ECEN 5053-002

Developing the Industrial Internet of Things

Week 2 - Lecture

Platforms, Software, Services

Dave Sluiter - Spring 2018

Credits

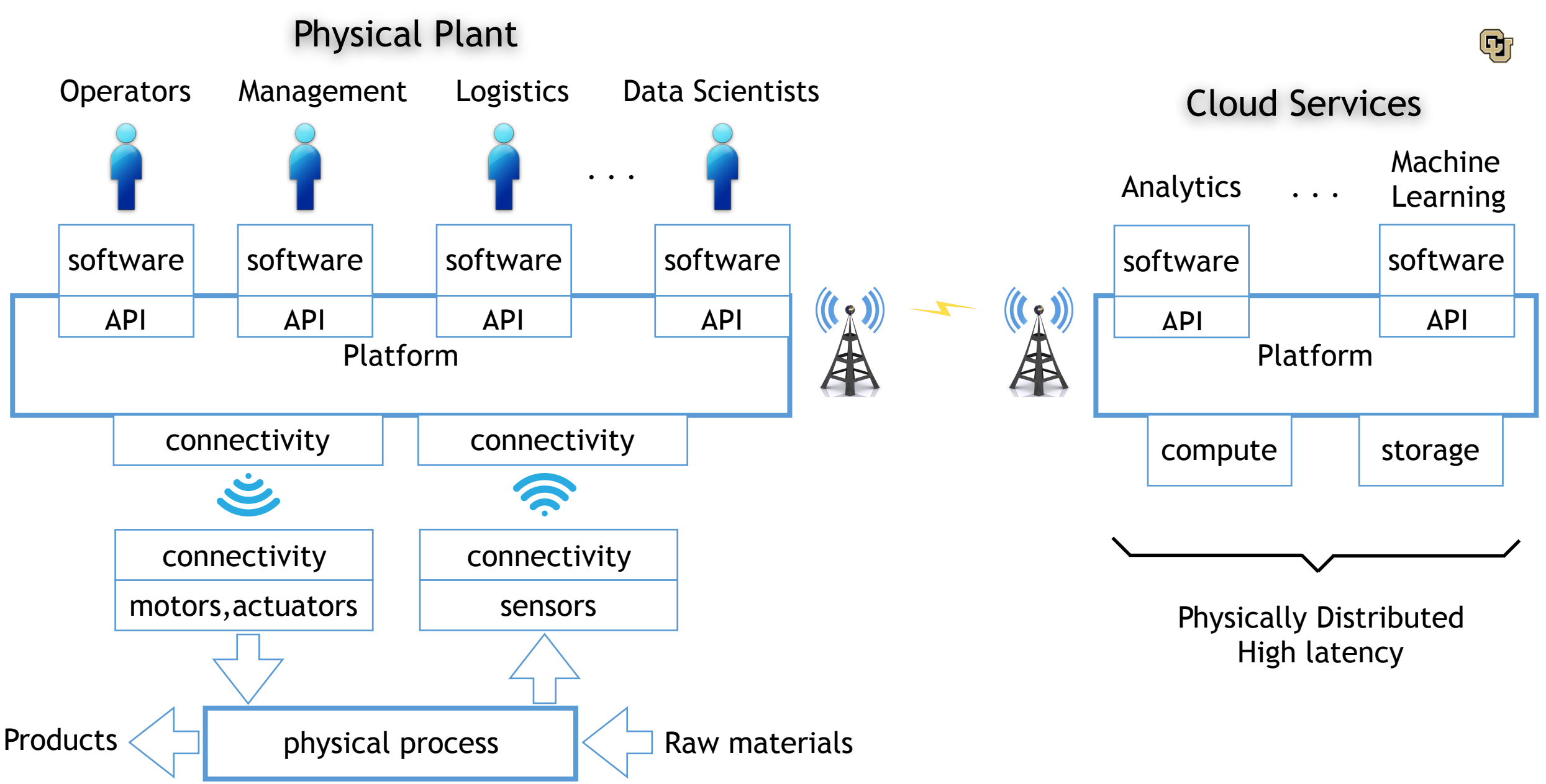
- If not otherwise indicated, market data by Markets and Markets, "*IOT Technology Market Forecast till 2022*"
- Used with permission
- http://www.marketsandmarkets.com

Learning Outcomes

- Understanding platforms, software solutions and services
- Understanding the market potential for platforms, software solutions and services

