Utilizing DevOps in Cargotec IoT Cloud

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Digital Solutions Hub’s main goal is to provide software products and services support to all Cargotec business units.

DiSH also owns and develops Cargotec IoT Cloud.

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Cargotec Business Units

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Cargotec IoT Cloud

An AWS based cloud platform for ingesting, processing, storing and retrieving data from various sources. Making this data available for building new customer applications.

Data figures

- Billions of rows / month
- ~200GiB / month
- ~9000 devices sending data

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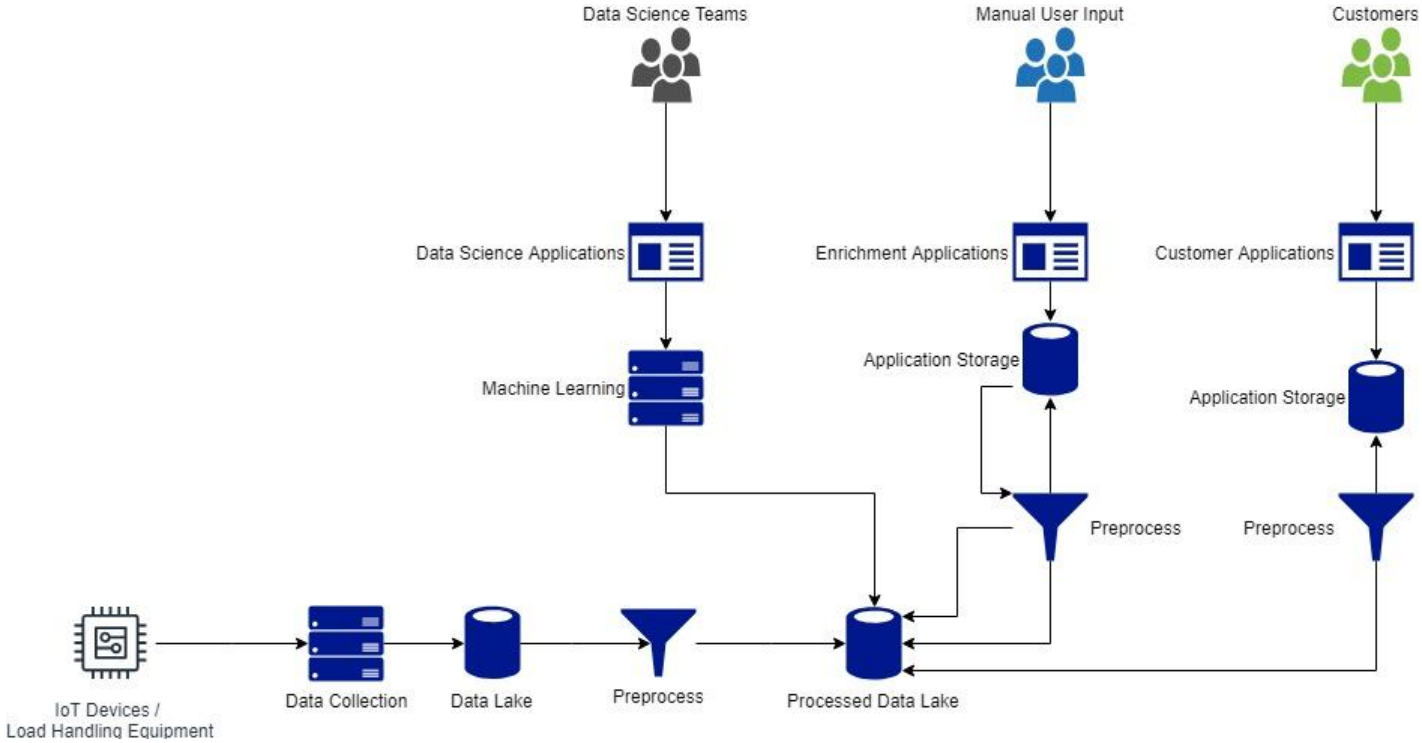
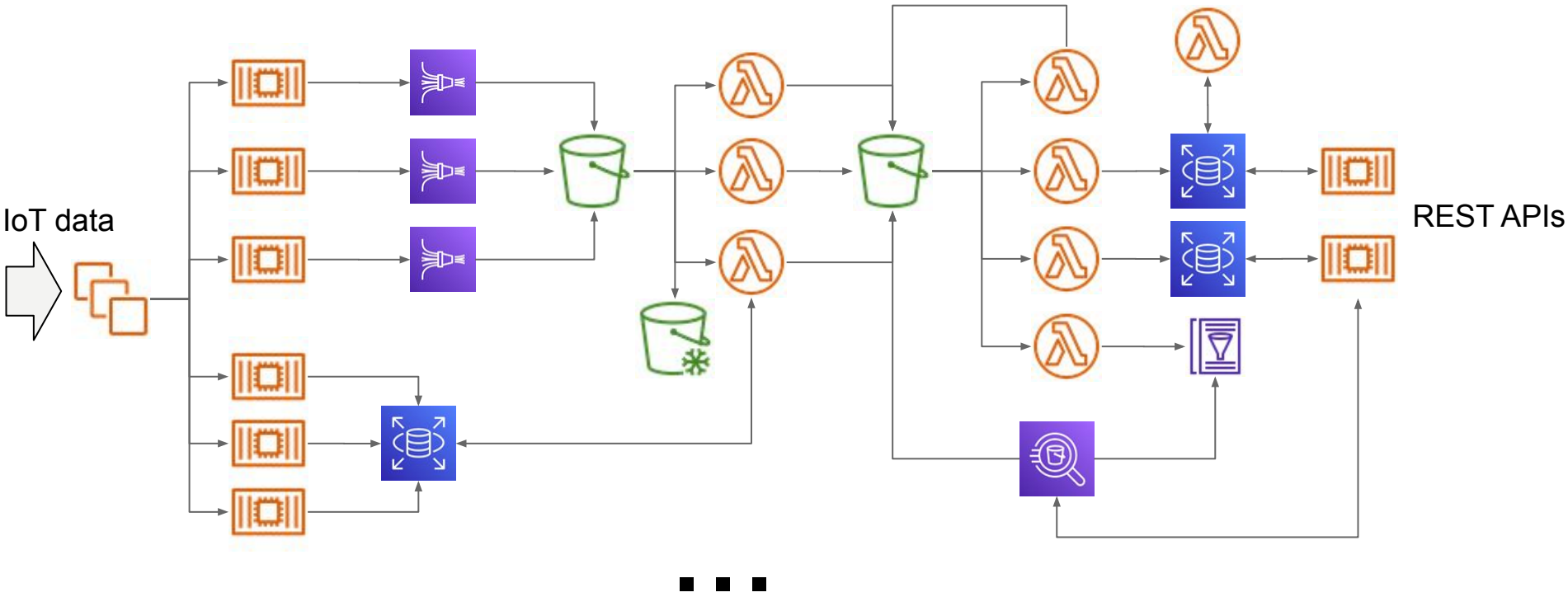
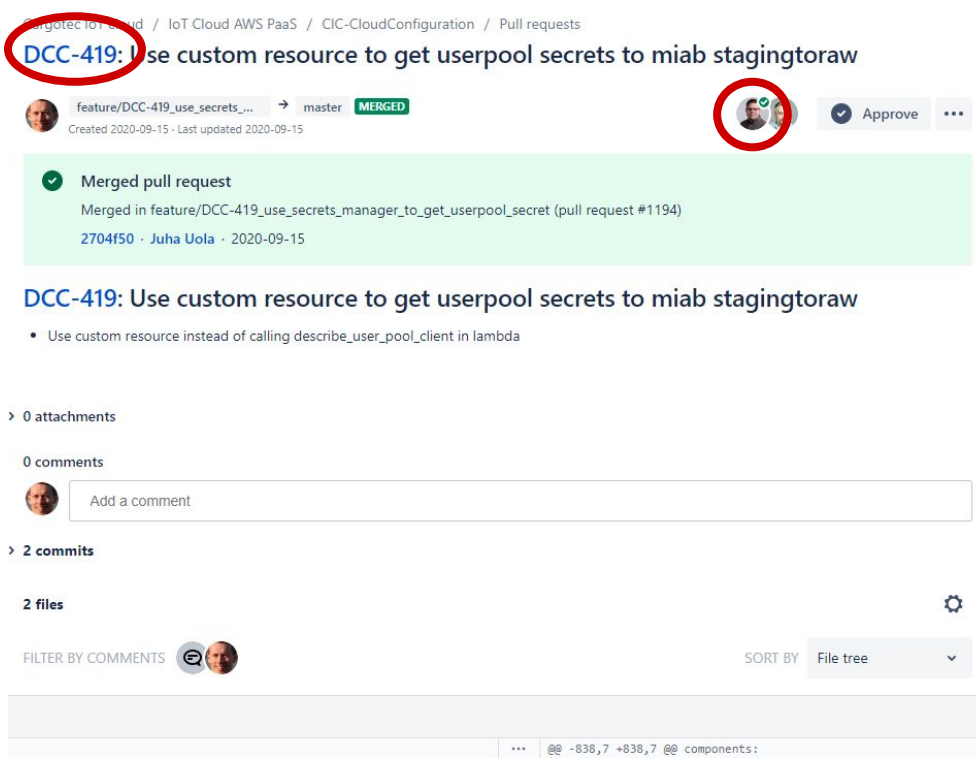
Cargotec IoT Cloud

