

Agile automated software testing into automotive V-Model process:

A practical case

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Agenda

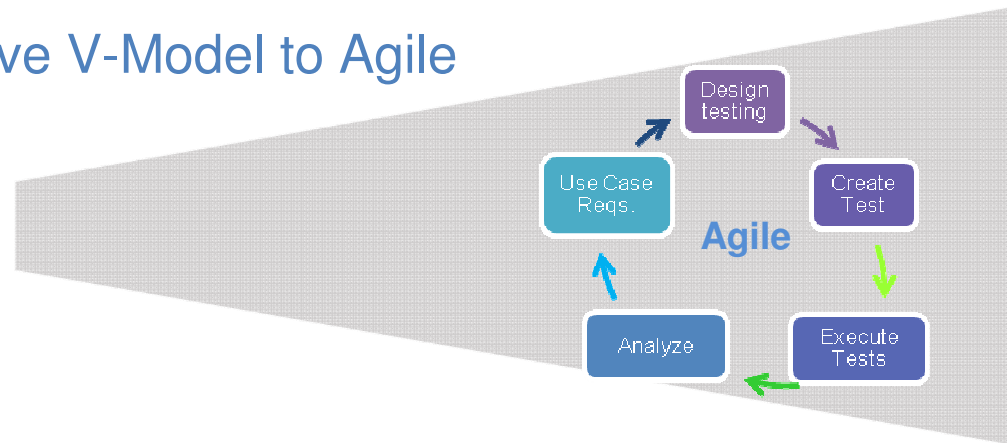
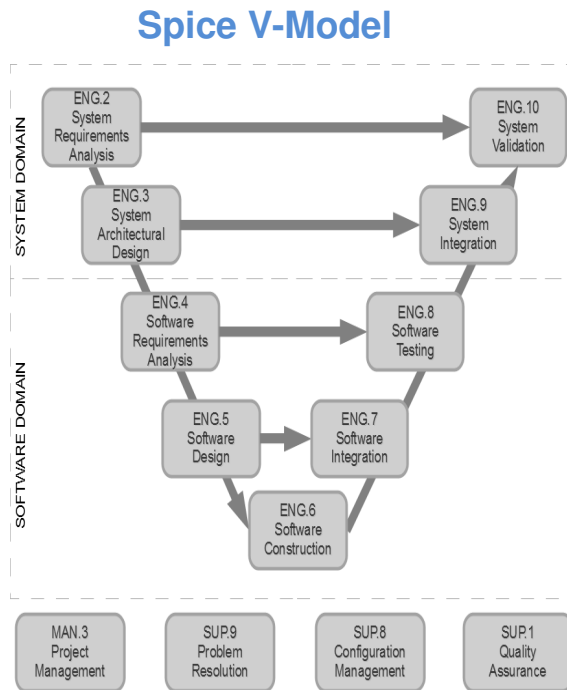
- Introduction
- Automotive Trends: Car Connectivity
- Car Telematics project Challenges
- Use Case Solution: From V-Model to Agile Testing
- Results and Conclusions

Introduction

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What is this presentation about?

- Expose a practical case of adoption of Agile techniques in automotive testing
- Converge Spice automotive V-Model to Agile

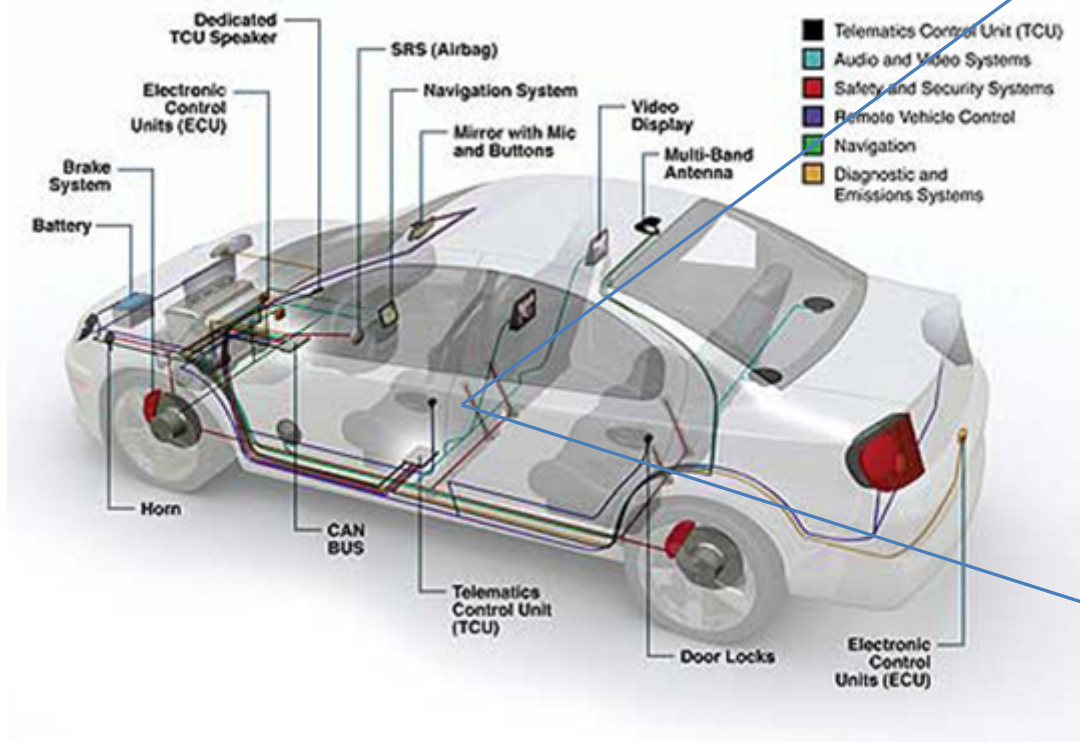


- Present Technical Solution adopted: Automation Test Framework
- Discuss results and Agile adequacy to Automotive industry