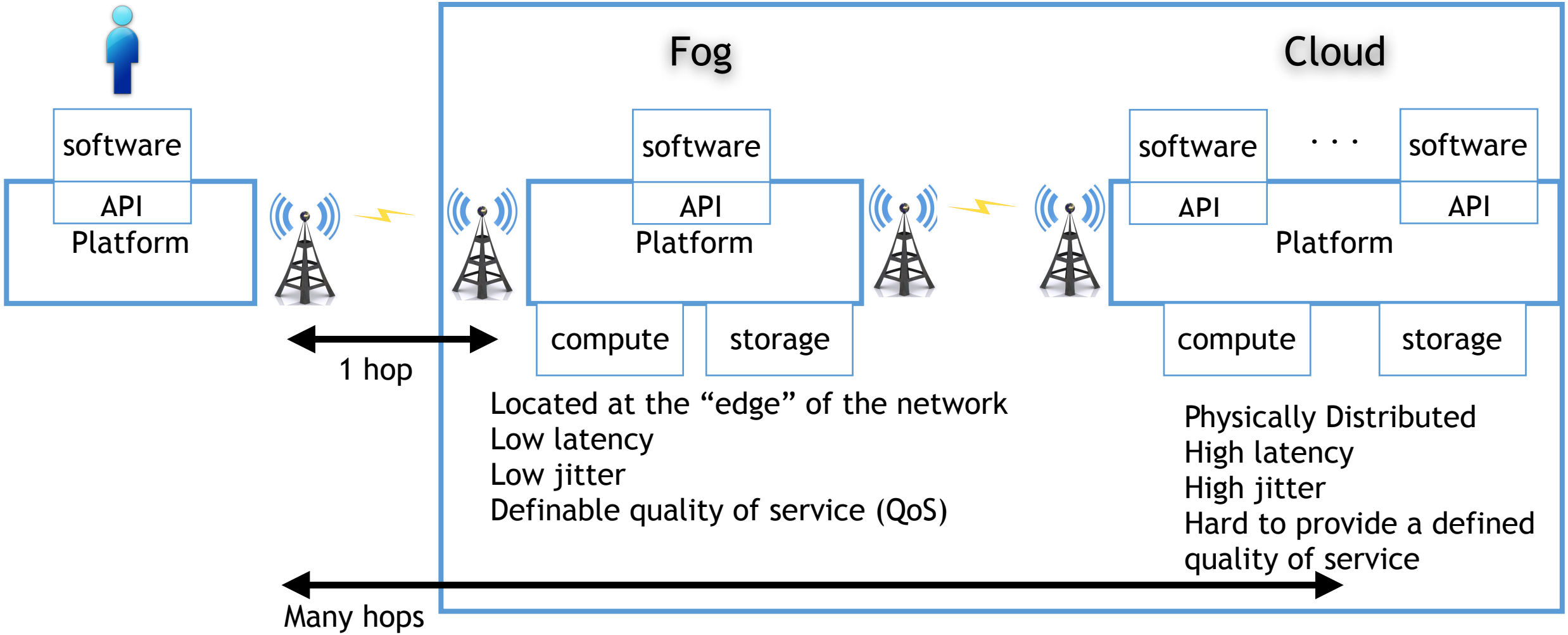
Material

- Platforms
- Software Solutions
- Services


Physical Plant
Operators
Management
Logistics
Data Scientists
. . .
software
software
software
software
API
API
API
API
Platform
connectivity
connectivity
connectivity
connectivity
motors,actuators
sensors
Products
physical process
Raw materials
Cloud Services
Analytics
. . .
Machine Learning
software
software
API
API
Platform
compute
storage
Physically Distributed
High latency