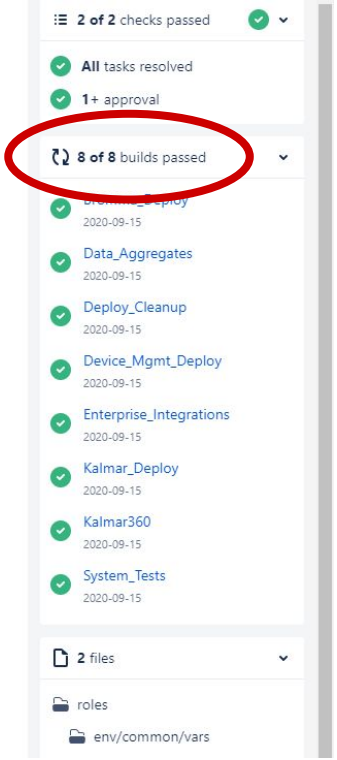


Architecture example



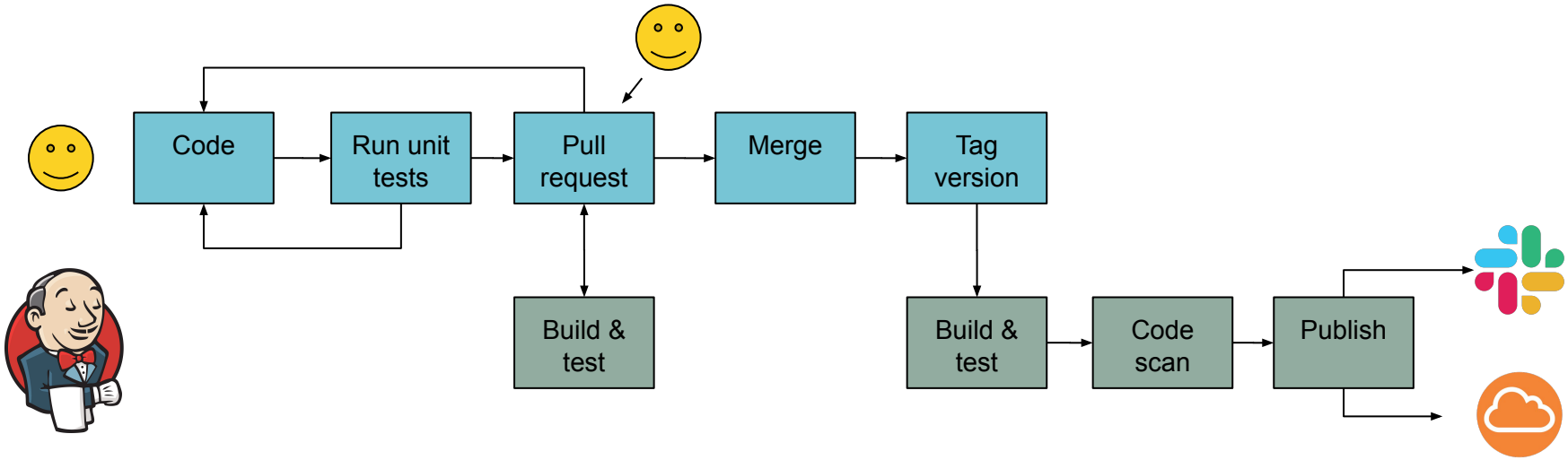
