relationship
  - 2.6.8 IoT DB Services in Support of IoT Platforms
  - 2.6.9 Monitoring Activity and Reporting Performance against SLA
  - 2.6.10 IoT Infrastructure Ecosystem as a Whole

# 3 IOT DATABASE INFRASTRUCTURE AND SERVICE FORECAST 2017 - 2022

- 3.1 Global Market Forecast 2017 2022
  - 3.1.1 Market by Segment and Sub-Segment
    - 3.1.1.1 Software and Application
    - 3.1.1.2 Services
  - 3.1.1.3 Infrastructure Device and Equipment
  - 3.1.2 Market by Database Type
  - 3.1.3 Market by Deployment Management & Cloud Types
  - 3.1.4 Market by Business Model
  - 3.1.5 Market by IoT Market Category
  - 3.1.6 Market by Industry Vertical
- 3.2 Regional Market Forecast 2017 2022
  - 3.2.1 APAC Market Forecast 2017 2022
    - 3.2.1.1 Segment and Sub-Segment
    - 3.2.1.2 Types of Database
    - 3.2.1.3 Types of Deployment Management
    - 3.2.1.4 Business Model
    - 3.2.1.5 Application Category
    - 3.2.1.6 Industry Vertical
    - 3.2.1.7 Market by Country
  - 3.2.2 Europe Market Forecast 2017 2022
    - 3.2.2.1 Segment and Sub-Segment
    - 3.2.2.2 Types of Database



- 3.2.2.3 Deployment Management
- 3.2.2.4 Business Model
- 3.2.2.5 IoT Application Category
- 3.2.2.6 Industry Vertical
- 3.2.2.7 Market by Country
- 3.2.3 North America Market Forecast 2017 2022
- 3.2.3.1 Segment and Sub-Segment
- 3.2.3.2 Types of Database
- 3.2.3.3 Deployment Management
- 3.2.3.4 Business Model
- 3.2.3.5 IoT Application Category
- 3.2.3.6 Industry Verticals
- 3.2.3.7 Market by Country
- 3.2.4 Latin America Market Forecast 2017 2022
- 3.2.4.1 Segment and Sub-Segment
- 3.2.4.2 Types of Database
- 3.2.4.3 Deployment Management
- 3.2.4.4 Business Model
- 3.2.4.5 IoT Application Category
- 3.2.4.6 Industry Vertical
- 3.2.4.7 Market by Country
- 3.2.5 Middle East & Africa Market Forecast 2017 2022
  - 3.2.5.1 Segment & Sub-Segment
  - 3.2.5.2 Types of Databases
  - 3.2.5.3 Deployment Management
  - 3.2.5.4 Business Model
  - 3.2.5.5 IoT Application Category
- 3.2.5.6 Industry Verticals
- 3.2.5.7 Market by Country

#### 4 CONCLUSIONS AND RECOMMENDATIONS

#### **5 APPENDIX**

- 5.1 Telecom and Computing Data
  - 5.1.1 Data Types
    - 5.1.1.1 Evolution of Data and Databases
    - 5.1.1.2 Structured, Unstructured, and Hybrid Data
    - 5.1.1.3 Transactional vs. Non-Transactional Data



- 5.1.2 Data Sources
- 5.1.3 Data Management Challenges
  - 5.1.3.1 Data Fragmentation
  - 5.1.3.2 Data Governance and Master Data Management
- 5.2 Data Services in Telecom and Computing
  - 5.2.1 Database Role in Support of Apps and Services
  - 5.2.2 Data as a Service (DaaS)
    - 5.2.2.1 Carriers to Leverage Structured and Unstructured Data
    - 5.2.2.2 Carriers Access to Continuous Data Feeds
    - 5.2.2.3 Carriers to Capture from Social Systems and Merge with Own Data
- 5.3 Database Technologies
  - 5.3.1 Database Access and Signalling
    - 5.3.1.1 Lightweight Directory Access Protocol (LDAP)
    - 5.3.1.2 Session Initiation Protocol (SIP)
    - 5.3.1.3 Signaling System Seven (SS7)
- 5.4 Telecom and Computing Databases
  - 5.4.1 Prepaid Communications, Content, and Commerce
  - 5.4.2 Toll Free Calling Database
  - 5.4.3 Calling Name Database
  - 5.4.4 Line Information Database (LIDB)
  - 5.4.5 Network Operator Subscriber Data Management (SDM) Databases
  - 5.4.6 Presence Management and Databases
  - 5.4.7 Location Management Infrastructure and Databases
    - 5.4.7.1 Location vs. Presence
    - 5.4.7.2 Location Management
  - 5.4.8 Number Portability and Number Pooling Systems and Databases
  - 5.4.9 Inter-carrier Messaging (MMS and SMS) Databases
    - 5.4.9.1 Short Messaging Service (SMS)
    - 5.4.9.2 Multimedia Messaging Service (MMS)
  - 5.4.10 Electronic Number (ENUM)
  - 5.4.11 Service Delivery Platforms (SDP)
  - 5.4.12 IMS Architecture, Framework, and Databases
    - 5.4.12.1 IMS Planes
    - 5.4.12.2 IMS Network Elements
    - 5.4.12.3 IMS Designed to Support NGN Services
  - 5.4.13 Other Databases
    - 5.4.13.1 RFID Databases
    - 5.4.13.2 Calling Party Pays Database
    - 5.4.13.3 Do Not Call Database



#### 5.4.13.4 Robo Call Databases

#### LIST OF FIGURES

Figure	1: lo	「Database	Infrastructure
--------	-------	-----------	----------------

Figure 2: IoT Identity Database

Figure 3: IoT Permissions Database

Figure 4: IoT Identity and Permissions Database Interactions

Figure 5: IoT Discovery Database

Figure 6: IoT Mediation

Figure 7: IoT Device Discovery Dashboard

Figure 8: IoT Device Discovery and Control via Smartphone

Figure 9: IoT Device Discovery and Control via Wearable Technology

Figure 10: IDoT Deployment Types

Figure 11: IoT Data Management

Figure 12: Managing IoT Data vs. Other Unstructured Data

Figure 13: IoT Data Management and Analytics Flow

Figure 14: IoT Data as a Service

Figure 15: Al Support of IoT Authorization and Monitoring

Figure 16: IoT Identity Registry

Figure 17: IoT Owners and Networks Register

Figure 18: IoT Identity Registry and Transaction Services

Figure 19: Identity Registry vs. Device Registry

Figure 20: IoT Virtual Identity Database

Figure 21: IoT Authentication Services

Figure 22: IoT Authorization Services

Figure 23: IoT Data and Analytics DB Services

Figure 24: IoT ID and Device Registry Relationship

Figure 25: IoT DB Services in Support of IoT Platforms

Figure 26: Performance Monitoring and SLA Reporting

Figure 27: IoT Orchestration and Mediation Ecosystem

Figure 28: Global IoT Database Infrastructure & Service Market 2017 - 2022

Figure 29: Big Data Value Chain

Figure 30: Data Fragmentation

Figure 31: DaaS for Network Operators

Figure 32: Merging Social, Network, and Behavior Data

Figure 33: Merging Network Operator, Enterprise, and Other Data

Figure 34: Query/Response System

Figure 35: Roaming in Cellular Networks



Figure 36: Location-based Billing

Figure 37: WIN based Prepay Call Flow

Figure 38: Universal Prepay

Figure 39: Toll Free Calling

Figure 33: Calling Name in Wireless Networks

Figure 41: Calling Name Presentation with WIN Call Flow

Figure 42: WIN Call Flow with Query to Calling Party DB

Figure 43: SDM Ecosystem

Figure 37: Unified Presence Server

Figure 45: Presence with LTE

Figure 46: Passive vs. Active and Autonomous vs. Non-Autonomous Presence

Figure 47: Next Generation App Leveraging Presence

Figure 48: Next Generation App Integration with Presence Server

Figure 49: Hierarchical and Recursive Presence and Location

Figure 50: Control Plane Location

Figure 51: Control Plane support of Enhanced 9-1-1 Calling

Figure 52: Control Plane in GSM Networks

Figure 53: Combined ANSI and GSM Control Planes

Figure 54: User Plane Location

Figure 48: Number Portability Administration

Figure 56: Number Portability Call Routing

Figure 57: Inter-Carrier SMS Messaging

Figure 58: MMS Functional Elements

Figure 59: Traditional Network Topology

Figure 60: Network Topology with IMS

Figure 61: IMS Planes

Figure 62: IMS Services Plane

Figure 63: IMS Control Plane

Figure 64: IMS Transport Plane

Figure 65: Enhanced Phone Book

Figure 66: Presence and Location support of Enhanced Phonebook

Figure 67: Social Media Integration with Enhanced Phonebook

Figure 68: Services Blending

Figure 69: WebRTC Framework

#### LIST OF TABLES

Table 1: Global IoT Database Infrastructure & Service Market by Segment 2017 - 2022

Table 2: Global IoT Database Infrastructure & Service Market by Software & Application



2017 - 2022

Table 3: Global IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 4: Global IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 5: Global IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 6: Global IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 7: Global Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 8: Global IoT Database Infrastructure & Service Market by Business Model 2017 - 2022

Table 9: Global IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 10: Global IoT Database Infrastructure & Service Market by Industry Vertical 2017 - 2022

Table 11: IoT Database Infrastructure & Service Market by Region 2017 - 2022

Table 12: APAC IoT Database Infrastructure & Service Market by Segment 2017 - 2022

Table 13: APAC IoT Database Infrastructure & Service Market by Software & Application 2017 - 2022

Table 14: APAC IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 15: APAC IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 16: APAC IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 17: APAC IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 18: APAC Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 19: APAC IoT Database Infrastructure & Service Market by Business Model 2017 - 2022

Table 20: APAC IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 21: APAC IoT Database Infrastructure & Service Market by Industry Vertical 2017 - 2022