Physical Plant

Fog and Cloud Services



Platforms

Platforms

- Apple HomeKit (consumer)
- https://developer.apple.com/reference/homekit

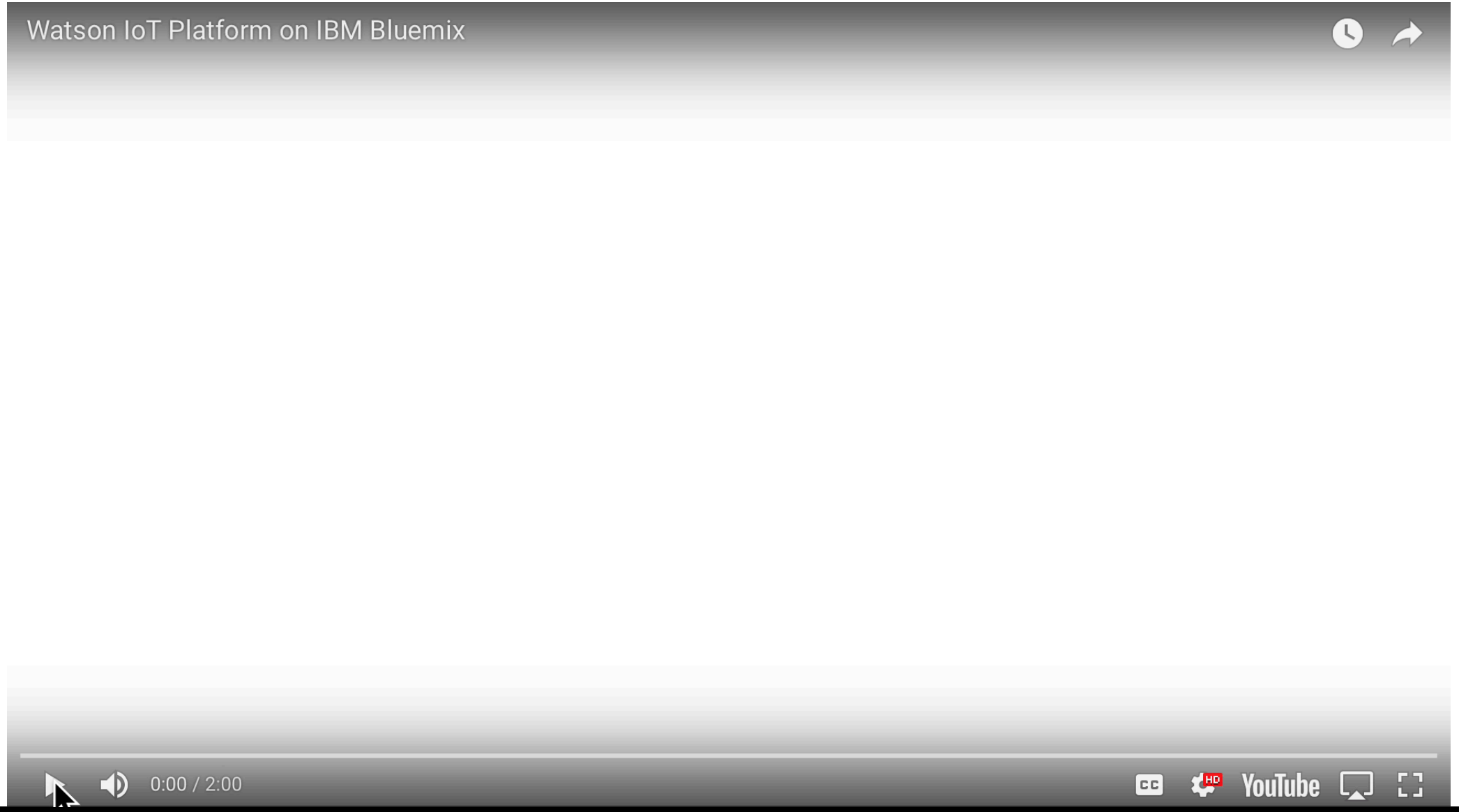
Platforms

- IoTivity
- The IoTivity is an open source project. The IoTivity project is hosted by the Linux Foundation, and sponsored by the OIC that is a group of technology companies such as **Samsung Electronics** and **Intel** who will be developing a standard specification and certification program to enable the Internet of Things. Includes AllJoyn now.
- https://api-docs.iotivity.org/latest/index.html
- http://www.intel.com/content/www/us/en/internet-of-things/white-papers/iot-platform-reference-architecture-paper.html?wapkw=iot+platform
- OIC (Open Interconnect Consortium), Samsung, Atmel, Broadcom, Dell, Intel and Wind River

Platforms

- IBM Watson
- http://www.ibm.com/internet-of-things/iot-solutions/watson-iot-platform/

Platforms - IBM Bluemix/Watson



Platforms

- GE Predix
- https://www.ge.com/digital/predix

Platforms

- Cisco Jasper
- https://www.jasper.com
- https://www.jasper.com/real-iot

Platforms

- Neura (FitBit, consumer)
- http://www.theneura.com

Platform Market

- The market for platforms is expected to grow at a CAGR of 29.0% between 2016 and 2022 to reach USD 29.83 billion by 2022.