DevOps developer support





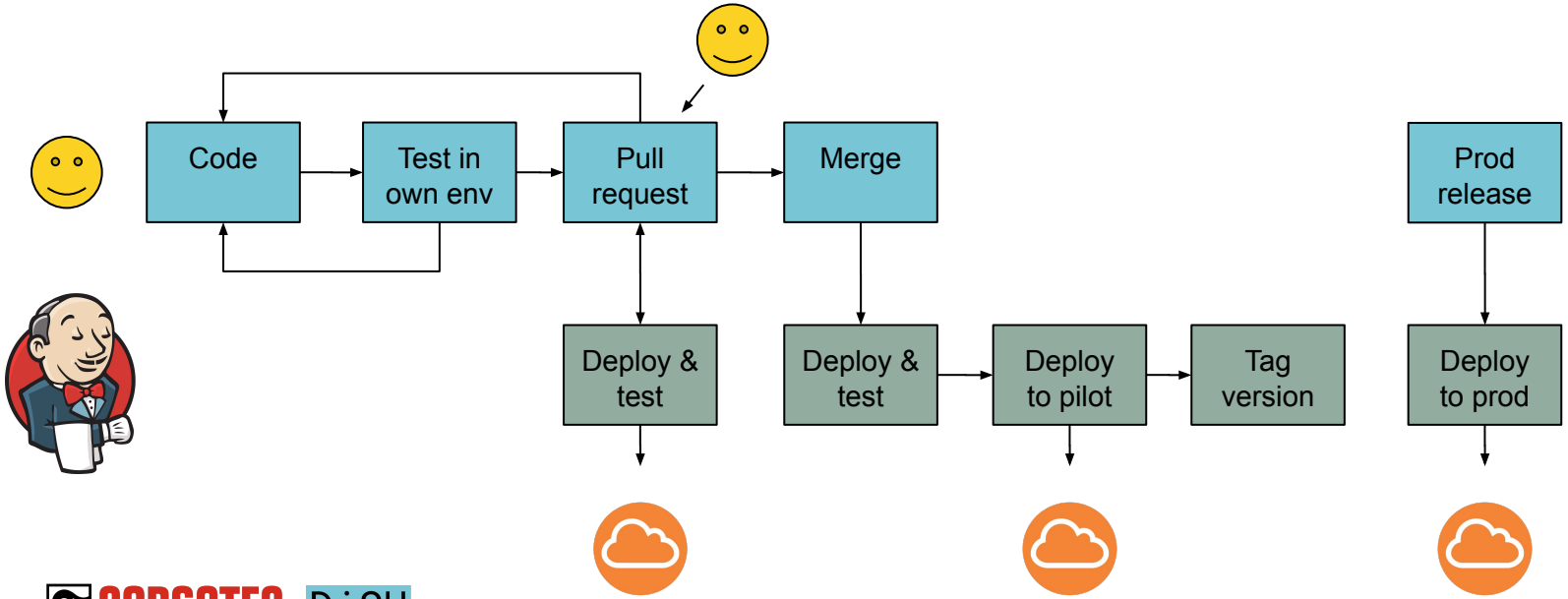
DevOps building block 1: Automated testing - unit tests

