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SYSTEM SOLUTIONS

Compliance Verification Process for Ethernet ECUs

It’s alive!

Munich, Feb, 3rd 2016

Georg Janker

CTO

Agenda

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1. Motivation
2. The Compliance Verification Process
3. OPEN Alliance Automotive Ethernet ECU Test Specification
4. Experiences
5. Conclusion

Motivation

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Successful startup of Compliance Verification:

- The first OPEN ALLIANCE TC8 Test Specification has been released
- A complete test process over all OSI/ISO layers has been put into reality. Test setups are already finished to make the test process reality.
- The Test Process has been successfully integrated into OEMs boardnet development projects.
- The first projects have been realized at the compliance test lab. RUETZ SYSTEM SOLUTIONS has successfully executed tests against TIER1 components and TIER2 devices.

Motivation

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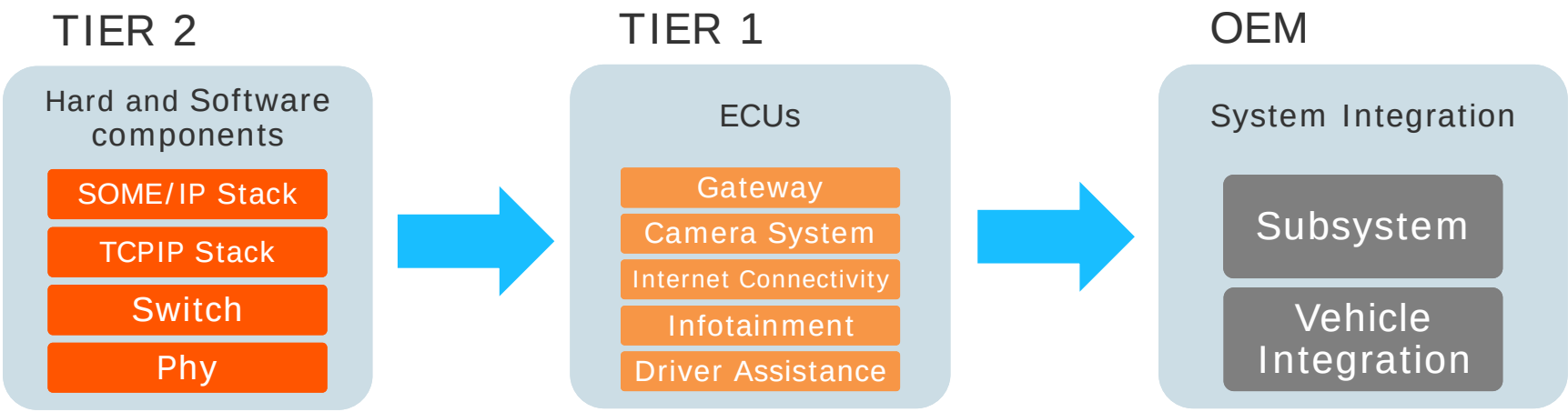
When to recognize bugs? -> As early as possible!



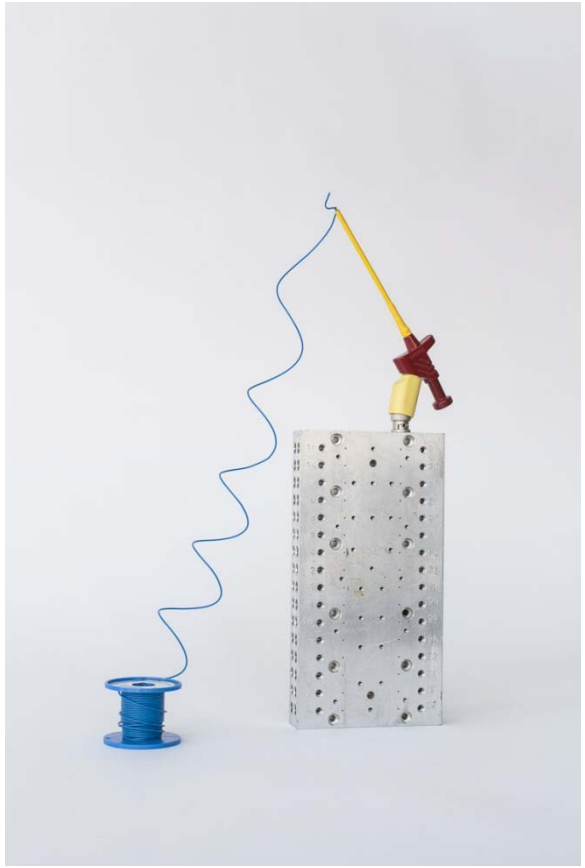
Goals:

- ☑ Transparency
- ☑ Standards
- ☑ Low effort
- ➡ Compliance

Motivation

Initial considerations

- How to get started as OEM?
- How to get started as TIER 1?
- What Test Scopes are important?
- What about quality?
- What kind of contribution is desirable / necessary?