Table 22: APAC IoT Database Infrastructure & Service Market by Country 2017 - 2022

Table 23: Europe IoT Database Infrastructure & Service Market by Segment 2017 -



#### 2022

Table 24: Europe IoT Database Infrastructure & Service Market by Software & Application 2017 - 2022

Table 25: Europe IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 26: Europe IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 27: Europe IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 28: Europe IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 29: Europe Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 30: Europe IoT Database Infrastructure & Service Market by Business Model 2017 - 2022

Table 31: Europe IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 32: Europe IoT Database Infrastructure & Service Market by Industry Vertical 2017 - 2022

Table 33: Europe IoT Database Infrastructure & Service Market by Country 2017 - 2022

Table 34: North America IoT Database Infrastructure & Service Market by Segment 2017 - 2022

Table 35: North America IoT Database Infrastructure & Service Market by Software & Application 2017 - 2022

Table 36: North America IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 37: North America IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 38: North America IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 39: North America IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 40: North America Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 41: North America IoT Database Infrastructure & Service Market by Business Model 2017 - 2022

Table 42: North America IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 43: North America IoT Database Infrastructure & Service Market by Industry



Vertical 2017 - 2022

2017 - 2022

Table 44: North America IoT Database Infrastructure & Service Market by Country 2017 - 2022

Table 45: Latin America IoT Database Infrastructure & Service Market by Segment 2017 - 2022

Table 46: Latin America IoT Database Infrastructure & Service Market by Software & Application 2017 - 2022

Table 47: Latin America IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 48: Latin America IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 49: Latin America IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 50: Latin America IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 51: Latin America Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 52: Latin America IoT Database Infrastructure & Service Market by Business Model 2017 - 2022

Table 53: Latin America IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 54: Latin America IoT Database Infrastructure & Service Market by Industry Vertical 2017 - 2022

Table 55: Latin America IoT Database Infrastructure & Service Market by Country 2017 - 2022

Table 56: MEA IoT Database Infrastructure & Service Market by Segment 2017 - 2022 Table 57: MEA IoT Database Infrastructure & Service Market by Software & Application

Table 58: MEA IoT Database Infrastructure & Service Market by Types of Services 2017 - 2022

Table 59: MEA IoT Database Infrastructure & Service Market by Infrastructure Device & Equipment 2017 - 2022

Table 60: MEA IoT Database Infrastructure & Service Market by Database Types 2017 - 2022

Table 61: MEA IoT Database Infrastructure & Service Market by Deployment Management 2017 - 2022

Table 62: MEA Cloud Hosted & Managed IoT Database Infrastructure & Service Market by Cloud Types 2017 - 2022

Table 63: MEA IoT Database Infrastructure & Service Market by Business Model 2017 -



#### 2022

Table 64: MEA IoT Database Infrastructure & Service Market by Application Category 2017 - 2022

Table 65: MEA IoT Database Infrastructure & Service Market by Industry Vertical 2017 - 2022

Table 66: MEA IoT Database Infrastructure & Service Market by Country 2017 - 2022

Table 67: Signaling System Seven (SS7) vs. Internet Protocol (IP)

Table 68: Traditional PSTN vs. Internet Capabilities Comparison

Sensors and Intelligent End-point Devices in IoT

#### 1 INTRODUCTION

- 1.1 Scope
- 1.2 Target Audience
- 1.3 Companies in Report

#### **2 EXECUTIVE SUMMARY**

#### 3 OVERVIEW

- 3.1 Sensors are the Key Enablers for IoT
- 3.2 Role of Sensors in IoT
- 3.3 Smart Sensors and Intelligent Endpoints
  - 3.3.1 Intelligence at the Edge of the Network
  - 3.3.2 Key Differentiations of Smart Sensors
- 3.4 High Potential Smart Sensor Applications
  - 3.4.1 Smart Home
  - 3.4.2 Smart Buildings and Enterprise Automation
  - 3.4.3 Smart Cities
  - 3.4.4 Smart Manufacturing
  - 3.4.5 Smart Industrial Processes

#### 4 SENSOR TECHNOLOGY AND DEVELOPMENTS

- 4.1 Architecture of Conventional Sensor
- 4.2 Smart Sensor Architecture
  - 4.2.1 Transducer Electronic Data Sheets (TEDS)
  - 4.2.2 Smart Transducer Interface Module and Network Capable Application Processor
- 4.3 Wireless Sensor Networks (WSN)



- 4.3.1 Sensor Nodes
- 4.3.2 WSN Topologies
- 4.3.3 Applications and Challenges
- 4.4 Virtual / Soft Sensors, Multi-sensing, and Sensor Fusion
- 4.5 Role of WSN and Sensor Fusion in IoT
  - 4.5.1 IoT Protocols used in WSN
    - 4.5.1.1 ZigBee Alliance
    - 4.5.1.2 Z-Wave Alliance
    - 4.5.1.3 Insteon
    - 4.5.1.4 Digital Living Network Alliance (DLNA)
    - 4.5.1.5 Thread
- 4.6 Sensor Analytics
- 4.6.1 Data Visualization
- 4.6.2 Data Infrastructure Issues
- 4.6.3 Sensor and Intelligent Endpoint Analytics

#### 5 SENSORS AND INTELLIGENT ENDPOINT OUTLOOK AND FORECASTS

- 5.1 Smart Sensors Demand 2016 2021
- 5.2 Intelligent Automation a Key Market Driver for Smart Sensors
- 5.3 Demand for Sensors by Industry Category 2016 2021
- 5.4 EMEA to Lead the Regional Markets for IoT Sensors through 2021

#### **6 FUTURE OF SENSORS IN IOT**

- 6.1 Sensor Data Management and IoT Security/Privacy
  - 6.1.1 Sensor Data Management
  - 6.1.2 Sensors and IoT Services and Infrastructure Mediation
- 6.2 Roadmap to One Trillion Sensors
  - 6.2.1 Opportunity for Sensor Manufacturers
  - 6.2.2 Demand for Short Range Sensors to Realize Brisk Growth
  - 6.2.3 Opportunity for Systems-on-Chip (SoC) Fabricators
  - 6.2.4 Use of IPV6 brings New Opportunities from Massive Connectivity

## **7 COMPANIES AND SOLUTIONS**

- 7.1 365 Agile Limited (365 Agile Group Plc)
- 7.2 Ambig Micro
- 7.3 B+B SmartWorx



- 7.4 Bosch Connected Devices and Solutions GmbH (BCDS)
- 7.5 Digi International
- 7.6 Fairchild Semiconductors International
- 7.7 LeddarTech Inc.
- 7.8 Nanjing IoT Sensor Technology Co., Ltd.
- 7.9 NYCE Sensors Inc.
- 7.10 Open Sensors Ltd.
- 7.11 Sensata Technologies
- 7.12 Seraphim Sense Ltd.
- 7.13 Silicon Laboratories, Inc.
- 7.14 Texas Instruments Inc.
- 7.15 Worldsensing
- 7.16 Wovyn LLC.

#### **LIST OF FIGURES**

- Figure 1: Fog Computing in IoT
- Figure 2: Fog Computing and Managing Intelligent Endpoint Data
- Figure 3: Elements of Traditional Sensor
- Figure 4: Elements of Smart Sensor
- Figure 5: Smart Sensor Model
- Figure 6: Smart Sensor Model with Functional Partitioning
- Figure 7: Sensor Node Components
- Figure 8: Wireless Sensor Network Topologies
- Figure 9: Sensor and Intelligent Endpoint Analytics
- Figure 10: Global IoT Markets 2016 2021
- Figure 11: Global Opportunity Forecast for Development of Smart Sensors 2016 2021
- Figure 12: Markets for Smart Sensors by IoT Type 2016 2021
- Figure 13: Markets for Sensor by Industry Category 2015 and 2020 (%)
- Figure 14: Demand for Sensor by Industry Category 2015 and 2020 (%)
- Figure 15: Markets for IoT Smart Sensors by Region 2016 2021
- Figure 16: IoT Infrastructure, Platform, and Software Mediation
- Figure 17: Phase One: Limited IoT Data Sharing without Formalized Mediation
- Figure 18: Phase Two: IoT Data Sharing between Limited Industries
- Figure 19: Phase Two: Broadly shared IoT Data across Industries and between
- Competitors

#### LIST OF TABLES



- Table 1: Overview of TEDs
- Table 2: Global IoT Markets 2016 2021
- Table 3: Global Opportunity Forecast for Development of Smart Sensors 2016 2021
- Table 4: Markets for Smart Sensors by IoT Type 2016 2021
- Table 5: Markets for Smart Sensors by Industry Sector 2016 2021
- Table 6: Markets for IoT Smart Sensors by Region 2016 2021
- Internet of Things (IoT) Software Market

#### 1 INTRODUCTION

- 1.1.1 Scope of Research
- 1.1.2 Target Audience
- 1.1.3 Company Coverage

#### **2 EXECUTIVE SUMMARY**

#### **3 OVERVIEW**

- 3.1 Introduction to IoT
- 3.2 IoT Segmentation
  - 3.2.1 The Consumer IoT
    - 3.2.1.1 Connected Home Entertainment Devices
    - 3.2.1.2 Connected Home Security and Monitoring Devices
    - 3.2.1.3 Connected Home Energy Conservation Devices
    - 3.2.1.4 Connected Home Utility Monitoring Devices
    - 3.2.1.5 Connected Car
    - 3.2.1.6 Wearables
  - 3.2.2 Industrial IoT (IIoT)
    - 3.2.2.1 Smart Manufacturing
    - 3.2.2.2 Smart Utility
    - 3.2.2.3 Smart Tracking
    - 3.2.2.4 Smart Instrumentation in Oil and Gas Industry
    - 3.2.2.5 Smart Healthcare
- 3.3 Overall Market for IoT 2016 2021