Automotive Trends: Vehicle Connectivity

Car Telematics

- Car Manufacturers start to add 3G/4G capabilities
- Connectivity opens new opportunities to develop services for both clients and manufacturers

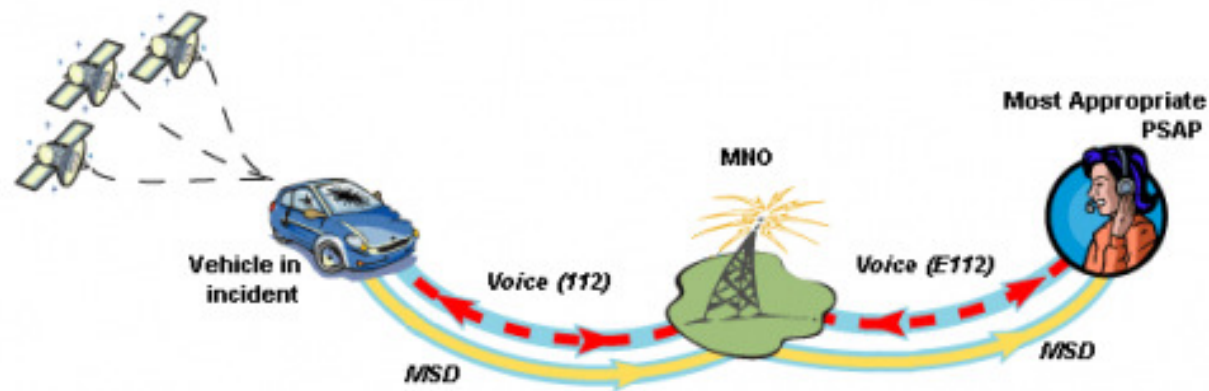


Connectivity Services

- Emergency Call
- Fleet Management
- Car Sharing
- Remote Car Diagnostics
- Stolen Vehicle Tracking (SVT)
- WOTA Update
- Dealer Services
- User Premium Services

Car telematics: eCall

- Emergency Call Service for Europe
- U.E Council proposes eCall obligatory in European Cars for end 2017
- Automatic call in case of accident or emergency will force car manufacturers to add IVTU to every new car for European Service
- Similar regulations for Russia, USA, BRA and PRC



Car Telematics Project Challenges

What is an iVTU?

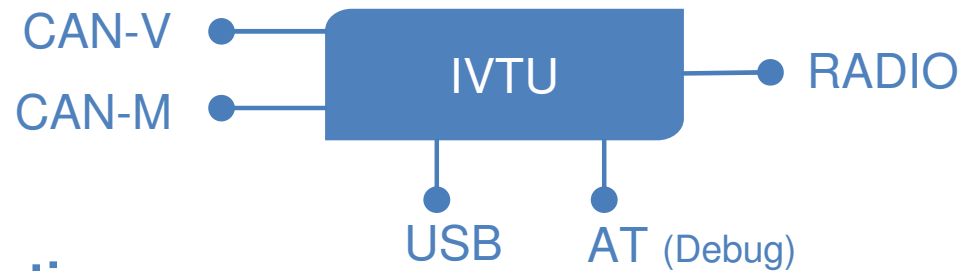
iVTU = in Vehicle Telematics Unit

- Electronic Unit in charge of granting 2G/3G/LTE connectivity to vehicles
- Two Main processors architecture:
 - DSPIC pseudo-real time processor handling CAN interfaces communication
 - Telematics Processor managing Radio Communications and high level services
 - Supervisor Micro, USB, Wi-Fi, Accelerometer, GPS,...

