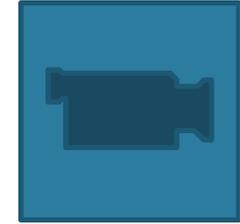


DevOps

A way to reduce risks for IoT?

Hui Song, SINTEF

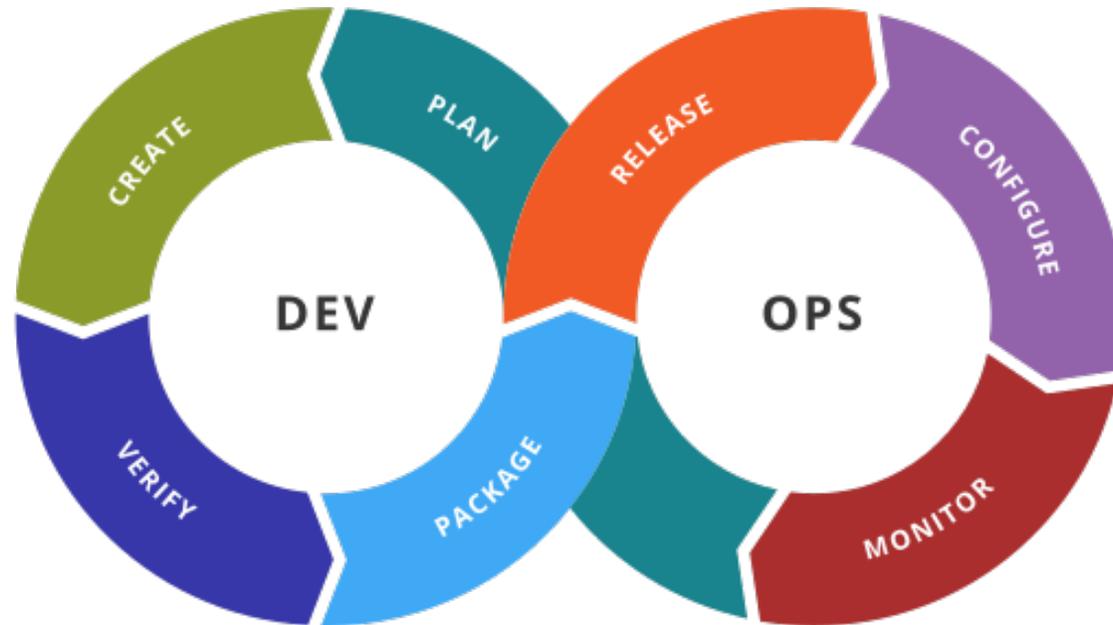
Internet of Things



As the IoT grows, so do the risks

- "I try to avoid all the risks before I go" – hardware thinking
 - Certification
 - Good design
 - Thorough testing
- "Hmm, we will see..." – software thinking
 - Keep changing
 - Continuous risk management
 - Prompt reaction