#### **4 IOT ECOSYSTEM**

- 4.1 Global Forecast for IoT Ecosystem by Segment 2016 2021
- 4.2 Regional Markets for IoT Ecosystem 2016 2021



#### **5 IOT SOFTWARE**

- 5.1 Defining IoT Software
- 5.2 Core Use of Software in IoT
  - 5.2.1 Connecting
    - 5.2.1.1 Connectivity Platforms
    - 5.2.1.2 IoT Protocols
      - 5.2.1.2.1 ZigBee
      - 5.2.1.2.2 OASIS MQTT (Message Queuing Telemetry Transport)
      - 5.2.1.2.3 XMPP (Extensible Messaging and Presence Protocol)
      - 5.2.1.2.4 OASIS AMQP (Advanced Message Queuing Protocol)
      - 5.2.1.2.5 Data Distribution Service (DDS)
      - 5.2.1.2.6 Thread
  - 5.2.2 Collecting
  - 5.2.3 Analyzing and Delivering
- 5.3 Supporting Software in IoT
  - 5.3.1 Software Development Kits (SDKs)
  - 5.3.2 Cloud Platforms
    - 5.3.2.1 Fog Computing and Cloud Platforms
  - 5.3.3 Security Solutions for IoT
  - 5.3.4 IoT Applications

#### **6 IOT AND OEM SYSTEMS**

- 6.1.1 Key Job Function of Implementation Partners
- 6.1.2 IoT Raises Importance of VARs, SIs, and ISVs
- 6.2 Demand for Industry Vertical Specialists Implementation Partners will Increase

#### 7 GLOBAL IOT SOFTWARE AND OEM SYSTEM MARKET 2016 - 2021

- 7.1 Global IoT Software Market 2016 2021
  - 7.1.1 Global IoT Software Market Growth at 11.9% CAGR through 2021
- 7.1.2 Global IoT Software Market License Type Breakdown in 2021
- 7.2 Regional Markets for IoT Software 2016 2021
- 7.3 Markets for IoT Software by Sales Channel 2016 2021
- 7.4 Markets for OEM Software by Channel Partners 2016 2021
- 7.5 OEM IoT Software Market by Deployment Model (Cloud / On Premise) 2016 2021



## **8 COMPANY COVERAGE**

- 8.1 Aeris Communications
- 8.2 AGT International
- 8.3 Amdocs
- 8.4 Ayla Networks
- 8.5 Bayshore Networks
- 8.6 Bosch Software innovations: Bosch IoT Suite
- 8.7 Cisco
- 8.8 Contiki
- 8.9 GE Digital
- 8.10 Jasper (Cisco)
- 8.11 Lynx Software Technologies, Inc.
- 8.12 MachineShop Inc.
- 8.13 MongoDB Inc.
- 8.14 NEC Corporation
- 8.15 Netgem
- 8.16 Oregan Networks Ltd.
- 8.17 ParStream (Cisco)
- 8.18 RIOT
- 8.19 SmartThings
- 8.20 Symantec
- 8.21 Unisys Corporation
- 8.22 Wind River
- 8.23 Xively (LogMeIn Inc.)

#### **LIST OF FIGURES**

- Figure 1: Global IoT Markets 2016 2021
- Figure 2: IoT Vendor Ecosystem
- Figure 3: IoT Markets by Segment of Ecosystem 2016 2021
- Figure 4: IoT Ecosystem: Market by Region 2016 2021
- Figure 5: Core Use of Software in IoT
- Figure 6: Framework for Big Data in IoT
- Figure 7: Fog Computing and IoT
- Figure 8: IoT Software Distribution Channels
- Figure 9: IoT Software Global Market 2016 2021
- Figure 10: Regional Markets for IoT Software 2016 2021
- Figure 11: IoT Software Markets by Sales Channel 2016 2021



- Figure 12: IoT Software Markets by Device Manufacturers 2016 2021
- Figure 13: IoT Software Markets by CSPs and ISPs 2016 2021
- Figure 14: IoT Software Markets by ISV, VAR, and SI Companies 2016 2021
- Figure 15: IoT Software Markets by Data and Analytics Providers 2016 2021
- Figure 16: IoT Software Markets by OEM Sales Channel 2016 2021
- Figure 17: OEM IoT Software Markets by Deployment Model 2016 2021
- Figure 18: IoT OEM Software Stack
- Figure 19: IoT Software Solution Stack Ecosystem

## **LIST OF TABLES**

- Table 1: Global IoT Markets 2016 2021
- Table 2: IoT Markets by Segment (H/W, S/W, Services, Devices) 2016 2021
- Table 3: IoT Ecosystem: Market by Region 2016 2021
- Table 4: IoT Security Challenges and Solutions at a Glance
- Table 5: Global IoT Software Market 2016 2021
- Table 6: Regional Markets for IoT Software 2016 2021
- Table 7: IoT Software Markets by Sales Channel 2016 2021
- Table 8: IoT Software Markets by OEM Sales Channel 2016 2021
- Table 9: OEM IoT Software Markets by Deployment Model 2016- 2021
- IoT Data Management and Analytics Market

#### 1 INTRODUCTION

- 1.1 Research Background
- 1.2 Research Scope
- 1.3 Target Audience
- 1.4 Companies Covered

#### **2 EXECUTIVE SUMMARY**

#### **3 OVERVIEW**

- 3.1 IoT Data in the Emerging Data Economy
  - 3.1.1 IoT Data Strategy
  - 3.1.2 IoT and the Analytics of Things
  - 3.1.3 Specific Strategic Considerations
    - 3.1.3.1 Focus on Data Tiers
    - 3.1.3.2 Maintain a Value-based Approach



- 3.1.3.3 Foster an Open Development Environment
- 3.2 Understanding IoT Data
  - 3.2.1 IoT Data vs. other Unstructured Data
  - 3.2.2 Key IoT Data Characteristics
    - 3.2.2.1 IoT Data is Real Time
    - 3.2.2.2 Massive Volumes of IoT Data
    - 3.2.2.3 IoT Data Generates Useful Insights
- 3.3 IoT Data Management Operations
  - 3.3.1 Basic Data Implementation and Operational Challenges
    - 3.3.1.1 IoT Data Scalability
    - 3.3.1.2 IoT Data Integration
  - 3.3.2 Data Management and Processing Raw Data
  - 3.3.3 Centralized Storage and Decentralized Processing
  - 3.3.4 Accessing and Exchanging IoT Data via APIs
  - 3.3.5 Data Security and Personal Information Privacy
- 3.4 Monetizing IoT Data and Analytics
  - 3.4.1 IoT Data vs. IoT Data Analytics
    - 3.4.1.1 IoT Data
  - 3.4.1.2 IoT Data Analytics
  - 3.4.2 Key IoT Data Management Monetization Issues
    - 3.4.2.1 IoT Data Ownership
  - 3.4.2.2 IoT Data Care of Custody
  - 3.4.3 Direct vs. Indirect Monetization
  - 3.4.4 Internal vs. External Enterprise IoT Data Monetization
    - 3.4.4.1 Enterprise Data and Analytics: Internal Monetization
    - 3.4.4.2 Enterprise Data and Analytics: External Monetization
  - 3.4.5 Public Data Monetization
  - 3.4.6 Hybrid IoT Monetization
  - 3.4.7 Emerging IoT Data Management and Analytics Marketplace
    - 3.4.7.1 IoT Data as a Service
    - 3.4.7.2 IoT Data Analytics as a Service
    - 3.4.7.3 Decisions as a Service
- 3.5 Related Monetization Areas
  - 3.5.1 IoT OSS and BSS
    - 3.5.1.1 IoT Operational Support Systems
    - 3.5.1.2 IoT Billing Support Systems
  - 3.5.2 IoT Mediation and Orchestration
  - 3.5.2.1 IoT Mediation and Orchestration Functionality
    - 3.5.2.1.1 IoT Mediation and Orchestration: Virtualization



- 3.5.2.1.2 IoT Mediation and Orchestration: Identity Management
- 3.5.2.1.3 Emerging Technologies for IoT Mediation and Orchestration
- 3.5.2.2 IoT Mediation and Orchestration in Support of Industry Verticals
- 3.5.2.3 Communication Service Provider Role in IoT Mediation and Orchestration Ecosystem
  - 3.5.2.4 IoT Mediation and Orchestration Roadmap
- 3.6 Market Outlook for IoT Data Analytics
  - 3.6.1 IoT Data Management is a Ubiquitous Opportunity across Enterprise
  - 3.6.2 IoT Data becomes a Big Revenue Opportunity by 2021
  - 3.6.3 Organizations increasing Adopt Predictive Analytics with IoT Data
- 3.6.4 Real-time Streaming IoT Data Analytics becoming a Substantial Business Opportunity
- 3.6.5 Intelligent Strategy and Smart Investment in IoT Data Analytics
- 3.6.6 IoT Data to Produce Substantial Operational Savings and Generate New Business
- 3.6.7 Tools Designed Specifically for IoT Data Management and Analytics
- 3.6.8 IoT Data Management and Analytics Roadmap 2016 to 2025
  - 3.6.8.1 IoT Data Landscape from 2016 to 2018
  - 3.6.8.2 IoT Data Landscape from 2019 to 2020
  - 3.6.8.3 IoT Data Landscape from 2021 to 2025

## **4 IOT DATA PLATFORM PROVIDERS**

- 4.1 Amdocs
- 4.2 AppCarousel
- 4.3 City Data Exchange
- 4.4 Horadata
- 4.5 Interdigital
- 4.6 RedKnee
- 4.7 Terbine
- 4.8 Tilepay

#### **5 TECHNOLOGIES ENABLING IOT DATA**

- 5.1 Present Technologies are Not Suitable for IoT Data
- 5.1.1 Enhanced Tools needed for Machine Generated Data in IoT
- 5.1.2 Advantages and Limitations of Hadoop in IoT Data
- 5.2 Technologies Specially Developed for IoT Data
- 5.2.1 Emerging Unified Logging Layer Approach



