APP**DYNAMICS**

Are Device Response Times a Neglected Risk of IoT?

Balwinder Kaur

Principal Software Engineer, Emerging Technologies
Open IoT Summit, Portland. February 22, 2017

Notice

The information and materials included in this presentation (collectively, the "Materials") are the confidential and proprietary information of AppDynamics, Inc. (the "Company"). No part of the Materials may be reproduced, distributed, communicated or displayed in any form or by any means, or used to make any derivative work, without prior written permission from the Company. © 2017 AppDynamics, Inc. All rights reserved.

All third party trademarks, including names, logos and brands, referenced by the Company in this presentation are property of their respective owners. All references to third party trademarks are for identification purposes only and shall be considered nominative fair use under trademark law.

About me: Balwinder Kaur

- Architect and Software Engineer
  - IoT since 2014 ([Delivered a Video Development Kit](#))
  - Android Camera Stack
  - Mobile (pre-smart phone era)
  - Enterprise Software
- Emerging Technologies @ AppDynamics
- @bkaurca
- #OpenIoT
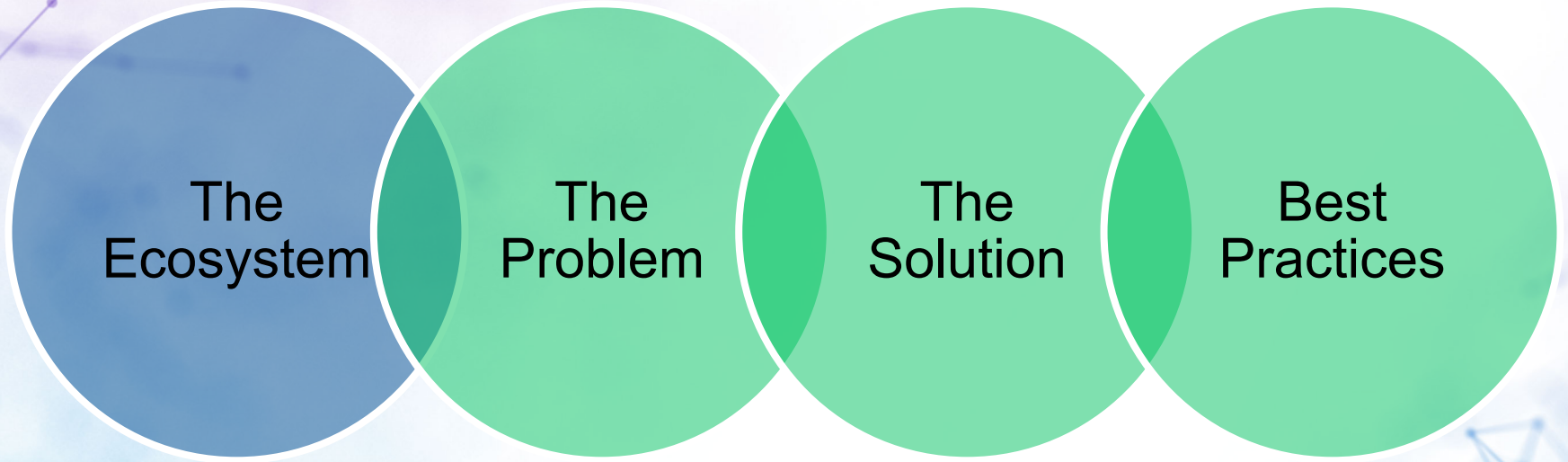- balwinder.kaur@appdynamics.com

Why This Talk?

HOUSTON...

WE HAVE A PROBLEM

memes.com
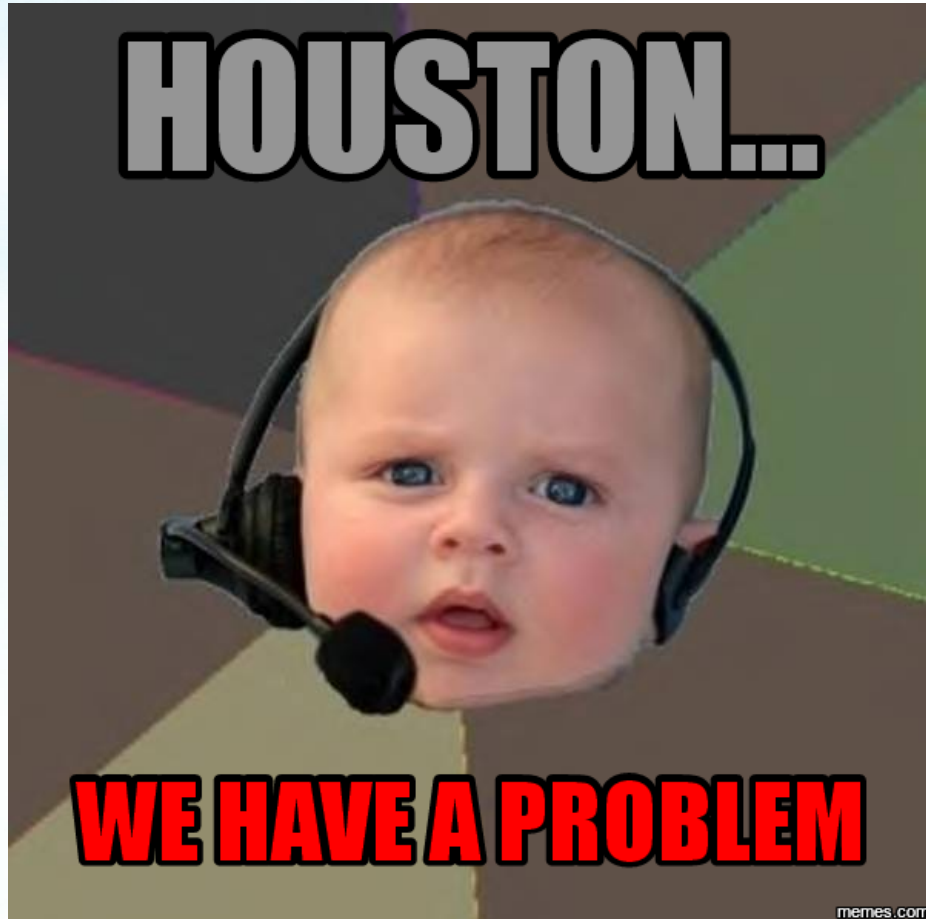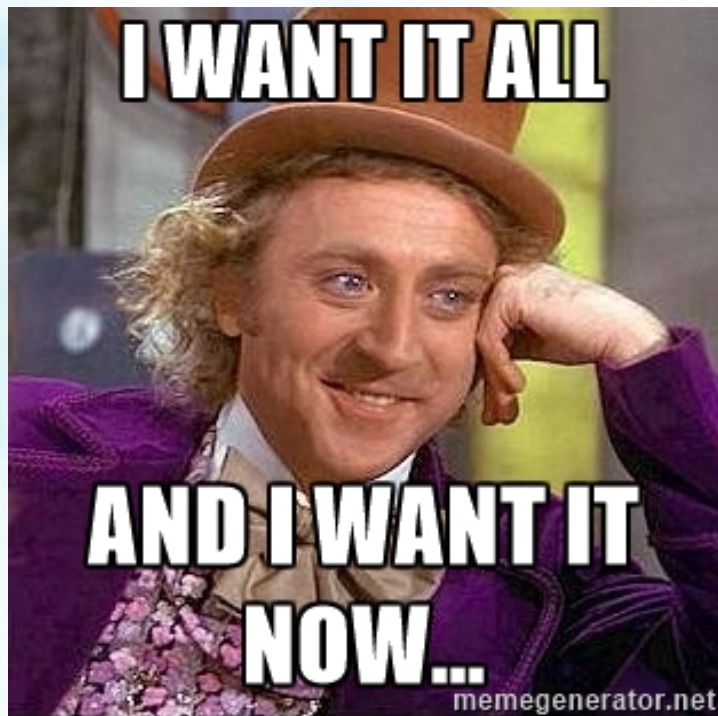
Agenda