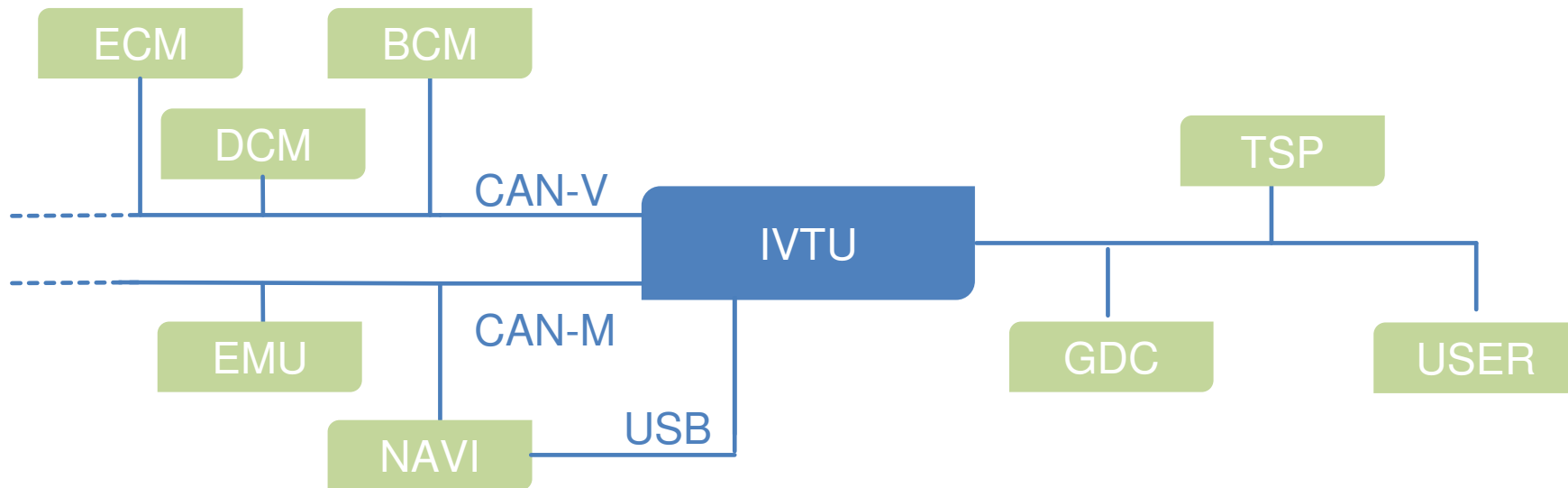


iVTU Interfaces

Black Box Interfaces:



On-Car Integration:

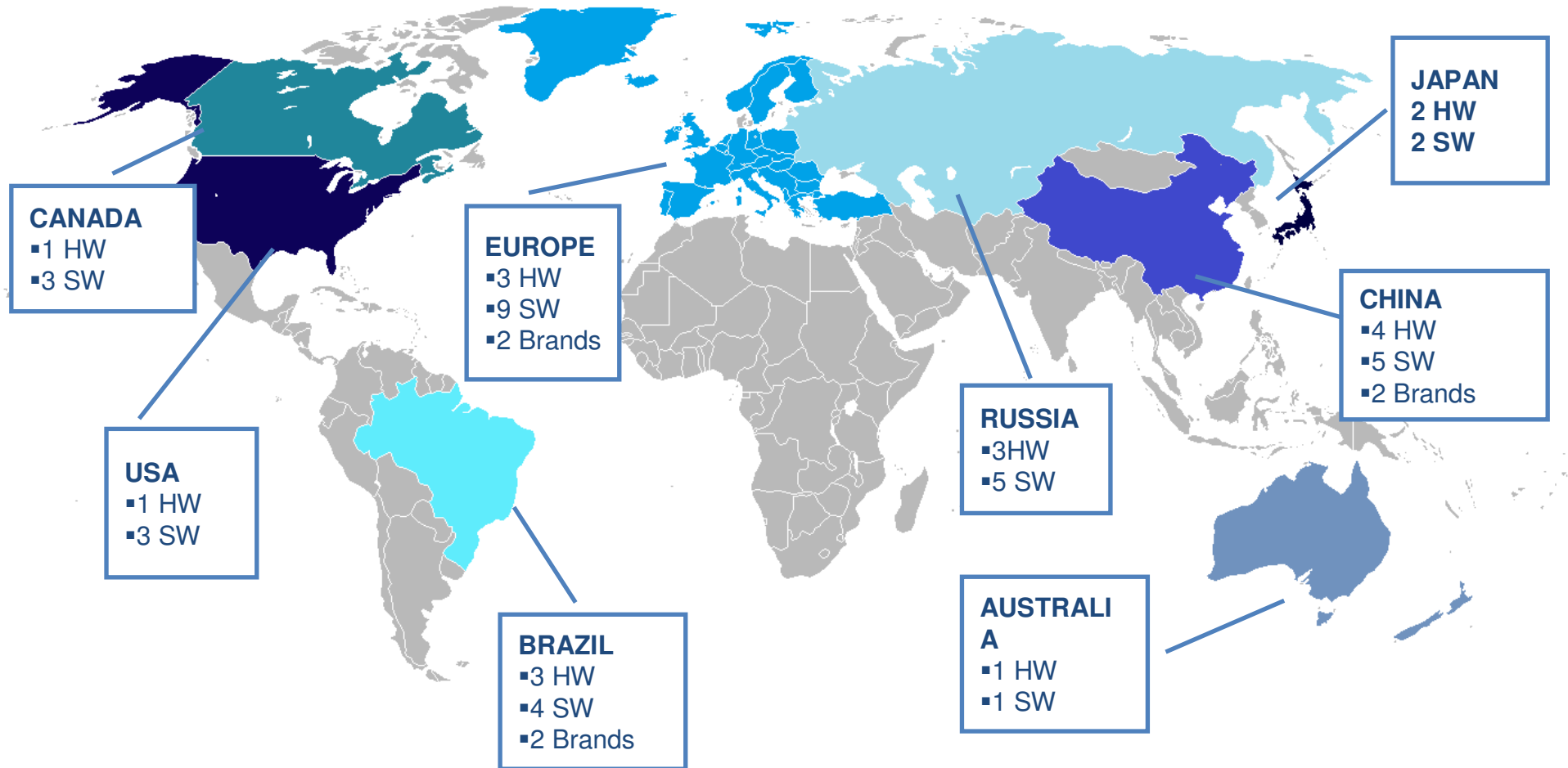


Project Challenges

- Embedded System
 - *High dependency of Hardware Development*
- Multiple Software Configurations for Multiple Hardware Variants
- 2 Car Manufacturers
- Number of releases
 - *Around 70 Releases per year*
- ISO 26262 Safety Requirements

- Continuous changes in requirements
 - Specifications blurriness

Hardware-Software Variability



Use Case Solution: From V-Model to Agile Testing

Automotive Spice & V-Model (1)

Automotive SPICE® :

- Comprises a set of assessment indicators of process performance and process capability
- Based on ISO/IEC ISO/IEC 15504-2
- Defines several levels of adherence to standard
- Focus on Process