- Further categorized into:
  - Device management
  - Application management
  - Network management

Device Management

- "The **device management platform** assists organizations in managing, tracking, securing, and sustaining the abundant devices that are used in the organization. It also helps in managing devices' content, configuration as well as assists in policy and compliance management."

Application Management

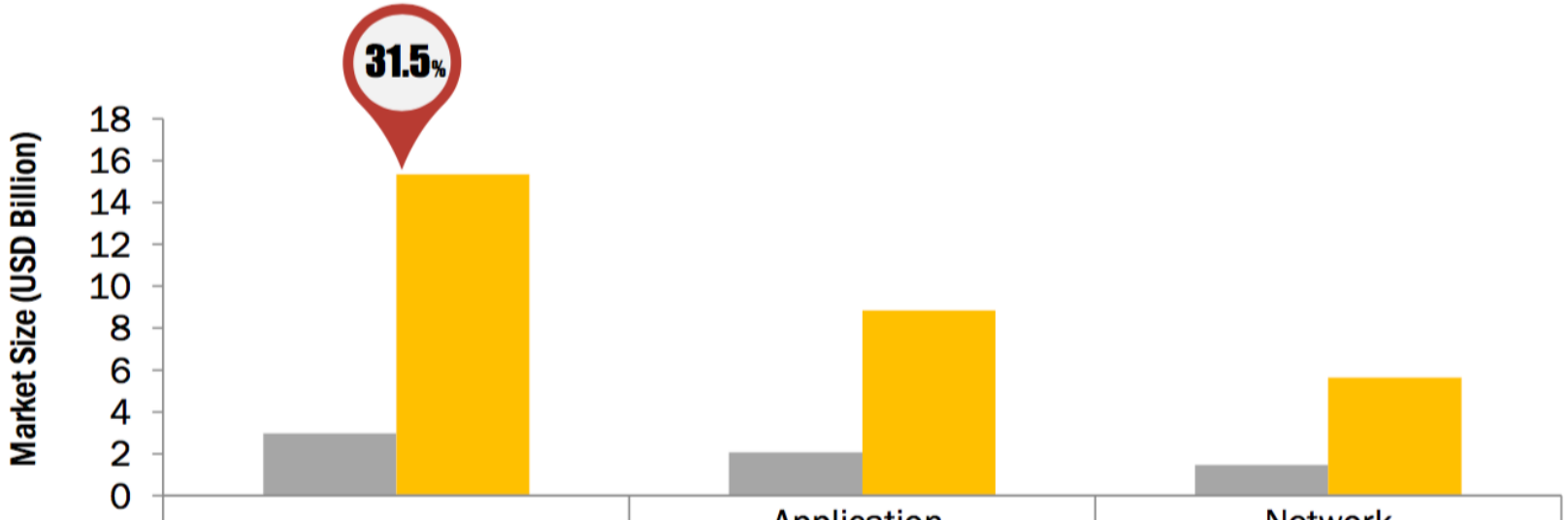
- “Connected devices generate huge amount of sensor data. Traditionally, this sensor data was sent to the applications that stored and managed it securely. However, the developers faced a tedious task to create applications based on a “home grown” application framework.
- The **application management platform** addresses the mentioned issues by connecting the devices over a network and assists in designing, developing, and managing applications. The application management platform offers various features such as application hosting, remote device management, data storage, monitoring, sharing, and management and analytics capabilities. The **application management platform API** is an important component. It provides access management, gateways, data communication and coordination, fault tolerance and security.”

Network Management

- "**Network management platform** provides a common platform to manage the entire network of an organization. The platform ensures that the users are able to receive IT services from anywhere and at any time. By using the platform, a network administrator can easily detect any failure in the network and resolve issues in realtime or by informing the support personnel."
- "The network management platform also assists in analyzing the amount of data transferring over a network and automatically routes them, to avoid congestion that can result in a crash of the network. For critical applications areas, such as mobility and transport, logistics, energy, and manufacturing, seamless and faster data transfer is required. This requires appropriate configuration of network devices and is possible only through a high level of visibility provided by the network management platform."

