IoT TASK WORK RESULTS

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BRIEFING

IoT Task Work Results

TASK

- Create a basic tenant on Azure IoT Hub
- Create a sample Android app that:
  - registers itself to Azure IoT Hub using (simulated) device and location information
  - logs (simulated) temperature (simulated) every 5 minutes
  - logs bandwidth (inbound + outbound) usage every 5 minutes (it's ok to use simulated values)

  We **encourage** use of the official example app provided in the Azure IoT Hub documentation as a starting point at least!
- implement alerts with Azure IoT Hub to:
  - notify when temperature raises above 10 °C
  - alert when temperature raises above 15 °C
  - notify when 5min bandwidth consumption exceeds 1 Mb

DELIVERABLES

- ✓ An Azure IoT Hub tenant configured to specification
- ✓ An Android sample app providing the described functionality
- ✓ A presentation describing:
  - a high-level overview of the current setup & implementations
  - challenges encountered & limitations of current solution
  - actions required to bring solution to production scale & grade
  - what you learned in the course of this task work
  - any other observations you wanted to make...

ASSUMPTIONS

IoT Task Work Results

- Telemetry data can be batched;
- Notifications are delivered in Slack;
- Alerts are delivered via SMS;
- Telemetry bandwidth usage:
  - ~1000 bytes per message(data + protocol overhead);
  - 1000*12*24*31 =~ 9MB/month -> negligible;
- The PoS fleet is growing at 75% of [redacted]s turnover growth rate, 200% YoY*, which gives us the following projection of POS units:
  - 4Q19: 500 units
  - 4Q20: 1250 units
  - 4Q21: 3125 units