V-Model:

- Extension of Waterfall Methodology
- Big Design Up Front
- Phases aligns with Automotive SPICE

Automotive SPICE & V-Model (2)

Benefits:

- The facto industry standards
- Defines a clear process *life-cycle*
- V-Model emphasis on testing, and particularly the importance of early test planning

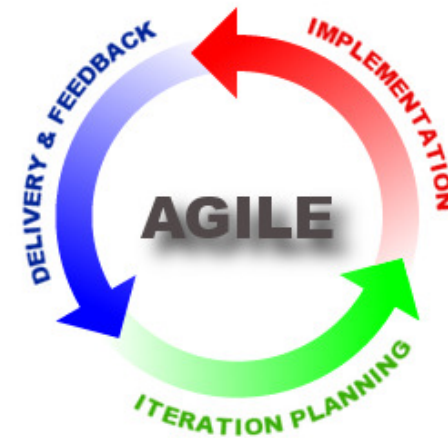
Drawbacks:

- The V-Model reflects a project management view of software development and fits the needs of project managers, accountants and lawyers rather than software developers or users.
- Inflexible and slow to respond to change.
- Process Overload
- Low Customer Implication

IVTU: Agile Project in a Waterfall World

Project Challenges:

- Multiple HW variants
 - Multiple SW variants
 - Continuous requirement Changes
 - Specifications blurriness
-
- ISO 26262 Safety Requirements
 - Industry Adherence



 **AUTOMOTIVE SPICE®**

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Why Use Agile?

Benefits:

- Flexibility to adapt to customer requirements changing during project life cycle
 - New features to be implemented
 - Redefinition of functions
- Fast time to market

Drawbacks:

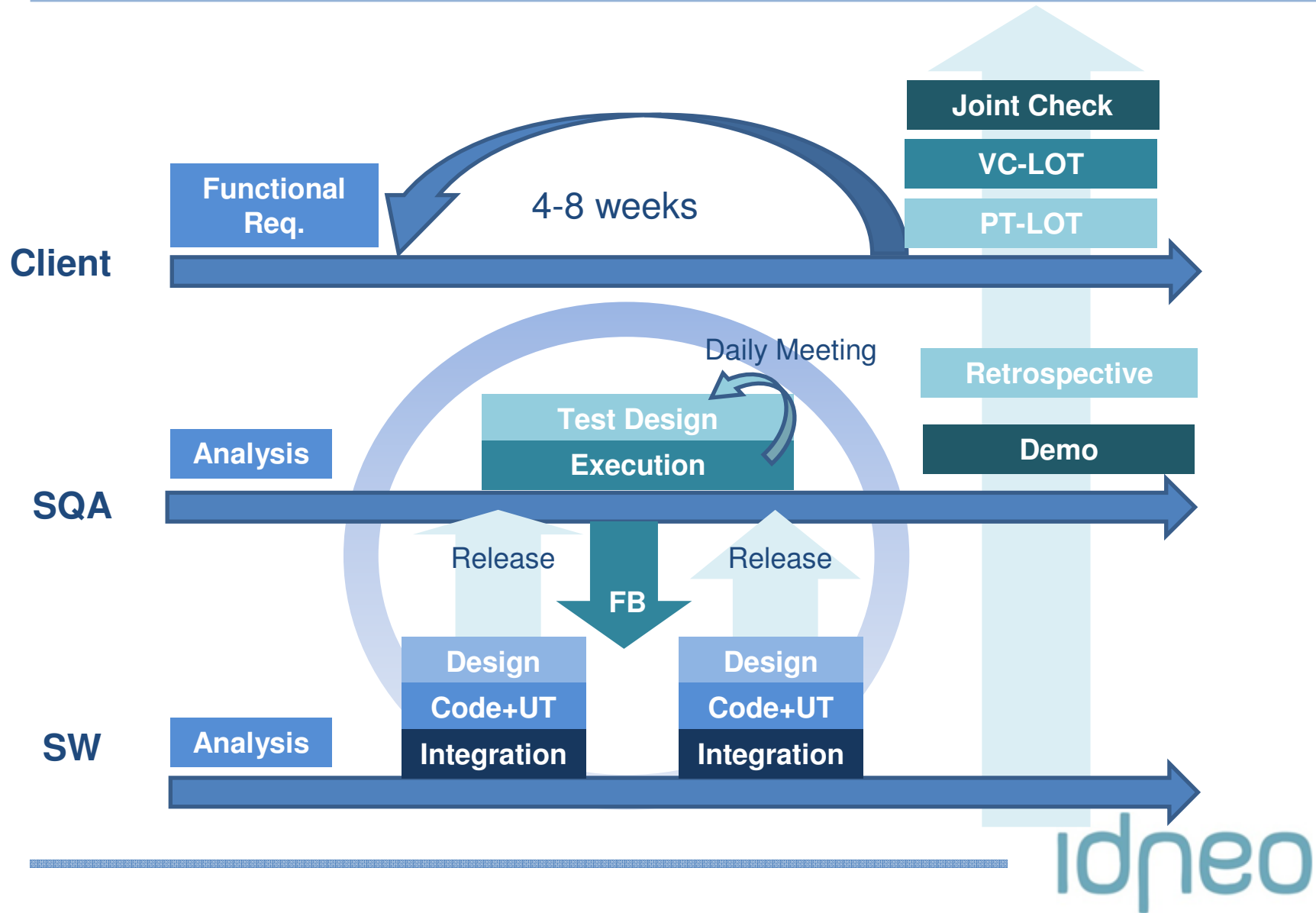
- Customer resistance
- Light process vs Automotive classical approach
- Not big design up front