Platform Market

FIGURE 33 DEVICE MANAGEMENT PLATFORM EXPECTED TO LEAD THE IOT TECHNOLOGY MARKET DURING THE FORECAST PERIOD



	Device Management Platform	Application Management Platform	Network Management Platform
2016-e	2.96	2.05	1.46
2022-p	15.34	8.84	5.65
CAGR (2016–2022)	31.5%	27.5%	25.2%

An example deployment

- Building automation for a 5-story building

An example deployment (con't)

- 5 floors
- 2 units per floor = 10 units
- 20 people/unit = 200 people/building
- 2 entrances

An example deployment (con't)

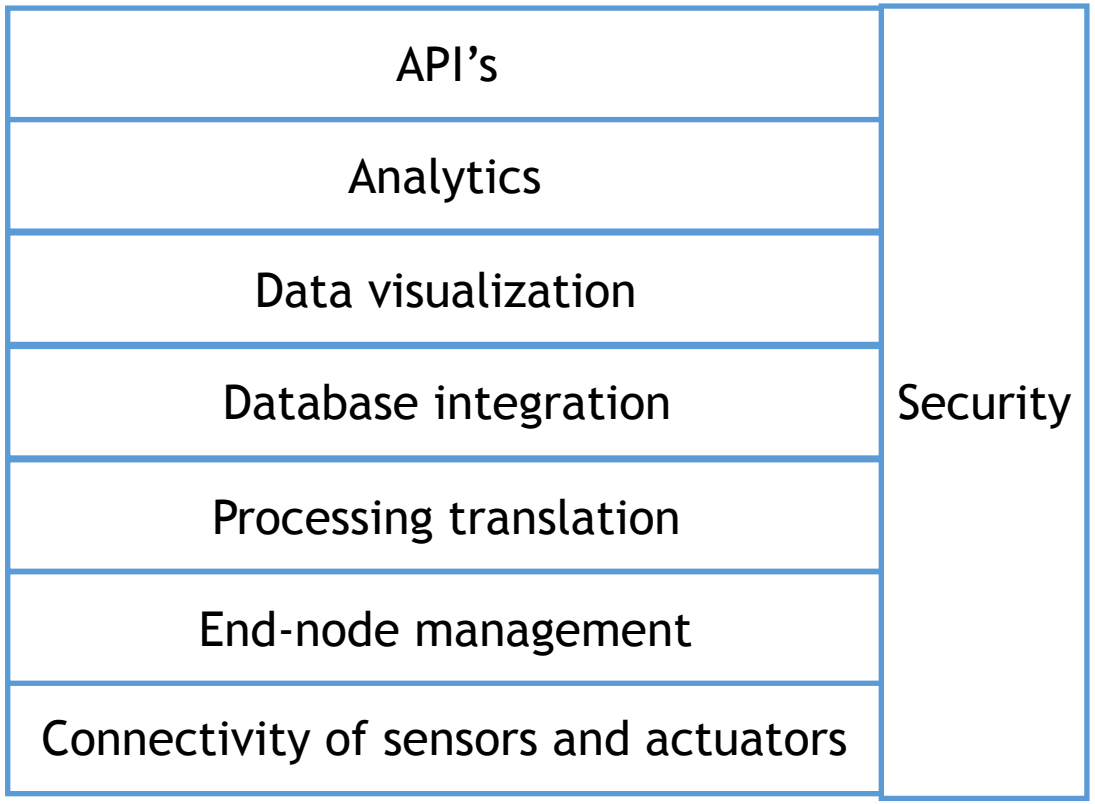
Sensor/Actuator	Protocol	# Needed
Occupancy	EnOcean	200 + 60 hall/stairs/elev = 260
Daylight	WHART	4
Thermostat	Z-Wave	4 zones/unit * 10 units = 40
Camera	WiFi	4 cam/unit * 10 units + 6 outside = 46
Power meter	ANT	10 units = 10
Locks	Zigbee	10 + 2 exterior = 12
Smoke/Gas detector	WHART	8/unit * 10 units + 60 hall/stairs/elev = 140
Lighting control	EnOcean	10/unit * 10 units + 60 hall/stairs/elev = 160
	total = 6	total = 672

An example deployment (con't)

- How do we connect all of this together?
- How do we manage all of these devices?