The Ecosystem

The Problem

The Solution

Best Practices

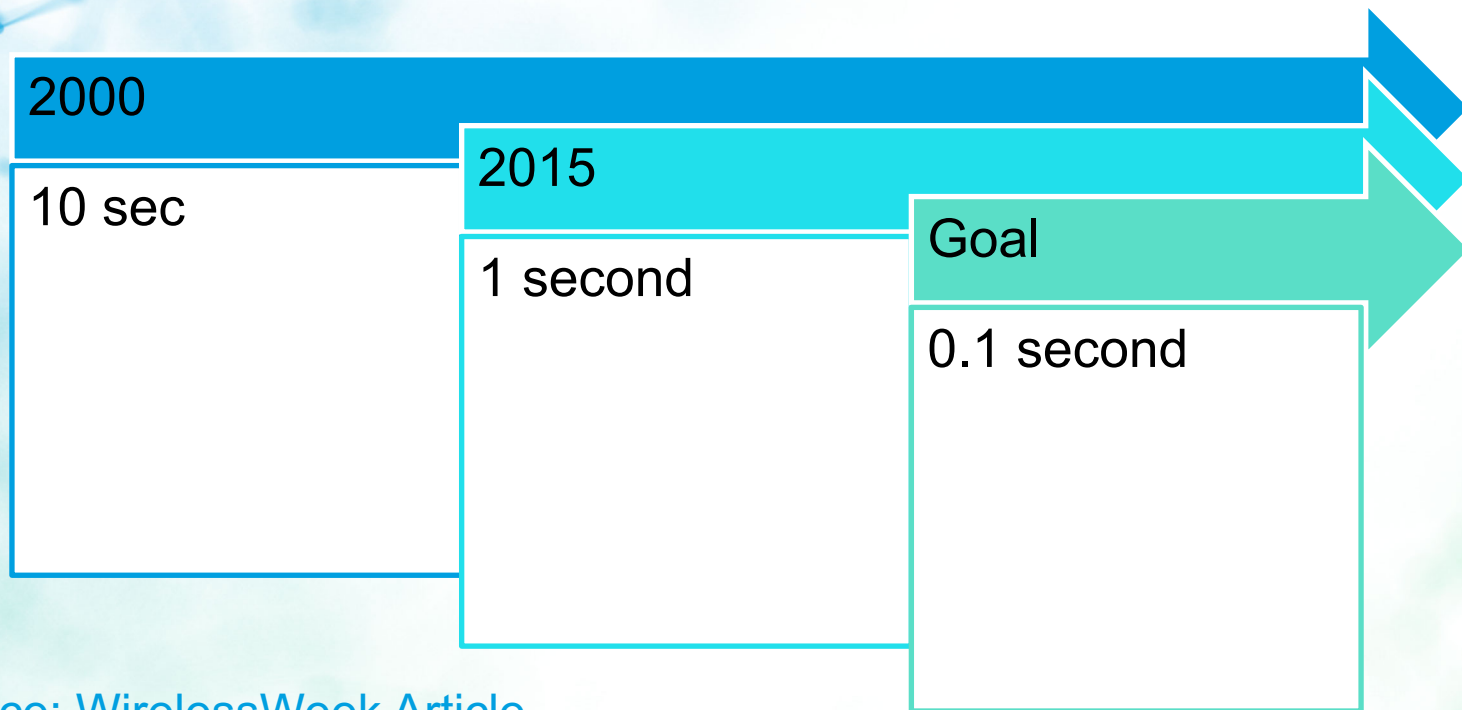The Ecosystem · The Problem · The Solution · Best Practices

