Actors Play backend role for Internet of Things

Grzegorz Kossakowski
@gkossakowski

Early Draft

Scala Camp, Kraków
May 2014
The Internet of Things (IoT) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure.

— Wikipedia
Internet of Things

**ABI Research**: more than 30 billion devices will be wirelessly connected to the Internet of Things by 2020.
Internet of Things

Cisco: $19 Trillion opportunity with public sector cost savings ~$4.6 Trillion.
Characteristics of Large IoT

• Large number of “nodes”.
• Potentially large number of messages to/from service providers and managers.
• Message sizes usually small.
• Message frequencies vary.
• Resilience requirements vary.
Characteristics of IoT

- **Response times from:**
  - **Real time:** \( \mu \)-seconds for avionics.
  - **Human time:** 10s–100s of milliseconds.
  - **Phoning home:** no response or slow response okay.
- **Connectivity:** Intermittent to always on.
Examples
Med. Devices, IT Appliances
Med. Devices, IT Appliances

• Phone home with status updates.
• Diagnose pending problems.
• Learn client usage patterns.
• Stable internet connection?
Trucks, Farm Equipment
Trucks, Farm Equipment

• **Phone Home** to report movements determined using GPS.
  • Optimize routing.
  • Spy on drivers?
• Occasional network.
Remote Sensors

GLOBAL SEISMOGRAPHIC NETWORK
& INTERNATIONAL MONITORING SYSTEM (IMS)

GSN IMS Designated Stations
● Other IMS Seismic Stations
Remote Sensors

- Human to Real Time: trigger alert systems.
- Earthquake warning systems.
- Nuclear test pinpointing – test ban compliance.
- Reliable networks
Wearable Electronics
Wearable Electronics

• **Phone Home to Real Time:**
  • Trigger health alerts.
  • Gather activity statistics.
• Unreliable networks.
iBeacons
iBeacons

• Small wireless devices
• Low–powered
• You can stick them on the wall
• They periodically (every 200ms) broadcast signal that can be “heard” by smartphones in the range
iBeacons

• Very limited storage capacity
• Very limited computing power
• Provide effectively one-way, passive communication capability
iBeacons

• Smartphones (iOS 7 and latest Android) provide APIs for listening to events
• Getting in/out of range of iBeacon
• Changing distance to iBeacon
The Core Infrastructure

The case for a Reactive implementation.
The Core Infrastructure

Reactive – the system responds to events quickly, rather than driving system activity
Reactive Manifesto

The Reactive Manifesto

Published on September 23 2013 (v1.1) Table of Contents

1. The Need to Go Reactive
2. Reactive Applications
3. Event-driven
4. Scalable
5. Resilient
6. Responsive
7. Conclusion

Sign the manifesto

1948 people already signed (Pull list)
Why a Manifesto?

• **Reactive** has been trending up:
  • Growing popularity of event-driven systems like Node.js, Erlang, Akka.
  • Evangelism: Erik Meijer, Jonas Bonér, Martin Thompson…
  • Define the “buzz word” preemptively…
Responsive

Scalable

Event-Driven

Resilient

reactivemanifesto.org
Event Driven

Reactive Applications scale up and down on demand

• Asynchronous Programming:
  • Transparently leverage all cores on each CPU.
  • Avoid resource contention; no blocking!
  • Add/remove servers dynamically.
Event Driven

Reactive Applications respond to changes in the world around them

• **Messages** are passed between services and subsystems.
• **Asynchronous and non-blocking throughout.**
• **You define the workflow;** the runtime decides how to **schedule those tasks.**
Actors

• Lightweight processes with event (message) inbox
• Process incoming events asynchronously in an event loop
• Can have internal state
• Provide an excellent model for programming event-driven applications
Actors and IoT

• Create virtual representation for physical devices
• Each actor represents a single device
• Virtual mirroring of devices allows one to enhance their capabilities with greater computing and communication power
Storing data in iBeacon
Storing data in iBeacon

- Broadcasted signal
- Register the phone
- Broadcasted signal
- Ask for registered phones
Demo

Code at: https://github.com/gkossakowski/vernier
Thanks!
Questions?