DevOps: The state of the art of software development practice

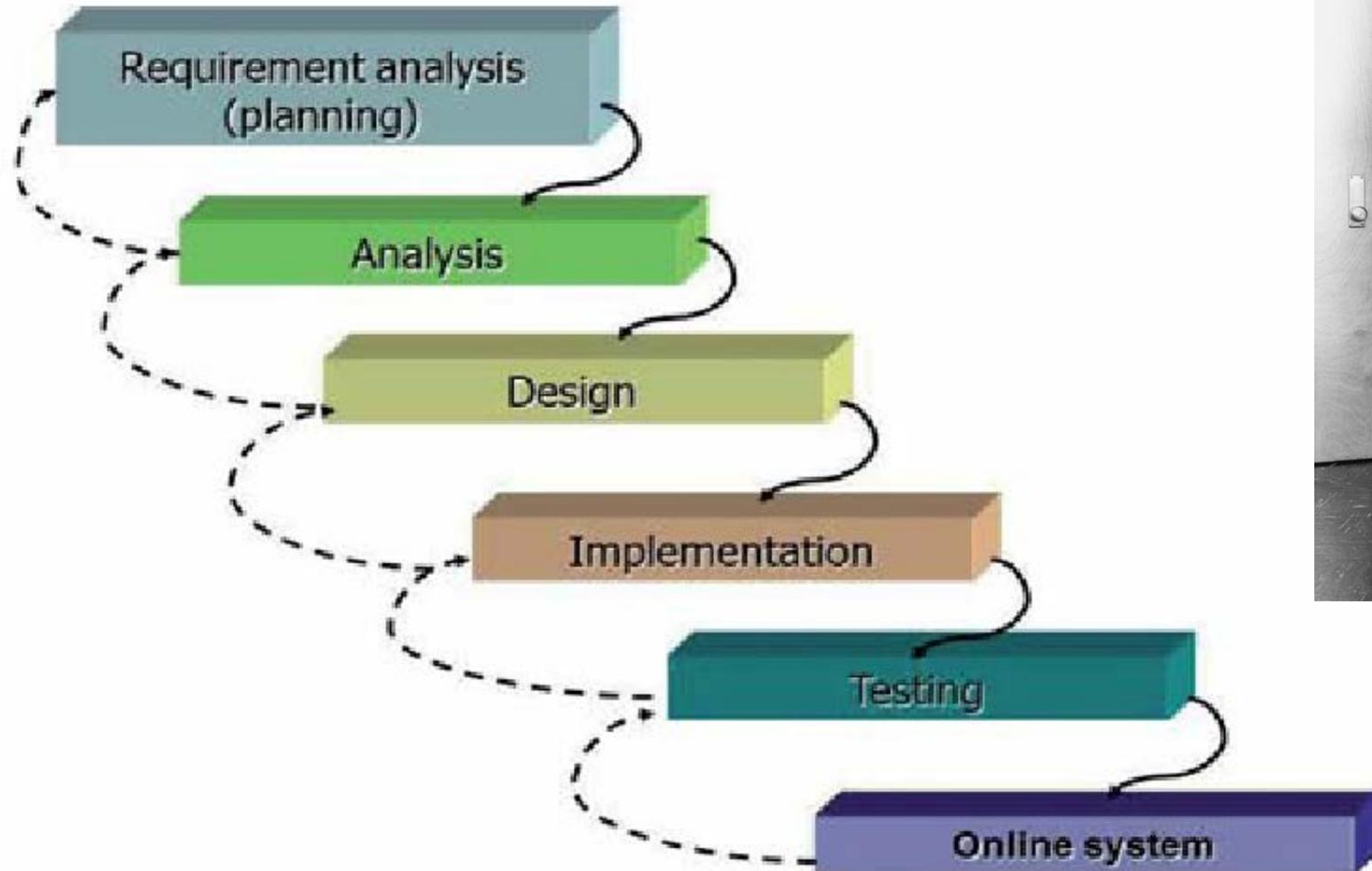


Up to 50 releases per day...

How software developers deal with risks

A short (simplified) history of software development models

It all started from "waterfall"

