# Modeling pilot project at Ericsson Expert Analytics

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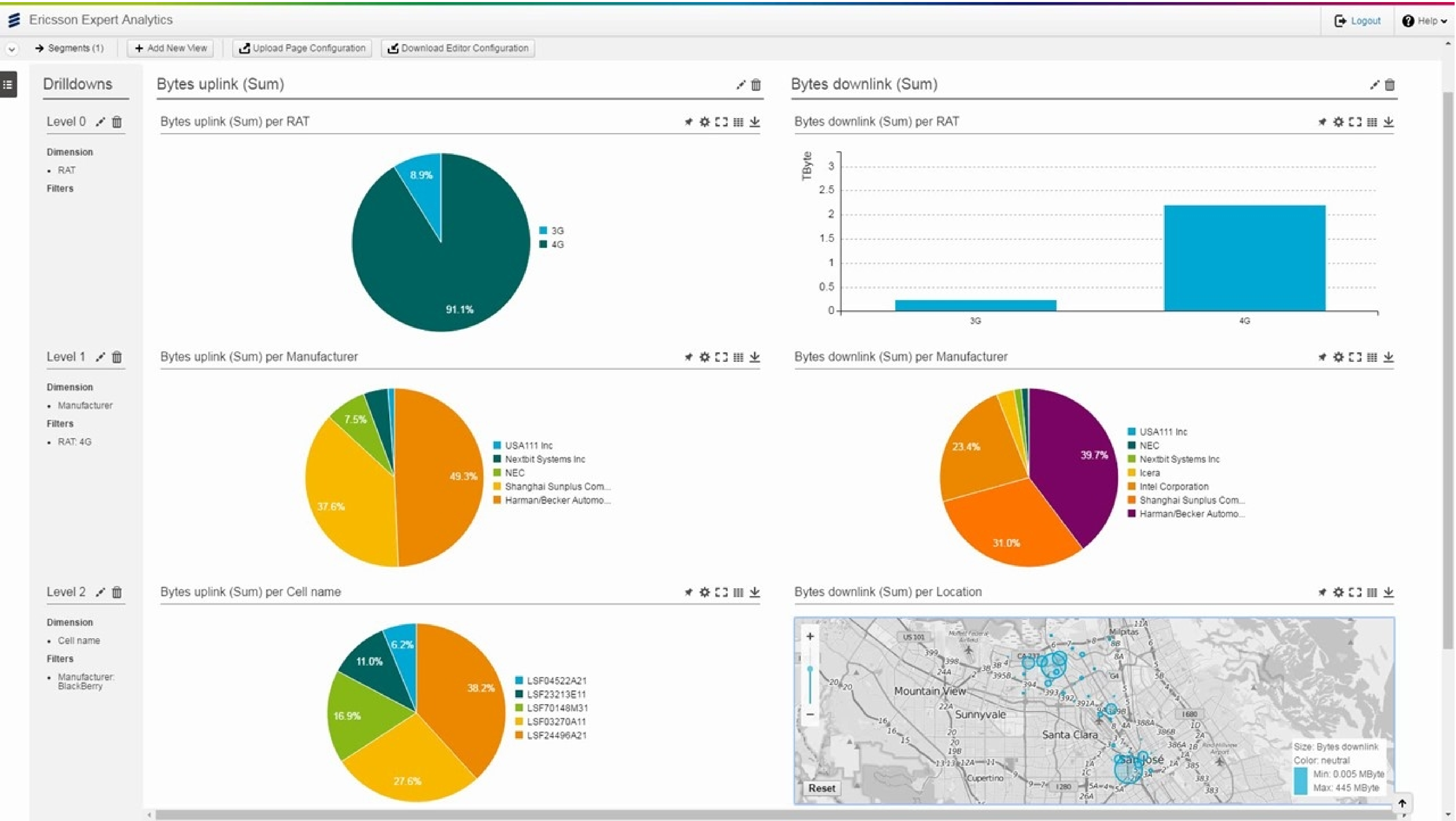
Ericsson Modeling Days,
Stockholm, 13-14 September 2016

# Overview

- Background of the pilot project
- Technology used
- Pilot project details
- Demo
- Questions