- All components should have unit tests
- Unit tests are ran by CI pipeline



DevOps building block 1: Automated testing - system tests

- Starting point: Basic system smoke test
- Goal: All main features covered with system tests
- Running system tests needs to be part of the CI pipeline
- Bonus: Developers are able to run system tests against their private test environment



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Learnings from automated testing

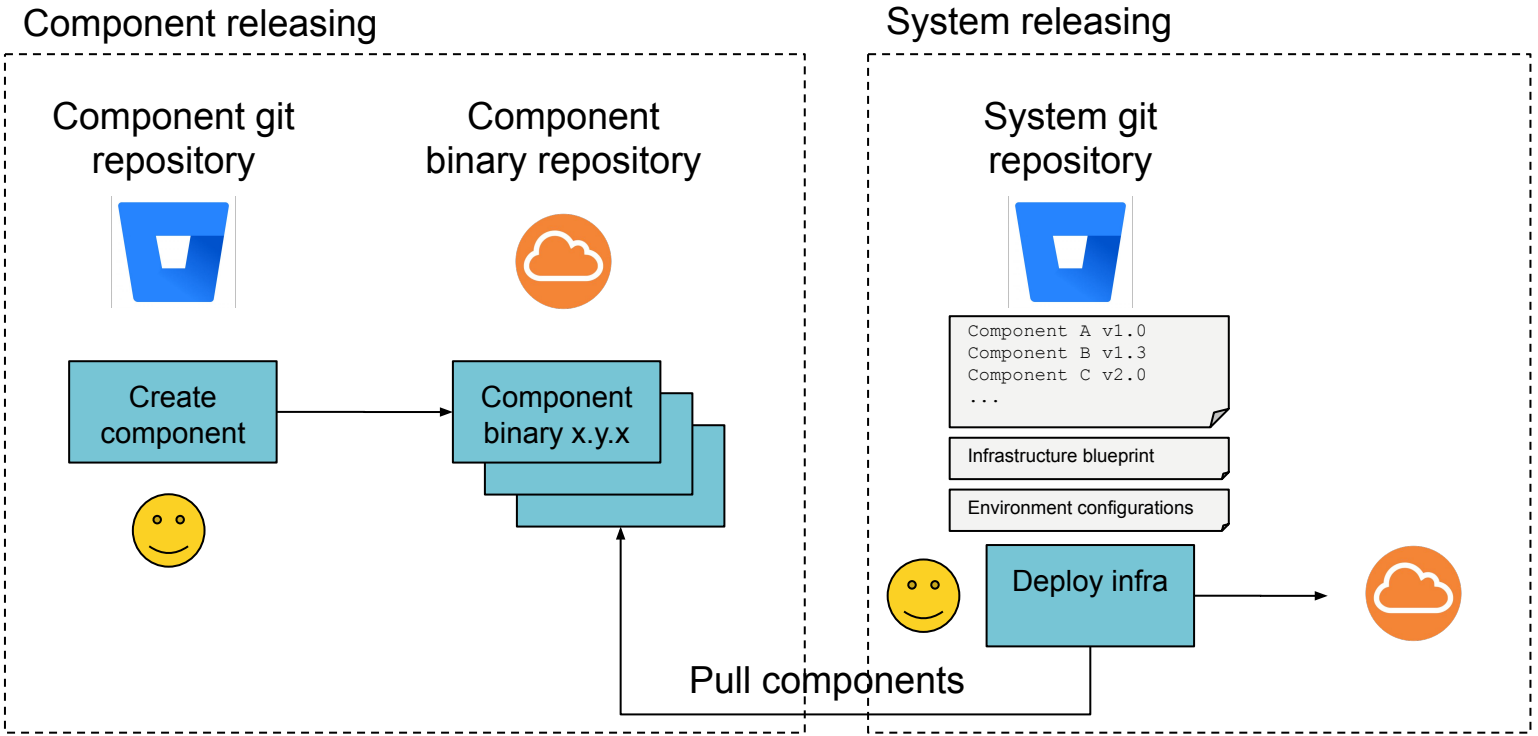
- Automated testing helps catching bugs early
- Tests need to be reliable for automation to work
  - Introducing new tests is a challenge for reliability
  - System test problems affect all developers
- Tests need to be ran in controlled environment
  - Jenkins build agents only have Docker installed
  - For system tests the whole test cloud environment should be created from scratch for each test run, but this is rarely possible in practise
  - Need to be able to at least update test cloud environment with desired changes
- Test results for pull request should come under 15 mins
  - May need to test in parallel and reduce pull request test set
- There are many build pipelines, those should be created as code to allow code reuse
- Tools that we use
  - BitBucket for git repository
  - Jenkins for build automation
  - Whitesource for security scanning
  - Robot Framework for system tests