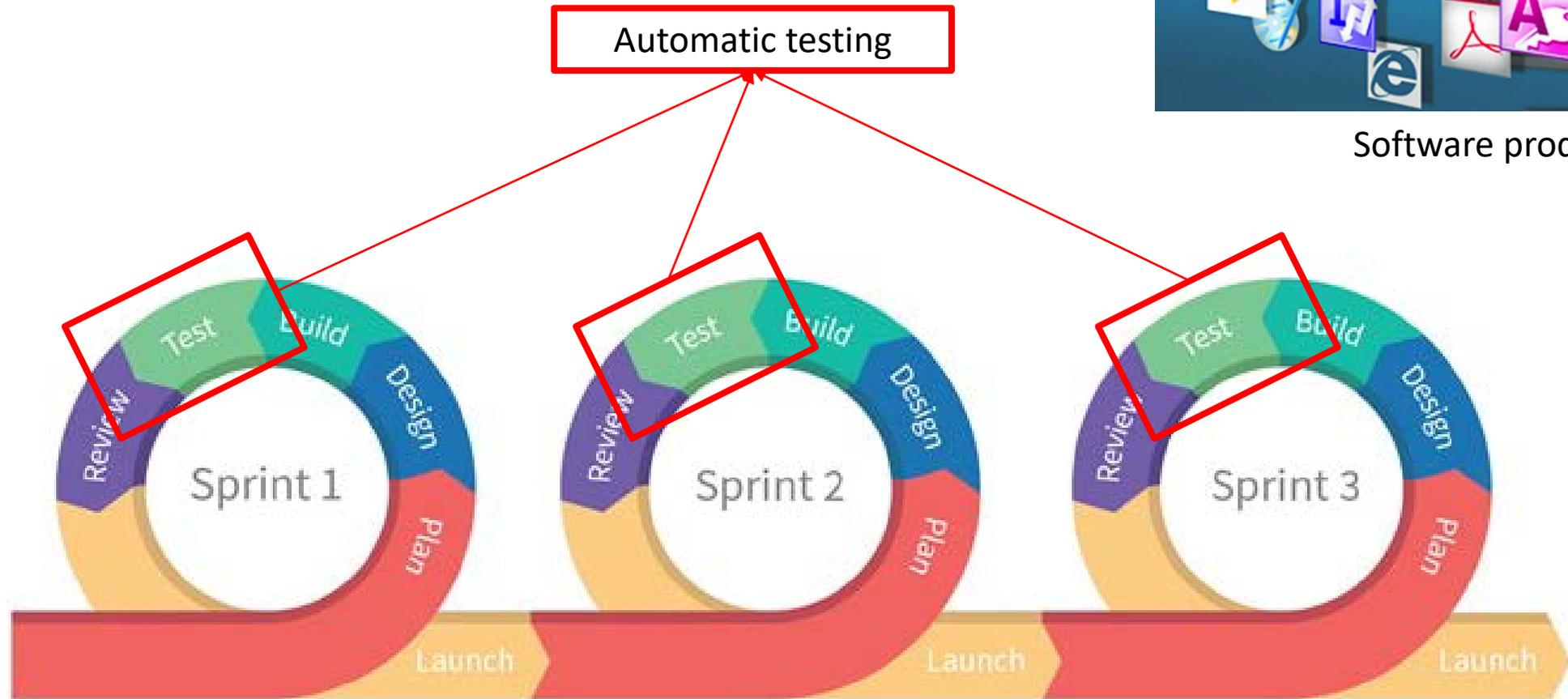


Software systems

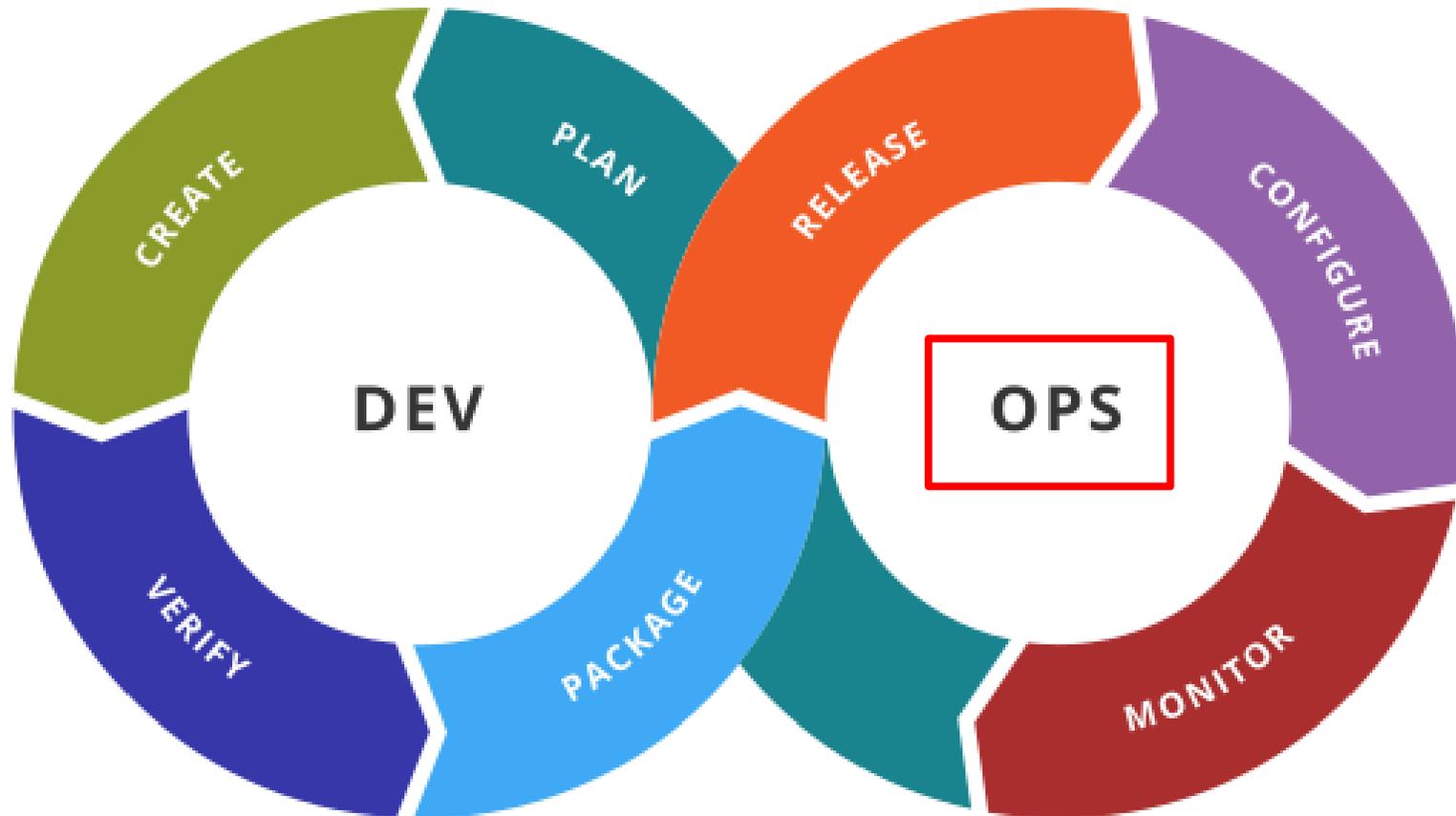
Agile development



Software products

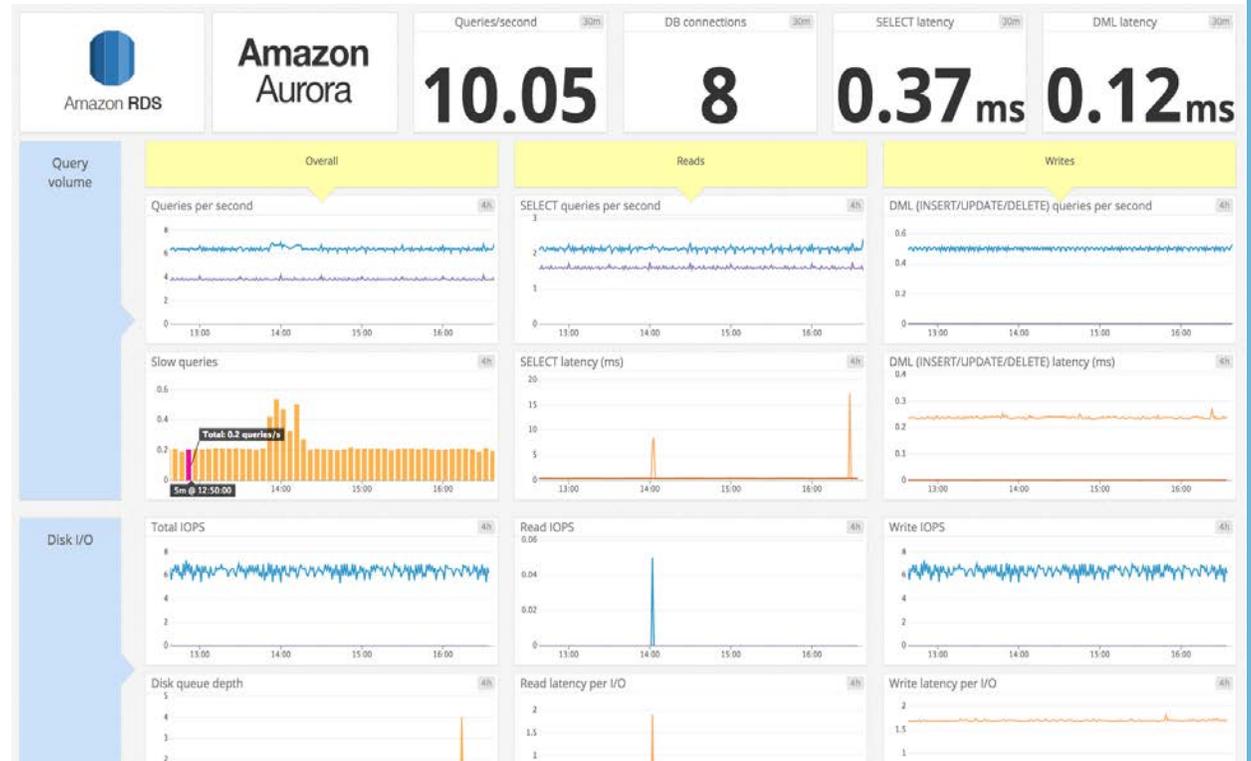


DevOps

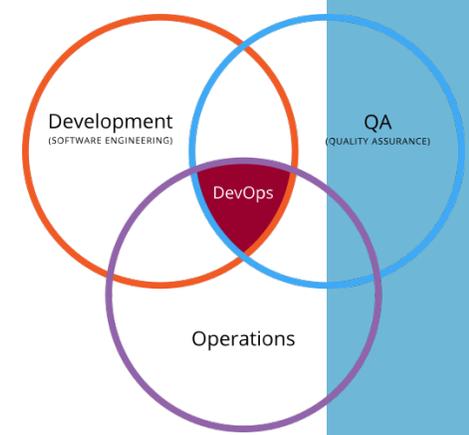


Software Services

Operation is different in cloud



A developer's view of the history



OKAY. BUT HOW?

Automatic test cases

Automatic deployment
Automatic monitoring

Do it often, automatically, and reproducibly



I can code

I can also
test it...

I can even
operate it

Waterfall

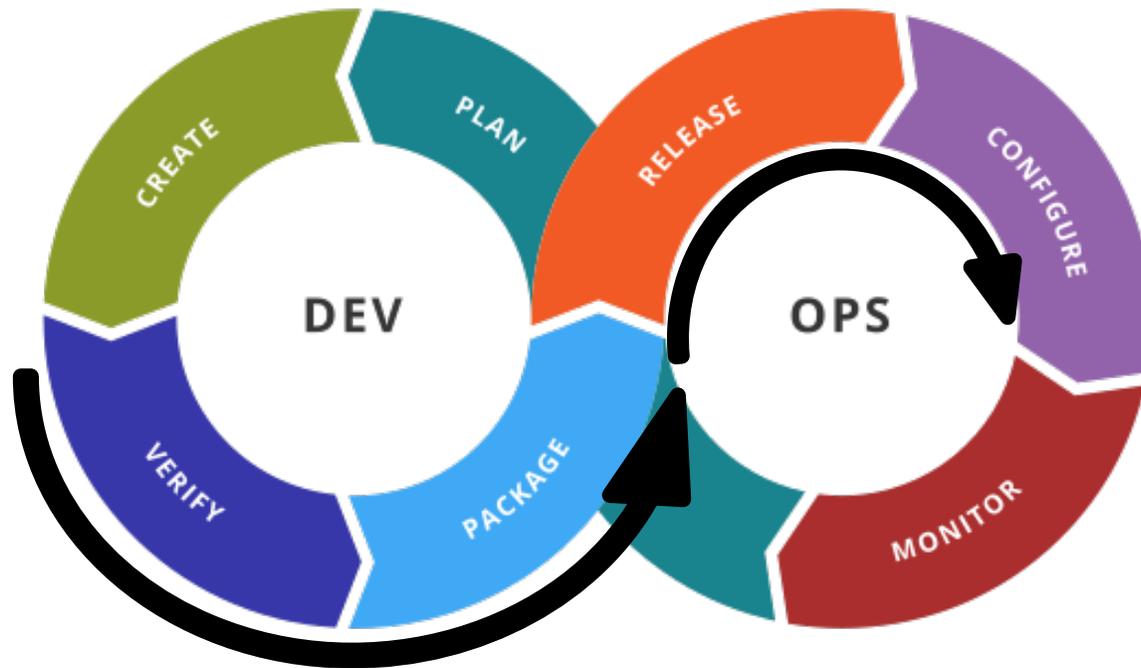
Agile

DevOps

How comes DevOps

- Driving force: Ever-changing requirements and environments
- Actually required: Software as a service
 - More control of the software lifecycle
 - Even more fine-grained modularity (microservices)
 - Small teams
- Enabled by: New technologies
 - Cloud and containers -> Reproducible deployment
 - Framework and high-level languages -> actually readable code
 - Continuous integration pipelines

DevOps



DevOps is a **set of practices (2)** intended **to reduce the time(1)** between committing a change to a system and the change being placed into normal production, **while ensuring high quality (3).**

