QuviQ

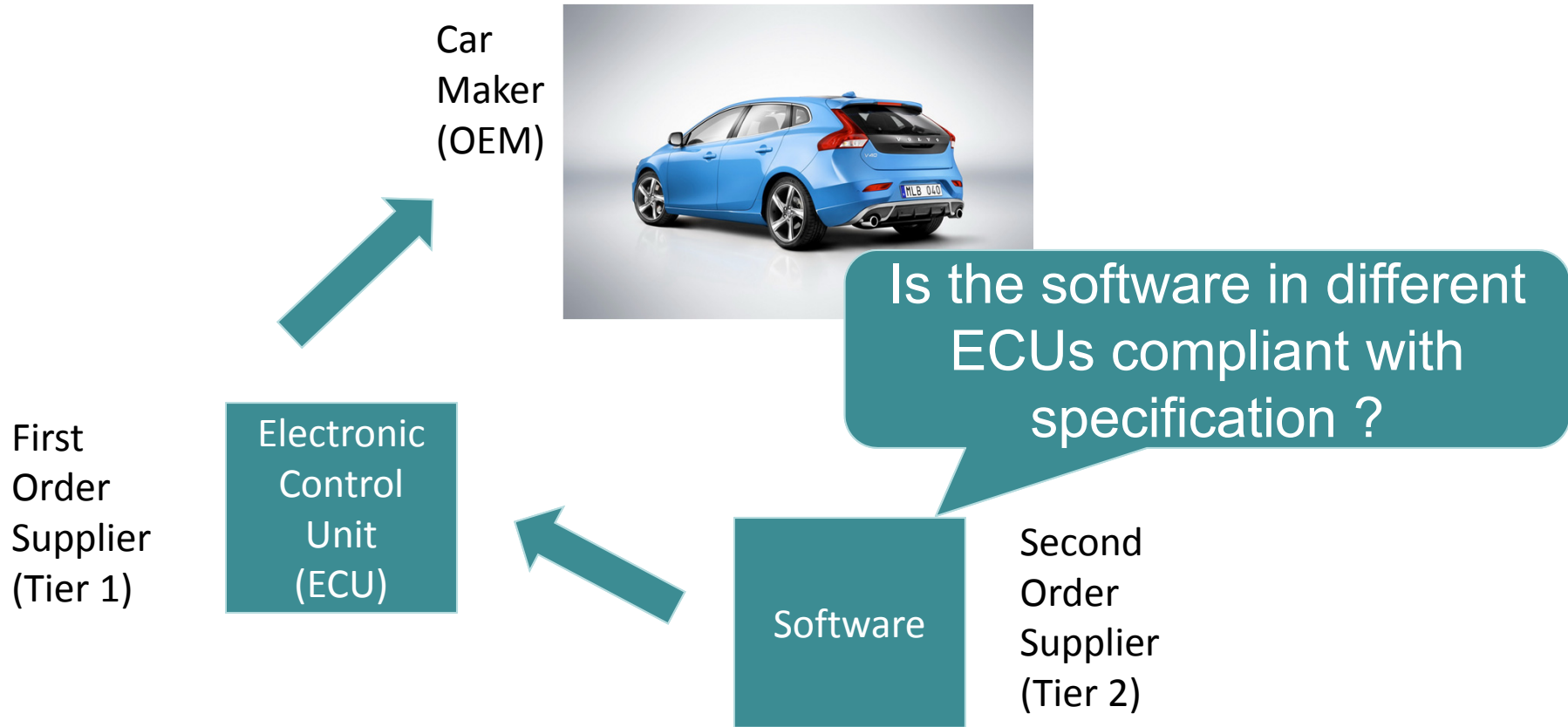# Testing AUTOSAR software with QuickCheck