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The Compliance Verification Process

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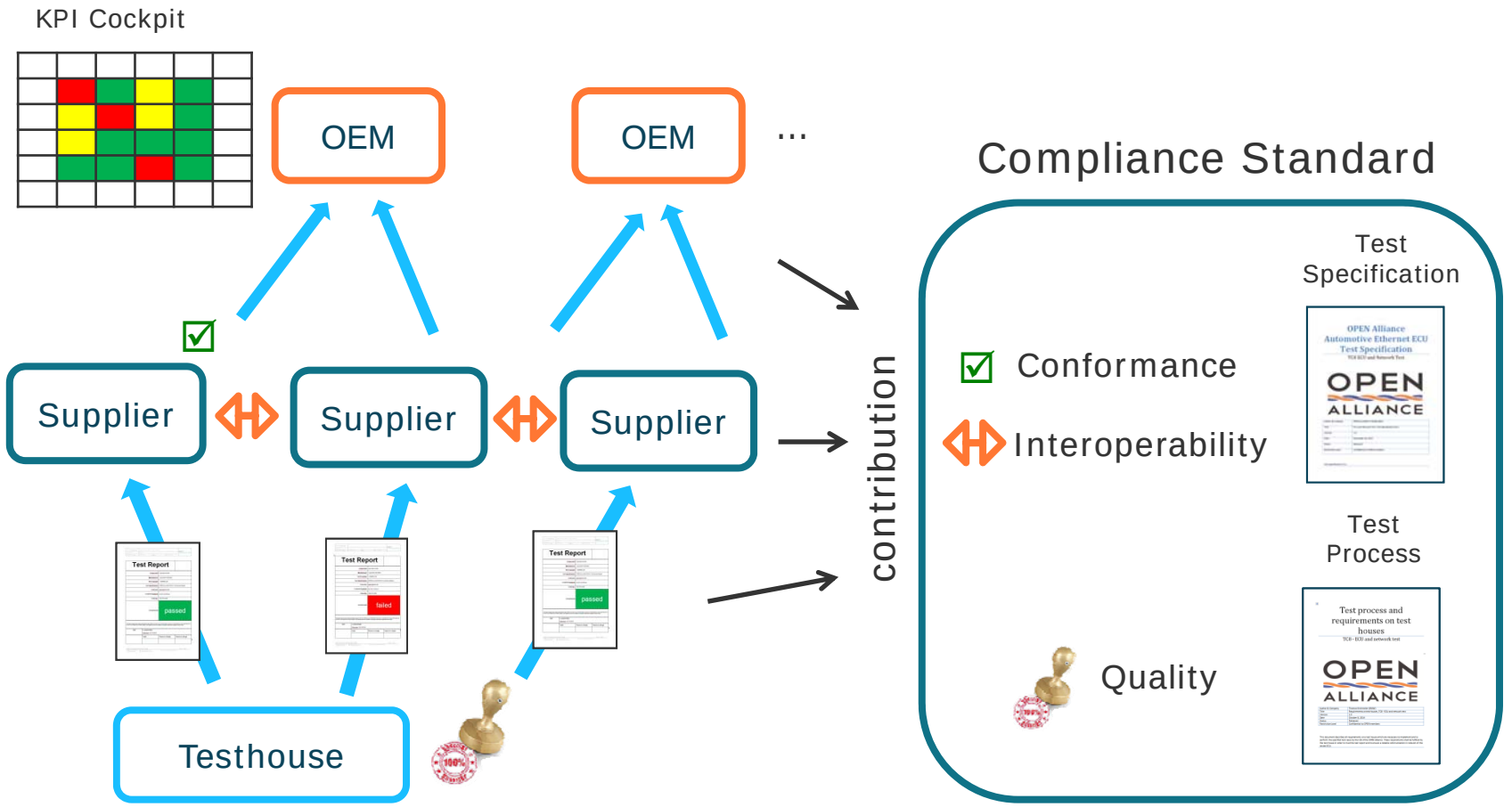
Overview