# Stakeholder:
# Ericsson Expert Analytics



Ericsson Expert Analytics

Drilldowns

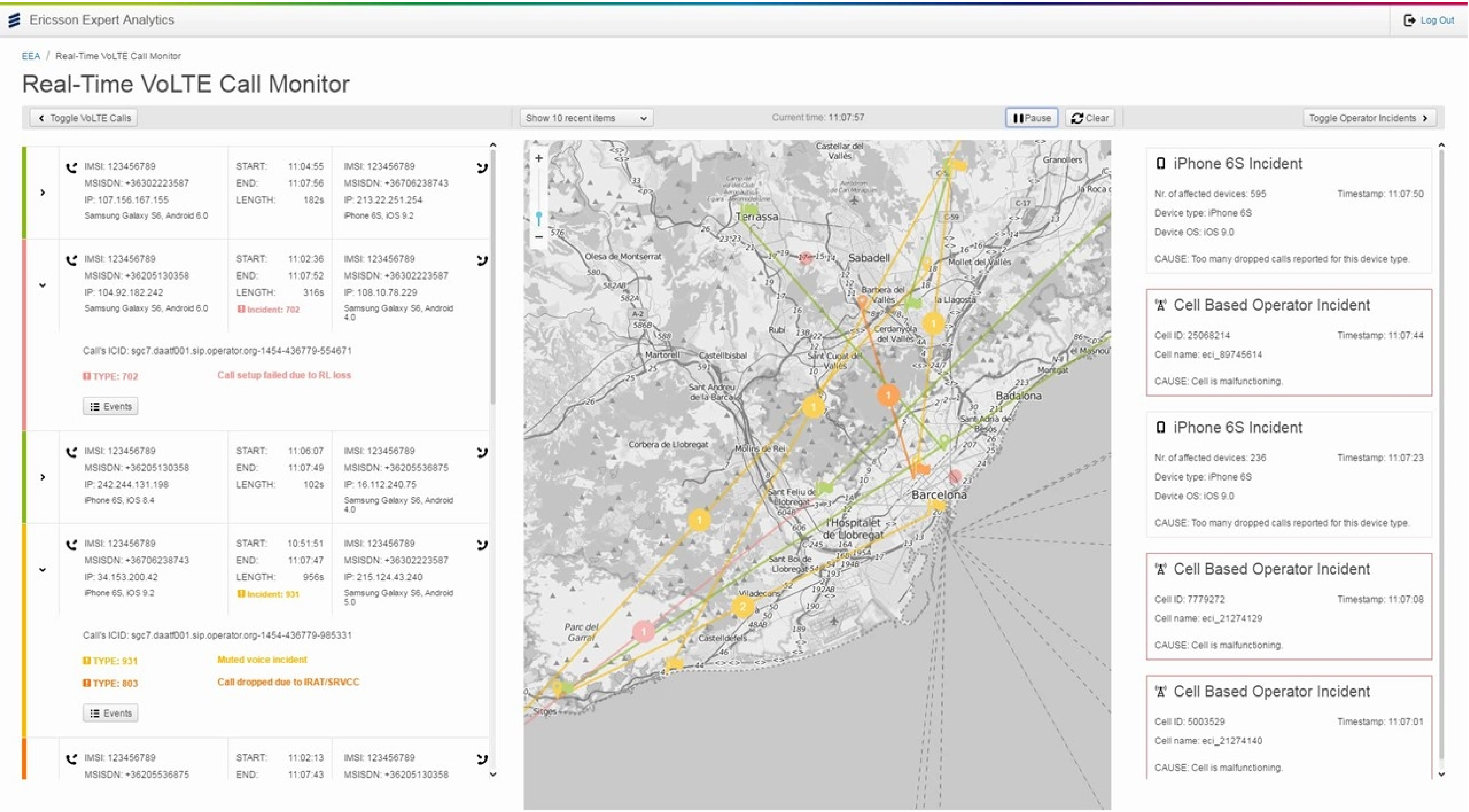
Level 0
- Dimension
  - RAT
- Filters

Level 1
- Dimension
  - Manufacturer
- Filters
  - RAT: 4G

Level 2
- Dimension
  - Cell name
- Filters
  - Manufacturer: BlackBerry

Slide: Ericsson (CRAFT conference, 2016)

# Stakeholder:
# Ericsson Expert Analytics


Ericsson Expert Analytics
Log Out
EEA / Real-Time VoLTE Call Monitor

## Real-Time VoLTE Call Monitor

Toggle VoLTE Calls
Show 10 recent items
Current time: 11:07:57
Pause
Clear
Toggle Operator Incidents

IMSI: 123456789
MSISDN: +36302223587
IP: 107.156.167.155
Samsung Galaxy S6, Android 6.0

START: 11:04:55
END: 11:07:56
LENGTH: 182s

IMSI: 123456789
MSISDN: +36706238743
IP: 213.22.251.254
iPhone 6S, iOS 9.2

IMSI: 123456789
MSISDN: +36205130358
IP: 104.92.182.242
Samsung Galaxy S6, Android 6.0

START: 11:02:36
END: 11:07:52
LENGTH: 316s
Incident: 702

IMSI: 123456789
MSISDN: +36302223587
IP: 108.10.78.229
Samsung Galaxy S6, Android 4.0

Call's ICID: sgc7.daatf001.sip.operator.org-1454-436779-554671

TYPE: 702 Call setup failed due to RL loss

IMSI: 123456789
MSISDN: +36205130358
IP: 242.244.131.198
iPhone 6S, iOS 8.4

START: 11:06:07
END: 11:07:49
LENGTH: 102s

IMSI: 123456789
MSISDN: +36205536875
IP: 16.112.240.75
Samsung Galaxy S6, Android 4.0

IMSI: 123456789
MSISDN: +36706238743
IP: 34.153.200.42
iPhone 6S, iOS 9.2

START: 10:51:51
END: 11:07:47
LENGTH: 956s
Incident: 931

IMSI: 123456789
MSISDN: +36302223587
IP: 215.124.43.240
Samsung Galaxy S6, Android 5.0

Call's ICID: sgc7.daatf001.sip.operator.org-1454-436779-985331

TYPE: 931 Muted voice incident

TYPE: 803 Call dropped due to IRAT/SRVCC

IMSI: 123456789
MSISDN: +36205536875

START: 11:02:13
END: 11:07:43

IMSI: 123456789
MSISDN: +36205130358

### iPhone 6S Incident

Nr. of affected devices: 595 Timestamp: 11:07:50
Device type: iPhone 6S
Device OS: iOS 9.0

CAUSE: Too many dropped calls reported for this device type.