APP**DYNAMICS**

The Changing Consumer

Response Time Expectation

2000

10 sec

2015

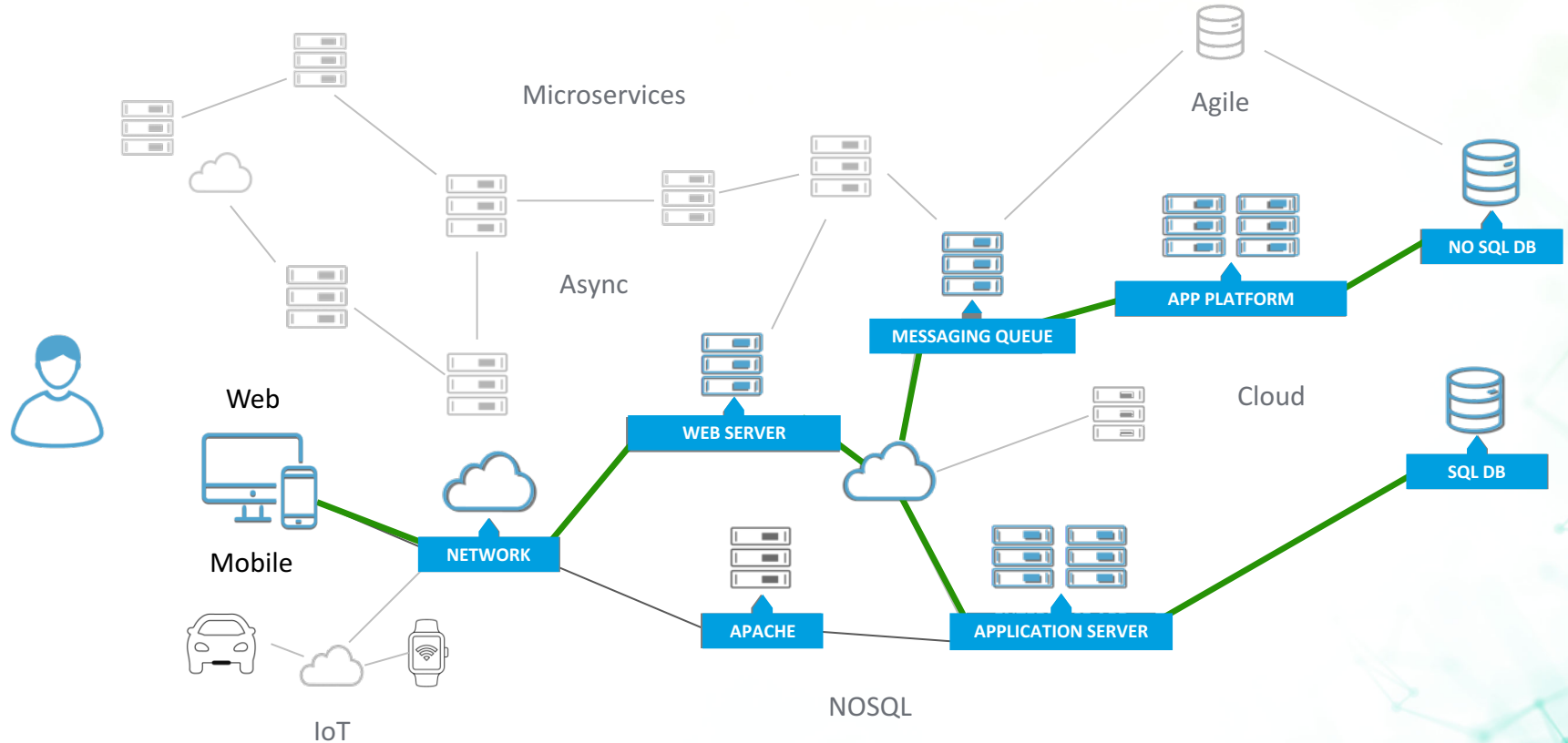1 second

Goal

0.1 second
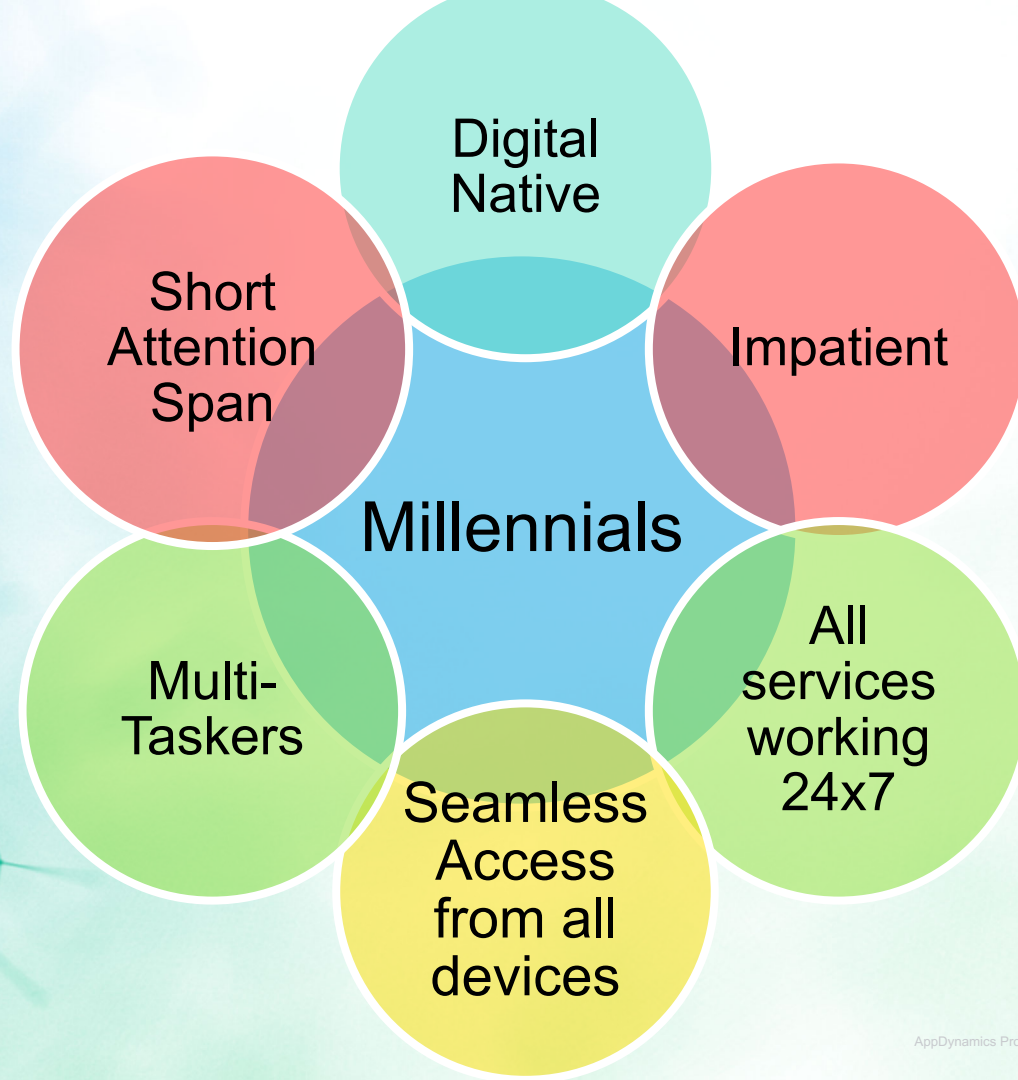
Source: WirelessWeek Article

The Changing Enterprise

Growing Complexity