DevOps building block 2: Repeatable cloud deployment

- Automated system testing requires that cloud environments can be created, updated and removed easily
- Repeatable cloud deployment requires
  - All software components are versioned
  - Cloud infrastructure is defined as code
  - Configurations for different environments, such as testing, pilot and production, are defined as code
  - DB schema changes are defined as code

```
docker-compose run ansible_playbook create_infra.yml -e "project=iotcloud env=testing stackName=myStack"
```

Repeatable cloud deployment

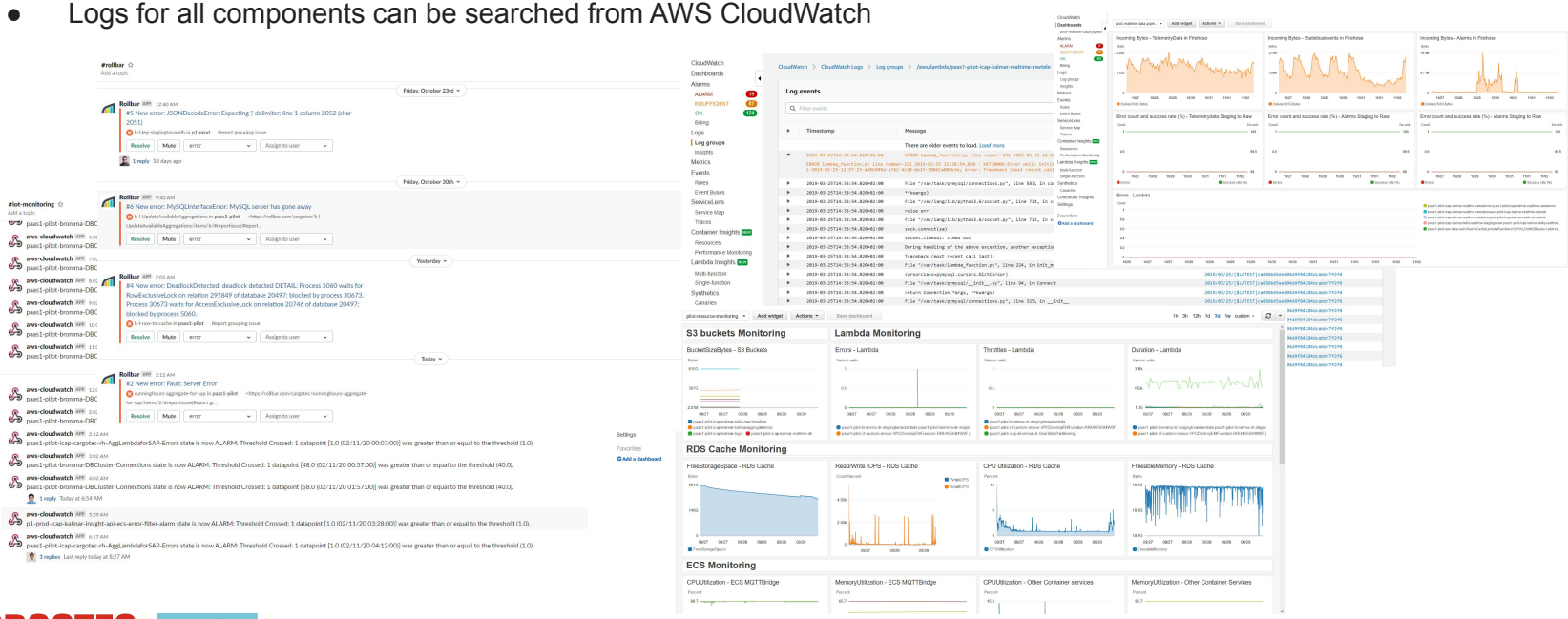


Learnings from repeatable cloud deployment

- Cloud deployment from scratch must pass system tests
- Cloud deployment from scratch takes several hours, updating is faster
- Manual operations are an exception in pilot and production, typically only CI pipeline is updating them
- Being able to create own test cloud is a treat for developers
  - Can be expensive, so need to downsize all possible resources and optimize availability
  - Cloud environment removal is important for developers, but it can break easily
    - Periodical CI job to test cloud creation, system tests and cloud removal
- Continuous delivery has been discussed
  - Component release could result a cloud deployment
  - Would require further emphasis on system testing
  - No requirements for high update frequency
- Technologies that we use
  - AWS CloudFormation + Jinja2 for infra definitions
  - Ansible for managing configurations and variables

DevOps building block 3: System monitoring

- Rotating support team within the development team
- Support team is alerted in Slack, if system is unhealthy
- AWS CloudWatch dashboards are used to debug the discovered issues
- Logs for all components can be searched from AWS CloudWatch



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Learnings from system monitoring

- System monitoring is required, if issues are to be found before customer starts complaining
- System health alerts are sent to dedicated Slack channel, but this can get noisy and hard to follow
  - Dedicated error monitoring tools such as Rollbar can help to categorize issues
- Technologies that we use
  - AWS CloudWatch for logs and dashboards (planning to use 3rd party tool)