Thomas Arts, John Hughes, Hans Svensson, Ulf Norell
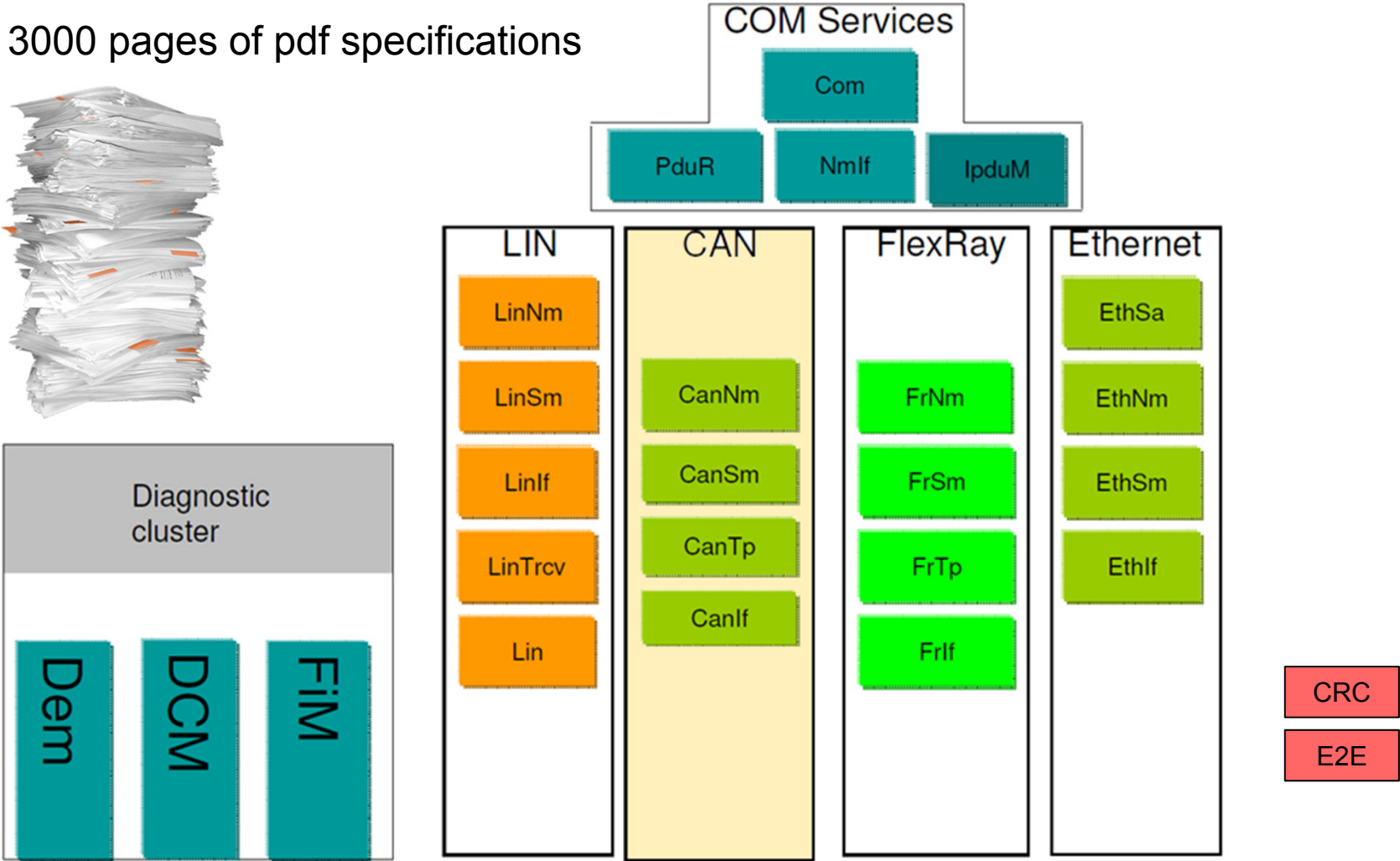
Is the software in different ECUs compatible?