What's Becoming More Complex?
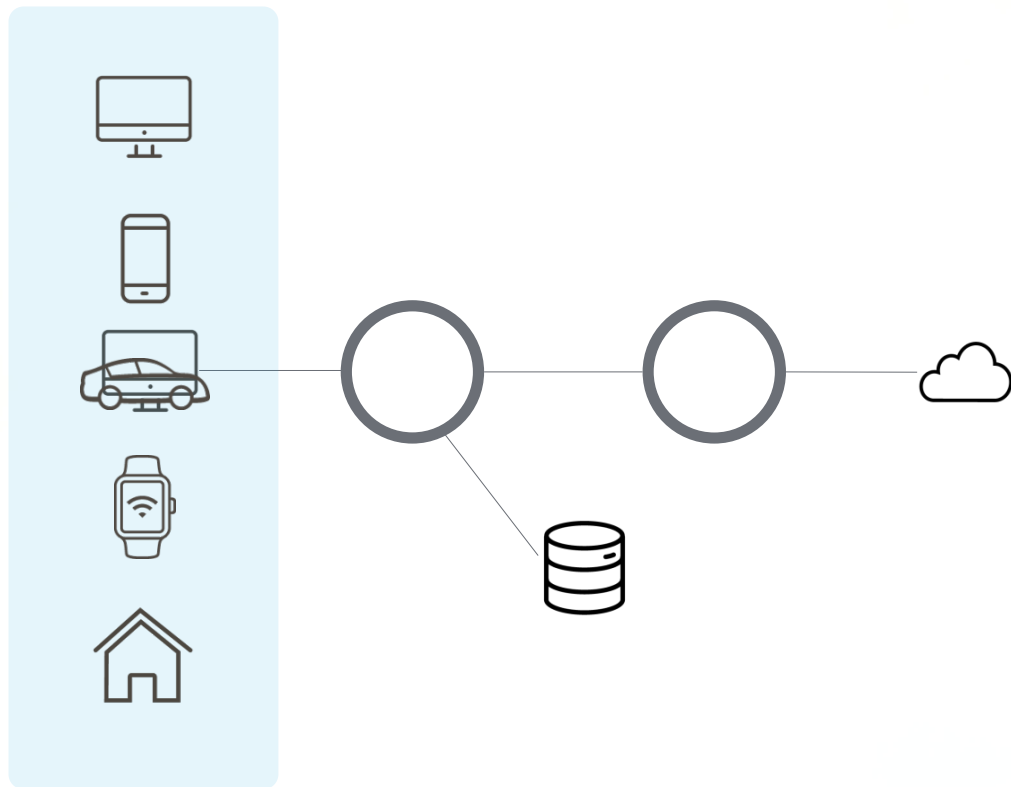
1. **More access points**

APP**DYNAMICS**

What's Becoming More Complex?
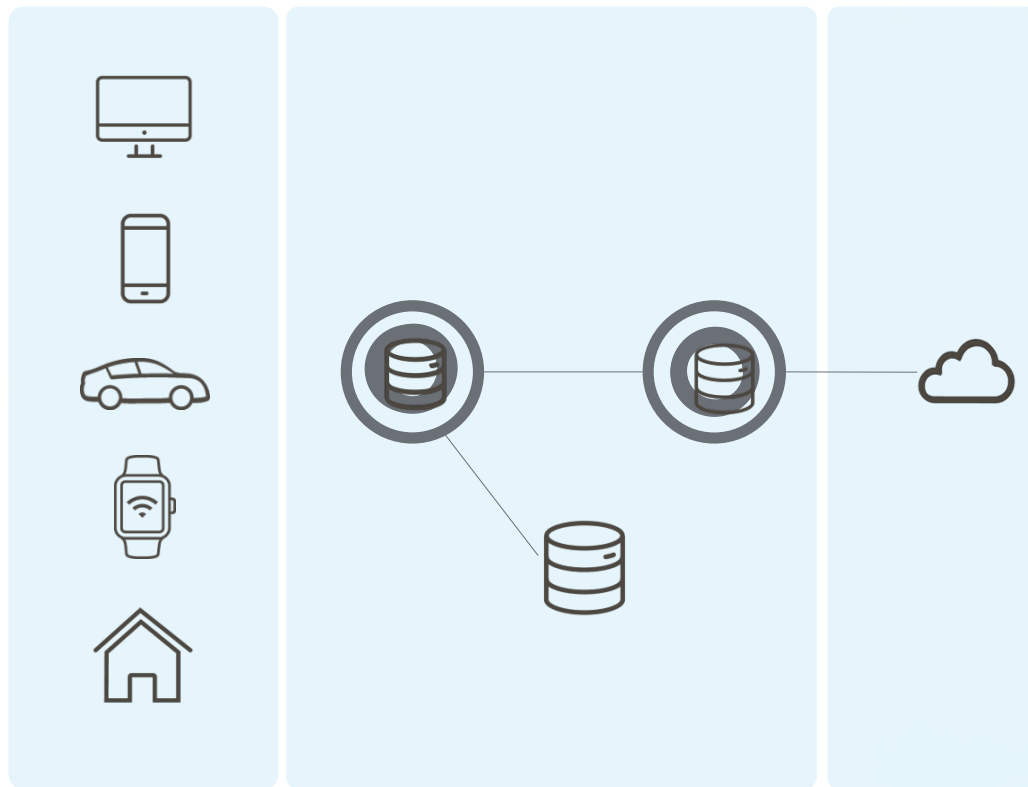
1. **More access points**
2. **Finer Grained Services**
3. **More external Services**