ARCHITECTURE: OVERVIEW

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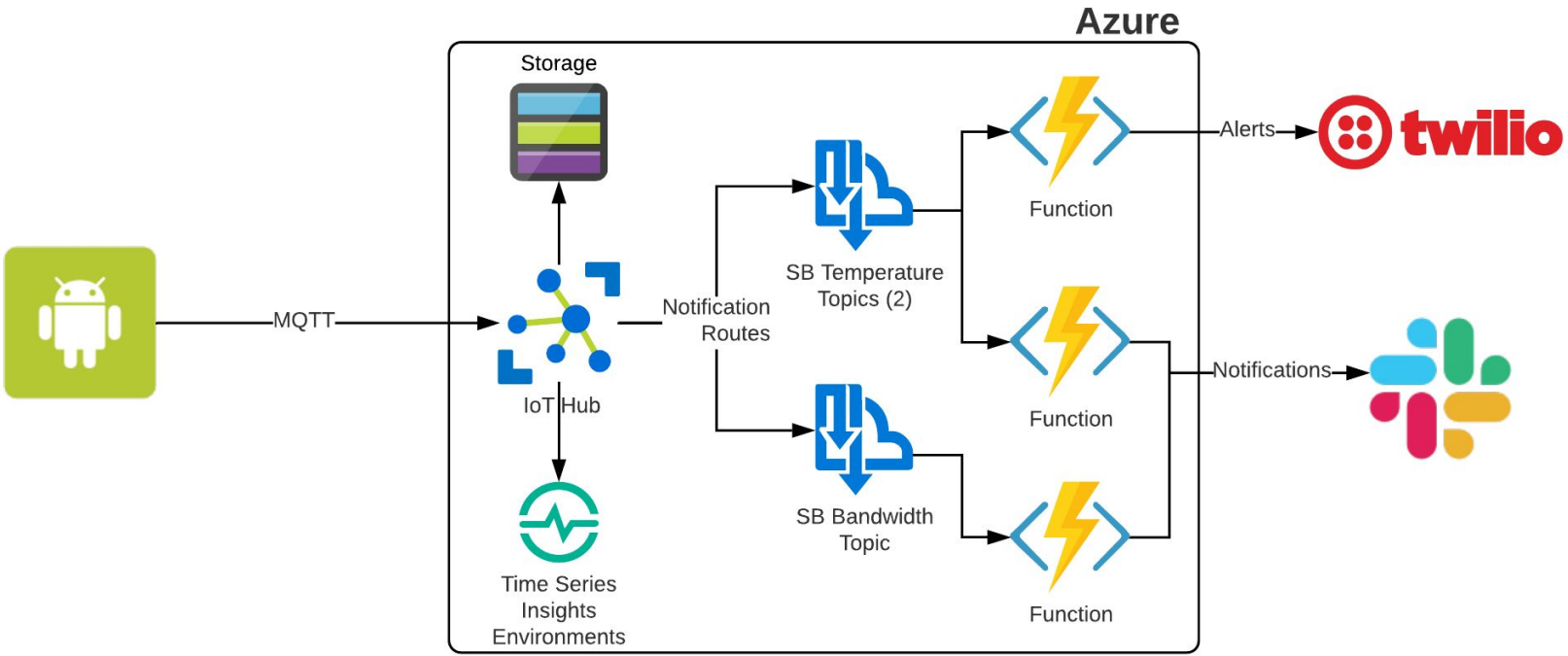
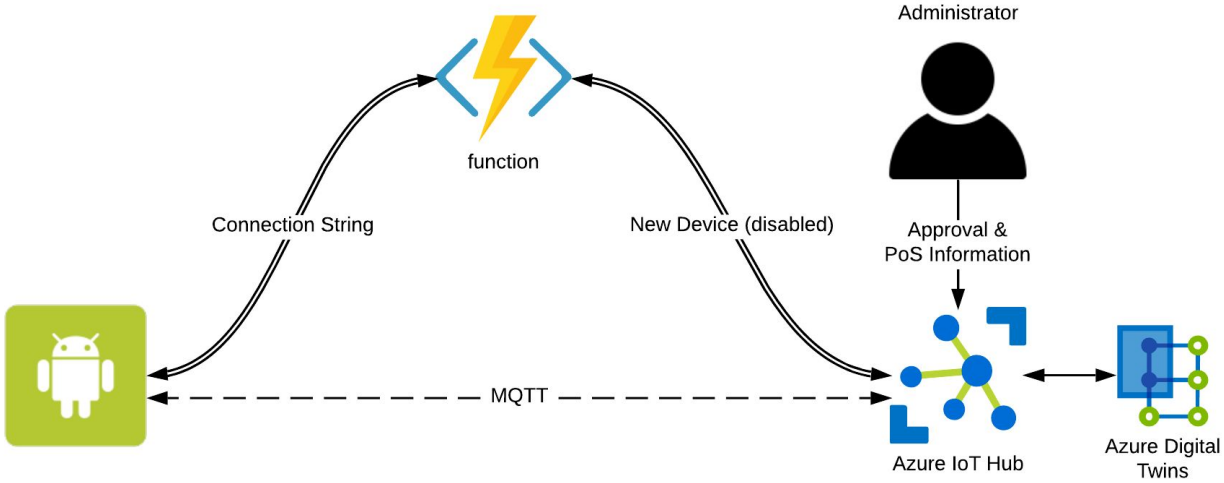


ARCHITECTURE: "SELF" PROVISIONING



Possible improvements:

- X.509 Certificates
- OOB confirmation (ex.: pin on screen)

* Self-provisioning is usually not a good idea

DELIVERABLES: IoT Hub

IoT Task Work Results

An S1 IoT Hub was created with custom messaging routes:

Resource group (change) : [redacted]
Status : Active
Current location : West Europe
Subscription (change) : Pay-As-You-Go
Subscription ID : 3014c1d5-dd9c-4126-8251-dafadb771e5a
Tags (change) : Click here to add tags

Hostname : [redacted]pos-iot-hub.azure-devices.net
Pricing and scale tier : S1 - Standard
Number of IoT Hub units : 1

Name	Data Source	Routing Query	Endpoint	Enabled
temperature-anomaly-route	DeviceMessages	$body.tempAvg >= 10.0	temperature-anomaly-bus-topic	true
temperature-alert-route	DeviceMessages	$body.tempAvg >= 15.0	temperature-anomaly-alert-bus-to...	true
bandwidth-anomaly-route	DeviceMessages	$body.inBw + $body.outBw >= 10...	bandwidth-anomaly-bus-topic	true
catchall-route	DeviceMessages	true	events	true
storage	DeviceMessages	true	[redacted]pos-telemetry-storage	true