The Compliance Verification Process

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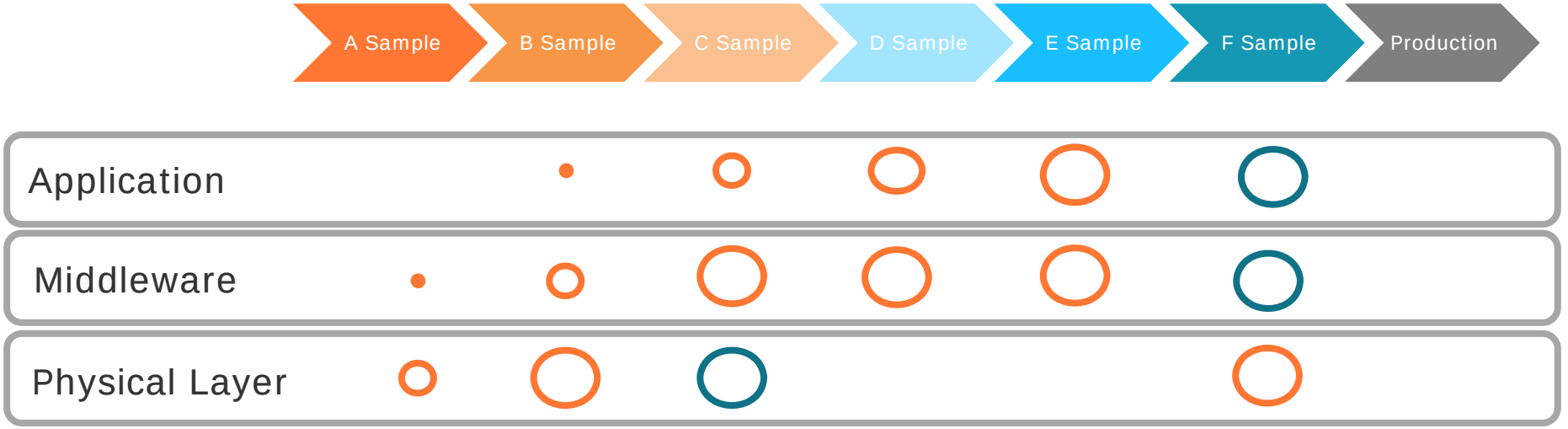
Compliance as important part of System Integration



→ Testing of new features at the earliest stage!

→ Don‘t forget Regression Testing!

Testing

Compliance

The Compliance Verification Process

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Example for a test cycle (at a Integration Step)

Supplier provides DUT information

Test House creates Testplan

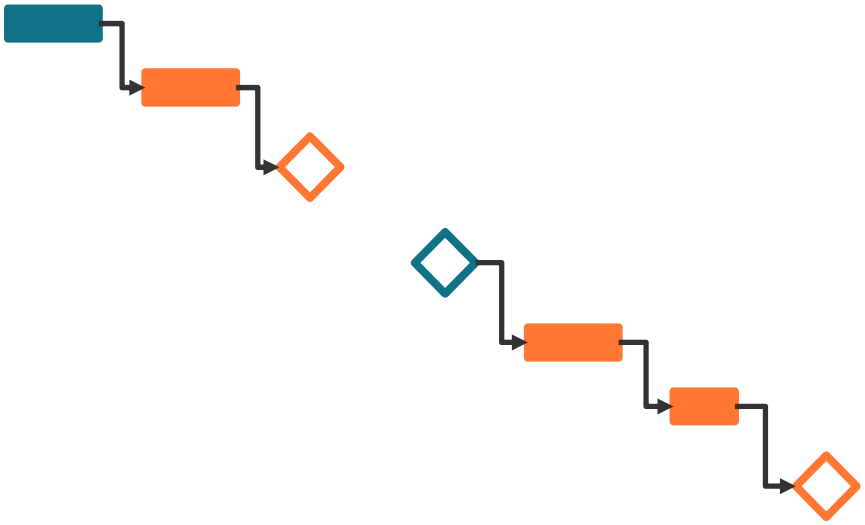
Release of Testplan

Delivery of DUT Sample

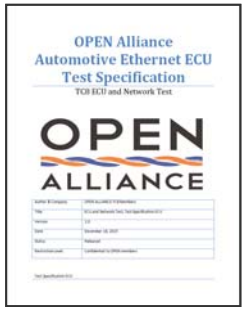
Test execution

Test result evaluation

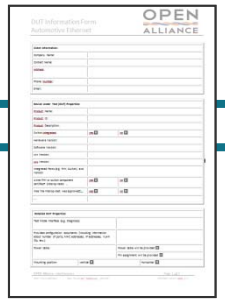
Delivery of Test Report



Test Specification



DUT Information
determines selection of Test cases



Test Plan

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4. Examples
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OPEN Alliance Automotive Ethernet ECU Test Specification