(1) Reduced time: relatively: 0, absolutely: up to 50 times a day*

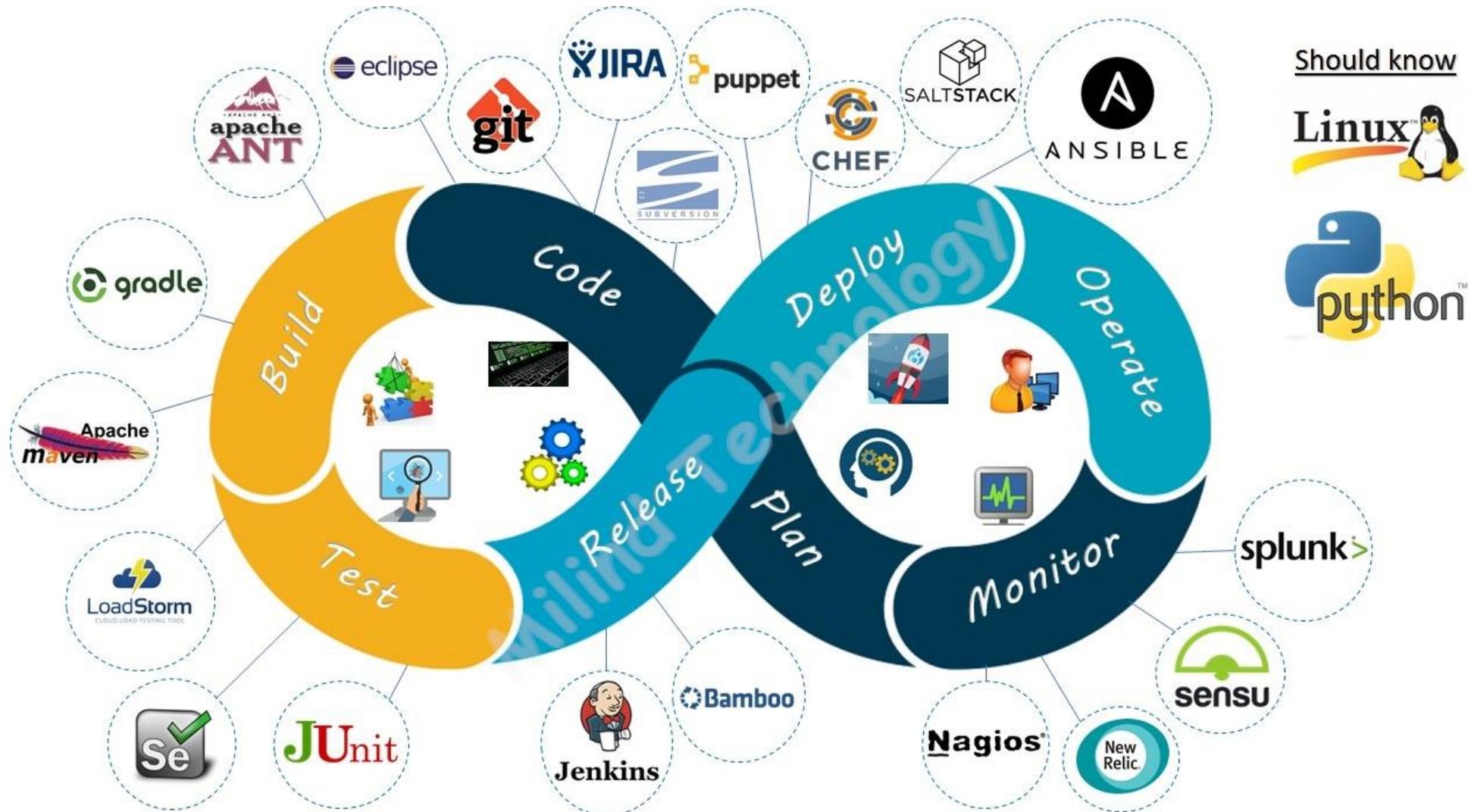
(2) Automatic: everything is code, therefore programmable and tracked

(3) Without sacrifice of quality: thorough testing, chaos engineering...

How does it look like? A use case from Etsy

- Making many small, continuous changes: "how comfortable am I with deploying a change right now?"
- Every developer a Virtual Machine, configured by Chef, with the same cookbooks used in production
- Try is a tool that allows a developer to test his changes in Jenkins, without having to commit to trunk.
- The CI cluster is powerful enough to support 150 engineers, and more than 14000 tests suites runs per day.
- The pipeline passes through the staging environment, the same production environment, but only Etsy's employees have access to it. One-click deployments by Deployinator
- Config flags supports completely enable or disable a feature or variants of a given feature, and thus allows A/B testing
- Developers do their own feature monitoring and everyone has access to all the graphs through dashboards.
- IRC is the main communication tool

Tools are the backbones to DevOps



Collaborate

Build

Test

Deploy

Run

Application Lifecycle Mgmt.



SCM/VCS



Testing



Deployment



Cloud / IaaS / PaaS



Communication & ChatOps



CI



Config Mgmt. / Provisioning



Orchestration & Scheduling



Knowledge Sharing



Build



Database Management



Artefact Management



BI / Monitoring / Logging



More tools

PERIODIC TABLE OF DEVOPS TOOLS (V1)

XebiaLabs
Deliver Faster

- Os Open Source
- Fr Free
- Fm Freemium
- Pd Paid
- En Enterprise

Database	SCM	Build
CI	Repo Mgmt	Testing
Deployment	Config / Provisioning	Containerization
Cloud / Iaas / Paas	Release Mgmt	Collaboration
BI / Monitoring	Logging	Security

1 En O 12c																				2 Fm Aws Amazon Web Services					
3 Os My MySQL	4 Os Gt Git																			5 En Ch Chef	6 En Pu Puppet	7 Os An Ansible	8 En Sl Salt	9 Os Dk Docker	10 Pd Az Azure
11 En Mq MSSQL	12 Os Sv Subversion																			13 Fr Ssh SSH	14 En Bl BladeLogic	15 Os Va Vagrant	16 Fr Tf Terraform	17 Os Rk rkt	18 Fm Hk Heroku
19 Os Pq PostgreSQL	20 Fr Mc Mercurial	21 Os Mv Maven	22 Os Gr Gradle	23 En Mr Meister	24 Os Jn Jenkins	25 Pd Bb Bamboo	26 Os Tr Travis CI	27 Fr Ar Archiva	28 Os Fn FitNesse	29 Fr Se Selenium	30 Os Gn Gatling	31 Pd Gd Deployment Manager	32 Os Sf SmartFrog	33 Fr Cb Cobbler	34 Os Bc Bcfg2	35 Os Kb Kubernetes	36 En Rs Rackspace								
37 Os Mg MongoDB	38 Fm Gh Github	39 Os Br Buildr	40 Os At ANT	41 Fm Bm BuildMaster	42 Fm Cs Codeship	43 Fm Sn Snap CI	44 Fm Cr CircleCI	45 Os Nx Nexus	46 Fr Cu Cucumber	47 Os Cj Cucumber.js	48 Fr Qu Qunit	49 Fr Cp Capistrano	50 Fr Ju JuJu	51 Os Rd Rundeck	52 Os Cf CFEngine	53 Fr Pk Packer	54 Fm Bx Bluemix								
55 En Db DB2	56 Fm Bb Bitbucket	57 Fm Qb QuickBuild	58 En Ub UrbanCode Build	59 Pd Ta Visual Build	60 Fm Tc TeamCity	61 Fm Sh Shippable	62 Os Cc CruiseControl	63 Os Ay Artifactory	64 Fr Ju JUnit	65 Fr Jm JMeter	66 Fr Tn TestNG	67 En Rd RapidDeploy	68 Fm Cy CodeDeploy	69 En Oc Octopus Deploy	70 Os No CA Nolio	71 En Eb ElasticBox	72 En Ad Apprenda								
73 Fr Cs Cassandra	74 En Hx Helix	75 Os Msb MSBuild	76 Os Rk Rake	77 Os Lb LuntBuild	78 Os Cu Continuum	79 Fm Ca Continua CI	80 Os Gu Gump	81 Os Ng NuGet	82 Os Ap Appium	83 En Xltv XL TestView	84 En Tc TestComplete	85 Os Go Go	86 En Ef ElectricFlow	87 En Xld XL Deploy	88 En Ud UrbanCode Deploy	89 Os Mo Mesos	90 Os Cf Cloud Foundry								