Car
Maker
(OEM)

First
Order
Supplier
(Tier 1)

Electronic
Control
Unit
(ECU)

Is the software in different ECUs compliant with specification ?

Second
Order
Supplier
(Tier 2)

Software

QuviQ

Volvo's acceptance testing project

Q...

3000 pages of pdf specifications

COM Services

Com

PduR | NmIf | IpduM

Diagnostic cluster

Dem | DCM | FiM

LIN
- LinNm
- LinSm
- LinIf
- LinTrcv
- Lin

CAN
- CanNm
- CanSm
- CanTp
- CanIf

FlexRay
- FrNm
- FrSm
- FrTp
- FrIf

Ethernet
- EthSa
- EthNm
- EthSm
- EthIf

CRC

E2E

What is difficult in writing test cases?

- Everything is configurable. Thousands of parameters can be specified
- AUTOSAR is modular. Tests are designed against a specification, but there is no specification for combinations of modules
- Complex scenario's... hard to think of all of them
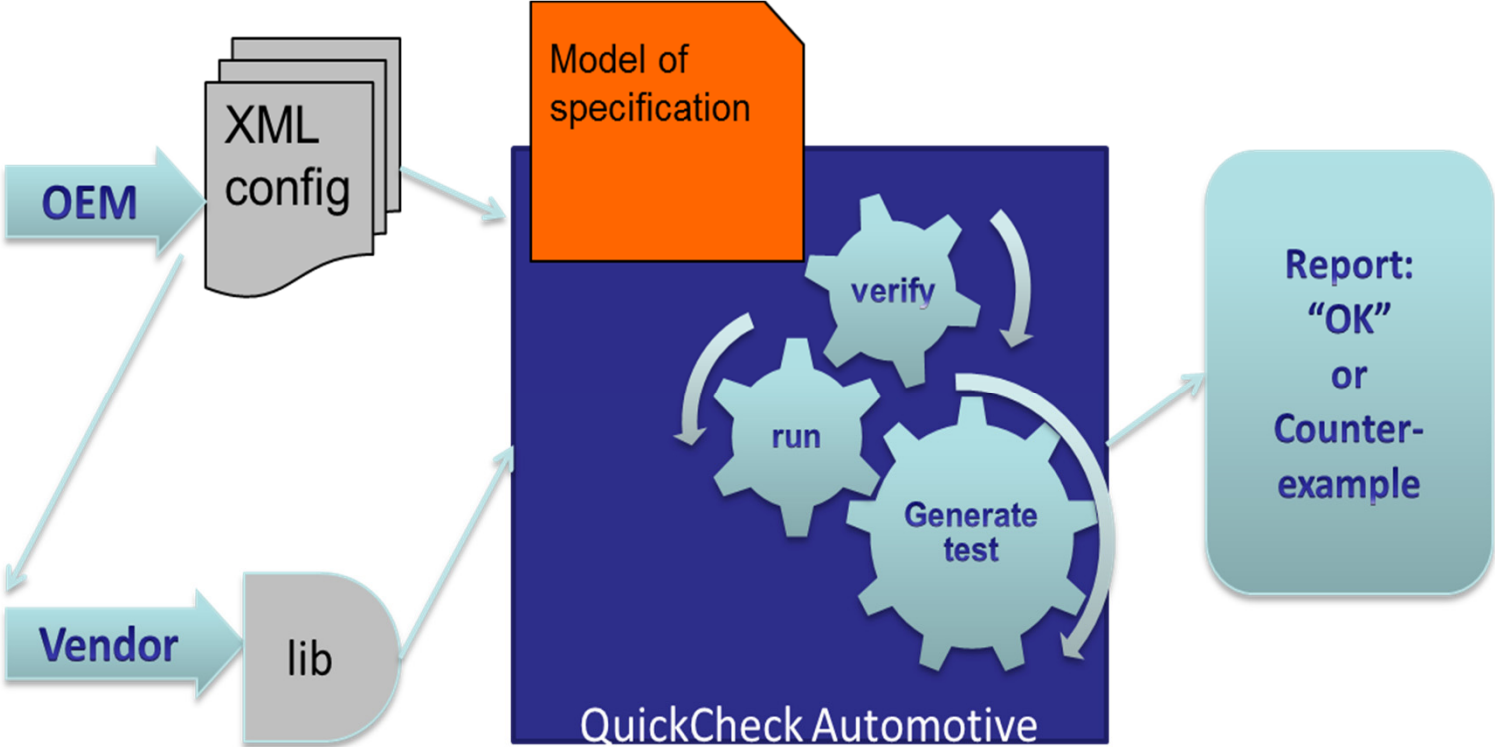- Some implementation freedom must be allowed