### Cell Based Operator Incident

Cell ID: 25068214 Timestamp: 11:07:44
Cell name: eci_89745614

CAUSE: Cell is malfunctioning.

### iPhone 6S Incident

Nr. of affected devices: 236 Timestamp: 11:07:23
Device type: iPhone 6S
Device OS: iOS 9.0

CAUSE: Too many dropped calls reported for this device type.

### Cell Based Operator Incident

Cell ID: 7779272 Timestamp: 11:07:08
Cell name: eci_21274129

CAUSE: Cell is malfunctioning.

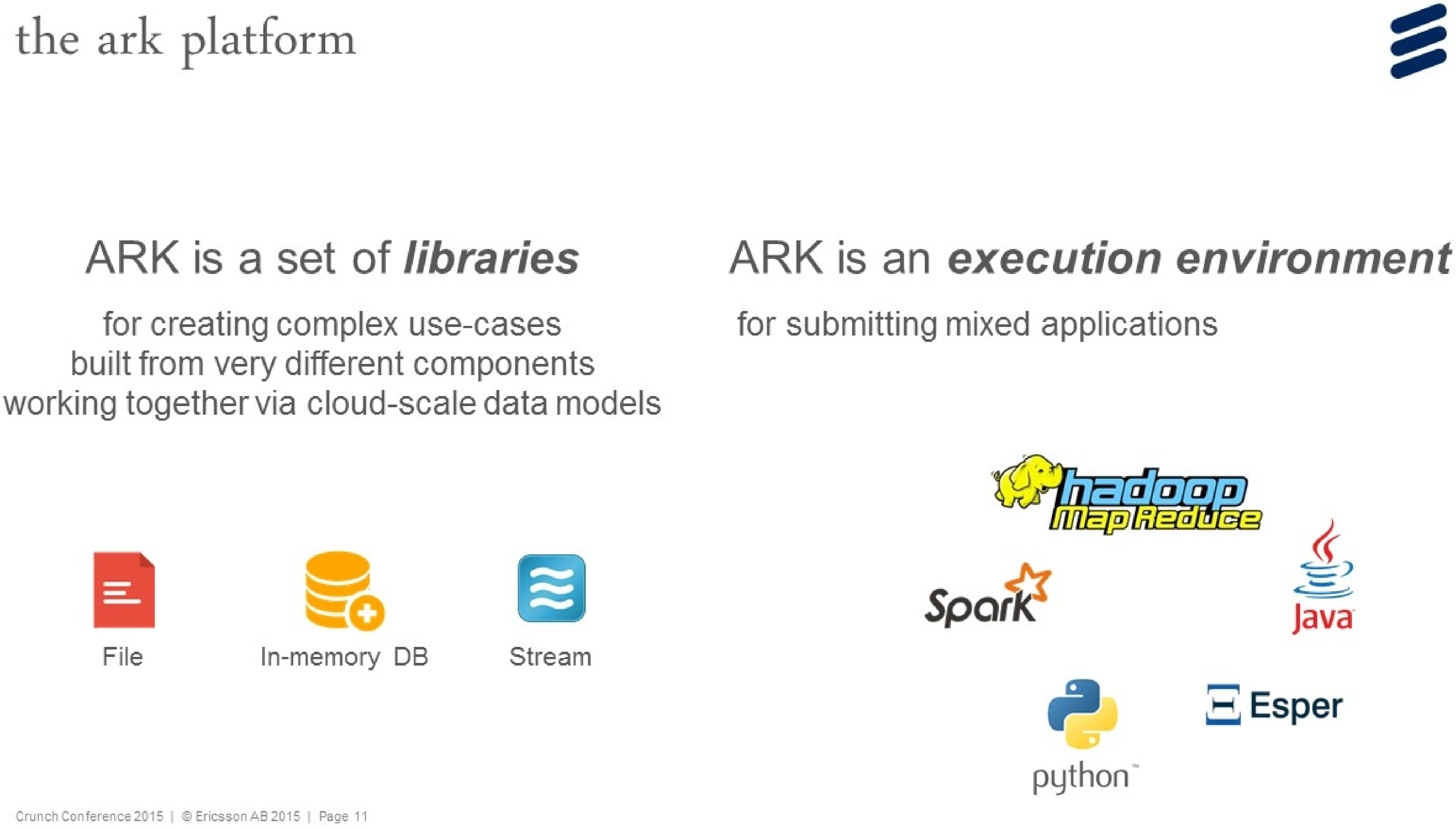
### Cell Based Operator Incident

Cell ID: 5003529 Timestamp: 11:07:01
Cell name: eci_21274140

CAUSE: Cell is malfunctioning.