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91 En Xlr XL Release	92 En Ur UrbanCode Release	93 En Ls CA Service Virtualization	94 En Bm BMC Release Process	95 En Hp HP Codar	96 Pd Ex Excel	97 En Pl Plutora Release	98 En Sr Serena Release	99 Fm Tr Trello	100 Pd Jr Jira	101 Fm Rf HipChat	102 Fm Sl Slack	103 Fm Fd Flowdock	104 Pd Pv Pivotal Tracker	105 En Sn ServiceNow
106 En Sp Splunk	107 Os Ki Kibana	108 Fm Nr New Relic	109 Os Ni Nagios	110 Os Gg Ganglia	111 Os Ct Cacti	112 Os Gr Graphite	113 Os Ic Icinga	114 Fm Sl Sumo Logic	115 Os Ls Logstash	116 Fm Lg Loggly	117 Os Gr Graylog	118 Os Sn Snort	119 Os Tr Tripwire	120 En Cy CyberArk

DevOps and risks

- Use tools to minimize the known risks
 - Automation, traceability, reproducibility, testing...
- So that developers can handle the unknown risks quickly and continuously

More about DevOps tools

- No tools, no DevOps
- Tools work with each other in a flexible way
- Every team needs their own tools

DevOps in IoT

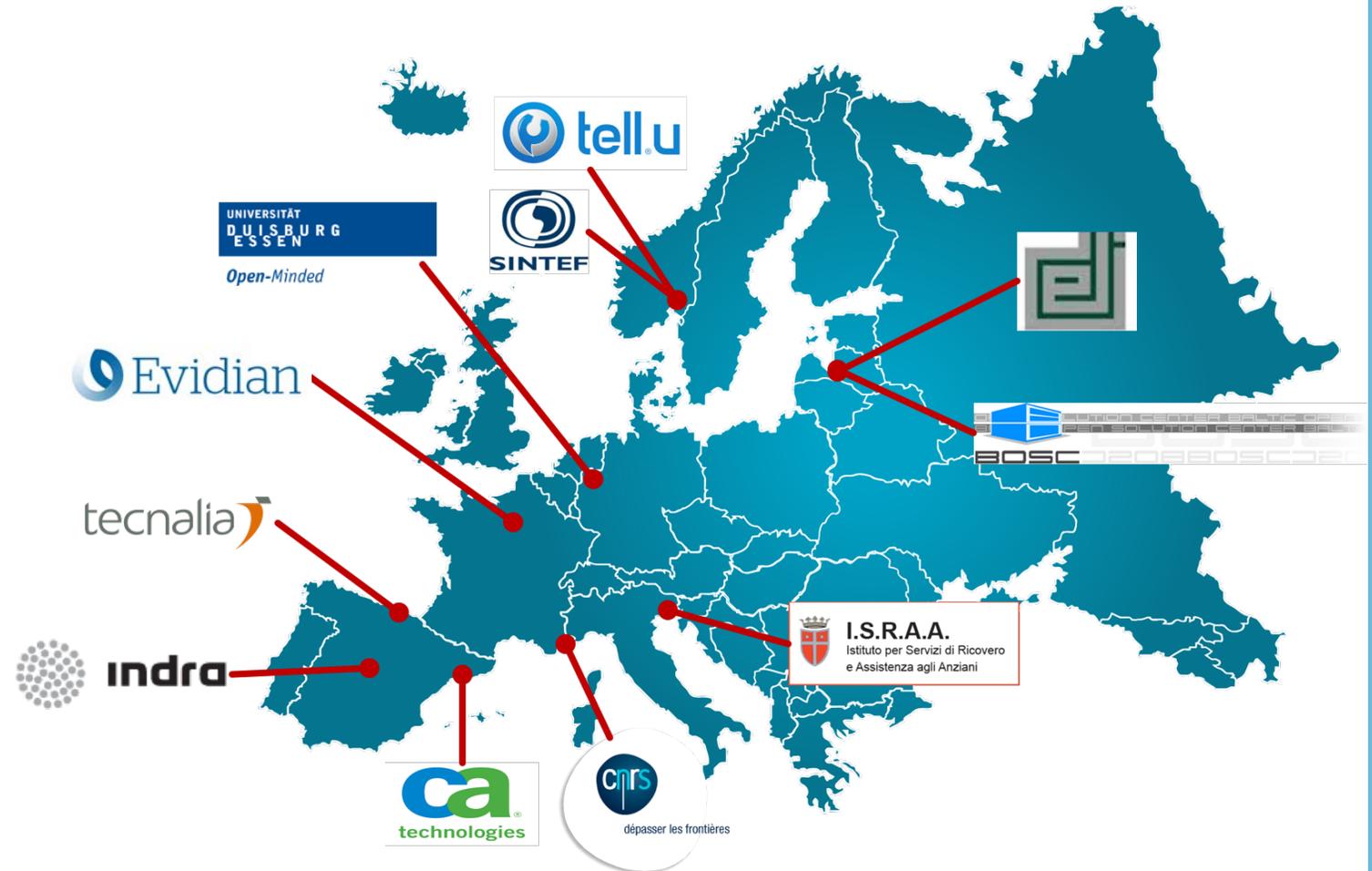
Fill-in the gaps

DevOps for IoT

- DevOps is far from being adopted in the IoT world
- Opportunities:
 - Fast to market, new devices and requirements, experimental culture...
 - A pragmatic way towards trustworthiness
- Challenges:
 - Hardware culture: certification, technical complexity, etc.
 - More unpredicted running environments
- Tool or Practice: a "chicken or the egg" problem:
 - A research and innovation action to build the *missing* tools
 - Demonstrate the practice on industrial use cases

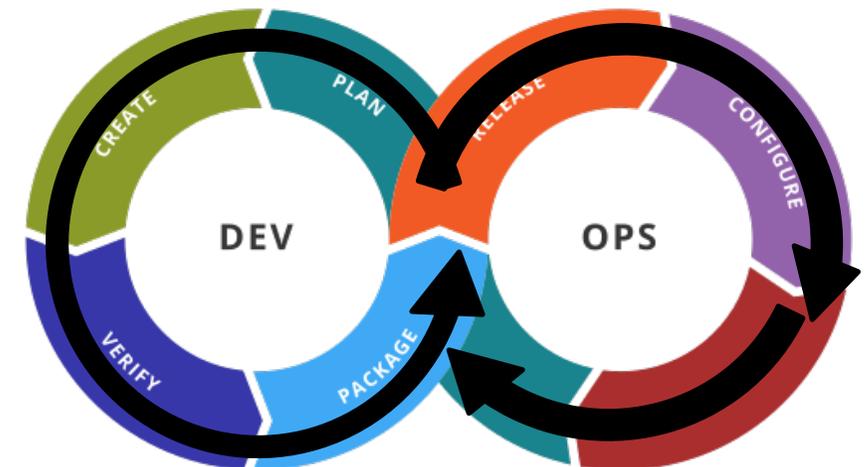
The ENACT project

- **Start date:** 01-01-2018
- **Duration:** 3 years
- **Project leader:** SINTEF
- **Consortium:** 11 partners