What's Becoming More Complex?
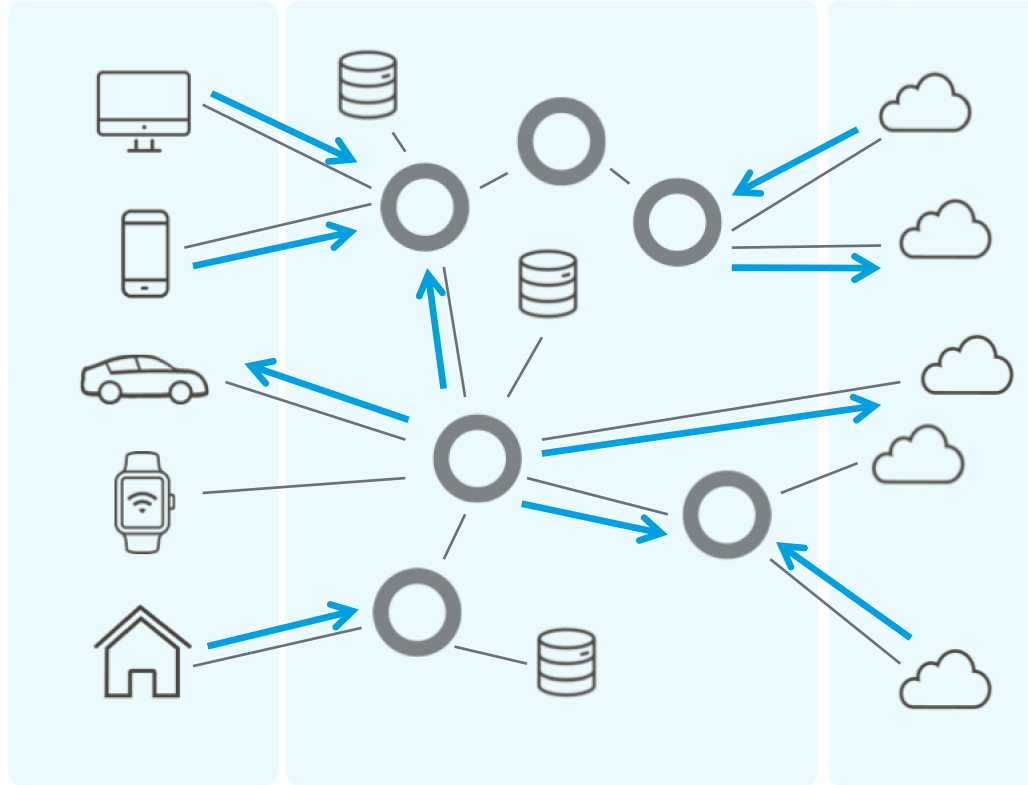
1. **More access points**
2. **Finer Grained Services**
3. **More external Services**
4. **Extremely Async**

APP**DYNAMICS**

What's Becoming More Complex?
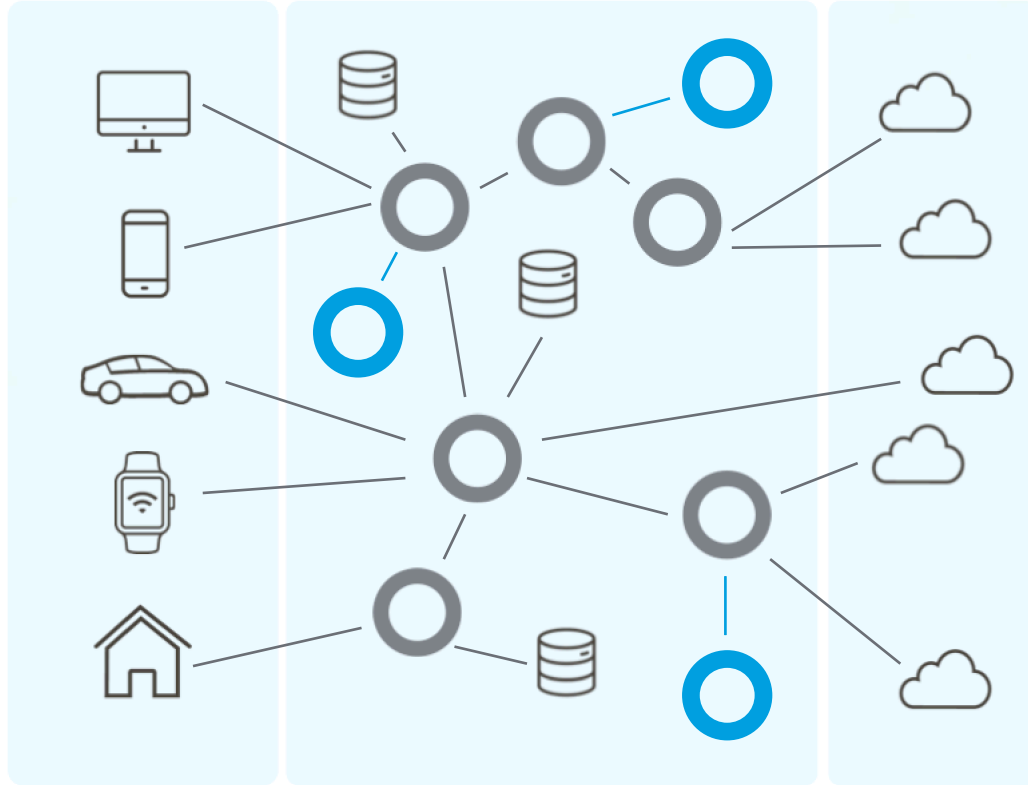
1. **More access points**
2. **Finer Grained Services**
3. **More external Services**
4. **Extremely Async**
5. **Ephemeral Services**

Latency Management

Uptime = $$$

Ultimately, Uptime = Success of the IoT Business

Voluminous Scale	Highly Distributed	Cross Organizational Transactions

Launching an IoT Solution

Risk Assessment

TOP IoT CONCERNS

What are your top 2 concerns for developing IoT solutions?