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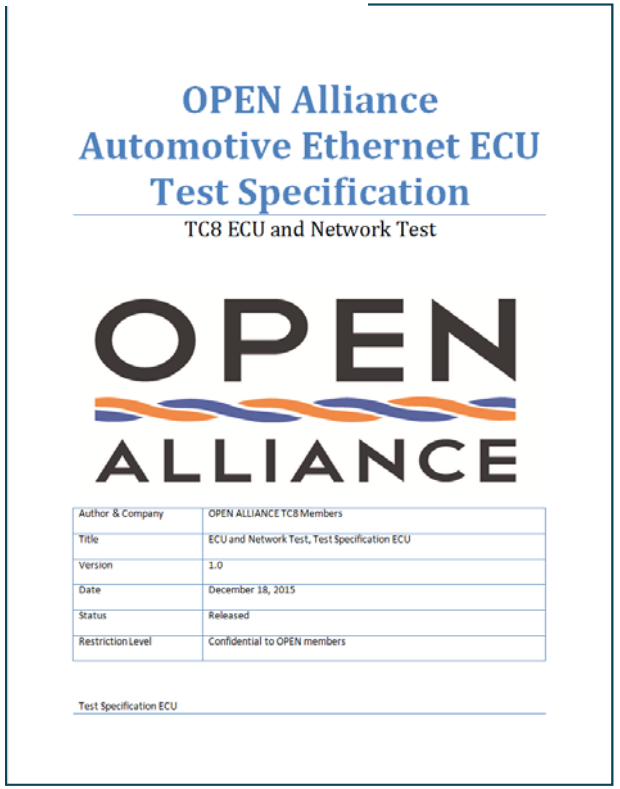
OPEN ALLIANCE

Home | About | FAQ | Members | Tech Committees | News & Events | Contact Us

Overview/Technology | Benefits | Use Cases | Membership | Specs | Forecast

- avaliable as public version
- 899 test cases
- 824 pages



OPEN Alliance
Automotive Ethernet ECU
Test Specification

TC8 ECU and Network Test

OPEN ALLIANCE

Author & Company	OPEN ALLIANCE TC8 Members
Title	ECU and Network Test, Test Specification ECU
Version	1.0
Date	December 18, 2015
Status	Released
Restriction Level	Confidential to OPEN members

Test Specification ECU

OPEN Alliance Automotive Ethernet

ECU Test Specification

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Test Scopes of Release 1.0

- Layer 1 (PHY)
  - Interoperability Tests
  - PMA
- Layer 2 (MAC)
  - VLAN Testing
  - QoS Testing
  - General Switch Testing
  - Ingress Filtering
  - Diagnostics

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Test Scopes of Release 1.0

- TCP/IP Protocol Family
  - Address Resolution Protocol (ARP)
  - Internet Control Message Protocol version 4 (ICMPv4)
  - Internet Protocol version 4 (IPv4)
  - Dynamic configuration of IPv4 Link Local Address
  - User Datagram Protocol (UDP)
  - Dynamic Host Configuration Protcol version 4 (DHCPv4)
  - Transmission Control Protocol (TCP)
- Automotive Protocols
  - SOME/IP
  - SOME/IP SD

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Current activities

Q1: What about the other Protocols?

Q2: What about Quality and Maintenance

- TC8 works now on Version 2.0
- IPv6 Test Cases
- Updates based on feedback from the first projects

