Cloud for IoT

Embedded Interface Design

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Learning Objectives

- Students will be able to…
  - Understand the key functions provided for IoT and connected devices by cloud services
  - Identify some of the key differentiators for cloud IoT implementations

Cloud Support for IoT

What are key features of cloud services that support connected embedded IoT systems, devices, and prototypes?

- Device Inventory Management
- Device SDKs
- Security
- IOT Application Protocols (MQTT, etc.)
- Storage
- Dashboards
- Big Data/Machine Learning/ Analysis Tools
- Scalability
- Integration and Interoperability
- OTA Updates
- Connectivity & System Management
- Serverless Processes
- Data Access and Storage
- Digital Twins
- Test and Development
- Communications (Mobile, SMS, etc.)

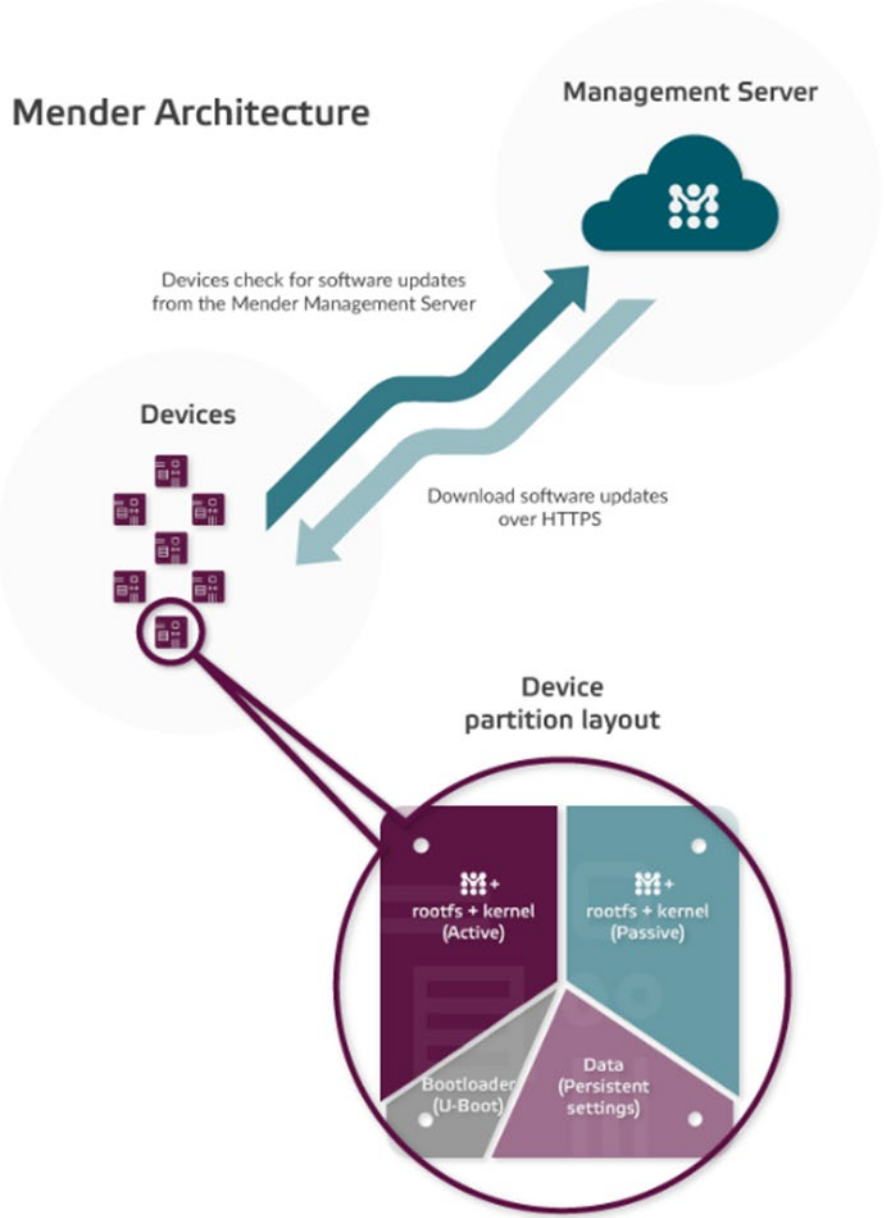
- Adapted from Reference [5]