DELIVERABLES: IoT Hub

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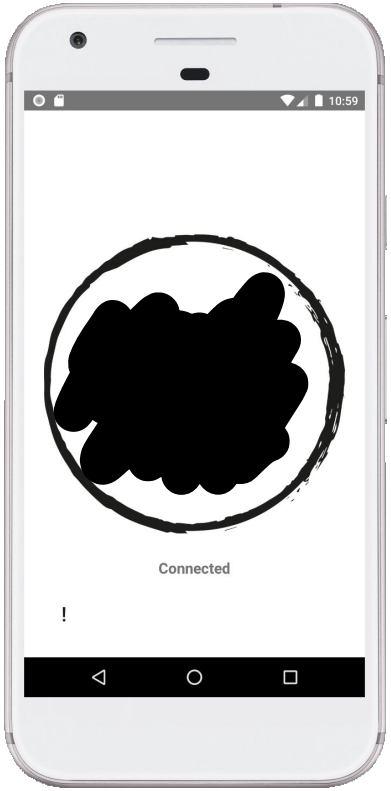
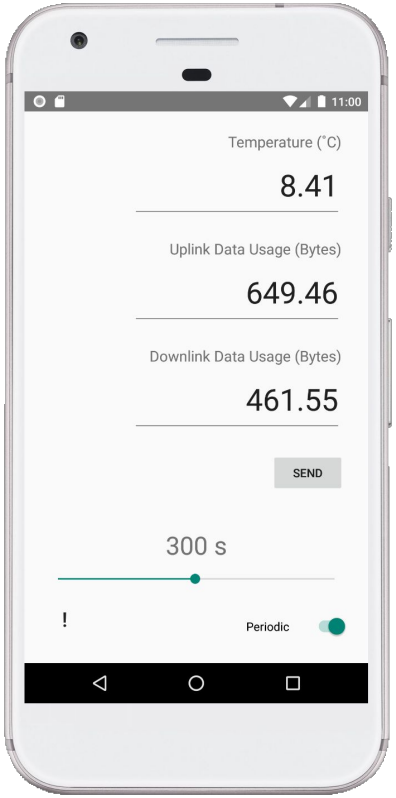
- Following the initial assumptions, [redacted] would need a standard **S1** hub, capable of up/down-stream messaging, twins and message routing:
  - Each S1 hub unit is capable of **400000** messages/day
  - Using batching, compression, aggregation, bundling, etc. we can target 1 telemetry message every 5 minutes at most. (Excluding alerts, transactional messages, command & control, etc.)
  - 4Q19*: 500 units * 24 hours * 12 messages = 144000 messages/day **(1 x S1 hub unit)**
  - 4Q21*: 3125 units * 24 hours * 12 messages = 900000 messages/day **(3 x S1 hub units)**

