

CASE Oura: Detecting Problems Earlier with Scalable End-to-End Testing

Laura Ojala

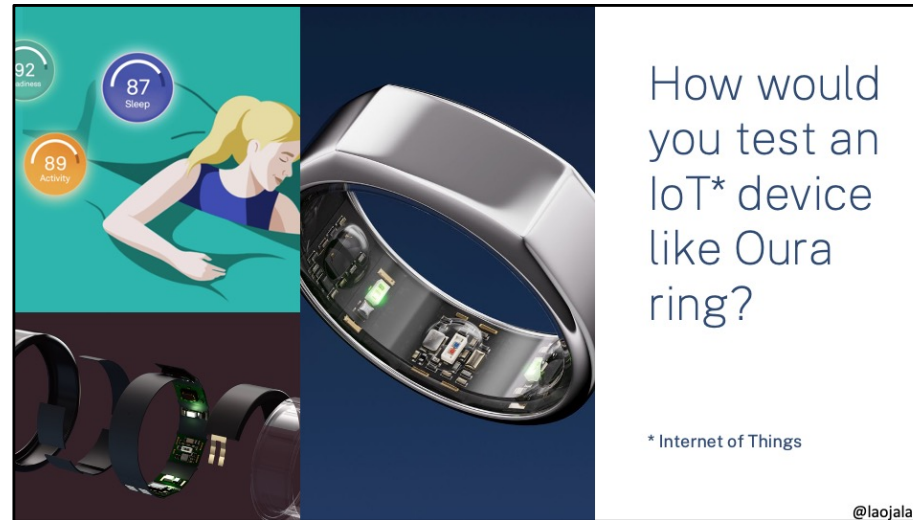
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Presentation: Testing Assembly 2021, November 23, Helsinki

[Image] Closeup of phone in hand, showing Oura app, with Oura ring on. Oura app displays text “Your period is likely to start in 6-7 days”, and a Readiness score 84 with a text “Do what feels good” and some smaller texts and buttons.



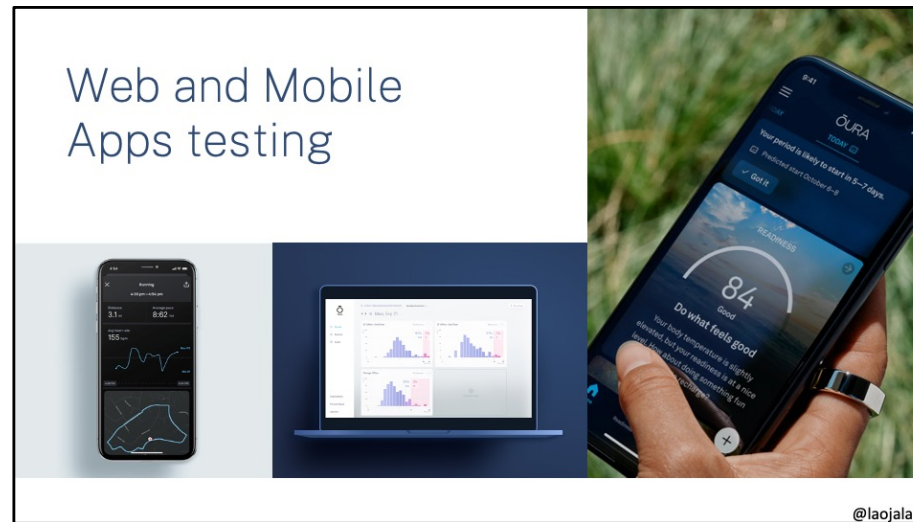
How would you test an IoT* device like Oura ring?