An example deployment (con't)

- Platform to the rescue



Source: Industry 4.0, Alasdair Gilchrist

An example deployment (con't)

- Connectivity: This layer provides the means to connect and support the sensors and actuators, supporting all the protocols
- End-node management: This layer provides the ability to identify, authenticate, authorize and manage end-nodes
- Data processing: This layer provides data translation and preparation for the data coming from sensors
- Database integration: This layer provides the connection between applications (software) and data storage
- Data visualization: This layer provides the tools/techniques to visualize the data in meaningful ways; charts, graphs etc
- Analytics: This layer can provide the processing for feedback, either realtime, or delayed.
- APIs: This layer provides the APIs and the software development kit (SDK) for programmers
- Security: Integrated into every layer to ensure confidentiality, integrity and availability

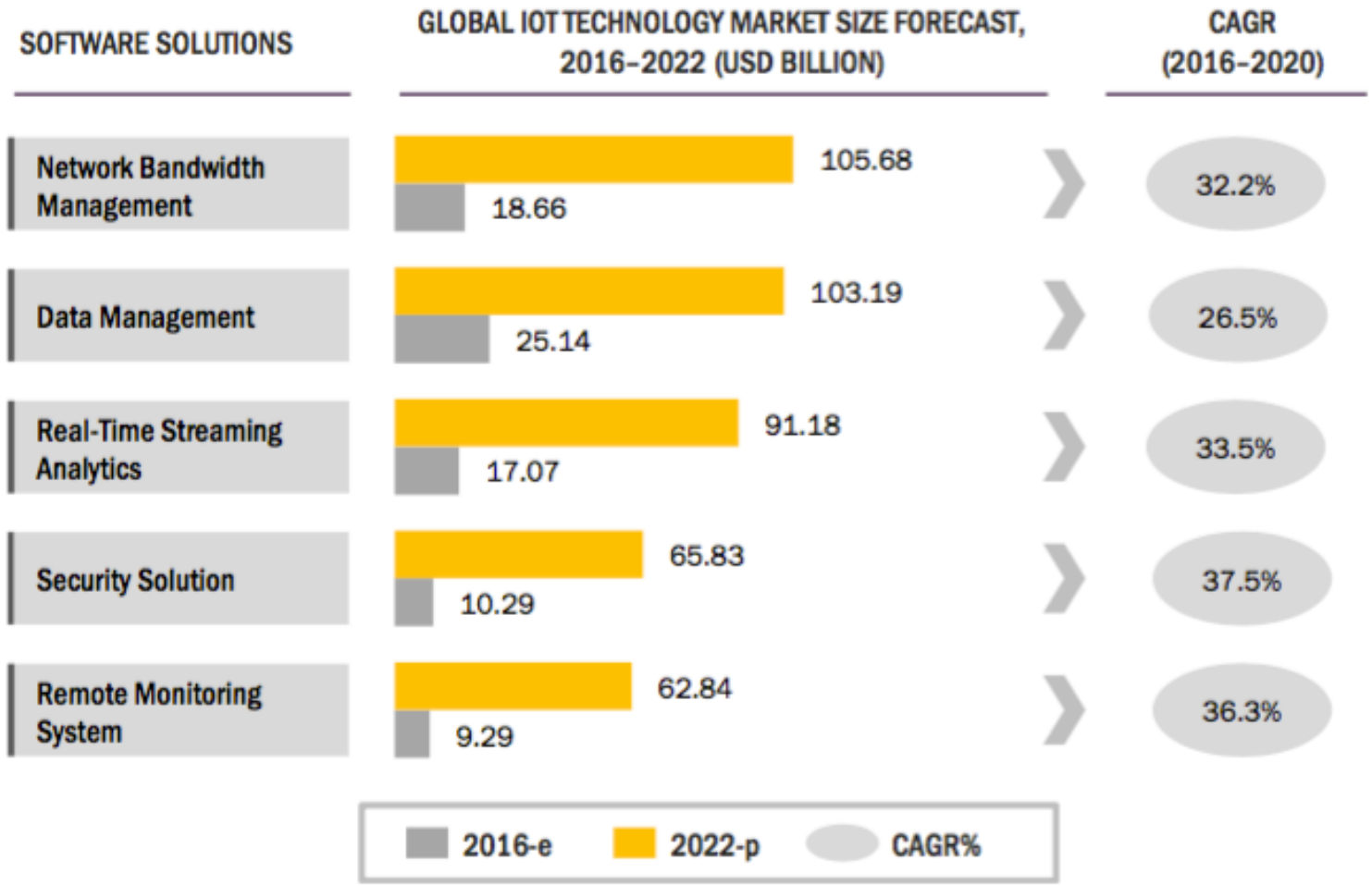
Software Solutions

Software Market Breakdown

- Real-time steaming analytics
- Network bandwidth management
- Remote monitoring
- Security
- Data management (big data - how to store and analyze)