- 5.2.2 Will JSON be Most Adopted Data Format for IoT Devices?
- 5.2.3 Leading IoT Protocols
- 5.2.3.1 OASIS MQTT Ver. 3.1.1 Emerging as Fundamental Enabler for IoT

## **Applications**

- 5.2.3.2 XMPP Increases its Suitability for IoT
- 5.2.3.3 AMQP Provides Rich Capabilities for Distributed Systems
- 5.2.3.4 DDS enables IoT Network Interoperability
- 5.2.4 Analytics Platforms and Cloud based Data Storage for IoT Data
  - 5.2.4.1 AGT offers IoTA a Cloud based Analytics Platform for IoT
  - 5.2.4.2 AT&T's M2X: Cloud-based Data Storage Service and Management Toolset
  - 5.2.4.3 Bosch IoT Suit 2. offers BDP for IoT Data Analysis
- 5.2.4.4 Cisco IOX Framework and Fog Computing: Compute and Analyze Data at the Edge
  - 5.2.4.5 GE Software Launched 24 Predictivity Solutions and GE Predix Platform
  - 5.2.4.6 Intel Provides Cloud based Analytics System for IoT
  - 5.2.4.7 MongoDB released Ver. 3.3.11 Database System
  - 5.2.4.8 ParStream (Cisco) New Version of Analytics Platform
  - 5.2.4.9 Connext DDS Comprehensive Messaging Platform

## 6 GLOBAL IOT DATA MARKET ANALYSIS AND FORECASTS 2016 - 2021

- 6.1 IoT Data Market Outlook
  - 6.1.1 Analytics for IoT Applications
- 6.1.2 IoT Data Processing and Analysis Pilots to Predominate through 2018
- 6.2 Market Outlook and Forecasts for IoT Data 2016 2021
  - 6.2.1 Full Fledged Deployments to Accelerate from 3Q 2018 through 2021
- 6.3 Investment in IoT Data 2016 2021
  - 6.3.1 IoT Data by Region 2016 2021
  - 6.3.2 IoT Data Analytics Services
  - 6.3.3 IoT Data Products 2016 2021
- 6.3.3.1 High Demand for Platforms Providing Full Stack IoT Data Functionality through 2021
  - 6.3.3.2 Single Product Platforms for IoT Data poised for Rapid Growth
    - 6.3.3.2.1 Deployment of Data Collection Solutions 2016 2021
    - 6.3.3.2.2 Deployment of Data Storage 2016 2021
    - 6.3.3.2.3 Deployment of Data Analytics 2016 2021
  - 6.3.3.3 IoT Data Management Support Software a Major Growth Opportunity Area
  - 6.3.4 Cloud vs. On-Premise IoT Data Platform Deployment 2016 2021
  - 6.3.5 Streaming IoT Data Analytics Revenue 2016 2021



- 6.3.5.1 Global Streaming Data Analytics Revenue for IoT
- 6.3.5.1 Global Streaming IoT Data Analytics Revenue by App, Software, and Services
  - 6.3.5.1 Global Streaming IoT Data Analytics Revenue in Industry Verticals
    - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Retail
    - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Telecom and IT
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Energy and Utility
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Government
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Healthcare and Life Science
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Manufacturing
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Transportation & Logistics
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Banking and Finance
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Smart Cities
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Automotive
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Education
  - 6.3.5.1.1 Streaming IoT Data Analytics Revenue in Outsourcing Services
  - 6.3.5.1 Streaming IoT Data Analytics Revenue by Leading Vendor Platform
  - 6.3.6 Global Investment in IoT Data by Industry Sector 2016 2021
    - 6.3.6.1 Healthcare Sector IoT Data Investment 2016 2021
    - 6.3.6.2 Substantial Revenue Potential for Retail Sector in Monetizing IoT Data
- 6.3.6.3 Healthy Growth in Manufacturing Sector due to Industrial Automation and IoT Data
  - 6.3.6.4 Investments by HVAC Industry in IoT 2016 2021
  - 6.3.6.5 Investments by Oil & Cargo Industry in IoT 2016 2021
  - 6.3.6.6 Investments in IoT Data by Transport & Cargo Industry in IoT 2016 2021
  - 6.3.6.7 Investments in IoT Data by Utility Industry in IoT 2016 2021
  - 6.3.7 IoT Data as a Service Prospects through 2021
- 6.4 IoT Data Infrastructure ROI Assessment
  - 6.4.1 Factors Determining ROI for IoT
  - 6.4.2 ROI for IoT Investments by Industrial Sector
    - 6.4.2.1 ROI Assessment for IoT Data in the Retail Sector
    - 6.4.2.2 ROI Assessment for IoT Data in the Healthcare Sector

#### **7 VENDOR ANALYSIS**

- 7.1 Key Vendor Trends in IoT Data
- 7.2 Large Companies to Lead through M&A and Partnerships
- 7.2.1 Early Beneficiaries: Established Companies in Analytics and Cloud Services
- 7.2.2 Flexible and Scalable Revenue Model will be Most Successful



- 7.3 Select Company Analysis
  - 7.3.1 Accenture
  - 7.3.2 AGT International
  - 7.3.3 Bosch Software Innovations
  - 7.3.4 Capgemini
  - 7.3.5 Cisco Systems, Inc.
  - 7.3.6 GE Digital
  - 7.3.7 Google
  - 7.3.8 Intel Corporation
  - 7.3.9 Lynx Software Technologies, Inc.
  - 7.3.10 Maana, Inc.
  - 7.3.11 Microsoft Corporation
  - 7.3.12 MongoDB Inc.
  - 7.3.13 ParStream (ParStream Cisco)
  - 7.3.14 PTC
  - 7.3.15 RIOT
  - 7.3.16 SAP SE
  - 7.3.17 SQLstream, Inc.
  - 7.3.18 Tellient
  - 7.3.19 Teradata Corporation
  - 7.3.20 Wind River

## **8 CONCLUSIONS AND RECOMMENDATIONS**

#### 9 APPENDIX

- 9.1 Regional Streaming IoT Data Analytics Revenue 2016 2021
  - 9.1.1 Revenue in Region
  - 9.1.2 APAC Market Revenue
  - 9.1.3 Europe Market Revenue
  - 9.1.4 North America Market Revenue
  - 9.1.5 Latin America Market Revenue
  - 9.1.6 ME&A Market Revenue
- 9.2 Streaming IoT Data Analytics Revenue by Country 2016 2021
  - 9.2.1 Revenue by APAC Countries
    - 9.2.1.1 Leading Countries
    - 9.2.1.2 Japan Market Revenue
    - 9.2.1.3 China Market Revenue
    - 9.2.1.4 India Market Revenue



- 9.2.1.5 Australia Market Revenue
- 9.2.2 Revenue by Europe Countries
  - 9.2.2.1 Leading Countries
  - 9.2.2.2 Germany Market Revenue
  - 9.2.2.3 UK Market Revenue
- 9.2.2.4 France Market Revenue
- 9.2.3 Revenue by North America Countries
  - 9.2.3.1 Leading Countries
  - 9.2.3.2 US Market Revenue
  - 9.2.3.3 Canada Market Revenue
- 9.2.4 Revenue by Latin America Countries
  - 9.2.4.1 Leading Countries
  - 9.2.4.2 Brazil Market Revenue
- 9.2.4.3 Mexico Market Revenue
- 9.2.5 Revenue by ME&A Countries
  - 9.2.5.1 Leading Countries
  - 9.2.5.2 South Africa Market Revenue
- 9.2.5.3 UAE Market Revenue

#### **LIST OF FIGURES**

- Figure 1: IT and OT IoT Data Merge
- Figure 2: IoT Data Strategy impacts Architecture
- Figure 3: A Vision of IoT Data by 2021
- Figure 4: IoT Data vs. Non-IoT Unstructured Data
- Figure 5: IoT Data Processing Flow
- Figure 6: Distributed IoT Data Architecture
- Figure 7: IoT Data Not Stored Only
- Figure 8: Real-time IoT Data Management and Analytics
- Figure 9: APIs enable IoT Data Access and Exchange
- Figure 10: Security in IoT Data Architecture
- Figure 11: IoT Data Care of Custody
- Figure 12: Direct vs. Indirect IoT Data Monetization
- Figure 13: Internal vs. External IoT Data Monetization
- Figure 14: Merging IoT Data Sources Hybrid Data
- Figure 15: IoT Data Exchange Marketplace
- Figure 16: IoT Mediation Architecture
- Figure 17: IoT Identity Database Functionality
- Figure 18: IoT Permissions Database



- Figure 19: IoT Permissions Hierarchy
- Figure 20: IoT Device Discovery and Alerting
- Figure 21: IoT Device Discovery Dashboard
- Figure 22: Smartphone Alert of Blocked IoT Connection Attempt
- Figure 23: Smart Watch Alert of Blocked IoT Connection Attempt
- Figure 24: IoT Mediation and Virtual Control of Real Objects
- Figure 25: IoT Mediation in Industry Verticals
- Figure 26: Phase One: Limited IoT Data Sharing without Formalized Mediation
- Figure 27: Phase Two: IoT Data Sharing between Limited Industries
- Figure 28: Phase Three: Broadly shared IoT Data across Industries and between