Slide: Ericsson (CRAFT conference, 2016)

# Target platform of the pilot project



the ark platform

**ARK is a set of *libraries***

for creating complex use-cases
built from very different components
working together via cloud-scale data models

File

In-memory DB

Stream

**ARK is an *execution environment***

for submitting mixed applications

hadoop
Map Reduce
Spark
Java
python
Esper

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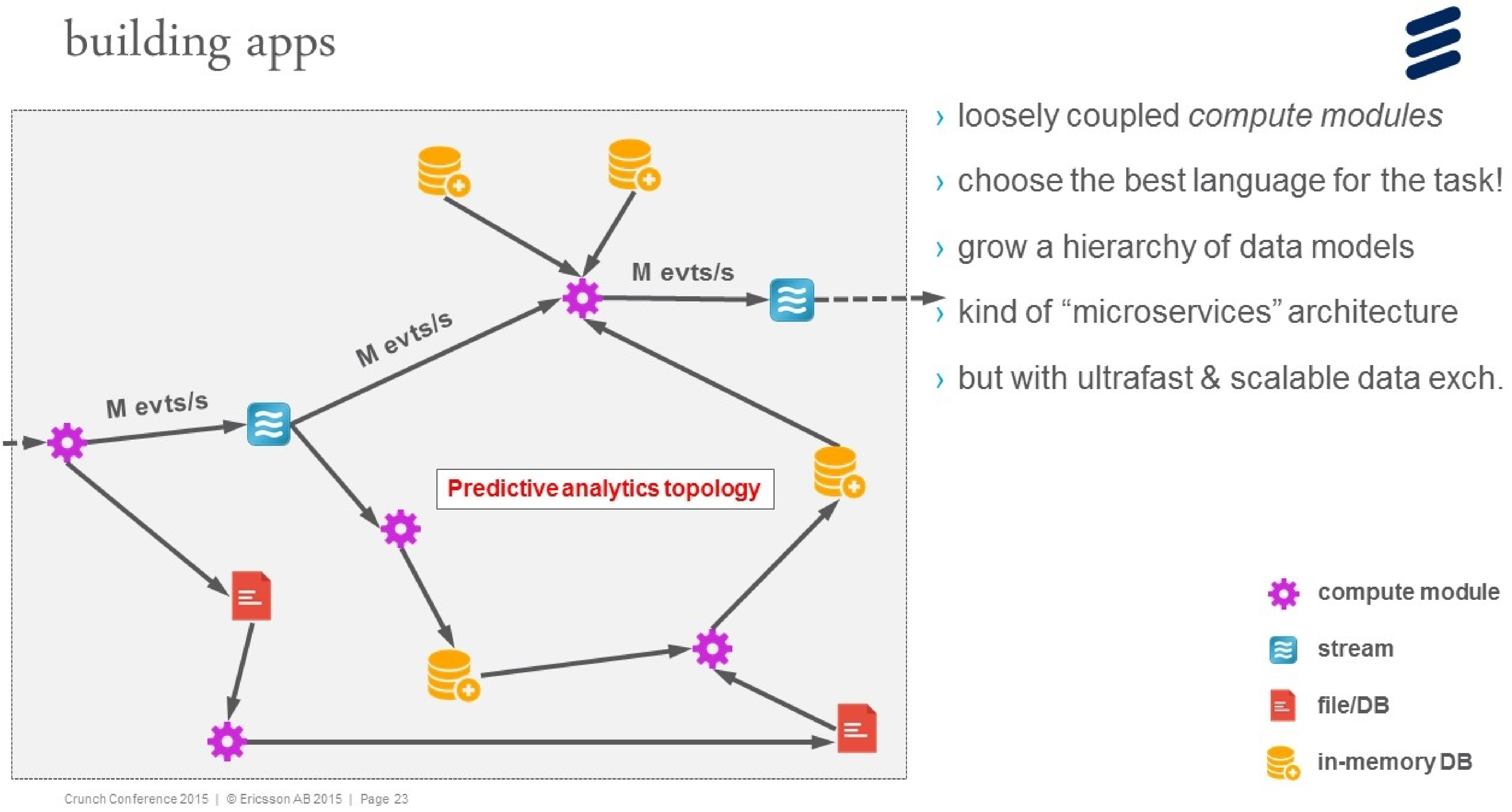
Slide: Ericsson (Crunch conference, 2015)

# Target platform of the pilot project



## building apps

- loosely coupled *compute modules*
- choose the best language for the task!
- grow a hierarchy of data models
- kind of “microservices” architecture
- but with ultrafast & scalable data exch.