Concern	Percentage
Security	47.4%
Interoperability	29.4%
Connectivity	22.3%
Integration with Hardware	20.9%
Cost	18.6%
Performance	16.3%
Privacy	15.7%
Complexity	13.2%
Maintenance	12.1%
Data Analytics	11.3%
Certification/Conformance	6.7%
Other	2.5%
I don't know	2.5%
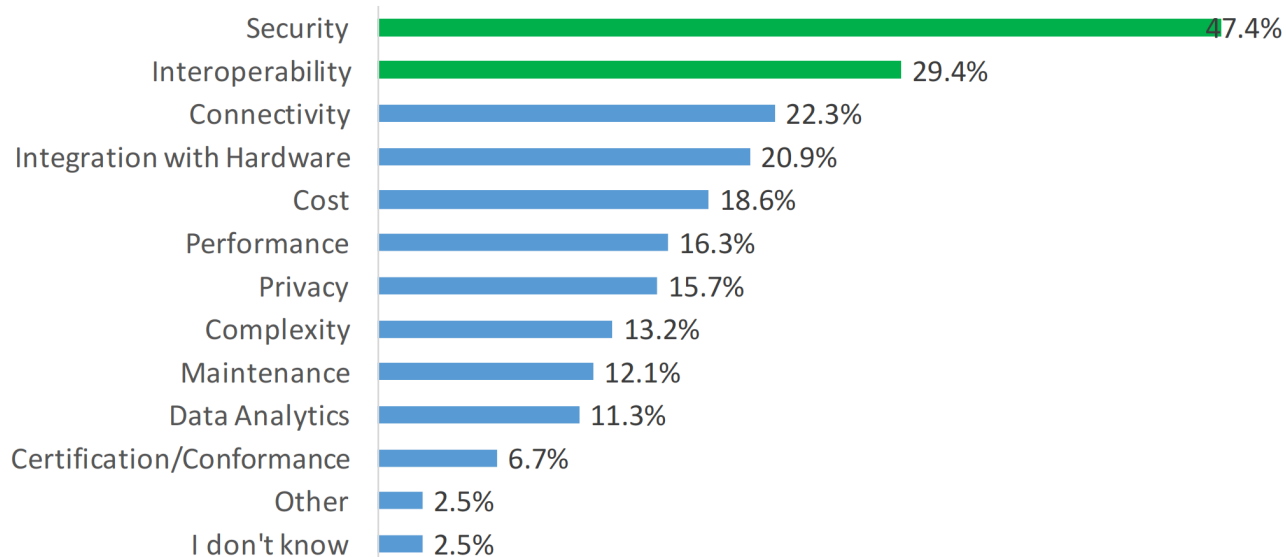
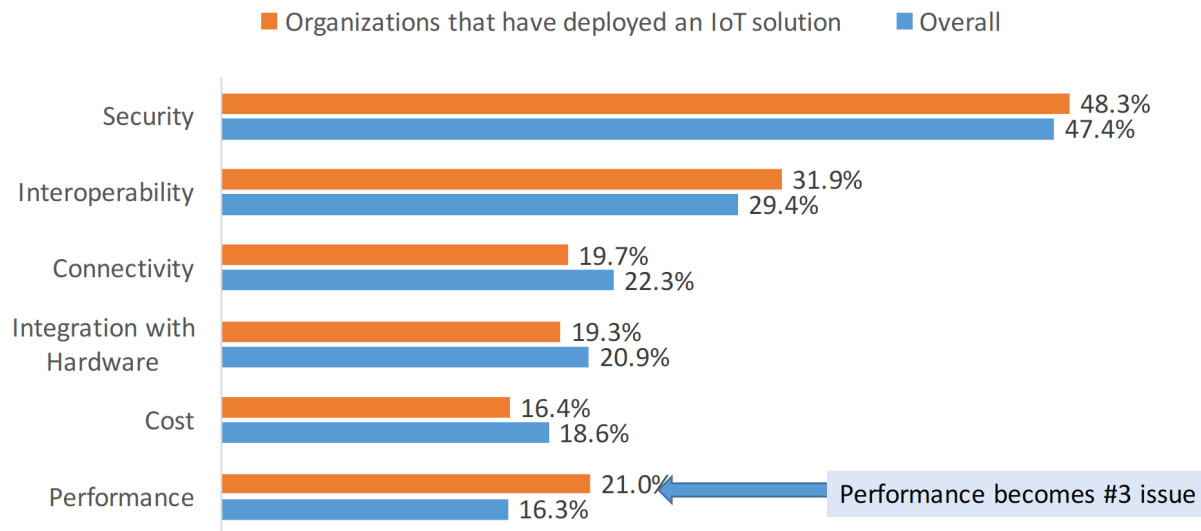4/14/16   IoT Developer Survey 2016 - Copyright Eclipse Foundation   15

Risk Assesment - After Deployment

ORGANIZATIONS THAT HAVE IoT SOLUTIONS TODAY

What are your top 2 concerns for developing IoT solutions?

■ Organizations that have deployed an IoT solution   ■ Overall

Concern	Organizations that have deployed an IoT solution	Overall
Security	48.3%	47.4%
Interoperability	31.9%	29.4%
Connectivity	19.7%	22.3%
Integration with Hardware	19.3%	20.9%
Cost	16.4%	18.6%
Performance	21.0%	16.3%