Agile testing

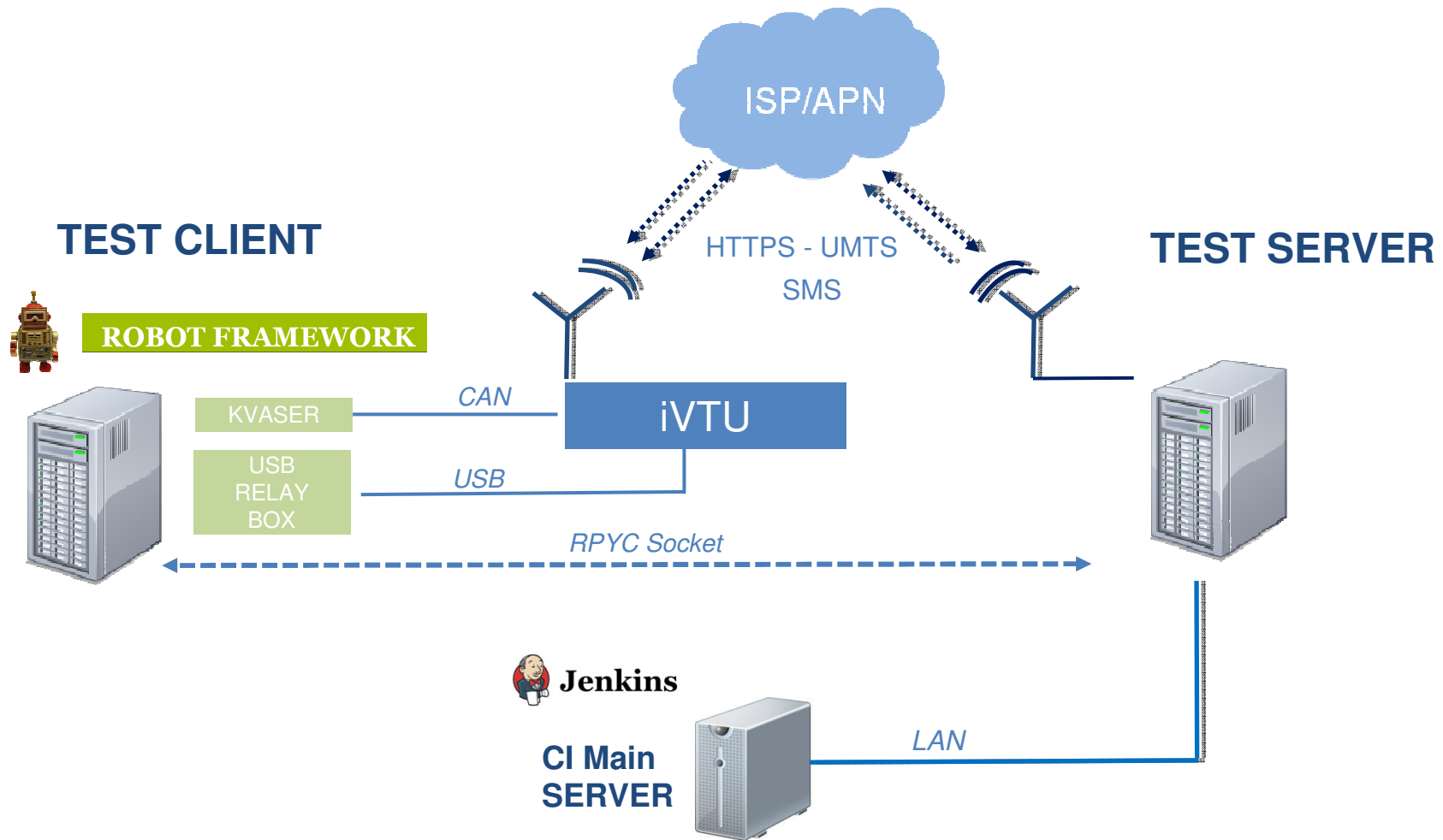
Incorporate Agile Methodology in System Tests:

- Test Group Works as an Agile Team
 - Kanban approach. Adapting pseudo-sprints to customers necessities
- Client participates actively in Test Team activities
 - *Demos*
 - *Specifications redefinition*
 - *Feedback*
- Automotive SPICE processes is kept
 - *Focused in Safety requirements*
 - *Auto-documented Testing*
- Test Automation to absorb number of release & System variability
 - *Jenkins CI & CD*
 - *Long duration Test Campaigns, robustness, stress*