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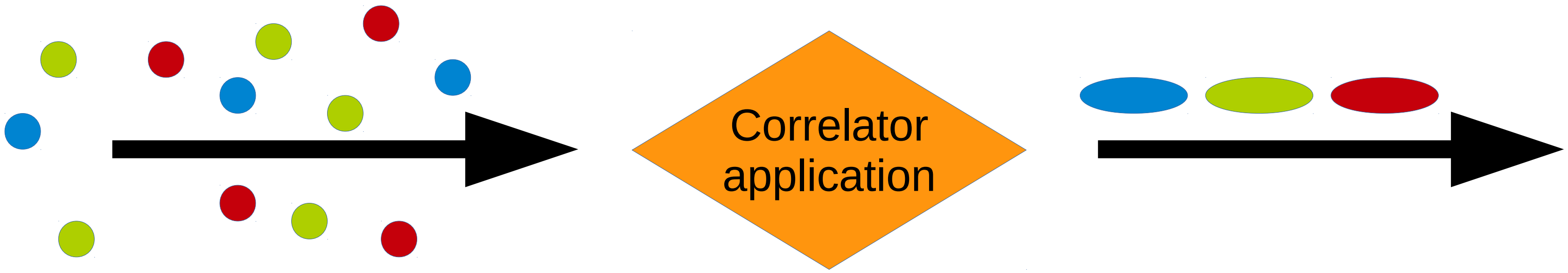
Slide: Ericsson (Crunch conference, 2015)

# Scope of the pilot project: “Call Correlator” application

- Call events are collected, grouped by call and aggregated



- Call details are analyzed by further components to check problem conditions and calculate KPIs

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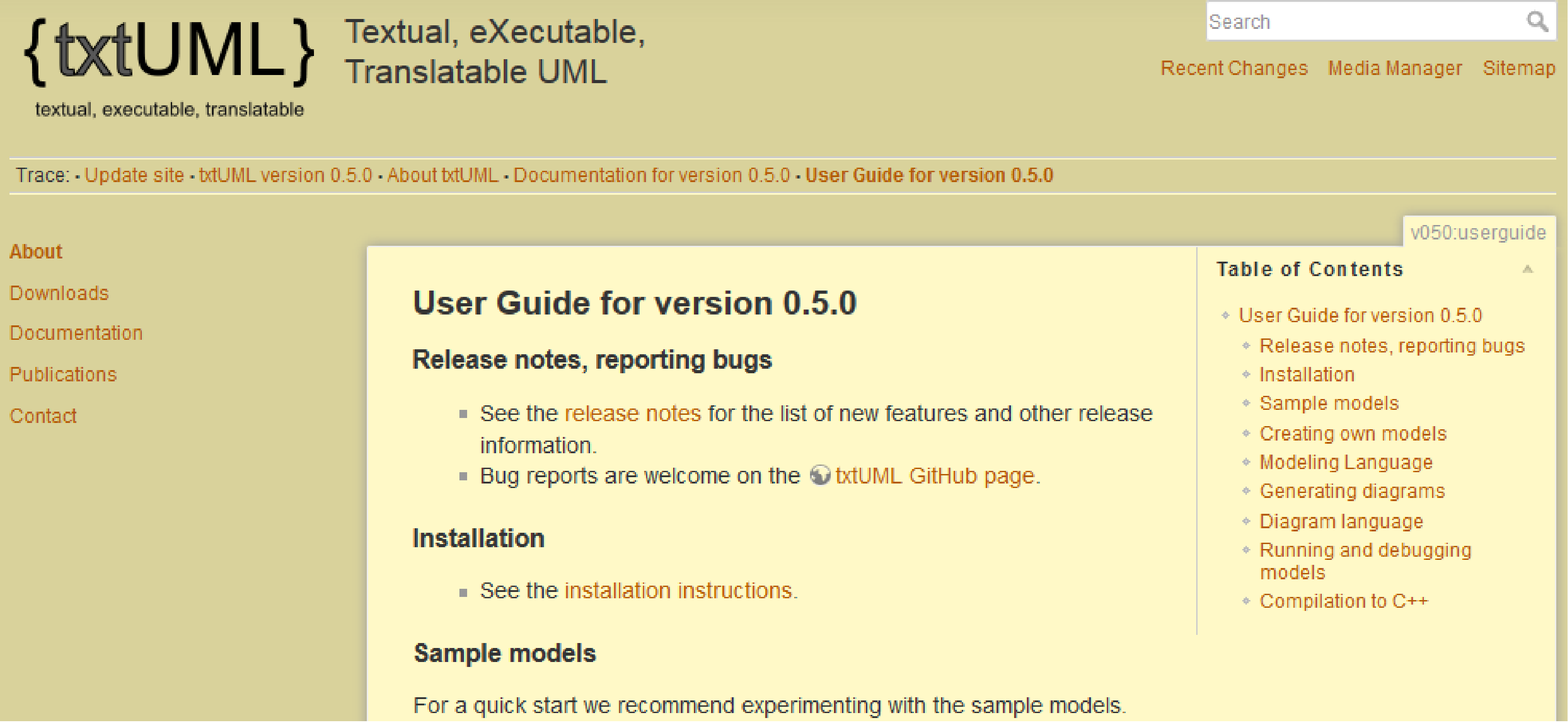
# txtUML

- Textual, executable, translatable UML
- Developed @ ELTE University, Budapest
- Open source: https://github.com/ELTE-Soft/txtUML
- Documentation, downloads: http://txtuml.inf.elte.hu


{txtUML}
textual, executable, translatable
Textual, eXecutable,
Translatable UML
Search
Recent Changes
Media Manager
Sitemap
Trace: · Update site · txtUML version 0.5.0 · About txtUML · Documentation for version 0.5.0 · User Guide for version 0.5.0
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v050:userguide

## User Guide for version 0.5.0

### Release notes, reporting bugs

- See the release notes for the list of new features and other release information.
- Bug reports are welcome on the txtUML GitHub page.