* Internet of Things

[3 Images]

1. Drawing of a person sleeping. Showing Oura scores: 92 Readiness, 87 Sleep, 89 Activity flowing above their head
2. Oura Generation 3 components
3. Oura silver ring with green LED's on

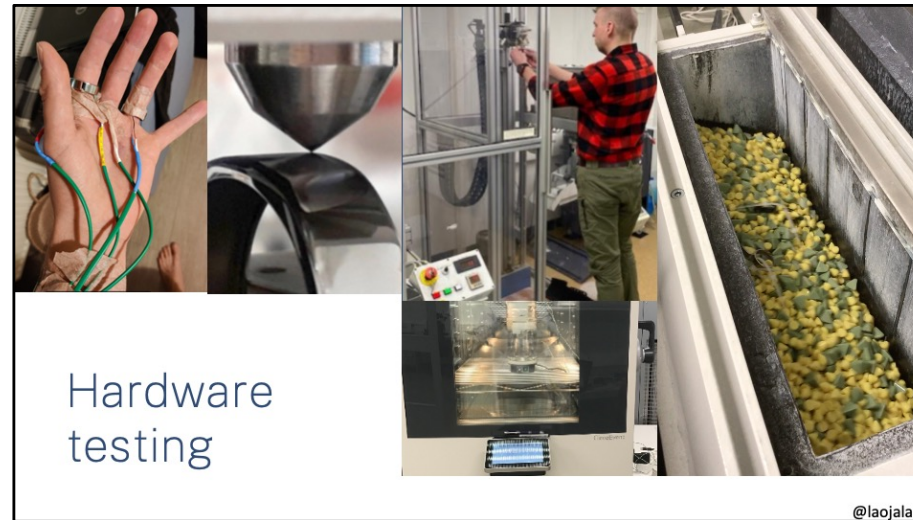
In every slide: Twitter handle @laojala



Web and Mobile Apps testing

[3 Images]

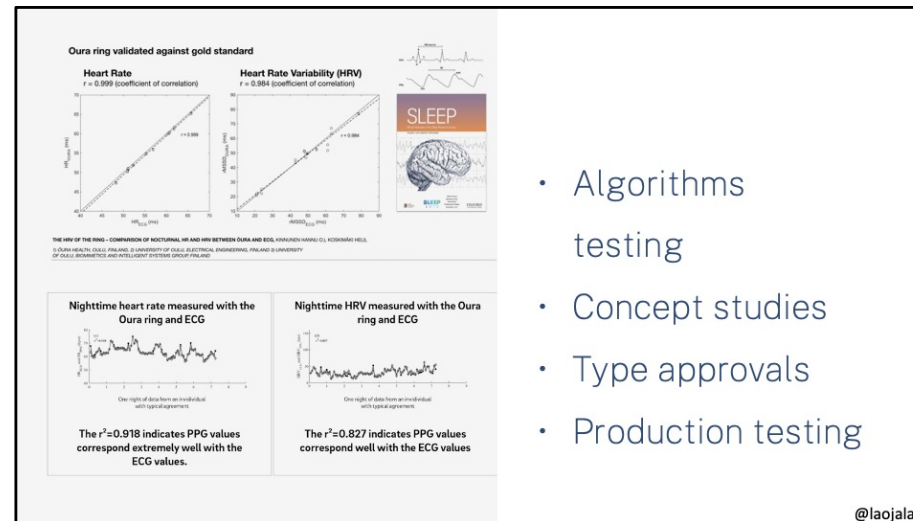
1. Oura mobile app showing Running route on a map. 3.1 miles run with a pace of 8:62 /mi between 4:30 pm - 4:54 pm. Average heart rate 155 BMP and a graph of HR during the exercise.
2. Laptop showing graphs from Oura Teams
3. Closeup of a phone in hand, showing Oura app, with Ouraring on.



Hardware testing

[5 Images]

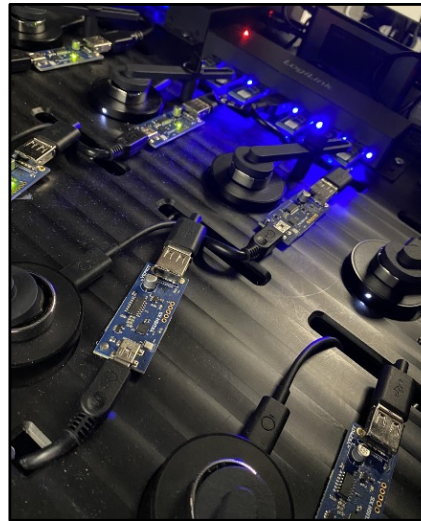
Oura HW reliability test lab: Oura rings in a hand with wires (testing temperature sensor), scratch test, a person wearing a plaid shirt setting up a drop test, heat cabinet, and rings rolling with small plastic rocks and water



- Algorithms testing
- Concept studies
- Type approvals
- Production testing

[Image] Images of scientific studies of "Oura ring validated against gold standard".