## Competitors

- Figure 29: Inclusion of Predictive Models in Streaming IoT Data Analytics
- Figure 30: Streaming IoT Data Sources Compared
- Figure 31: Comparison of IoT Data Analytics Investment Focus
- Figure 32: IoT Data Analytics Technology and Tool Choice in Enterprise
- Figure 33: IoT Data Operational Savings and New Revenue Opportunities
- Figure 34: IoT Data Management and Analytics Roadmap 2016 to 2025
- Figure 35: IoT Data Platform Functions
- Figure 36: IoT Data Market 2016 2021
- Figure 37: Regional Investment in IoT Data 2016 2021
- Figure 38: Investment in IoT Data Products by Segment 2016 2021
- Figure 39: Investment in Full Stack Platforms for IoT Data 2016 2021
- Figure 40: Investment in Single Product Platforms for IoT Data 2016 2021
- Figure 41: Investment in Data Collection Solutions 2016 2021
- Figure 42: Regional Investment in Data Collection Solutions 2016 2021
- Figure 43: Data Storage Solutions 2016 2021
- Figure 44: Regional Investment in Data Storage Solutions 2016 2021
- Figure 45: Investment in Data Analytics Solutions 2016 2021
- Figure 46: Regional Investment in Data Storage Solutions 2016 2021
- Figure 47: Investment in Supporting Software 2016 2021
- Figure 48: Investment in IoT Data by Deployment Model 2016 2021
- Figure 49: Global Streaming IoT Data Analytics 2016 2021
- Figure 50: Investment in IoT Data by Industry Vertical 2016 2021
- Figure 51: Investment in IoT Data by Healthcare Industry 2016 2021
- Figure 52: Regional Investment in IoT Data by Healthcare Industry 2016 2021
- Figure 53: Investment in IoT Data by Retail Industry 2016 2021
- Figure 54: Regional Investment in IoT Data by Retail Industry 2016 2021
- Figure 55: Investments in IoT Data by Manufacturing Industry 2016 2021
- Figure 56: Regional Investment in IoT Data by Manufacturing Industry 2016 2021



- Figure 57: Investment in IoT Data by HVAC Industry 2016 2021
- Figure 58: Regional Investment in IoT Data by HVAC Industry 2016 2021
- Figure 59: Investment in IoT Data by Oil and Gas Industry 2016 2021
- Figure 60: Regional Investment in IoT Data by Oil and Gas Industry 2016 2021
- Figure 61: Investment in IoT Data by Transport and Cargo Industry 2016 2021
- Figure 62: Regional Investment in IoT Data by Transport and Cargo Industry 2016 2021
- Figure 63: Investment in IoT Data by Utility Industry 2016 2021
- Figure 64: Regional Investment in IoT Data by Utility Industry 2016 2021
- Figure 65: IoT Data-as-a-Service Market 2016 2021
- Figure 66: IoT Data-as-a-Service Revenue by Region 2016 2021
- Figure 67: IoT Data-as-a-Service Revenue by Industry Sector 2016 2021
- Figure 68: Global ROI Assessment of IoT Data Investment 2016 2021
- Figure 69: ROI Assessment of IoT Data Investment by Retail Sector 2016 2021
- Figure 70: IoT Data Investment in Retail Sector by ROI Factors 2016 2021
- Figure 71: ROI Assessment of IoT Data Investment by Healthcare Sector 2016 2021
- Figure 72: IoT Data Investment in Healthcare Sector by ROI Factors 2016 2021
- Figure 73: IoT Technology and Solutions Stack

## **LIST OF TABLES**

- Table 1: IoT Data Market 2016 2021
- Table 2: Regional Investment in IoT Data 2016 2021
- Table 3: Investment in IoT Data Products by Segment 2016 2021
- Table 4: Investment in Full Stack Platforms for IoT Data
- Table 5: Investment in Single Product Platforms for IoT Data 2016 2021
- Table 6: Investment in Data Collection Solutions 2016 2021
- Table 7: Regional Investment in Data Collection Solutions 2016 2021
- Table 8: Investment in Data Storage Solutions 2016 2021
- Table 9: Regional Investment in Data Storage Solutions 2016 2021
- Table 10: Investment in Data Analytics Solutions 2016 2021
- Table 11: Regional Investment in Data Analytics Solutions 2016 2021
- Table 12: Investment in Supporting Software 2016 2021
- Table 13: Investment in IoT Data by Deployment Model 2016 2021
- Table 14: Global Streaming IoT Data Analytics Revenue by App, Software, and Service 2016 2021
- Table 15: Global Streaming IoT Data Analytics Revenue in Industry Vertical 2016 2021
- Table 16: Retail Streaming IoT Data Analytics Revenue by Retail Segment 2016 2021



- Table 17: Retail Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 18: Telecom & IT Streaming IoT Data Analytics Rev by Segment 2016 2021
- Table 19: Telecom & IT Streaming IoT Data Analytics Rev by App, Software, and Services 2016 2021
- Table 20: Energy & Utilities Streaming IoT Data Analytics Rev by Segment 2016 2021
- Table 21: Energy & Utilities Streaming IoT Data Analytics Rev by App, Software, and Services 2016 2021
- Table 22: Government Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 23: Government Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 24: Healthcare & Life Science Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 25: Healthcare & Life Science Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 26: Manufacturing Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 27: Manufacturing Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 28: Transportation & Logistics Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 29: Transportation & Logistics Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 30: Banking and Finance Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 31: Banking & Finance Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 32: Smart Cities Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 33: Smart Cities Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 34: Automotive Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 35: Automotive Streaming IoT Data Analytics Revenue by Apps, Software, and Services 2016 2021
- Table 36: Education Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 37: Education Streaming IoT Data Analytics Revenue by App, Software, and Services 2016 2021
- Table 38: Outsourcing Service Streaming IoT Data Analytics Revenue by Segment 2016 2021
- Table 39: Outsourcing Service Streaming IoT Data Analytics Revenue by App,



Software, and Services 2016 - 2021

Table 40: Streaming IoT Data Analytics Revenue by Leading Vendor Platforms 2016 – 2021

Table 41: Investment in IoT Data by Industry Vertical 2016 – 2021

Table 42: Investment in IoT Data by Healthcare Industry 2016 – 2021

Table 43: Regional Investment in IoT Data by Healthcare Industry 2016 – 2021

Table 44: Investments in IoT Data by Retail Industry 2016 – 2021

Table 45: Regional Investment in IoT Data by Retail Industry 2016 - 2021

Table 46: IoT Data by Manufacturing Industry 2016 – 2021

Table 47: Regional Investment in IoT Data by Manufacturing Industry 2016 – 2021

Table 48: Investments in IoT Data by HVAC Industry 2016 – 2021

Table 49: Regional Investment in IoT Data by HVAC Industry 2016 – 2021

Table 50: Investments in IoT Data by Oil and Gas Industry 2016 – 2021

Table 51: Regional Investment in IoT Data by Oil and Gas Industry 2016 – 2021

Table 52: Investment in IoT Data by Transport and Cargo Industry 2016 – 2021

Table 53: Regional Investment in IoT Data by Transport and Cargo Industry 2016 – 2021

Table 54: Investment in IoT Data by Utility Industry 2016 – 2021

Table 55: Regional Investment in IoT Data by Utility Industry 2016 – 2021

Table 56: IoT Data as a Service Market 2016 – 2021

Table 57: IoT Data as a Service Revenue by Region 2016 – 2021

Table 58: IoT Data as a Service Revenue by Industry Vertical 2016 – 2021

Table 59: Global Rol Assessment of IoT Data Investment 2016 – 2021

Table 60: ROI Assessment of IoT Data Investment by Industry Sector 2016 – 2021

Table 61: ROI Assessment of IoT Data Investment by Retail Sector 2016 – 2021

Table 62: IoT Data Investment in Retail Sector by ROI Factors 2016 – 2021

Table 63: ROI Assessment of IoT Data Investment by Healthcare Sector 2016 – 2021

Table 64: IoT Data Investment in Healthcare Sector by ROI Factors 2016 – 2021

Table 65: Streaming IoT Data Analytics Revenue in Region 2016 – 2021

Table 66: APAC Streaming IoT Data Analytics Revenue by Solution and Services 2016 - 2021

Table 67: APAC Streaming IoT Data Analytics Revenue in Industry Vertical 2016 - 2021

Table 68: APAC Streaming IoT Data Analytics Revenue by Leading Vendor Platforms 2016 – 2021

Table 69: Europe Streaming IoT Data Analytics Revenue by Solution and Services 2016 - 2021

Table 70: Europe Streaming IoT Data Analytics Revenue in Industry Vertical 2016 - 2021

Table 71: Europe Streaming IoT Data Analytics Revenue by Leading Vendor Platforms



2016 - 2021

Table 72: North America Streaming IoT Data Analytics Revenue by Solution and Services 2016 - 2021

Table 73: North America Streaming IoT Data Analytics Revenue in Industry Vertical 2016 - 2021

Table 74: North America Streaming IoT Data Analytics Revenue by Leading Vendor Platforms 2016 - 2021

Table 75: Latin America Streaming IoT Data Analytics Revenue by Solution and Services 2016 - 2021

Table 76: Latin America Streaming IoT Data Analytics Revenue in Industry Vertical 2016 - 2021

Table 77: Latin America Streaming IoT Data Analytics Revenue by Leading Vendor Platforms 2016 – 2021

Table 78: ME&A Streaming IoT Data Analytics Revenue by Solution and Services 2016 - 2021

Table 79: ME&A Streaming IoT Data Analytics Revenue in Industry Vertical 2016 - 2021

Table 80: ME&A Streaming IoT Data Analytics Revenue by Leading Vendor Platforms 2016 - 2021

Table 81: Streaming IoT Data Analytics Revenue by APAC Countries 2016 – 2021

Table 82: Japan Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 83: Japan Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 84: China Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 85: China Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 86: India Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 87: India Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 88: Australia Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 89: Australia Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 90: Streaming IoT Data Analytics Revenue by Europe Countries 2016 – 2021

Table 91: Germany Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 92: Germany Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 93: UK Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021



Table 94: UK Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 95: France Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 96: France Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 97: Streaming IoT Data Analytics Revenue by North America Countries 2016 – 2021

Table 98: US Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 99: US Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 100: Canada Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 101: Canada Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 102: Streaming IoT Data Analytics Revenue by Latin America Countries 2016 – 2021