Performance becomes #3 issue

MTTR

Mean Time To
Resolution

KPI for Success

Performance Impact

Backend Services

Devices

APP**DYNAMICS**

The Ecosystem

The Problem

The Solution

Best Practices

APPDYNAMICS
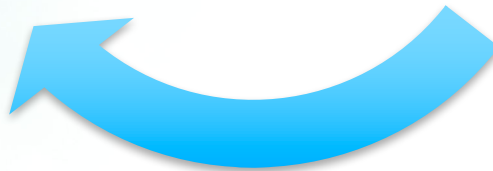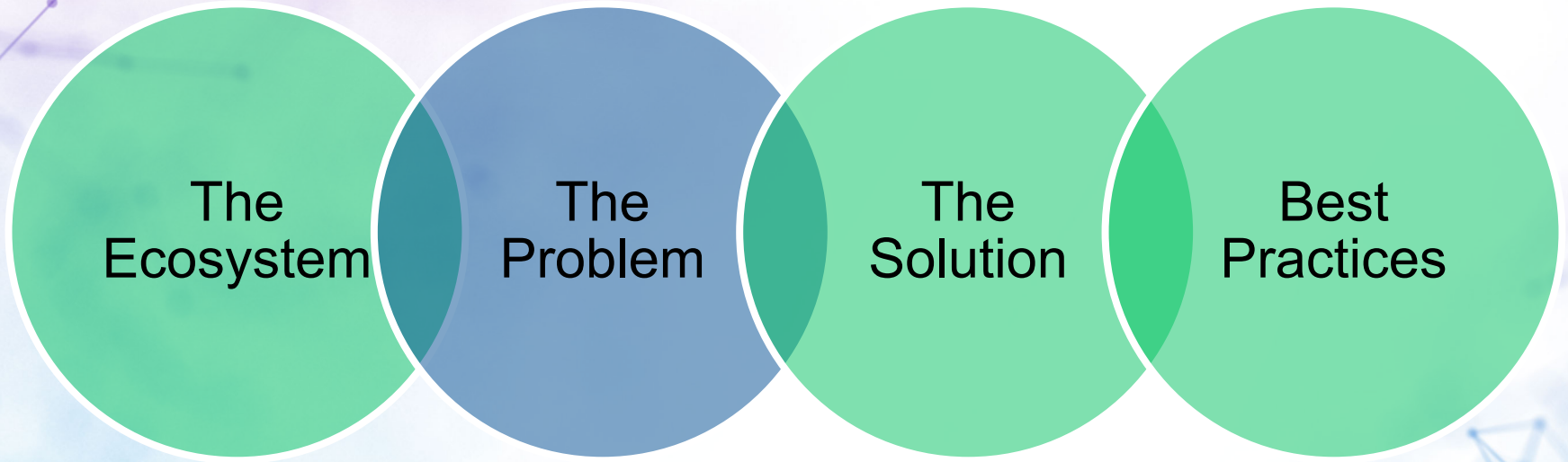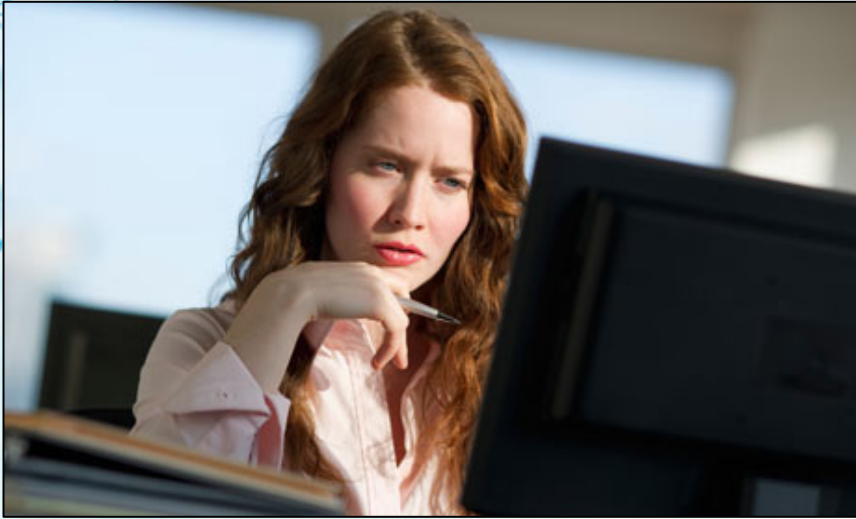
Teresa

Director, **IT Services**
Inventory Management Company

- Manage web applications on the cloud for customers to fulfil their orders from mobile and web.
- Recently launched an RFID based automated inventory management system
- It is now possible to track and manage inventory in real time.
- The backend applications see an unexpected load that is bringing down her systems

Ivan

Head, Operations
White Goods Company
- Recently Launched a connected washer dryer system
- Getting complaints of unresponsive control panels.

Where can problems happen?

Devices Unavailable

Devices Unhealthy

Network Lags

Third Party Cloud Services

Backend Service Problems

Deep Dive - Problems Originating from Devices

Power	Connectivity	UI	Mobility
CPU	RAM	Storage	Version mismatch

Deep Dive - Problems Originating from Aggregation of Devices

| Scale of Devices | Volume of Data | Velocity of Data | Variety of Data |

| Highly Distributed | Hybrid Environments |

1.0 second — User Response Time Expectations — 0.1 seconds[1]

[1] wirelessweek

APPDYNAMICS

Poor MTTR

Trapped Metrics

Manual Correlation

Manual Remediation

Organizational Gaps

The Ecosystem   The Problem   The Solution   Best Practices
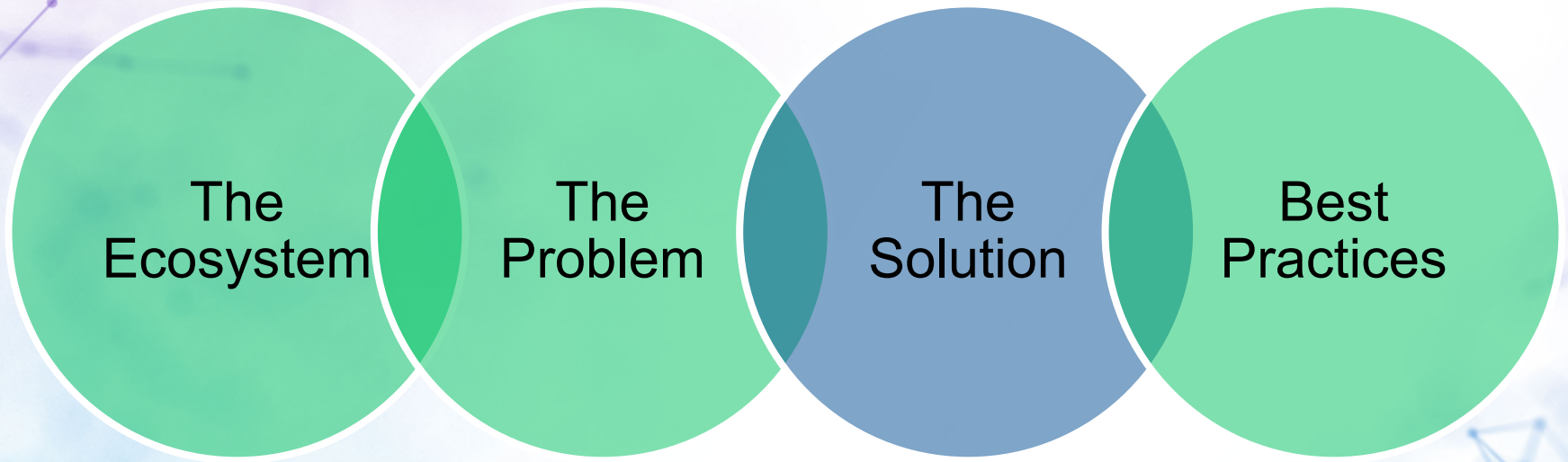
End to End Monitoring Solution