Links to studies can be found on Oura blog: <https://ouraring.com/blog/category/research-validation/>



Today: 4 cases from Oura

1. Ring API test
2. Detecting problems using results database
3. Scalable test automation
4. Saving time in HW testing

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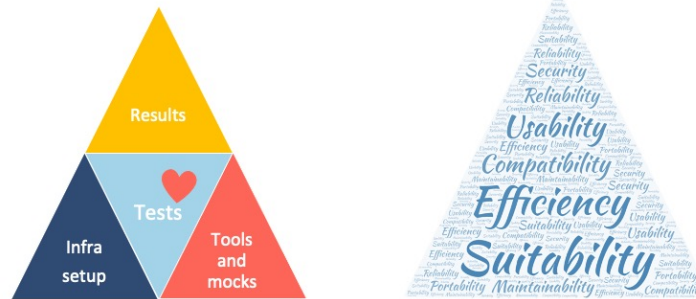
Today:

4 cases from Oura

1. Ring API test
2. Detecting problems using results database
3. Scalable test automation
4. Saving time in HW testing

[Image] Close-up to a server rack with Oura rings in a charger. Each charger is connected to YKUSH USB Switchable Hub. On background USB dongles with blue led's.

Test automation infrastructure is more than just the tests...

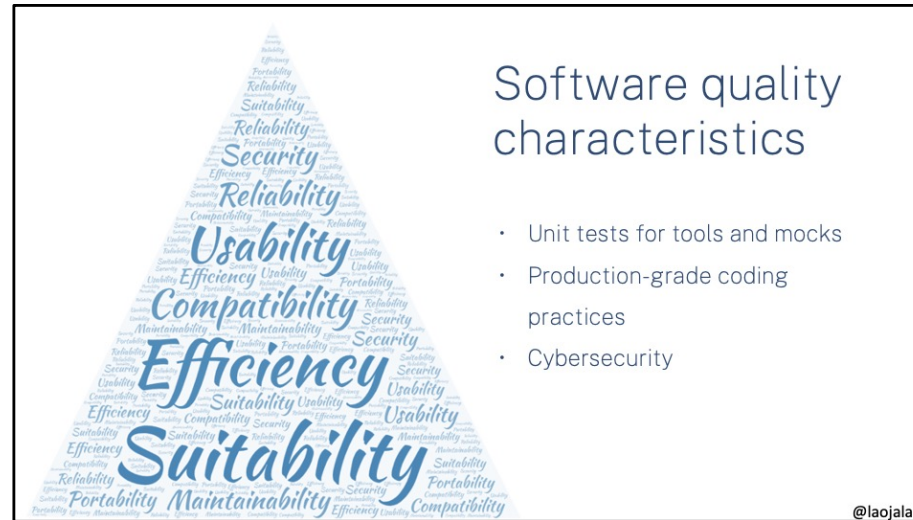


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Test automation infrastructure is more than just the tests...

[Image] 2 pyramid-shaped graphics:

1. Bottom of a pyramid: Infra setup, Tools and mocks. Middle: Tests (and a heart icon). Top: Results
2. Word cloud of Software quality characteristics: Suitability, Maintainability, Efficiency, Compatibility, Usability, Reliability and Security.