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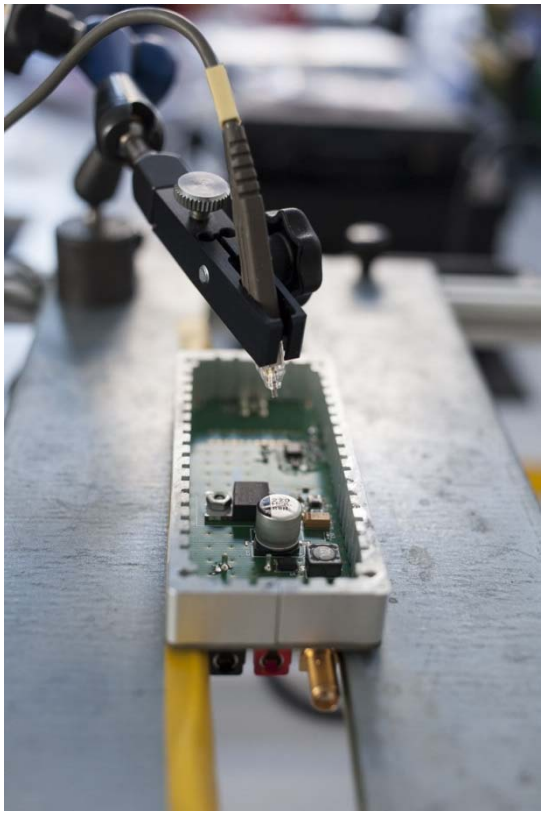
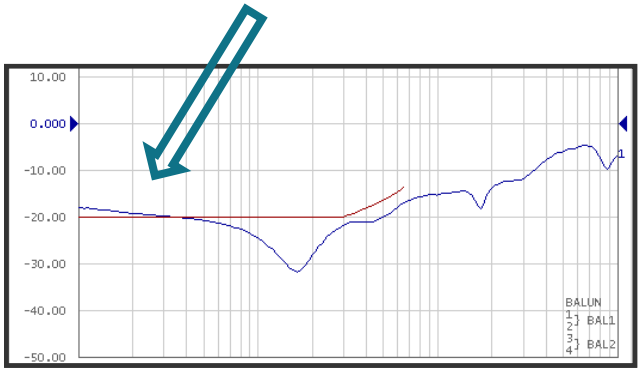
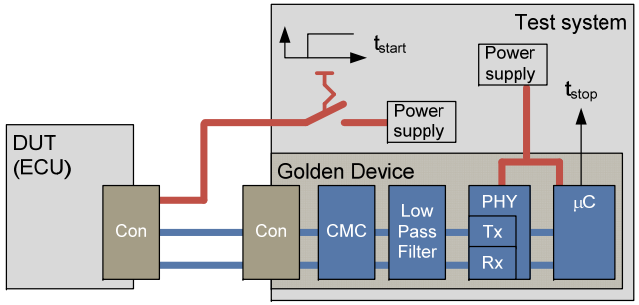
Physical Layer Findings:



- Signal integrity violations



- Link up after power on too late, caused by unsufficient aplication



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MAC Layer Findings

- MAC Address incremented for every new frame transmitted
- VLAN ingress filter does not distinguish between Tag Protocol Identifier and Tag Control Information

16 bits	3 bits	1 bit	12 bits
TPID	TCI		
	PCP	DEI	VID

- Unsufficient switch configuration as root cause to busload an security issues:
  - Forbidden VLAN tags and Ethertypes were not dropped
  - VLAN hopping possible due to wrong ingress filters for double tags

Experiences

TCP / IP

- 3 way handshake timeouts
  - SYN-ACK too late (>3sec!)
  - FIN-ACK not sent

- Bootloader Flash Interruption due to wrong configuration of
  - Congestion Control / Flow Control
  - Nagle Algorythm

- Address management errors within:
  - Auto IP mechanisms
  - IP Addressing

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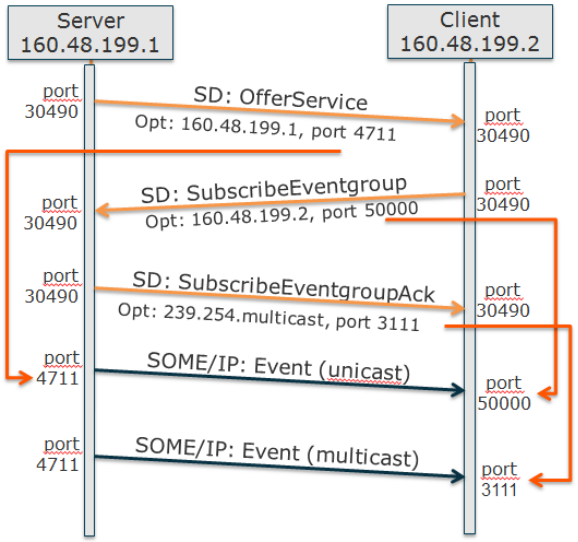
SOME/IP

- Ports not configured (ICMP port unreachable)
- Subscribe with wrong port values
- Timings (cyclic offer) not correctly implemented
- Wrong Headers
- Serializer not correctly implemented
- SD state machines
  not correctly implemented
- Subscribe without offer
  → cyclic ARP requests



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Conclusion

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The Compliance Process is up and running now!

- It introduces standardized test methods
- It converges new Automotive Standards to reliable systems
- It provides an ecosystem for component and ECU verification
- It eases the entry for new OEMs and Suppliers

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Thank you for your attention!

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