Configurations are vendor specific

System template → Configuration tool → XML Config → Code generation tool → lib / .h
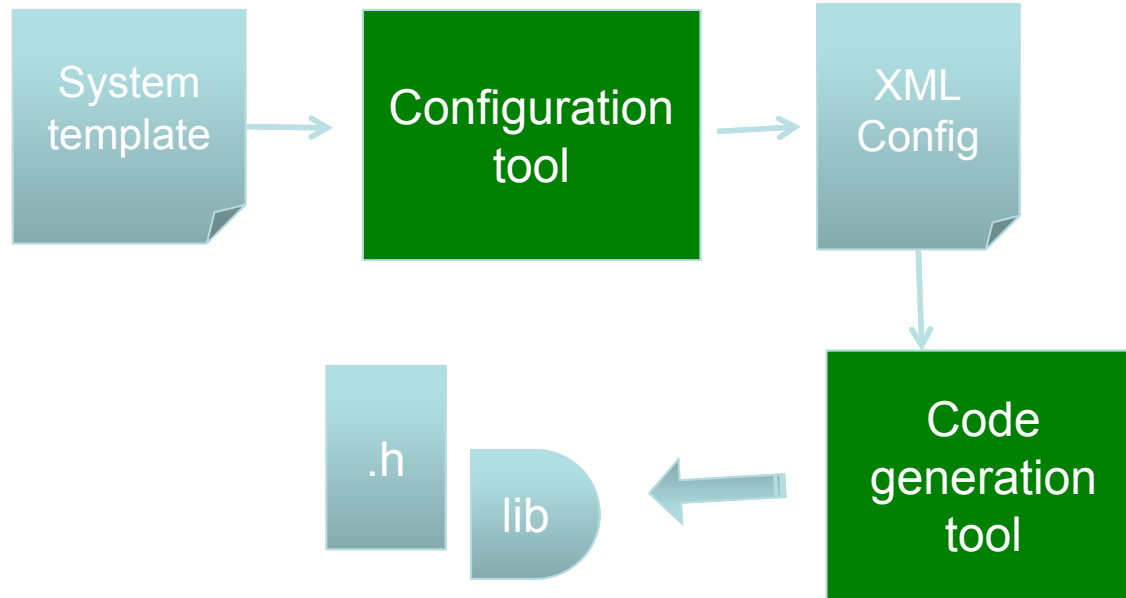
A test is:

A configuration and a set of API calls with their expected results.
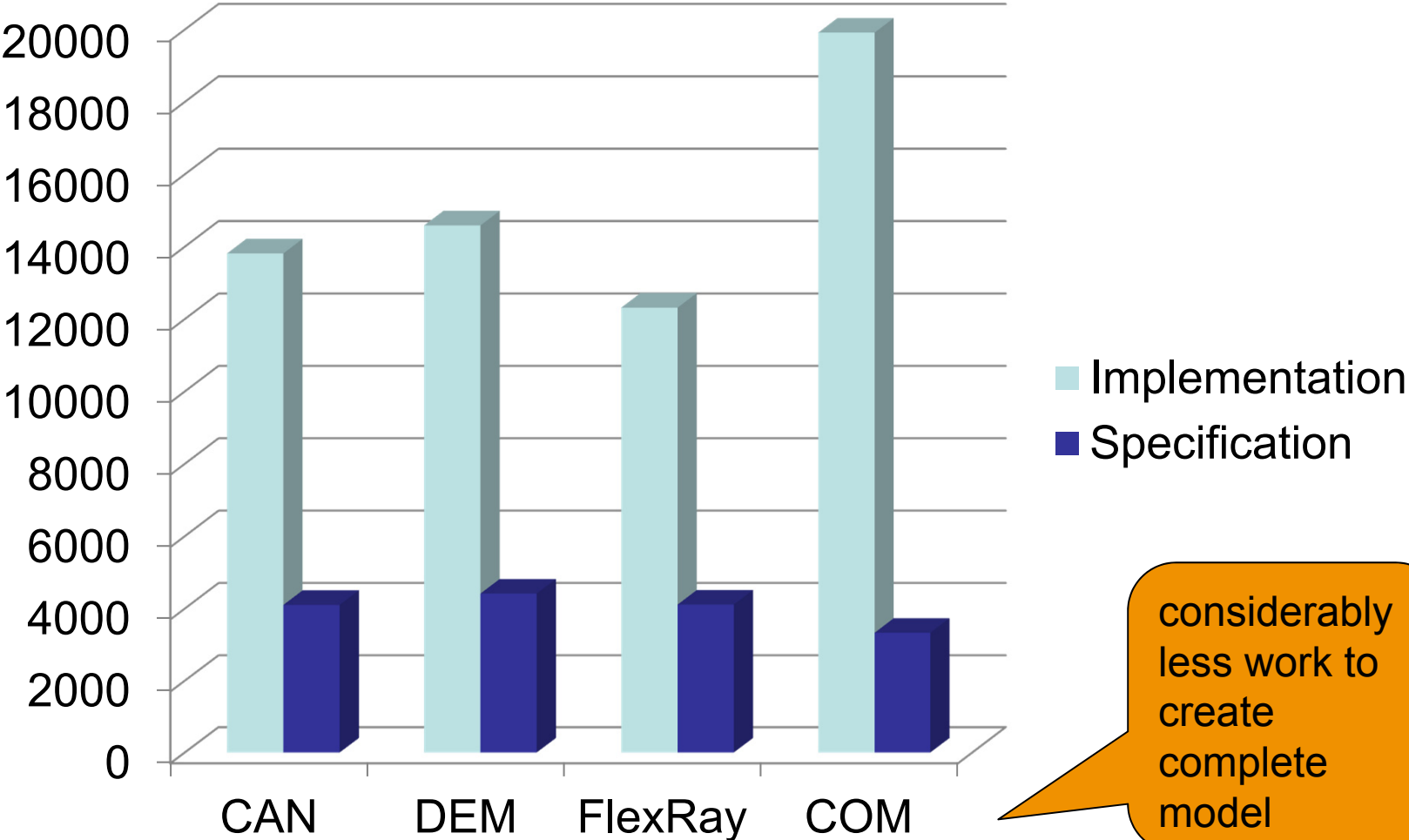
Highly configurable

Properties vs. Test Cases

Q...

Module	TTCN lines of code	TTCN #test cases	QuickCheck lines of code	QuickCheck time to generate 100 different tests
CanIf	16930	65	1978	24 sec
CanSM	6751	17	1255	10 sec
CanNm	12318	58	1716	47 sec
CanTp	21984	105	2062	20 sec
cluster	57983	245	7011	33 sec

8 times less code to maintain many more tests

Model-based testing is effective

Finding issues

Q

During development of models we kept issue tracker:

–   227 issues for version 4.0.2 of the models
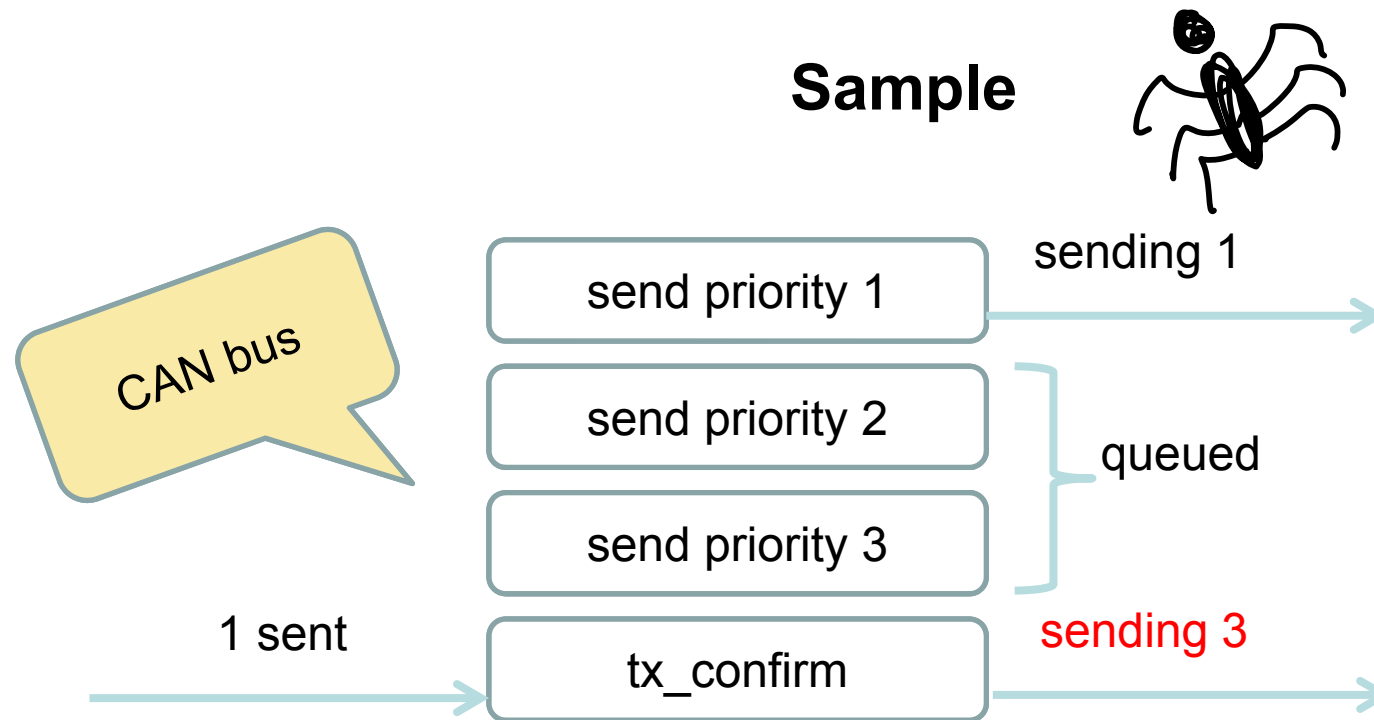
–   classification (slightly subjective):

classification	# issues
spec defect	180
vendor defect	
model defect	

- filed 20 Bugzilla's (via Volvo) some other issues already found by concurrent implementation activity or considered, implementation freedom or not important.

Property: highest priority message should be send first

Sample

send priority 1

sending 1

CAN bus

send priority 2

send priority 3

queued

1 sent

tx_confirm

sending 3

Cause: failure to mask a bit off an extended CAN-identifier

Jan 6 – Jan 31 (2014)

Confirmed errors in production code
- Com: over 20
- Can: over 30, mostly in CanSM and CanTp
- Lin: 5 errors, Requesting a schedule cannot be tested due to incompatibility.

In some cases, model more precise than vendors want to be.