### Installation

- See the installation instructions.

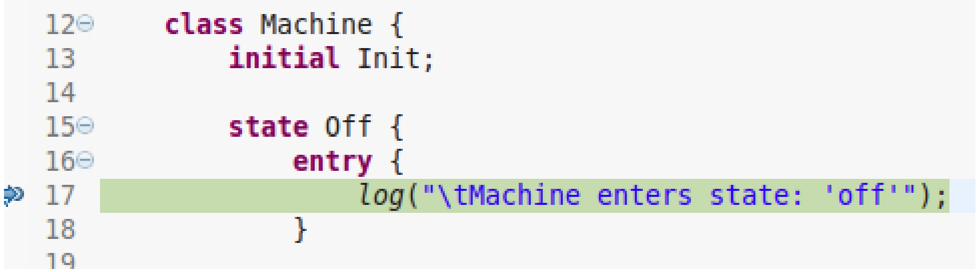
### Sample models

For a quick start we recommend experimenting with the sample models.

Table of Contents

# txtUML

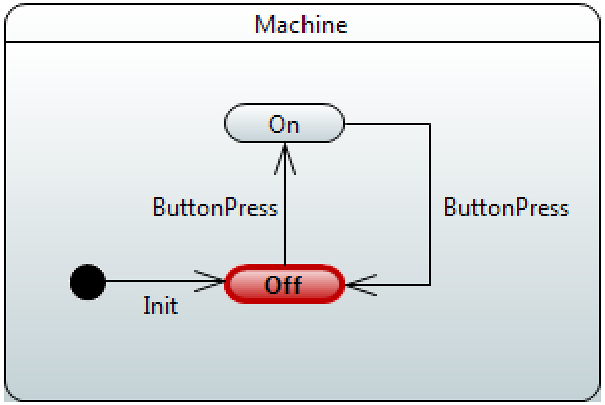
- Textual modeling language
  - DSL syntax
  - Java API syntax

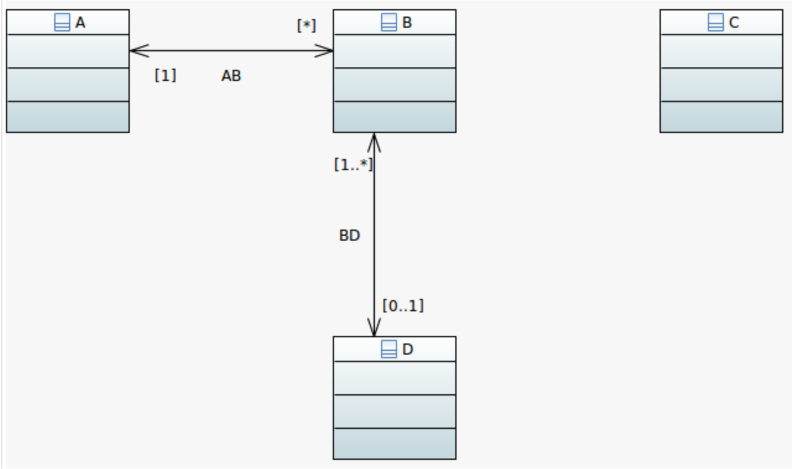


```
class Machine {
    initial Init;

    state Off {
        entry {
            log("\tMachine enters state: 'off'");
        }
```

- Generated UML diagrams in Papyrus
- Execution and debugging
- Model compiler generating C++





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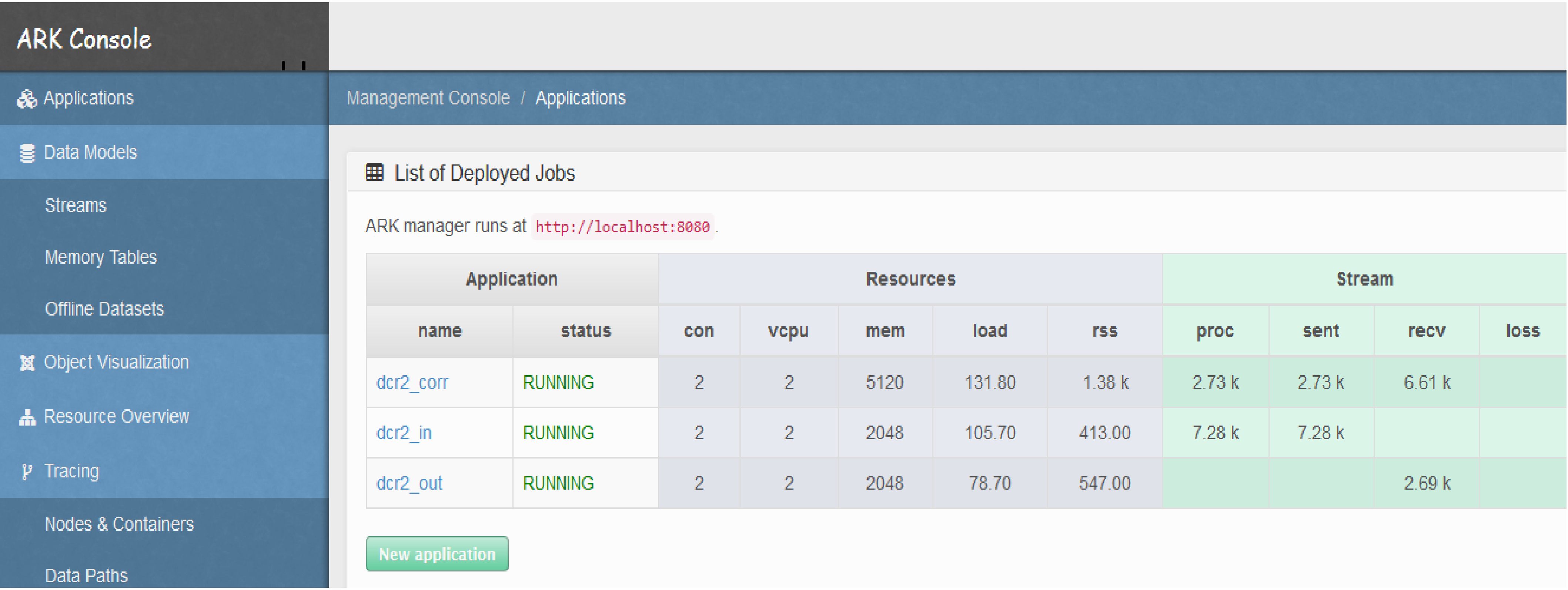
# Motivation