Software quality characteristics

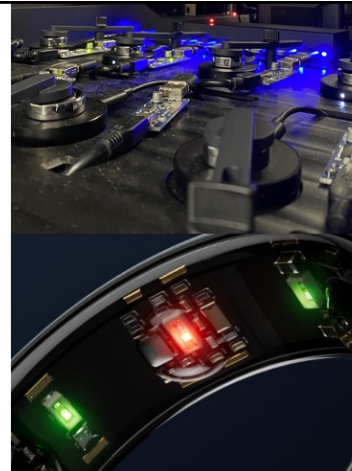
- Unit tests for tools and mocks
- Production-grade coding practices
- Cybersecurity

[Image] Word cloud with software quality characteristics

Case 1

Typical system test for Ring API

- Testing battery level indication
- Resource allocation
- Controlling power in the ring
- Reading and validating messages over Bluetooth



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Typical system test for Ring API

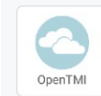
- Testing battery level indication
- Resource allocation
- Controlling power in the ring
- Reading and validating messages over Bluetooth

[2 Images]

Close up to a server rack with Aura rings testbed. Image

Close up to Aura ring Generation 3 with green and red led's

Results are stored
in a database



OpenTMI
Open Source Test Management Infrastructure

- **Test verdict and metadata** of the system under test go to a database
- Not storing test result reports for more than a few weeks

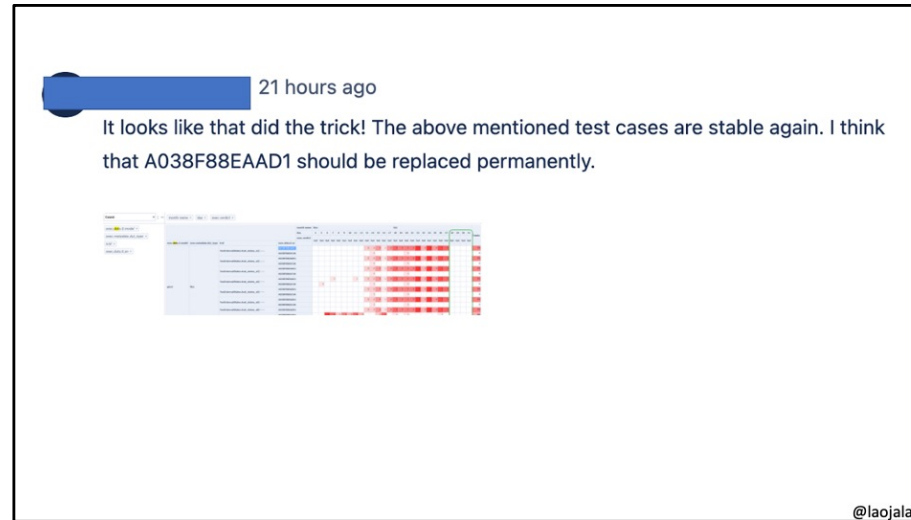
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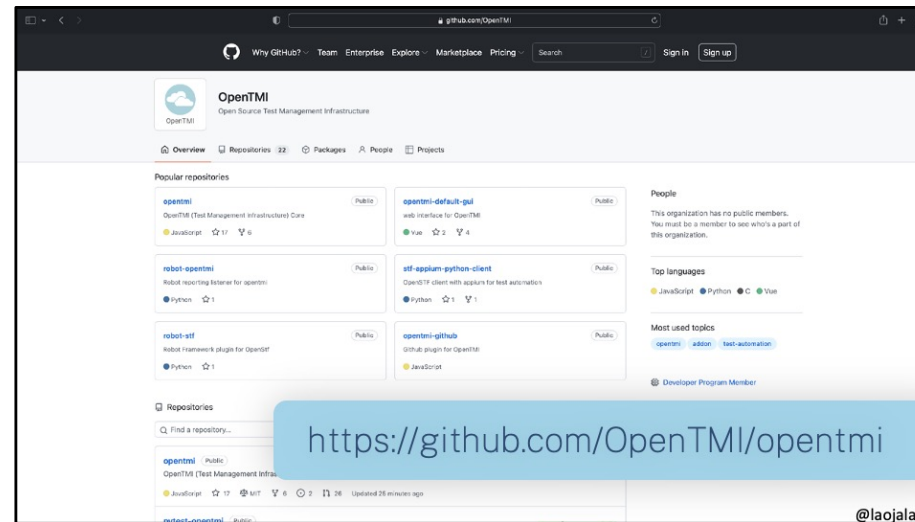
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- Not storing test result reports for more than a few weeks

[Image] OpenTMI logo, Open Source Test Management Infrastructure





[Image] Comment from task management system: “21 hours ago. It looks like that did the trick! The above mentioned test cases are stable again. I think that A038F88EAAD1 should be replaced permanently.” Same picture as on a previous slide.