Availability → Performance → Correlation → Remediation → Analytics

APP**DYNAMICS**

Device Side Instrumentation

Capture and report Device Metrics

Capture and report Device Events

APP**DYNAMICS**

Enterprise Grade Performance Monitoring Solution

Instrument all kinds Apps

Aggregate Data at Scale

Correlate

Single Pane View of the Enterprise

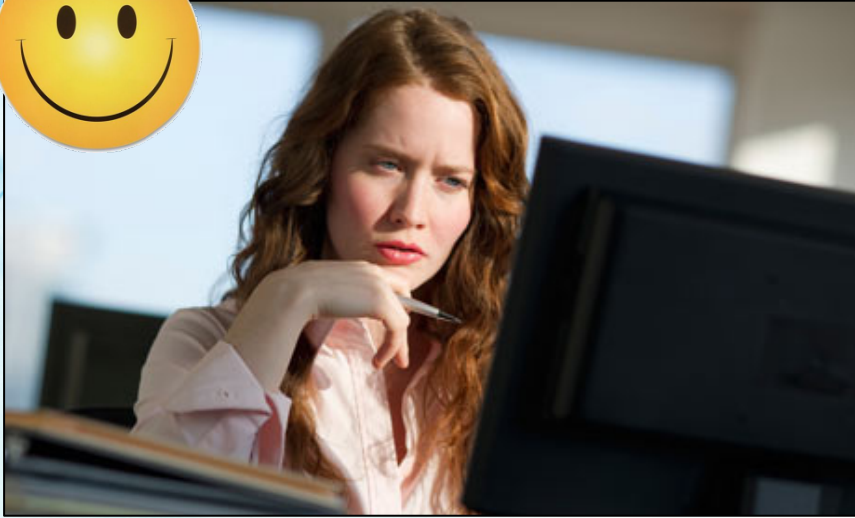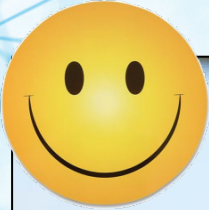# Enterprise Grade Performance Monitoring Solution (contd)

Deep instrumentation

Diagnose Problems Quickly

Provide Alert Mechanisms

Measure the Business Impact

Teresa

Recap
The business services see an unexpected load bringing down the systems

Problem
- *The RFID reader was updating the GPS coordinates every minute whether the value changed or not!*

How it was detected
- Both the backend Java Webservice and the RFID reader were instrumented for performance metrics
- The Application Monitoring Solution was able to correlate that the traffic from the RFID reader was very high

Solution: An OTA update to the RFID reader solved the problem.

Ivan

Recap
Connected Washer Dryer had unresponsive panels

Problem
- *The HTTP Endpoint was upgraded w/o informing the device team*

How it was detected
- Both the backend java webservice and the Washer Dryer were instrumented for performance metrics
- The Application Monitoring Solution was able to correlate that the traffic from the Washer Dryer was ending up in timeouts

Solution: The Webservice team rolled back their change untill Ivan's team was ready with a patch.

The Ecosystem • The Problem • The Solution • Best Practices

Best Practices – For the Device Manufacturer and Embedded Application Developer

- Runtime performance instrumentation is now a Must-Have, not a Nice-To-Have
- Allocate CPU/Memory Budget for it.
  - 2 ~5% overhead is a good estimate

Guidelines to choosing an agent

Choose an agent with following attributes:

- Configurable
- Controllable
- Small Footprint
- Secure
- Available in your favorite programming language
  - Languages that support Auto instrumentation like Java, post compile time auto agents is an option.
- Collect and send Crash Information
- Supports Offline mode

APP**DYNAMICS**

Best Practices – For the IoT Cloud Service Provider

- Make runtime performance instrumentation agent on the device as part of your acceptance plan

- Ensure it provides a heartbeat.

- Ensure it provides
  - Device health metrics
  - Application transaction health
  - Application crash info
  - Customizable to tag w/ Business Metrics

- Understand that requirements for Embedded Agents differ than those on the Backend

APPDYNAMICS

Choosing Instrumentation Agents for IoT Devices

	Web Agent	Embedded Agent
Message Payload Format	JSON	ProtoBuf, CBOR. BSON
Application Layer	HTTP/HTTPS	MQTT/MQTT-SN, CoAP
Security	TLS	DTLS
Transport Layer	TCP/UDP	UDP
Network Layer	IPv4/IPv6	IPv6/ 6LowPAN
Link Layer	Ethernet, 802.11	802.15.4

Guidelines to choosing a Management Console

- Ensure it can display both time series data and events
- Correlates instrumentation data in near real-time from different data sources
  - Mobile, Browser, Webapps, Databases
- Provide Alerts, Configurable dashboards
- Provide a single pane view of the entire system
- Analyze crashes
- Nice to have: Ability to ingest custom data (performance or business)

APP**DYNAMICS**

Open Source Solutions

- Plethora of open source tools to monitor performance or Device Health
  - top, vmstat, lsof, tcpdump , htop, iotop, monit, nagios, vmstat, perf_events
- Tracing Tools like dtrace, LTTng (Open source tracing framework for Linux.)

- Prometheus.io: Open-source service monitoring system & time series database
- Influxdata.com: Platform for managing, storing and visualizing time series data
- Graphite: Real-time graphing system for numeric time-series data.
- Graphana: Popular visualization library for multiple Time Series backends.

Questions or Comments?

balwinder.kaur@appdynamics.com

@bkaurca

APPDYNAMICS