- Original implementation is in Python
  - Excellent for prototyping
  - Hard to understand and maintain
- Questions:
  - Can real EEA applications be modeled?
  - Can they run on the Ark platform?
  - Can modeling improve maintainability?
  - Runtime performance?

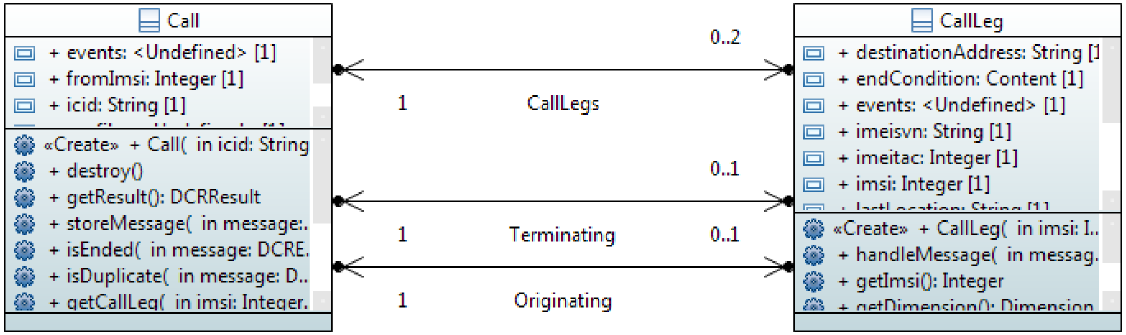
# Result: Modeled application runs on the Ark platform

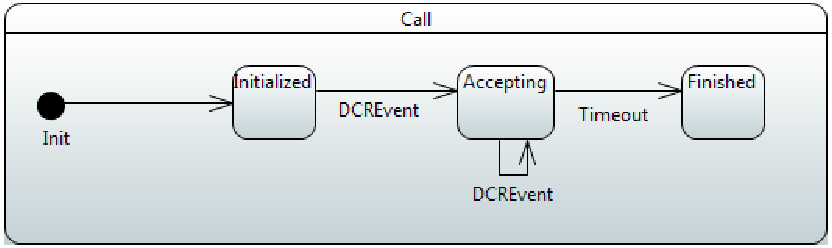


List of Deployed Jobs

ARK manager runs at `http://localhost:8080` .