Cloud Support for IoT

- Choices for Features/Tools
  - Cloud Service Vendors
  - Third Party Vendors
  - Open Source
  - Custom Development

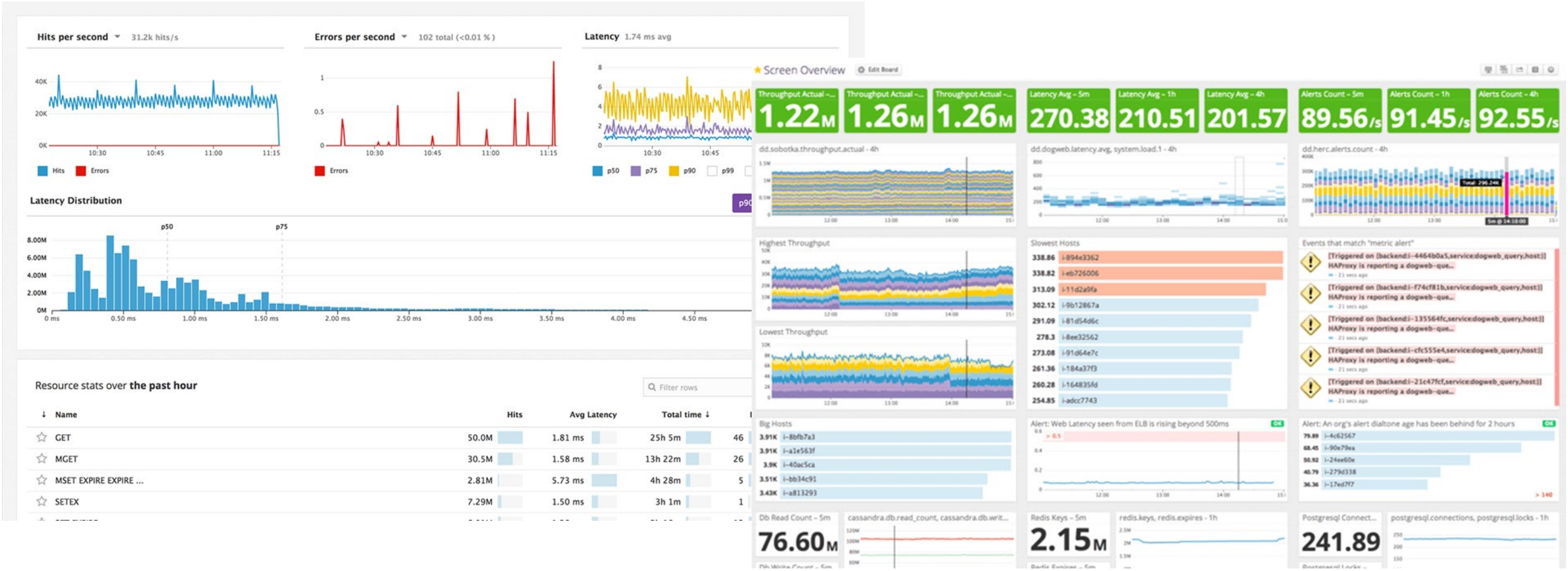
OTA (Over-The-Air) Updates

- Firmware/software patches
- Security updates
- Configuration file updates
- Device resets
- Diagnostics
- Example: AWS provides “device jobs” for OTA Updates [1]
- Example: Mender is an OTA tool for Embedded Linux IoT Devices [2], [3]