Table 103: Brazil Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 104: Brazil Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 105: Mexico Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 106: Mexico Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 107: Streaming IoT Data Analytics Revenue by ME&A Countries 2016 – 2021

Table 108: South Africa Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 109: South Africa Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

Table 110: UAE Streaming IoT Data Analytics Revenue by Solution and Services 2016 – 2021

Table 111: UAE Streaming IoT Data Analytics Revenue in Industry Vertical 2016 – 2021

#### 3D PRINTING MARKET OUTLOOK AND FORECASTS

#### 1 OVERVIEW

- 1.1 3D Printing and Additive Manufacturing
  - 1.1.1 Stereo Lithography and Additive Manufacturing



- 1.2 Traditional Manufacturing vs. Additive Manufacturing
- 1.3 3D Printing Process
- 1.4 Business Benefits of 3D Printing
  - 1.4.1 Creation of Complex Design
  - 1.4.2 High Level of Customization
  - 1.4.3 Keep Fixed Costs Low following Single Tool Process
  - 1.4.4 Prototyping Process Much Faster and Increase Time of Market
  - 1.4.5 Help Businesses Reduce Waste
- 1.5 3D Printing Market: SWOT Analysis
- 1.5.1 Strengths and Opportunities in 3D Printing
  - 1.5.1.1 Rise of Outsourced Service Ecosystem for 3D Printing
  - 1.5.1.2 Rise of Cloud Powered Virtual Inventory based Supply Chain
  - 1.5.1.3 Beginning the Era of Distributed, Holistic, and True Manufacturing
  - 1.5.1.4 The Use of 3D Printing in Other Industries
  - 1.5.1.5 Increasing Support of Governments and R&D Activities
  - 1.5.1.6 Internet of Things and Artificial Intelligence opens New Opportunities
- 1.5.2 Market Weakness and Threats
  - 1.5.2.1 High Cost Involvement with Large Scale Production
  - 1.5.2.2 Vulnerability of Printing Materials
  - 1.5.2.3 Challenges of Printing High Precision Products
- 1.6 3D Printing Investment Trend Analysis
  - 1.6.1 Regional Investment Trends: US, Europe and APAC
  - 1.6.2 Corporate Investment Trends in US, Europe and APAC
  - 1.6.3 Emerging Investment Opportunity in 3D Printing Ecosystem
    - 1.6.3.1 Medical 3D Printing Application
    - 1.6.3.2 Metal 3D Printing
    - 1.6.3.3 3D Printing Materials
    - 1.6.3.4 3D Software
  - 1.6.4 Risk Exposure Analysis in 3D Printing
- 1.6.5 3D Printing Merger and Acquisition Analysis
- 1.6.6 3D Printing Patent Analysis

#### 2 3D PRINTING MARKET ANALYSIS AND FORECASTS 2017 TO 2022

- 2.1 Global 3D Printing Market 2017 to 2022
  - 2.1.1 3D Printing Market by Segment
    - 2.1.1.1 Industrial Market vs. Consumer Market
  - 2.1.2 3D Printing Market by Component
  - 2.1.2.1 3D Printing Product Market



- 2.1.2.1.1 Industrial vs. Desktop Printers
- 2.1.2.2 3D Printing Raw Material Market 2017 to 2022
  - 2.1.2.2.1 Polymer and Plastic Market
  - 2.1.2.2.2 Metals and Alloy Market
- 2.1.2.2.3 Ceramic Market
- 2.1.2.2.4 Other Materials
- 2.1.2.3 3D Printing Software and Services Market
- 2.1.3 Global 3D Printing Market by Technology 2017 to 2022
  - 2.1.3.1 Stereo Lithography
  - 2.1.3.2 Jetting Technology
- 2.1.3.3 Powder Bed Fusion
- 2.1.3.4 Fused Deposition Modelling
- 2.1.3.5 Laminated Object Manufacturing
- 2.1.3.6 Fused Filament Fabrication
- 2.1.3.7 Selective Deposition Lamination
- 2.1.4 Global 3D Printing Market by Application
- 2.1.5 Global 3D Printing Market by End User Industry
- 2.2 Regional 3D Printing Market 2017 to 2022
  - 2.2.1 Americas 3D Printing Market by Segment, Component, Tech, App, and Industry
    - 2.2.1.1 Americas 3D Printing Market by Country
  - 2.2.2 Europe 3D Printing Market by Segment, Component, Tech, App, and Industry
    - 2.2.2.1 Europe 3D Printing Market by Country
  - 2.2.3 APAC 3D Printing Market by Segment, Component, Tech, App, and Industry
    - 2.2.3.1 APAC 3D Printing Market by Country
- 2.2.4 Rest of the World 3D Printing Market by Segment, Component, Tech, App, and Industry
  - 2.2.4.1 ROW 3D Printing Market by Country
- 2.3 3D Printer Shipments 2017 to 2022
  - 2.3.1 Global 3D Printer Shipments by Segment
  - 2.3.2 Global 3D Printer Shipments by Industry
  - 2.3.3 3D Printer Shipments by Region
    - 2.3.3.1 Americas 3D Printer Shipments by Country
    - 2.3.3.2 Europe 3D Printer Shipments by Country
    - 2.3.3.3 APAC 3D Printer Shipments by Country
    - 2.3.3.4 ROW 3D Printer Shipments by Country
- 2.4 3D Printing Raw Materials Supply 2017 to 2022
  - 2.4.1 Global 3D Printing Raw Materials Supply by Form
  - 2.4.2 Global 3D Printing Raw Materials Supply by Type
  - 2.4.3 Global 3D Printing Raw Materials Supply by Industry



- 2.4.4 3D Printing Raw Materials Supply by Region
  - 2.4.4.1 Americas 3D Printing Raw Materials Supply by Country
  - 2.4.4.2 Europe 3D Printing Raw Materials Supply by Country
  - 2.4.4.3 APAC 3D Printing Raw Materials Supply by Country
  - 2.4.4.4 ROW 3D Printing Raw Materials Supply by Country

#### 3 3D PRINTING ECOSYSTEM AND VENDOR ANALYSIS

- 3.1 3D Printing Value Chain and Elements
  - 3.1.1 Multi-material vs. Mesostructure Material
- 3.2 Emerging 3D Printing Ecosystem
  - 3.2.1 Object Distribution
  - 3.2.2 Printer Control Systems
  - 3.2.3 Printer Access Networks
  - 3.2.4 IoT and Artificial Intelligence
- 3.3 3D Printer Pricing Analysis
- 3.4 Average Industry Order Value and Funding Chart
  - 3.4.1 Order Value by Industry
  - 3.4.2 Order Value by Company Size
  - 3.4.3 Yearly Industry Funding in 3D Printing Category
- 3.5 Popular Printer Chart: Desktop vs. Industrial Printer and by Regions
- 3.6 3D Printing Vendor Ecosystem
  - 3.6.1 3D Printer Manufacturer
  - 3.6.2 3D Printing Service Provider
  - 3.6.3 3D Printing Marketplace Providers
  - 3.6.4 3D Printing Application Providers
  - 3.6.5 3D Scanner Manufacturer
  - 3.6.6 3D Printing CAD Software Providers
  - 3.6.7 3D Printing Raw Material providers
  - 3.6.8 3D Printing Network Providers
  - 3.6.9 3D Printing Communities

#### 4 MARKET DIRECTION AND FUTURE OF 3D PRINTING

- 4.1 Fourth Industrial Revolution: Industry 4.
- 4.2 Multi-Material and Cheaper 3D Printer and New Raw Materials
- 4.3 Wider Accessibility to 3D Modeling
- 4.4 3D Applications in Everyday Life
- 4.5 Implications for Enterprise in various Industries



## **LIST OF FIGURES**

Figure 1: SLA-1: World's First 3D Printer

Figure 2: 3D Printing Process

Figure 3: Adoption and Impact Timeline of 3D Printing

Figure 4: 3D Printed Auto Chassis designed by AI Technology

Figure 5: Schema of SLA Technology

Figure 6: Schema of Material Jetting Technology

Figure 7: Schema of Binder Jetting Technology

Figure 8: Schema of FDM Technology

Figure 9: 3D Printing Impact on Industries

Figure 10: Global 3D Printer Shipment 2017 – 2022

Figure 11: Global 3D Printing Raw Materials Supply 2017 – 2022

Figure 12: 3D Printing Value Chain Partner and Activity

Figure 13: Mesostructure Material Design Diagram

Figure 14: 3D Printer Prices for Consumer, Enterprise, and Industrial Market Segments

Figure 15: Average Order Value of 3D Printing by Industry

Figure 16: Average Order Value of 3D Printing by Company Size

Figure 17: Average Yearly Industry Funding for 3D Printing by 3D Printing Category