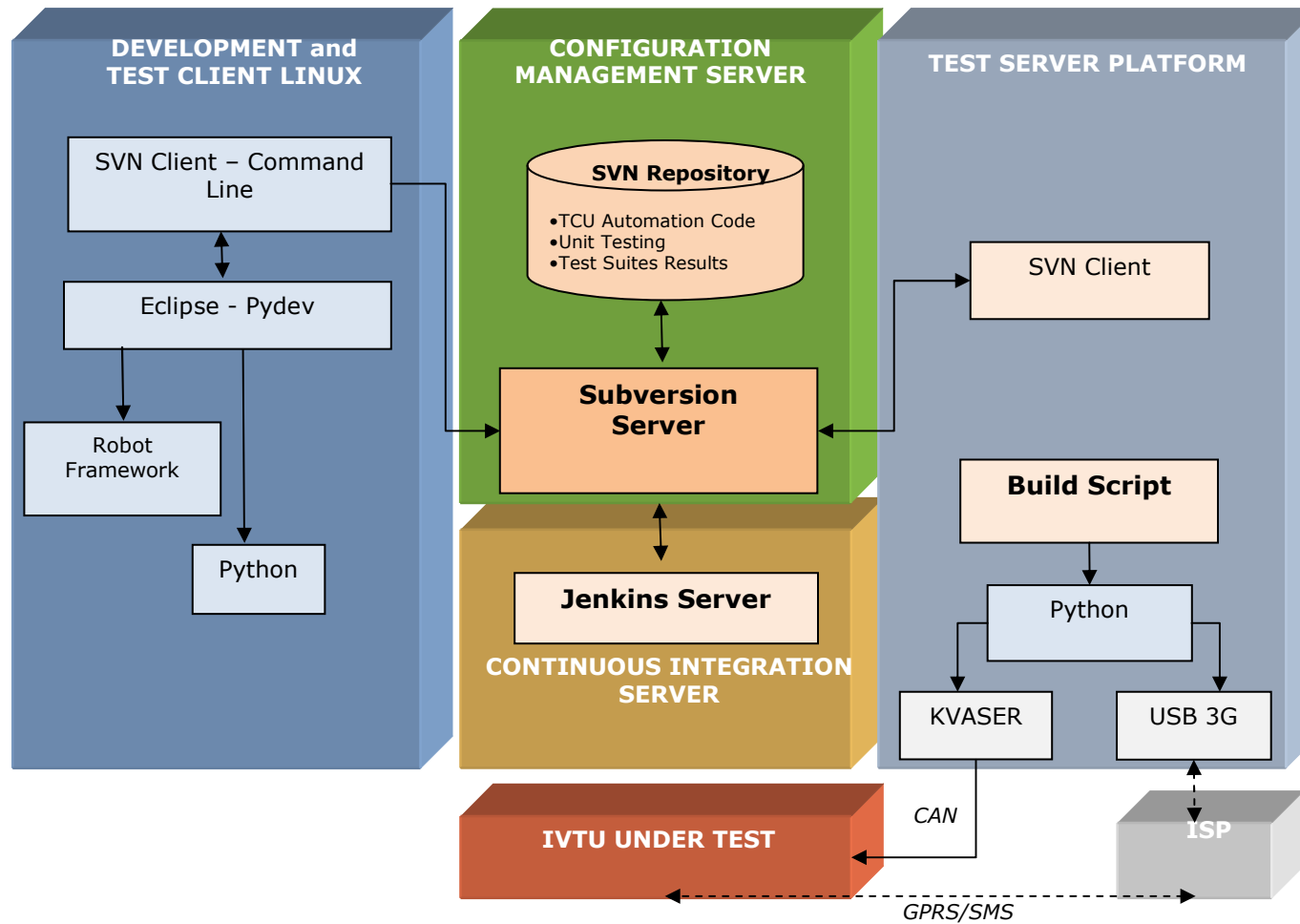
Testing Agile Alignment



Solution: Deployment Diagram



Solution: Logical Diagram



Robot Framework: Keyword Driven testing

Nominal ACNCall Sequence [VCAN Trigger][Front Or Side Crash][Server Hang Up][High Bus Load]

[Documentation] Purpose:

... **The aim of this test is to check whether ACNCall is started when VCAN trigger cause is present for "front or side crash". At same time this test is checking server hang up by sending DTMF tone '6' and service behavior when high CAN bus load present.**

...

... **Acceptance criteria:**

... **ACNCall is triggered for "front or side crash" state.**

... **Service behavior with high CAN bus load is correct.**

... **ACNCall is correctly terminated from server side.**

[Setup] Acncall Test Setup

Start Airbag Frame

Bus Load ON

Crash [Front Or Side Crash]

Check MPDT Message [ACNCall Start]

Send MPDT Message [ACNCall Started]

TSP Server Action [Pick Up Call On Primary Server]

Check MPDT Message [ACNCall Voice Calling]