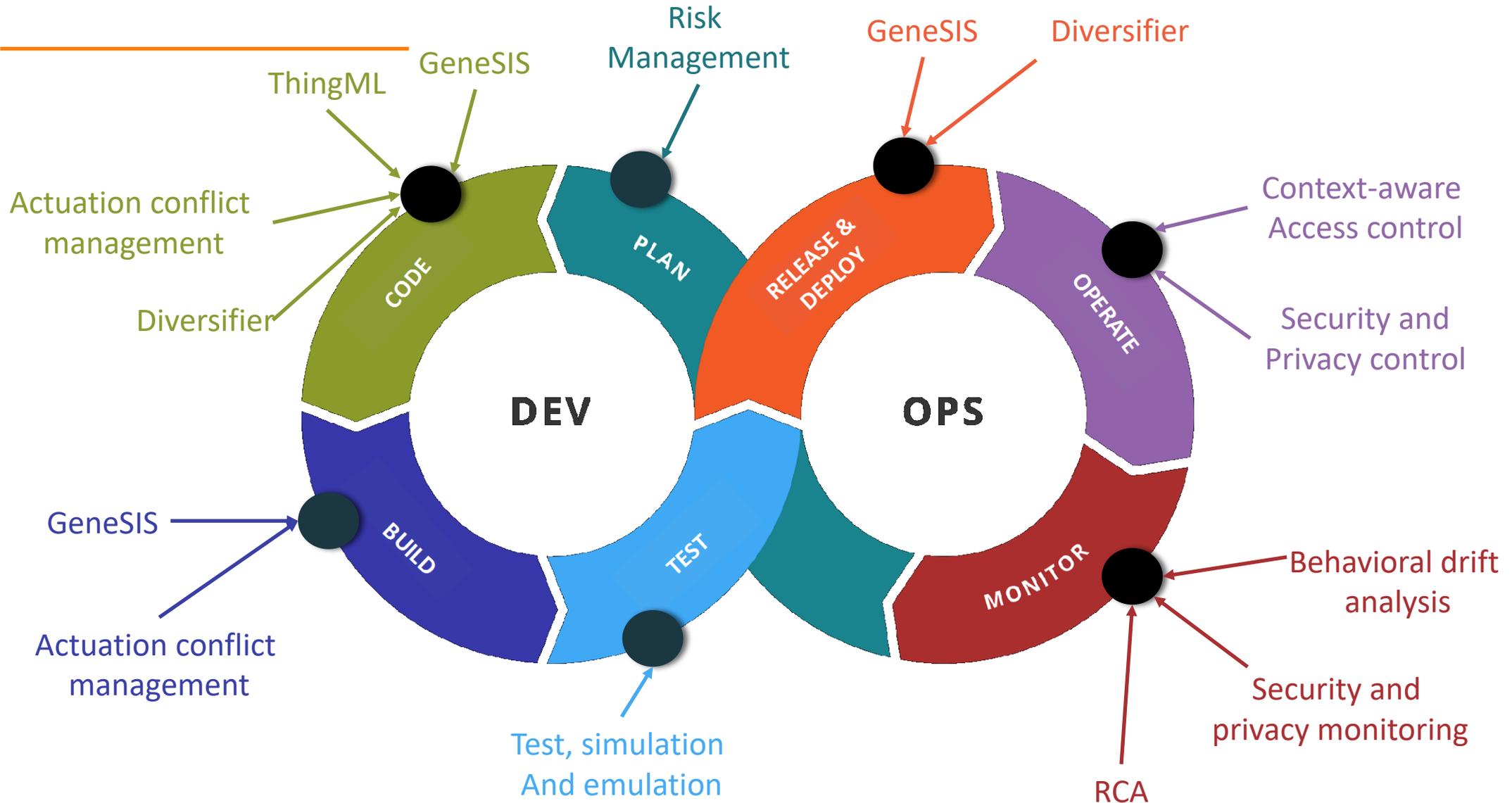


DevOps for Trustworthy Smart IoT Systems

- Four high-level user stories: As a developer, I want to...
 - **develop** new and trustworthy features into an SIS in an agile way, so that I can promptly and continuously bring new values to the end users
 - **release** the changes into the running smart IoT system **automatically and reproducibly**, so that I can immediately see the effect of the changes
 - **patch** the running IoT system promptly and continuously, so that it keeps trustworthy despite **internal threats** (such as insufficient security setting, unexpected attacks, system failures, unexpected actuation conflicts, etc.)