<https://github.com/OpenTMI/opentmi>

[Image] Screenshot of OpenTMI project in GitHub

Challenges with software testing in IoT hardware:

how to identify when test failed because of unstable HW?

how to identify unique unstable HW in test lab?

how to identify if certain test causes that HW's become unstable/unusable?

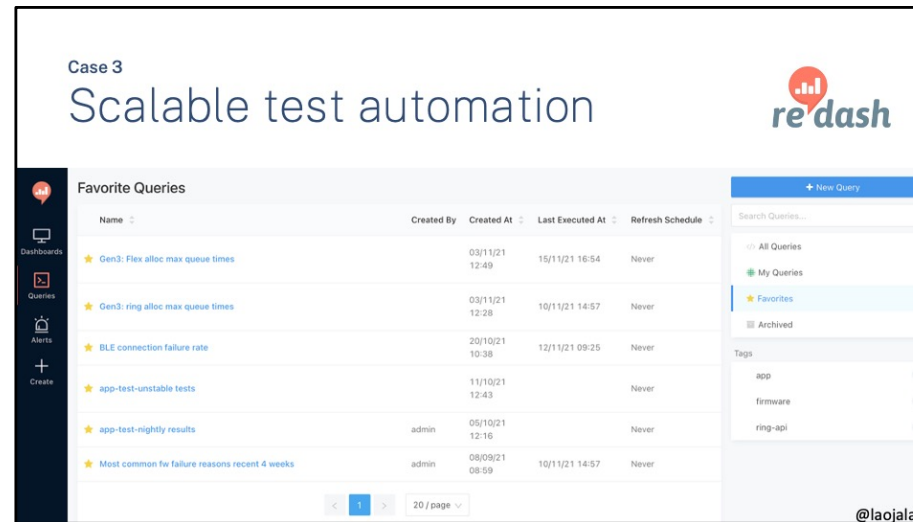
how to estimate when HW start to be unstable/unusable (e.g. memory start burning out)?

how to direct testing to right HW when there is multiple HW configurations?

how to identify if tools deployment (e.g. new test framework revision) causes more test failures?

how to optimize test execution time?

how to manage all of these automatically?



Case 3

Scalable test automation

[Image] Screenshot from Redash showing 6 favourite queries. Query names:

- Gen3: Flex alloc max queue times
- Gen3: ring alloc max queue times
- BLE connection failure rate
- app-test-unstable tests
- app-test-nightly results
- Most common fw failure reasons recent 4 weeks



[Image] Screenshot of a Redash dashboard for " Gen3: Flex alloc max queue times". Show 3 graphs (seconds-dates). One graph has a daily peak of 1766 seconds.



Infrastructure scalability

- Infrastructure as Code
- Metal-As-A-Service -> Remote installations for servers
- Version controlled configurations
- ... and lots of leading (putting wires together)

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- Infrastructure as Code
- Metal-As-A-Service -> Remote installations for servers
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[Image] Close up of a Oura rings in a server rack

Case 4:

Test automation in HW reliability testing

- Before test automation: running test set for 20 rings took 1-2 days. Now we can do it in an hour.
- Accurate and repeatable tests



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[Image] Video of rings in a wearing resistance test device. Rings are rolled in with coloured stones and liquid.



"The only way we will survive is by being kind. The only way we can get by in this world is through the help we receive from others. No one can do it alone, no matter how great the machines are." - Amy Poehler

[Image] Oura ring at a Japanese style beige sand garden