Check ACNCall MSD Message

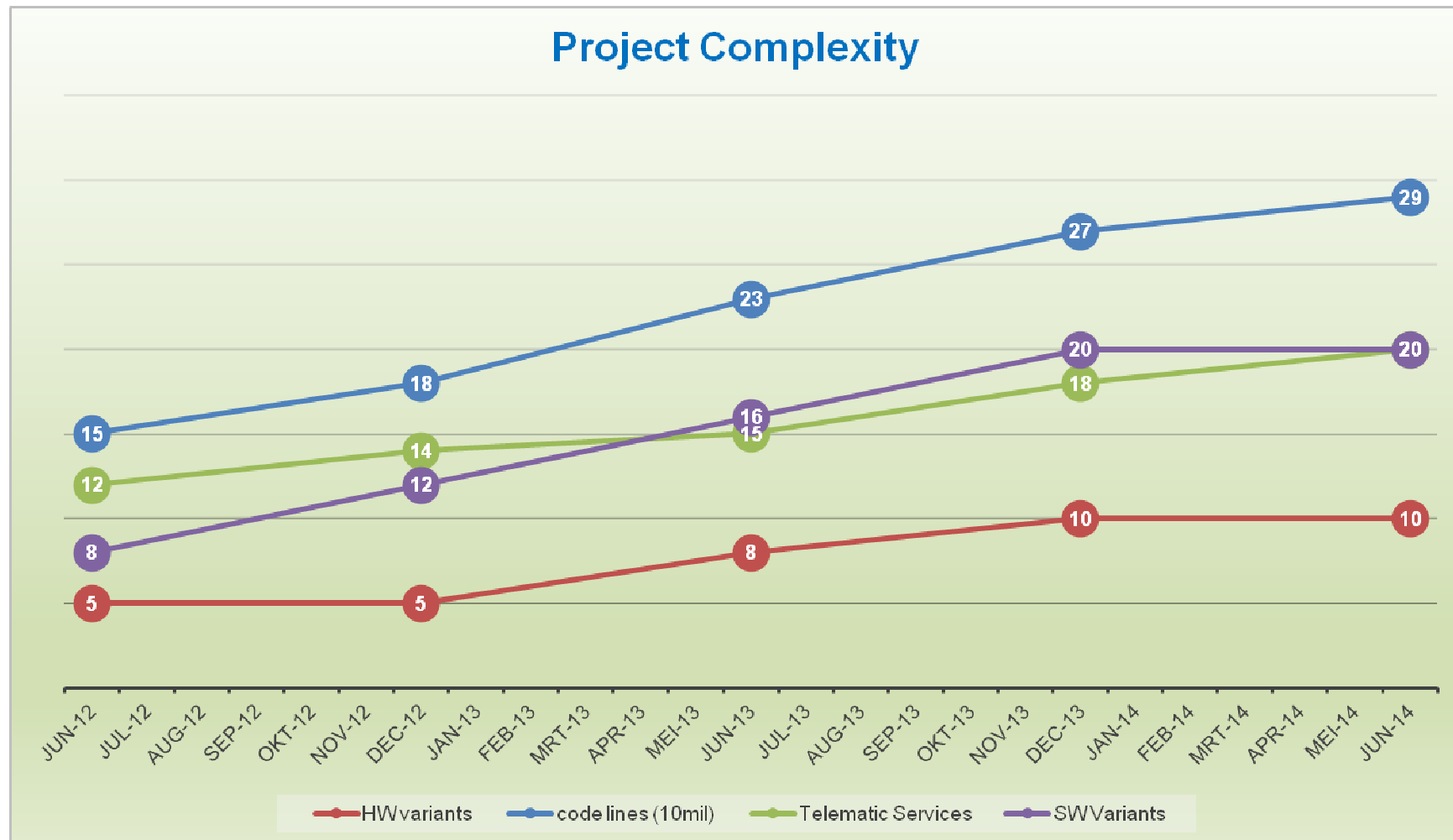
TSP Server Action [Terminate Request]

Check MPDT Message [ACNCall Voice Call Disconnected]