Figure 18: 3D Printing Vendor Ecosystem

Figure 19: Potential Future 3D Printing Application

## LIST OF TABLES

Table 1: Global Public Investment in 3D Printing System

Table 2: Original Patent of 3D Technology and Expiration Timeline

Table 3: 3D Printing Patent Filling Status by Technology and Top Player

Table 4: Top Ten Patent Companies by Region

Table 5: Global 3D Printing Market 2017 – 2022

Table 6: Global 3D Printing Market by Segment 2017 – 2022

Table 7: Global 3D Printing Market by Component 2017 – 2022

Table 8: 3D Printing Product Market by Type 2017 – 2022

Table 9: 3D Printing Raw Material Market by Type 2017 – 2022

Table 10: 3D Printing Raw Material: Polymer Market by Type 2017 – 2022

Table 11: 3D Printing Raw Material: Metals and Alloy Market by Type 2017 – 2022

Table 12: 3D Printing Raw Material: Ceramic Market by Type 2017 – 2022

Table 13: 3D Printing Raw Material: Other Material Market by Type 2017 – 2022

Table 14: 3D Printing Software and Services Market by Type 2017 – 2022



- Table 15: Global 3D Printing Market by Technology 2017 2022
- Table 16: 3D Printing Technology: Jetting Technology Market by Type 2017 2022
- Table 17: 3D Printing Technology: Powder Bed Fusion Market by Type 2017 2022
- Table 18: Global 3D Printing Market by Application 2017 2022
- Table 19: Global 3D Printing Market by Industry 2017 2022
- Table 20: 3D Printing Market by Region 2017 2022
- Table 21: Americas 3D Printing Market by Segment 2017 2022
- Table 22: Americas 3D Printing Market by Component 2017 2022
- Table 23: Americas 3D Printing Market by Technology 2017 2022
- Table 24: Americas 3D Printing Market by Application 2017 2022
- Table 25: Americas 3D Printing Market by Industry 2017 2022
- Table 26: Americas 3D Printing Market by Country 2017 2022
- Table 27: Europe 3D Printing Market by Segment 2017 2022
- Table 28: Europe 3D Printing Market by Component 2017 2022
- Table 29: Europe 3D Printing Market by Technology 2017 2022
- Table 30: Europe 3D Printing Market by Application 2017 2022
- Table 31: Europe 3D Printing Market by Industry 2017 2022
- Table 32: Europe 3D Printing Market by Country 2017 2022
- Table 33: APAC 3D Printing Market by Segment 2017 2022
- Table 34: APAC 3D Printing Market by Component 2017 2022
- Table 35: APAC 3D Printing Market by Technology 2017 2022
- Table 36: APAC 3D Printing Market by Application 2017 2022
- Table 37: APAC 3D Printing Market by Industry 2017 2022
- Table 38: APAC 3D Printing Market by Country 2017 2022
- Table 39: ROW 3D Printing Market by Segment 2017 2022
- Table 40: ROW 3D Printing Market by Component 2017 2022
- Table 41: ROW 3D Printing Market by Technology 2017 2022
- Table 42: ROW 3D Printing Market by Application 2017 2022
- Table 43: ROW 3D Printing Market by Industry 2017 2022
- Table 44: ROW 3D Printing Market by Country 2017 2022
- Table 45: Global 3D Printer Shipment by Segment 2017 2022
- Table 46: Global 3D Printer Shipment by Industry 2017 2022
- Table 47: 3D Printer Shipments by Region 2017 2022
- Table 48: Americas 3D Printer Shipments by Country 2017 2022
- Table 49: Europe 3D Printer Shipments by Country 2017 2022
- Table 50: APAC 3D Printer Shipments by Country 2017 2022
- Table 51: ROW 3D Printer Shipments by Country 2017 2022
- Table 52: Global 3D Printing Raw Materials Supply by Form 2017 2022
- Table 53: Global 3D Printing Raw Materials Supply by Type 2017 2022



Table 54: 3D Printing Raw Material: Polymer Material Supply by Type 2017 – 2022

Table 55: 3D Printing Raw Material: Metals Material Supply by Type 2017 – 2022

Table 56: 3D Printing Raw Material: Ceramic Material Supply by Type 2017 – 2022

Table 57: 3D Printing Raw Material: Other Material Supply by Type 2017 – 2022

Table 58: Global 3D Printing Raw Materials Supply by Industry 2017 - 2022

Table 59: 3D Printing Raw Materials Supply by Region 2017 - 2022

Table 60: Americas 3D Printing Raw Materials Supply by Country 2017 - 2022

Table 61: Europe 3D Printing Raw Materials Supply by Country 2017 - 2022

Table 62: APAC 3D Printing Raw Materials Supply by Country 2017 - 2022

Table 63: ROW 3D Printing Raw Materials Supply by Country 2017 – 2022

Table 64: Desktop and Industrial Printer Model by Technology

Table 65: Printer Model Market Share by Region

Smart Workplace: Devices, Applications, and Services

#### 1 INTRODUCTION

- 1.1 Defining the Smart Workplace
- 1.2 Transition to Agile Workplace
- 1.3 High Performance Workplace Outcomes
- 1.4 Impact on Businesses and Employees
- 1.5 Steps involved in Creating Smart Workplace Environments

#### 2 SMART WORKPLACE MARKET DYNAMIC ANALYSIS

- 2.1 Growth Drivers
  - 2.1.1 Connected Devices: Wearables, Smartphones, and Humanoid Robots
  - 2.1.2 Automation Services, Energy Efficient Applications, and IoT
  - 2.1.3 Mobile Edge Computing and Enterprise Services
  - 2.1.4 Broadband Wireless and Collaborative Work
  - 2.1.5 M2M, Artificial Intelligence, and Deep Learning Capabilities
  - 2.1.6 Advanced Commerce Technologies in the Workplace
  - 2.1.7 Unified Communication and Cloud Computing
  - 2.1.8 Hyper Connected Employees and Empowerment
  - 2.1.9 Emergence of Knowledge Workers
  - 2.1.10 Growth of Connected Industrial Machines and Remote Operations
  - 2.1.11 Virtualization Trend and Impact
  - 2.1.12 Smart Power and Energy Management System
- 2.2 Market Challenges
  - 2.2.1 Enterprise Security Risks for Data, Information, and Infrastructure



- 2.2.2 Employee Privacy Risks and BYOD
- 2.2.3 Diversity among Communication Standard and Infrastructure Sharing
- 2.2.4 Policy for Human and Machine Interaction
- 2.2.5 Commercial Off-the-Shelf (COTS) Electronic Device Market
- 2.3 Value Chain Analysis
  - 2.3.1 Connectivity Technology and Service Providers
  - 2.3.2 Communication Technology and Automation Solution Providers
  - 2.3.3 Original Equipment Manufacturers (OEM)
  - 2.3.4 Infrastructure Solution Providers
  - 2.3.5 Analytics and Security Solution Providers
  - 2.3.6 System Aggregators
  - 2.3.7 End Users

## 3 SMART WORKPLACE MARKET, SEGMENTS AND FORECASTS

- 3.1 Global Market Size
- 3.2 Market by Construction
  - 3.2.1 Retrofit Building
  - 3.2.2 New Building
- 3.3 Market by Categories
  - 3.3.1 Smart Devices
  - 3.3.2 Software and Application Services
  - 3.3.3 Infrastructure and System
  - 3.3.4 Professional Services
- 3.4 Market by Product and Services
  - 3.4.1 Smart Lighting Systems
  - 3.4.2 Security and Access Control Systems
  - 3.4.3 Energy Management Systems
  - 3.4.4 Smart HVAC Control Systems
  - 3.4.5 Audio Video Conferencing Systems
  - 3.4.6 Fire and Safety Control Systems
  - 3.4.7 Office Automation Software and Services
  - 3.4.8 Enterprise Wearable Systems
  - 3.4.9 Autonomous Robots Services
  - 3.4.10 Enterprise Data Centre Market
  - 3.4.11 Visual Analytics System
  - 3.4.12 Smart Office Appliances Market
  - 3.4.13 Enterprise Healthcare System
  - 3.4.14 Enterprise Cloud Server and Solution



- 3.5 Market by Connectivity and Communication Technology
  - 3.5.1 Cellular Connectivity
  - 3.5.2 Digital Addressable Lighting Interface (DALI)
  - 3.5.3 BACnet
  - 3.5.4 LPWAN (NB IoT, Zigbee, Sigfox, LoRaWAN, etc.)
  - 3.5.5 LonWorks
  - 3.5.6 KNX EIB
  - 3.5.7 Modbus RTU
  - 3.5.8 National Electrical Manufacturers Association (NEMA)
  - 3.5.9 Fixed and Short Range Connectivity like Broadband, WiFi, LiFi, etc.
  - 3.5.10 Office Communication Technology like wikis, WebEx, etc.
- 3.6 Market by Region
  - 3.6.1 North America
  - 3.6.2 APAC
  - 3.6.3 Europe
  - 3.6.4 Latin America
  - 3.6.5 Middle East and Africa (ME&A)

#### 4 SMART WORKPLACE SOLUTION PROVIDER ANALYSIS

- 4.1 ABB Ltd.
- 4.2 Cisco Systems
- 4.3 Crestron Electronics
- 4.4 Honeywell International
- 4.5 Johnson Controls
- 4.6 Koninklijke Philips N.V
- 4.7 Lutron Electronics
- 4.8 Schneider Electric
- 4.9 Siemens AG
- 4.10 United Technologies Corporation (UTC)
- 4.11 Smart Office Solutions
- 4.12 Telkom SA Soc Ltd

#### **5 CONCLUSIONS AND RECOMMENDATIONS**

- 5.1 Recommendations for Enterprise
- 5.2 Recommendations for Solution Providers
- 5.3 Recommendations for Healthcare Service Provider
- 5.4 Recommendations for Facility Management Service Provider



- 5.5 Recommendations for Workplace Design Provider
- 5.6 Recommendations for Workplace Service Providers

#### LIST OF FIGURES

- Figure 1: Smart Workplace: Workforce, Environment, and Components
- Figure 2: High Performance Smart Workplace Outcomes
- Figure 3: Steps to Create a Smart Workplace Environment
- Figure 4: Global Smart Workplace Market Revenue 2016 2021
- Figure 5: Global Smart Workplace Market Revenue by Construction 2016 2021
- Figure 6: Global Smart Workplace Market Revenue by Category 2016 2021
- Figure 7: Global Smart Workplace Revenue Product and Service 2016 2021
- Figure 8: Global Smart Workplace Revenue by Connectivity and Com Tech 2016 2021
- Figure 9: Smart Workplace Market Revenue by Region 2016 2021
- Figure 10: Technical Component of Network Services of SWCs
- Figure 11: Technical Component of Cisco Smart Work Center Services
- Figure 12: Smart Work Centers Network and Collaborative Society
- Figure 13: Functional Architecture of Smart Work Centers
- Figure 14: Honeywell Thermostats Kit
- Figure 15: Telkom Smart Broadband LTE Deals
- Figure 16: Telkom Value Added Service with Multi-site Internet Connectivity Solutions