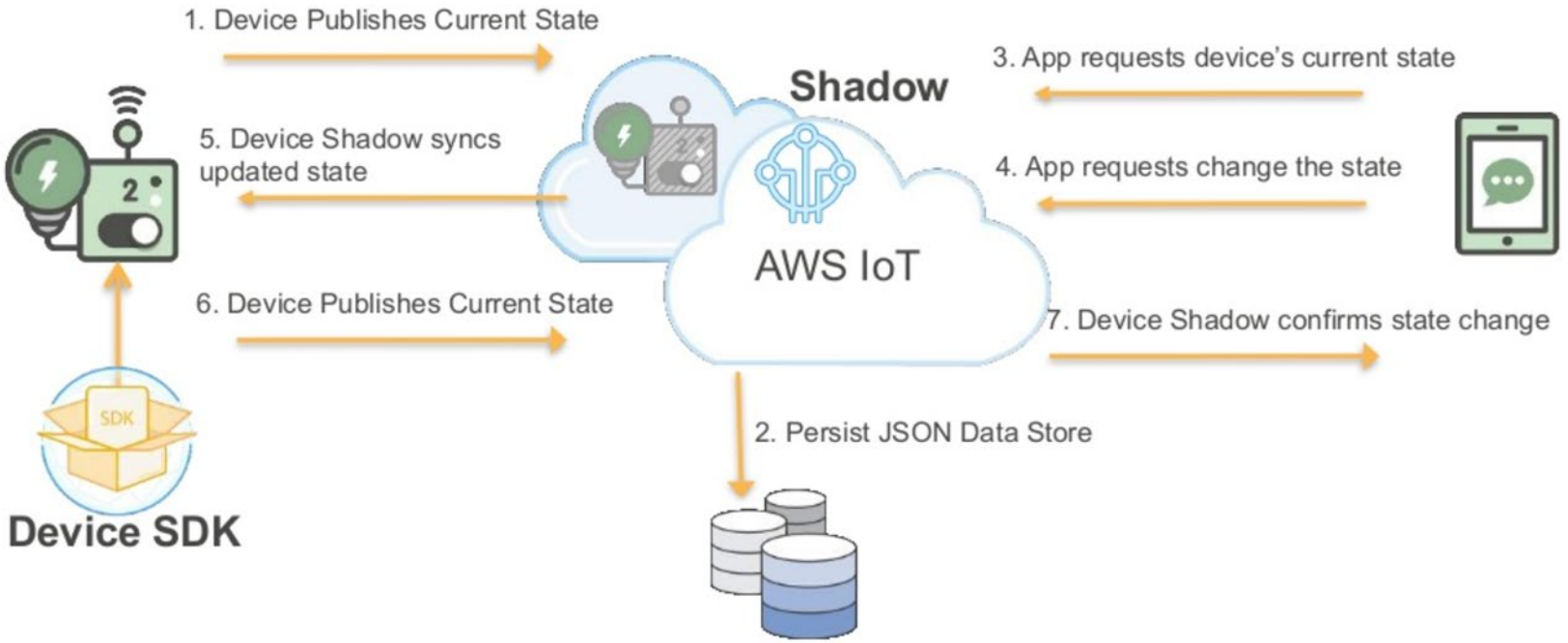
Dashboards with Status and Alerts

- Monitoring health of networks of IoT Devices [4]



Digital Twins

- ”virtual replicas of physical devices” [6]
- Can be used to simulate devices before build and deployment
- Can be used to buffer communications and state for connected devices
- Ex. AWS IoT Device Shadows [7]



Serverless Processes

- Now a common feature of Cloud services
- Being able to execute code for transactions without provisioning a virtual machine
- Uses: Real-time data processing and analysis, API integration
- Examples: AWS Lambda, Google Cloud Functions [8], Azure Functions

Other IoT Cloud Features

- IOT Application Protocols (MQTT, etc.)
- Storage & Scalability
- Device Inventory Management – device registries, catalogs, services
- Security – Authentication, Authorization, Accounting (AAA), secure device communications and encryption
- Big Data/Machine Learning/Analysis Tools
- Integration and Interoperability – APIs, Protocol Support
- Test and Development Services and Device SDKs
- Communications (Mobile, SMS, etc.) Services

References

[1] https://aws.amazon.com/blogs/iot/using-device-jobs-for-over-the-air-updates/
[2] https://mender.io/
[3] https://mender.io/product/how-it-works
[4] https://www.datadoghq.com/dg/monitor/iot/
[5] Enterprise Internet of Things Handbook, Ravulavaru, 2018, Packt – Chapter 10 Platform Comparisons
[6] https://www.networkworld.com/article/3280225/internet-of-things/what-is-digital-twin-technology-and-why-it-matters.html
[7] https://www.slideshare.net/AmazonWebServices/the-lifecycle-of-an-aws-iot-thing
[8] https://cloud.google.com/functions/