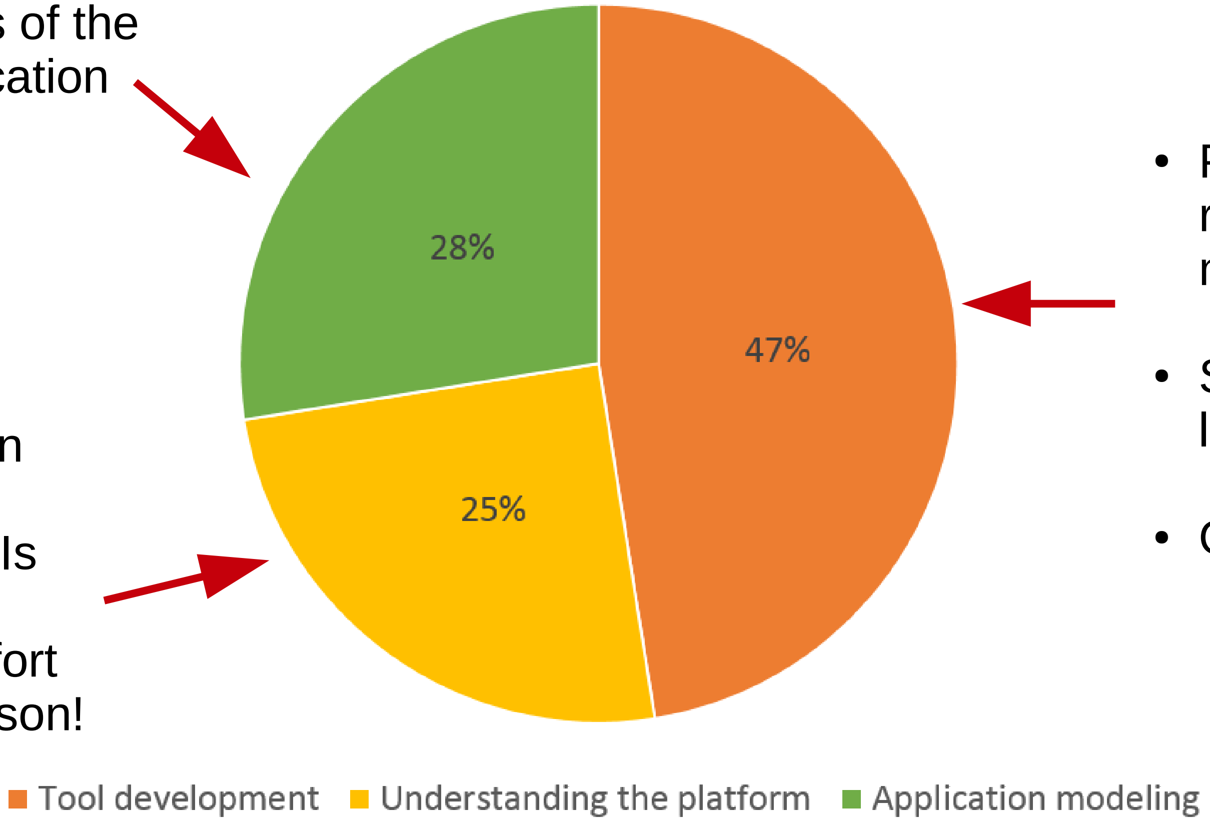
| Application | | Resources | | | | | Stream | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| name | status | con | vcpu | mem | load | rss | proc | sent | recv | loss |
| dcr2_corr | RUNNING | 2 | 2 | 5120 | 131.80 | 1.38 k | 2.73 k | 2.73 k | 6.61 k | |
| dcr2_in | RUNNING | 2 | 2 | 2048 | 105.70 | 413.00 | 7.28 k | 7.28 k | | |
| dcr2_out | RUNNING | 2 | 2 | 2048 | 78.70 | 547.00 | | | 2.69 k | |


Call
+ events: <Undefined> [1]
+ fromImsi: Integer [1]
+ icid: String [1]
«Create» + Call( in icid: String
+ destroy()
+ getResult(): DCRResult
+ storeMessage( in message:.
+ isEnded( in message: DCRE.
+ isDuplicate( in message: D..
+ getCallLeg( in imsi: Integer.
0..2
1
CallLegs
0..1
1
Terminating
0..1
1
Originating
CallLeg
+ destinationAddress: String [1
+ endCondition: Content [1]
+ events: <Undefined> [1]
+ imeisvn: String [1]
+ imeitac: Integer [1]
+ imsi: Integer [1]
«Create» + CallLeg( in imsi: I..
+ handleMessage( in messag.
+ getImsi(): Integer
+ getDimension(): Dimension



# Effort: 2.5 + 0.5 man-months

- Two models of the same application



- Platform-specific runtime of the modeling tool
- Some new language features
- One-time effort!

- Configuration
- Learning APIs
- One-time effort for each person!

# Comparison

| | Legacy solution | Modeling solution |
|---|---|---|
| Language | Python | txtUML model (94%) and Java (6%) |
| Runtime | Python interpreters on top of Ark | JVMs on top of Ark |
| Debugging | Analysis of the logs and traces of the deployed application | Eclipse debugger and state machine animation on local machine |
| Deployment | Process boundaries are hard-coded | Process boundaries are configurable |
| Code size | 495 lines | 624 lines (!) |
| Performance | Initial measurements show similar message processing rates, detailed measurements to come. | |

# Challenges

- Ark supports Java7, while the original model runtime used Java 8
- Platform and language specific optimizations make the legacy implementation hard to understand
- Python and Java interfaces to the used memory database support different capabilities
- Need for stateless applications
- Technology hook-in:
  - Can be minimized by switching txtUML's pure Java API
  - The tool is open source

# Advantages

- Platform-independent model
  - Higher abstraction level, easier to understand
  - Inter-process communication, serialization are not visible in the model
- Process boundaries are configurable
- Generated UML diagrams help maintenance
- Testing and debugging in local IDE is possible
- Typed interfaces
  - Instead of dynamic Python dictionaries

# Questions revisited

- Can real EEA applications be modeled?
  - **Yes!**
- Can they run on the Ark platform?
  - **Yes!**
- Can modeling improve maintainability?
  - **Seems so.**
- Runtime performance?
  - **Seems OK, more measurements to come.**

# Next steps

- Performance measurements with real data
- Formal presentation of the result to engineers and management at Ericsson Expert Analytics

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**More information:**
**http://txtuml.inf.elte.hu/**