4.5 IOT TECHNOLOGY SOFTWARE SOLUTIONS MARKET, BY TYPE (2016–2022)

FIGURE 16 NETWORK BANDWIDTH MANAGEMENT SEGMENT TO DOMINATE THE SOFTWARE SOLUTIONS MARKET DURING THE FORECAST PERIOD



Real-time streaming analytics

- “Organizations worldwide are focusing towards the use of advanced IT systems to overcome the challenges faced by them in day-to-day operations. Huge data volumes are generated through various smart and connected devices which are used for various applications across different industry verticals.
- This data could be transformed into crucial information and insights with the help of data analytics to yield greater efficiency, productivity, and profitability to the organizations.
- Advanced solutions such as real-time streaming analytics have transformed conventional management into fact-based, decision-driven management.”

Real-time streaming analytics (con't)

- "Moreover, it also helps to detect anomalies in real-time data and trigger alert when there is an error. This can assist organizations for easy decision-making, customer retention, and taking appropriate business related decisions in realtime.
- Therefore, understanding the increasing importance of this technology, companies such as Microsoft Corporation, SAP SE, Amazon Web Services, and IBM Corporation have developed realtime analytics solution for IoT. Large investments in cloud-based solutions and high internet penetration are the factors propelling the growth of the market."

Real-time streaming analytics (con't)

- https://www-ssl.intel.com/content/www/us/en/analytics/overview.html?wapkw=advanced+analytics
- https://www-ssl.intel.com/content/www/us/en/it-management/intel-it-best-practices/joining-iot-with-advanced-data-analytics-to-improve-manufacturing-results-paper.html?wapkw=advanced+analytics

Security

- “The diversified reach of IoT has led to the evolution of several threats such as malware and bots, which can cause huge losses in financial and personal data. These threats could have a devastating impact on smart grid and smart transportation where a single cyber-attack could prove fatal for businesses and can lead to great financial loss. IoT security solutions include application security, device security, and network security solutions.”
- “Companies such as Cisco Systems and Symantec Corporation are developing security solutions that enable organizations to secure their IoT ecosystem.”

Security (con't)

- http://www.cisco.com/c/en/us/solutions/internet-of-things/iot-security.html

Data Management

- “Data is crucial in every sector and managing it is of utmost importance, to understand the patterns and develop logical information out of it. Companies such as IBM Corporation, SAP SE, and Oracle Corporation are developing solutions under data management to provide various sectors with ease of information for future decisions.”
- “Therefore, to manage this data, organizations require software solutions featured with analytics to easily handle this data and derive various useful patterns. A data management solution is an important software solution in the IoT segment as IoT devices produce enormous amounts of data that pose a challenge for the providers to deal with efficiently.”

Data Management (con't)

- http://www.sap.com/belgie/solution/internet-of-things/iot-platform.html

Remote Monitoring

- “A remote monitoring system is a very reliable facility that enables efficient monitoring and management of various systems, remotely. Through this system, one can change the operations of the devices from a central office. It has various applications such as smart grid, train control, pipeline sensors, and server monitoring. Remote monitoring is not a recent concept for industrial automation; various organizations in many countries have been using this technology for 25 years through hardwired Ethernet connections.”
- “A remote monitoring system also contributes to cost saving and helps to improve business operations by minimizing and preventing unplanned downtime and access to real-time situational data in the organization. Remote monitoring systems are also useful for managing remote devices in case of breakdown or maintenance. A remote monitoring system also takes care of field update services, customization methods, security implications, and device selections. Hence, remote monitoring is an important solution that takes care of the entire IoT ecosystem, ranging from device provisioning, remote access, configuration, administration, software management, and device monitoring and troubleshooting.”

Remote Monitoring (con't)

- https://azure.microsoft.com/en-us/solutions/remote-monitoring/

Network Bandwidth Management

- “A network bandwidth management solution not only ensures that the users are notified when outages occur, but also increases network efficiency by tracking bandwidth and resource consumption. It is an important instrument to assure the performance and availability of the servers and the entire network.”
- “Huge amount of unstructured data and increasing need for IoT data management is expected to be the primary driver for the growth of the network bandwidth management software segment.”