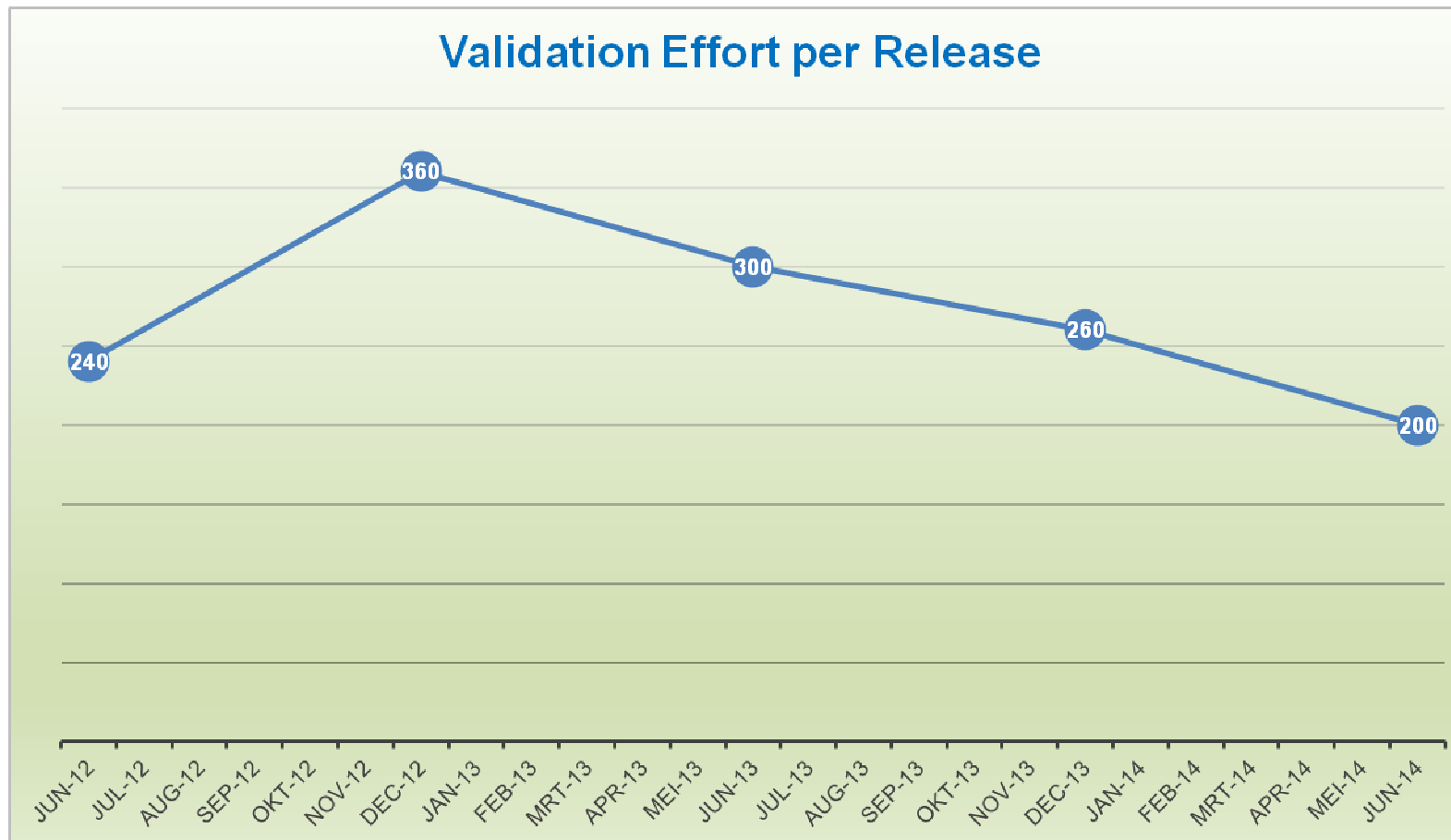
[Teardown] Acncall Test Teardown

Results and Conclusions

Results: Project Complexity

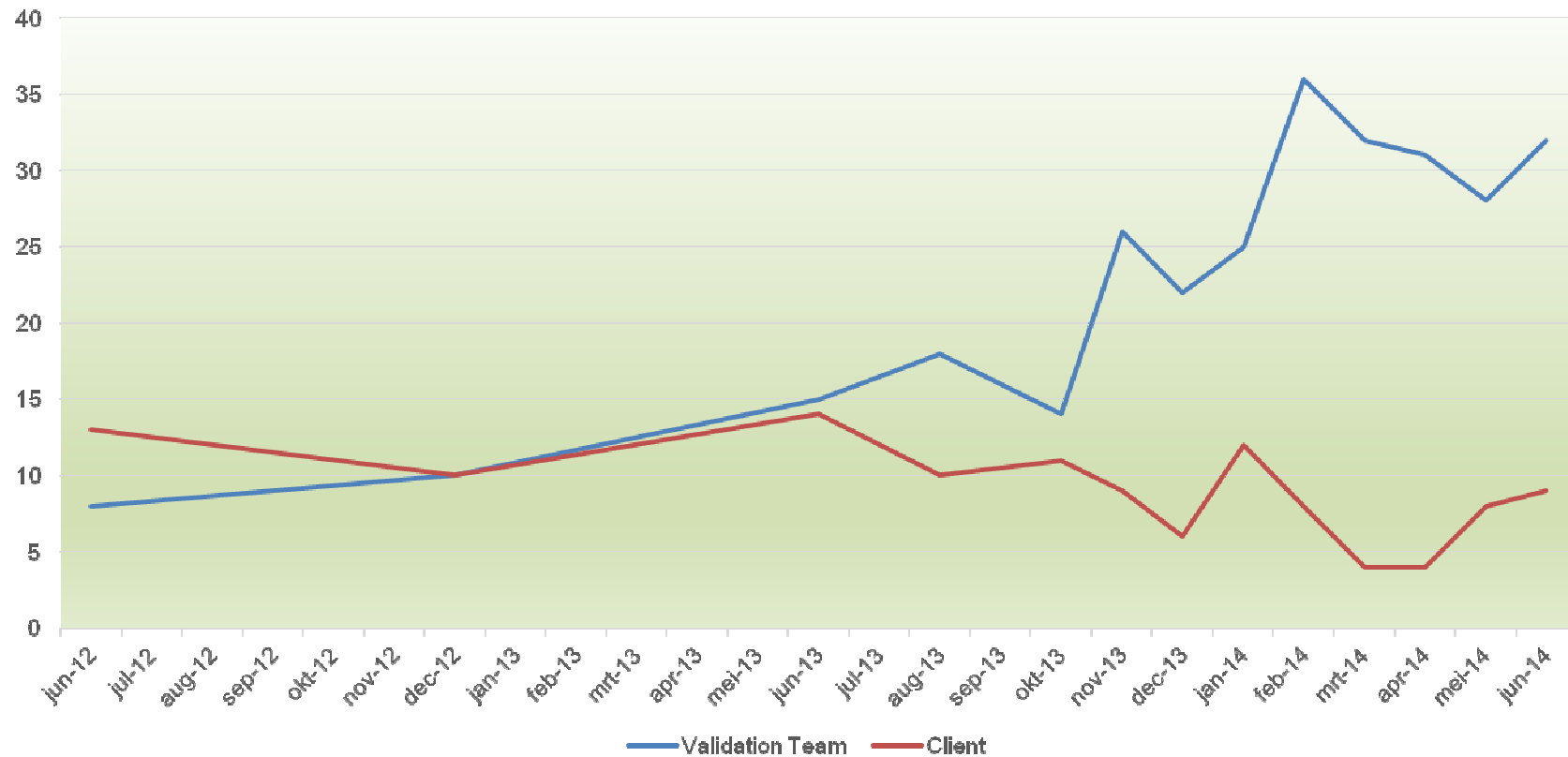


Results: Validation Effort



Results: Quality

Defects found (release average)



Conclusions

- Complexity of Project can be better handled by means of Agile Methodologies
- Intensive automated testing and client demonstrations helps to produce better products, rising clients satisfaction
- Agile Methodologies can be introduced with success in some projects of automotive industry
- Agile methods like SCRUM usually do not support some essentials, which are required in the automotive context.
- We do not recommend a pure Agile approach, but rather a custom version integrated in current project life-cycles.
- Agile and SPICE Automotive can be combined to obtain best of both worlds.

Future Challenges

- Reduce number of bugs reported by client
- Involve client into sprint
- Converge process to accomplish SPICE reporting
 - Automatic Doors Reporting
 - Automatic Data Test Package Generation
- Extend Agile to SW Development

THANK YOU!!!!

QUESTIONS?

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