  - Rollbar for keeping track of application errors

IoT Cloud DevOps journey

From

- Manually set up servers and infrastructure
- EC2-based architecture
- Manually maintained development, pilot and production clouds with different configurations
- Changing and deploying components directly in production
- Manually testing the system after each change (or not at all)
- Each developer having their own components that nobody else knows about
- Each component deployed differently
- No component versioning
- No system versioning
- No automated system testing
- Errors are detected by customer

=> Development team spending most of its time figuring out why system is not working and what broke it

To

- Infrastructure as code
- Cloud-native architecture
- Setups can be checked from source code
- Similar development, pilot and production clouds
- Managed cloud environments are updated only by changes in source code
- All code is peer-reviewed, which spreads the knowledge
- Automated system tests
- Components are versioned and published is similar fashion
- System is versioned and test results for each version are available
- System monitoring alerts to Slack
- Errors are detected by the development team

=> Development team spending most of its time developing new features and creating new tests

Iot Cloud DevOps next goals

- Monitor also data quality, not just data ingestion operation
- Shorten development cycle time
- Improve system deployment time
- Improve system tests coverage, reliability and performance
- System performance testing
- Make development process status more visible for stakeholders

IoT Cloud recent failures

- Updating a library version inside component A caused change in component A output, other system components were unable to read the new format -> 100 days of aggregated IoT data corrupted
  - Cause: Missing system test covering component A
  - Solution: Revert the change, recalculate data, create system test
- Change in cloud infrastructure code caused pilot deployment to fail even though system tests in dev environment passed
  - Cause: Pilot environment had old manual configuration that prevented the update
  - Solution: Remove manual configuration and add corresponding infrastructure code to master branch