Teleoperation and Telerobotics in Industrial Internet of Things (IIoT)

## 1. EXECUTIVE SUMMARY

## 2. OVERVIEW OF INDUSTRIAL IOT (IIOT)

- 2.1 HOW INDUSTRIAL IOT (IIOT) IS DIFFERENT FROM CONSUMER IOT?
- 2.2 TECHNOLOGY TRANSFORMATION: WIRED AND WIRELESS
- 2.3 INDUSTRIAL PRODUCTIVITY AND IIOT ECONOMIC CONTRIBUTION
- 2.4 INDUSTRIAL EFFICIENCY AND IIOT
- 2.5 IIOT ADOPTION TRENDS GLOBALLY
- 2.6 INDUSTRY 4. AND AUTOMATION
- 2.7 INDUSTRIAL REVOLUTION AND MIGRATION
- 2.8 IIOT BUILDING BLOCKS
- 2.9 INDUSTRIAL AUTOMATION AND IIOT
- 2.10 HUMAN ASPECT OF IIOT
- 2.11 INTEGRATED DIGITAL AND HUMAN WORKFORCE
- 2.12 WEARABLE TECHNOLOGY AND IIOT



- 2.13 WORKFORCE AUGMENTATION
- 2.14 HYBRID INDUSTRY AND ROBOTICS
- 2.15 DRONE LOGISTICS

## 3. TELEOPERATION AND TELEROBOTICS

- 3.1 TELEROBOTICS
  - 3.1.1 AGILE ROBOTS: MOVE LIKE HUMANS IN DANGEROUS ENVIRONMENTS
  - 3.1.2 COLLABORATIVE INDUSTRIAL ROBOTS (COBOTS)
- 3.2 TELEPRESENCE
- 3.3 TELEOPERATION
- 3.4 TELEMANIPULATOR
- 3.5 INTERNET TELEROBOTICS
- 3.6 THE WEB AND TELEROBOTICS
- 3.7 REAL-TIME TRANSPORT PROTOCOL (RTP)
- 3.8 TECHNICAL ARCHITECTURE OF TELEROBITCS SYSTEM
  - 3.8.1 TELEROBOT
  - 3.8.2 WEB CLIENT
  - 3.8.3 COMMUNICATIONS
  - 3.8.4 TRANSMISSION PROTOCOL
- 3.9 BILATERAL CONTROL AND HAPTIC FEEDBACK
  - 3.9.1 THE ROBONAUT CASE
- 3.10 UNILATERAL VS. BILATERAL MODEL
  - 3.10.1 PERFORMANCE MATRIX

#### 4. ROLE OF TELEOPERATION AND TELEROBOTICS

- 4.1 THE ROLE OF TELEROBOTICS IN INDUSTRIAL AUTOMATION
- 4.2 IMPACT ON LOGISTICS AND SUPPLY CHAIN
- 4.3 INDUSTRIAL PRODUCER/CONSUMER (PROSUMER) VALUE CHAIN
- 4.4 EMPLOYMENT TRANSFORMATION AND THE FUTURE FOR FACTORY WORKERS
- 4.5 CLEAR PRODUCTION
- 4.6 MANUFACTURING SUPPLY CHAIN AND ROBOTICS
- 4.7 CONNECTED SERVICE AND TELEOPERATION
- 4.8 BENEFITS AND DRAWBACKS
- 4.9 FOG COMPUTING
- 4.10 SWARM COMPUTING



## 5. TELEOPERATION AND TELEROBOTICS MARKET AND FORECASTS 2016 - 2021

- 5.1 IIOT TELEOPERATION AND TELEROBOTICS MARKET
  - 5.1.1 GLOBAL INDUSTRIAL IOT MARKET AND TECHNOLOGY
- 5.1.2 IIOT TELEOPERATION AND TELEROBOTICS SOLUTION MARKET AND CORE TECHNOLOGY
- 5.1.3 TECHNOLOGIES USED IN IIOT TELEOPERATION AND TELEROBOTICS SOLUTIONS
  - 5.1.4 IIOT TELEOPERATION AND TELEROBOTICS SOLUTION BY SEGMENTS
- 5.1.5 IIOT TELEOPERATION AND TELEROBOTICS SOLUTION BY REGION
- 5.1.6 INDUSTRIAL IOT CONNECTION BASE
- 5.1.7 INVESTMENT AND DEAL INTO INDUSTRIAL IOT
- 5.2 TECHNOLOGY APPLICATION
- 5.2.1 IIOT TELEOPERATION AND TELEROBOTICS SOLUTION BY TECHNOLOGY AND APPLICATION
  - 5.2.2 SPACE TECHNOLOGY
  - 5.2.3 VIDEOCONFERENCING
  - 5.2.4 MARINE ROBOTICS
  - 5.2.5 ROBOTIC IN HEALTHCARE
  - 5.2.6 OTHER AREAS
- 5.3 INDUSTRY VERTICAL
- 5.3.1 TELEOPERATION AND TELEROBOTICS SOLUTION BY INDUSTRY VERTICAL
  - 5.3.2 TRANSPORTATION
  - 5.3.3 NUCLEAR OPERATIONS
  - 5.3.4 ENERGY AND POWER OPERATIONS
  - 5.3.5 AEROSPACE & DEFENSE
  - 5.3.6 UNDERWATER FACILITIES
  - 5.3.7 MAINTENANCE AND REPAIR
  - 5.3.8 MANUFACTURING
  - **5.3.9 RETAIL**
  - 5.3.10 HEALTHCARE
  - 5.3.11 OIL AND GAS
  - 5.3.12 METALS AND MINING
  - 5.3.13 AGRICULTURE
- 5.4 TELEOPERATION AND TELEROBOTICS DRIVEN MARKET
- 5.4.1 ARTIFICIAL INTELLIGENCE (AI) IN TELEOPERATION AND TELEROBOTICS SOFTWARE SOLUTIONS



# 5.4.2 SMART MACHINE AND MACHINE LEARNING IN TELEOPERATION AND TELEROBOTICS

5.4.3 INVESTMENT IN INDUSTRIAL ROBOTICS

#### 6. IMPACT OF TELEOPERATION AND TELEROBOTICS

- 6.1 TECHNOLOGIES DRIVING AND FACILITATING HYPER AUTOMATION
- 6.2 RISE OF THE HYBRID ENTERPRISE TO OPTIMIZE IIOT
- 6.3 INTELLIGENT HUMAN WORKFORCE WILL BE AUGMENTED BY AI AND ROBOTS
- 6.4 DRONE LOGISTICS TO BECOME COMMON FOR B2B AS WELL AS B2C
- 6.5 INDUSTRIAL ROBOTICS REMAINS THE KEY AREA OF FOCUS
- 6.6 RISE OF THE SMART MACHINE DRIVEN FACTORY OF THE FUTURE
- 6.7 THE INDUSTRIAL CONSUMER: ENGAGEMENT THROUGHOUT THE PRODUCT LIFECYCLE
- 6.8 A TRANSFORMATION TO AN OUTCOME ECONOMY
- 6.9 INFORMATION TECHNOLOGY (IT) & OPERATIONAL TECHNOLOGY (OT) CONVERGENCE
- 6.10 NEW STAKEHOLDERS EMERGE AND NEW RELATIONSHIPS DEVELOP

## 7. CONCLUSIONS AND RECOMMENDATIONS

7.1 NEED FOR ENHANCED OPERATIONAL SUPPORT

7.2 IIOT: DON'T FORGET THE CONSUMER

#### LIST OF FIGURES

- Figure 1: Telerobotics System Architecture
- Figure 2: Web Based Robotic System
- Figure 3: Fog Computing Architecture
- Figure 4: Installed IIoT Connection base 2016 2021
- Figure 4: Deals and Total Investment in IIoT Sectors 2012 2015
- Figure 6: Total Investment in IIoT Robotics Sector 2016 2021

## **LIST OF TABLES**

- Table 1: Global Industrial IoT Total Market by Core Technology 2016 2021
- Table 2: Teleoperation and Telerobotics Market by Core Technology 2016 2021
- Table 3: Teleoperation and Telerobotics Solution Technologies



- Table 4: Teleoperation and Telerobotics Solution by Segment 2016 2021
- Table 5: Teleoperation and Telerobotics Solution Market by Region 2016 2021
- Table 6: Teleoperation and Telerobotics by Sector/Tech/App 2016 2021
- Table 7: Teleoperation and Telerobotics Solution by Industry Vertical 2016 2021
- Table 8: Al in Teleoperation and Telerobotics Software Market 2016 2021
- Table 9: Smart Machines in Teleoperation and Telerobotics Market 2016 2021



## I would like to order

Product name: Industrial IoT Market by IIoT Technology (5G, APIs, Databases), Device (Sensors, RFID,

Robots, Smart Meters), Software (Controls, Data Management, PLM), Application (3D Printing, Industrial Analytics, Process Automation, Smart Workplace, Teleoperation),

Industry Vertical, and Geography

Product link: https://marketpublishers.com/r/l172D6AD7E9EN.html

Price: US\$ 3,995.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer

Service:

info@marketpublishers.com

## **Payment**

First name:

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <a href="https://marketpublishers.com/r/l172D6AD7E9EN.html">https://marketpublishers.com/r/l172D6AD7E9EN.html</a>

To pay by Wire Transfer, please, fill in your contact details in the form below:

Last name:	
Email:	
Company:	
Address:	
City:	
Zip code:	
Country:	
Tel:	
Fax:	
Your message:	
	**All fields are required
	Custumer signature

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <a href="https://marketpublishers.com/docs/terms.html">https://marketpublishers.com/docs/terms.html</a>



To place an order via fax simply print this form, fill in the information below and fax the completed form to  $+44\ 20\ 7900\ 3970$