Network Bandwidth Management (con't)

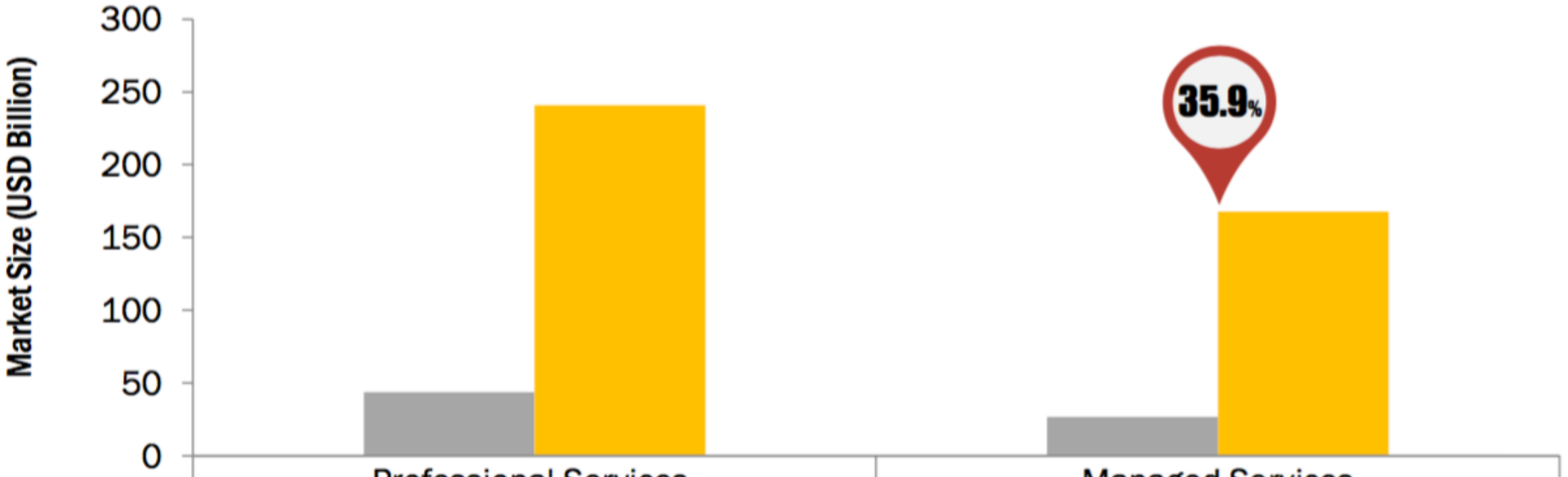
- https://www.softperfect.com/products/bandwidth/

Services

Services Market Breakdown

- Professional Services
- Managed Services

FIGURE 36 PROFESSIONAL SERVICES EXPECTED TO LEAD THE IOT TECHNOLOGY MARKET FOR SERVICES DURING THE FORECAST PERIOD



	Professional Services	Managed Services
2016-e	43.46	26.65
2022-p	240.74	167.59
CAGR (2016–2022)	33.0%	35.9%

Professional Services

- “Professional services include deployment and integration services, and support & maintenance services. Some companies do not have the required expertise to effectively manage infrastructure; therefore, to maintain the desired level of safety and protection, they outsource it to the third parties who possess expertise in such services. Professional services are required during and after the implementation of IoT systems. These services include planning, designing, consulting, and upgrading. Companies offering these services encompass consultants and dedicated project management teams that specialize in design and delivery of support software, tools, services, and expertise. Growth of the professional services segment is mainly governed by complexity of operations and growing deployment of IoT solutions.”

Professional Services (con't)

- https://www.business.att.com/enterprise/Family/internet-of-things/iot-professional-services/

Managed Services

Running an IIoT System

- “Managed services are considered crucial, as they are directly related to customer experience; these services help companies sustain their positions in the market. Moreover, it has become difficult for companies to focus on core business processes and support IIoT functions, which, in turn, increases the significance of managed services. These services offer technical skills that are required to maintain and update software in the IoT ecosystem. All the pre- and post-deployment queries and needs of customers are addressed under the managed services area. Integrated facility management, consultancy, round-the-clock help desk, finance and accounting are some of the upcoming managed services required by operators. This segment is mainly driven by the increasing adoption of outsourced managed services in the IoT market.”

Managed Services

- https://www.ericsson.com/spotlight/services/managed-services/

End