Thank you! 😊

For more information about DiSH,
Jobs and trainee positions

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Appendix

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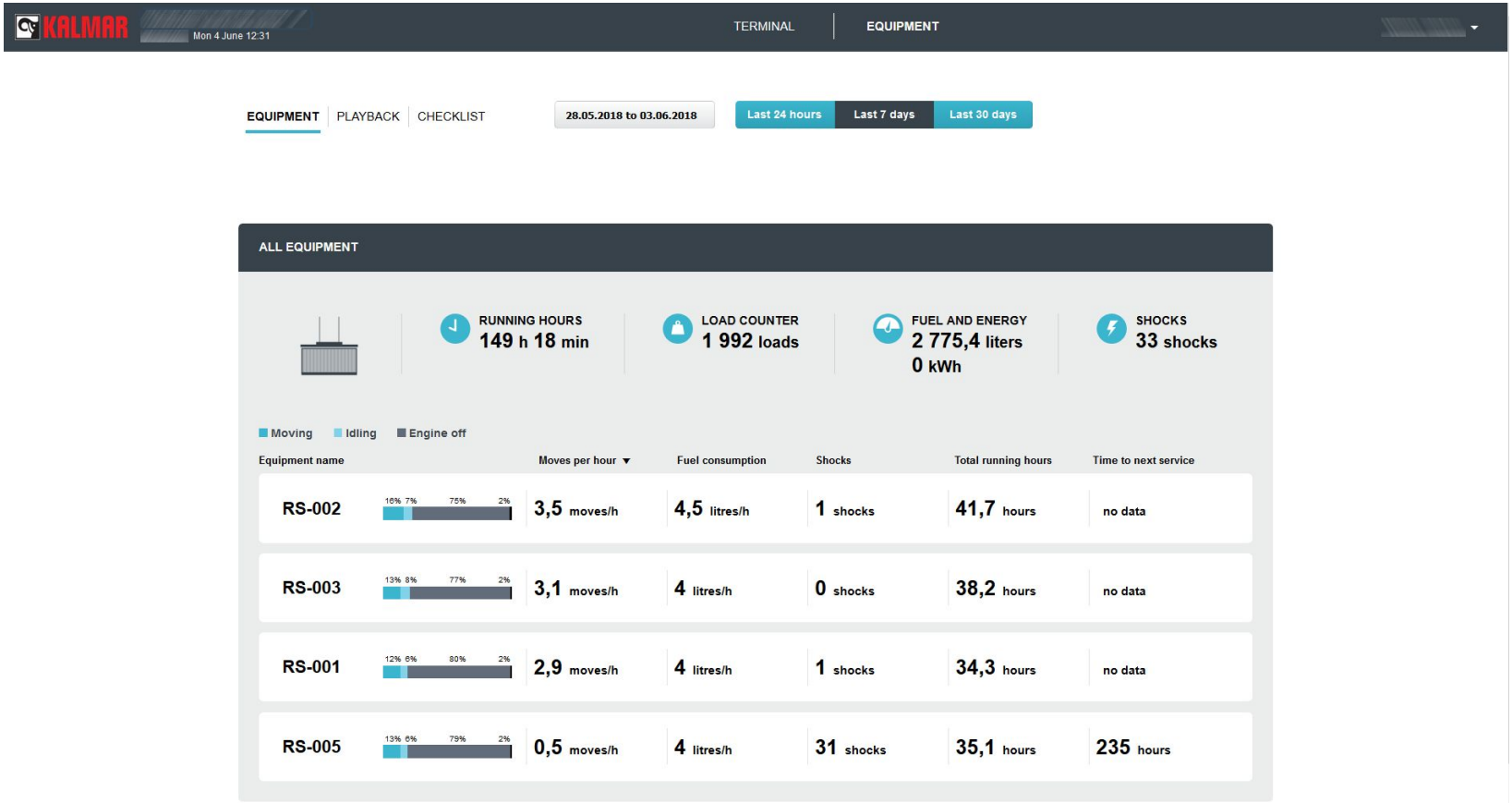

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