* Calculation

DELIVERABLES: Android App





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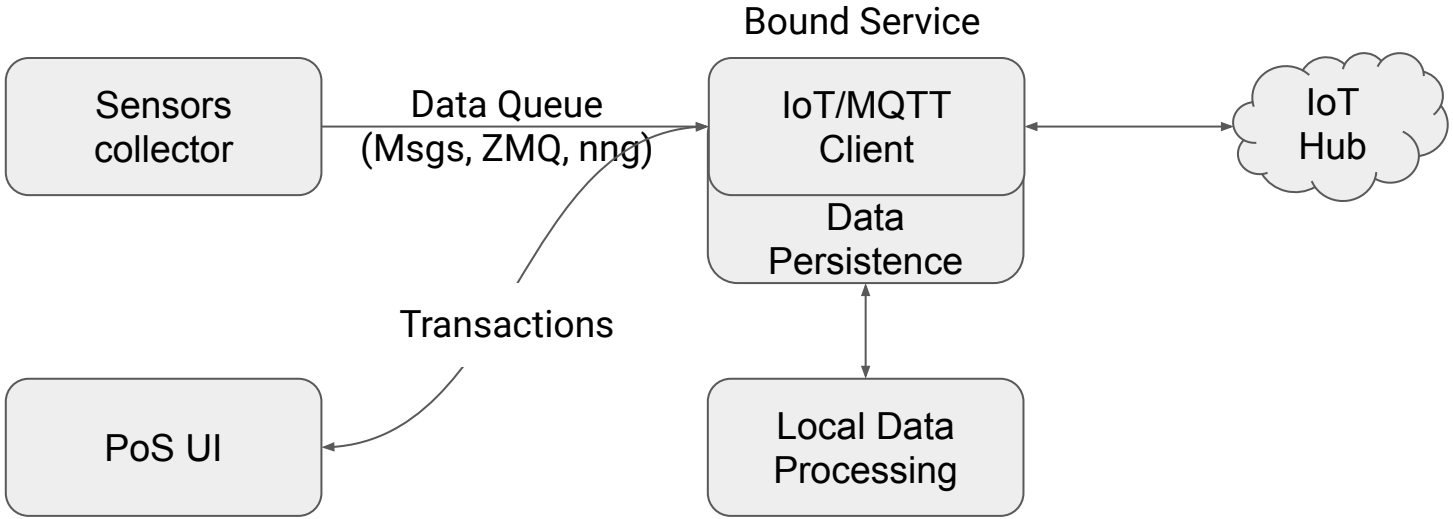
CHALLENGES & LIMITATIONS

IoT Task
Work Results

- Azure's offerings and UI required some time to digest; tying services together is too "verbose" and in general, feels bloated. AWS and GCP are more straightforward;
- Feature tiers could be an issue (Ex.: I had to start from scratch twice because some initial tier choices posed hard limitations);
- A cloud IoT platform alone is not enough for proper management and monitoring of an IoT fleet;

GOING INTO PRODUCTION - APP/PoS

- Implement Digi APIx for Android;
- Use a modular service architecture:



GOING INTO PRODUCTION - ORCHESTRATION

IoT Task Work Results

- A Remote Monitoring and Management dashboard should provide easy fleet observability, KPIs and issue tracking, shortcuts to everyday actions, and other relevant features.
- "Self-provisioning" can be dangerous, so it's advisable for the provisioning to happen at the factory or through an operator's interface;

GOING INTO PRODUCTION - MAINTENANCE

IoT Task Work Results

- Anomaly triggers must raise service issues in a Fleet Service Management platform or ticketing system, not a shot-and-forget alert;
- Bulk telemetry should be piped into streaming analytics to support predictive maintenance and anomaly detection;
- Anomalous telemetry data must be correlated with other signals, in order to avoid false triggers. Ex.: Avoid temperature alarm during sales peak;
- Build a redundant path for alerts and notifications(Message Bus + Stream Analysis);
- Support the maintenance team with a Root Cause Analysis methodology, focusing on diagnostics and mitigation of recurrent issues, instead of "putting out fires";
- Highly available systems and reactive maintenance are very costly. Preventative, Predictive and Self Maintenance should be the main "line of defense" against downtime;
- Telemetry collection and transmission architecture should be robust against network and power outages (buffering, persistence, UPS);

GOING INTO PRODUCTION - BANDWIDTH

IoT Task Work Results

- Bandwidth optimization is an exciting field, as bandwidth is not cheap and some optimization techniques are available;
- Bandwidth usage should be measured "over the wire" and not "at the edge", and the network operator should provide accurate data. Nevertheless, this naive approach could work as an indicator;
- IoT telemetry and transactional data should use a lean, resilient and secure protocol such as MQTT;
- Edge processing could be used to analyze raw data, react on-spot, and message uplink just the consolidate, transactional, and vital signals;
- Use Multipath Bandwidth Budgeting;
- Company processes should account for bandwidth costs, just as any other limited resource;

* EY Entrepreneur Of The Year Video

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Thank you!