 - **patch** the running IoT system promptly and continuously, so that it keeps trustworthy despite **external threats** (new vulnerabilities, software updates, new security strategies, new user profiles, policies changes, etc.)



Tools



A sample story

Diversifier
(alternative architectures)

GeneSIS

Risk
Management

GeneSIS

Diversifier
(choose one architecture)

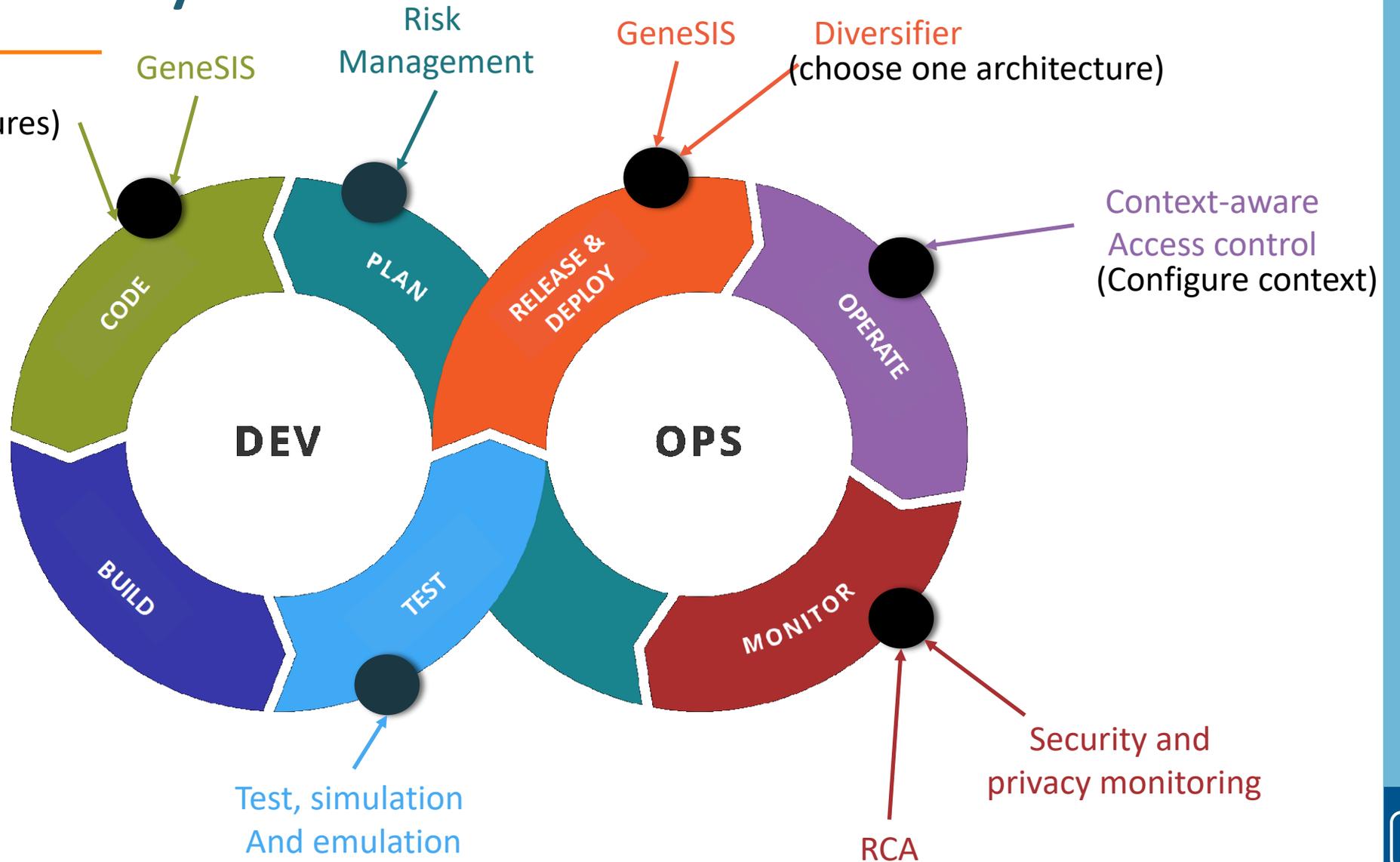
Rail Domain



Smart Building



eHealth



Conclusions

- DevOps facilitates agility
- DevOps makes real-time risk management possible
- IoT requires DevOps
- Currently some key tools are missing for IoT DevOps
- At SINTEF, we are trying to deal with this problem

Thanks!

