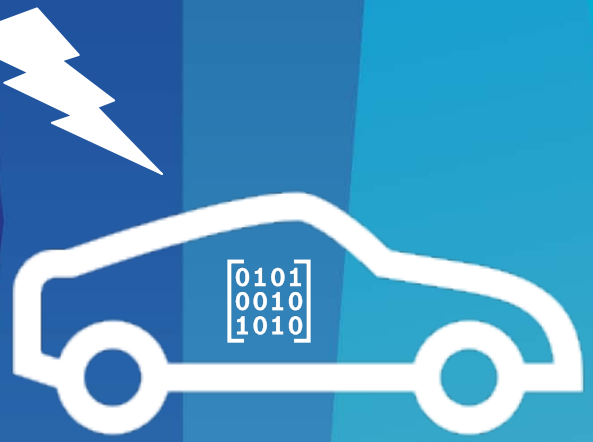
RETHINKING FUZZING FOR AUTOMOTIVE SOFTWARE



FuzzCon Europe Automotive Edition

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Rethinking Fuzzing for Automotive Software

What is this talk about?

- Why fuzz automotive software?
- How is automotive software different?
- Why rethink fuzzing for automotive software?
- Thoughts about rethinking
- Conclusions and takeaways

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Why fuzz automotive software?

- Take proactive measures
  - Continuous fuzzing of automotive software (especially for SAE automation level 3 and above)
- Technically effective
  - Fuzzing also makes technical sense: to combat large number of false positives of static analysis, finding subtle bugs that go beyond simple coding guideline checks etc.

Fuzzing makes sense and just doing it!

- Compliance to internal/future norms
  - Internal guidelines and norms at companies
  - Future Norms e.g. ISO/SAE 21434
- Requirements from customers
  - Automotive manufacturers emphasize that fuzz testing be done

Fuzzing gets imposed and having to do it!

Intrinsic and extrinsic motivations for fuzzing automotive software

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Difference #1: Platform dependence

Peculiarities

- Stronger platform dependence due to resource constraints and optimizations
- Well established Hardware-in-the-Loop (HiL) testing
- Customary use of certified compilers

Impediments

- Stubbing necessary to eliminate platform dependencies
- Execution on Linux is not always possible out of the box
- Complex build chains (e.g. code generation) require special treatment
- Non trivial interfaces make creation of fuzz targets challenging

High entry barrier for fuzzing automotive applications

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Difference #2: Statefulness

Peculiarity

- Automotive software is predominantly stateful -> a set of state transitions have to occur before something interesting happens

Impediments

- Traditional fuzzers target software with single input whereas stateful programs require sequence of inputs
- Adequate consideration of evolving program state during input generation is missing
- Resetting (cleaning up resources for) the software that runs on its own (in infinite loop) is challenging

Novel fuzzing techniques are required to fuzz stateful embedded software

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Difference #3: Integration of multi-party software including binaries

Peculiarity

- Automotive software often involves multiparty software (binaries) from different vendors

Impediments

- Unavailability of source code makes it hard to achieve the performance equivalent of state of the art modern fuzzers
- Executing native automotive binaries virtually is not always possible using prominent instruction set emulators like QEMU, UniCorn, Gem5

Scalable approaches needed for fuzzing automotive applications

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Now why rethink after all?

Where fuzzing excels today

- Analysis of software with access to source-code
- Optimizations to fuzzing techniques (efficiency)
- Protocol fuzzing tools and vibrant community of bleeding edge open source tools for software fuzzing

Where fuzzing needs rethinking!

- **Automotive projects also integrate 3rd party software binaries w/o access to source-code**
- **Enabling automotive projects to start fuzzing is more crucial than optimizing fuzzing**
- **Open source tools impose restrictions that only handful of automotive projects satisfy**

Automotive software benefits from effective techniques first and efficient techniques later

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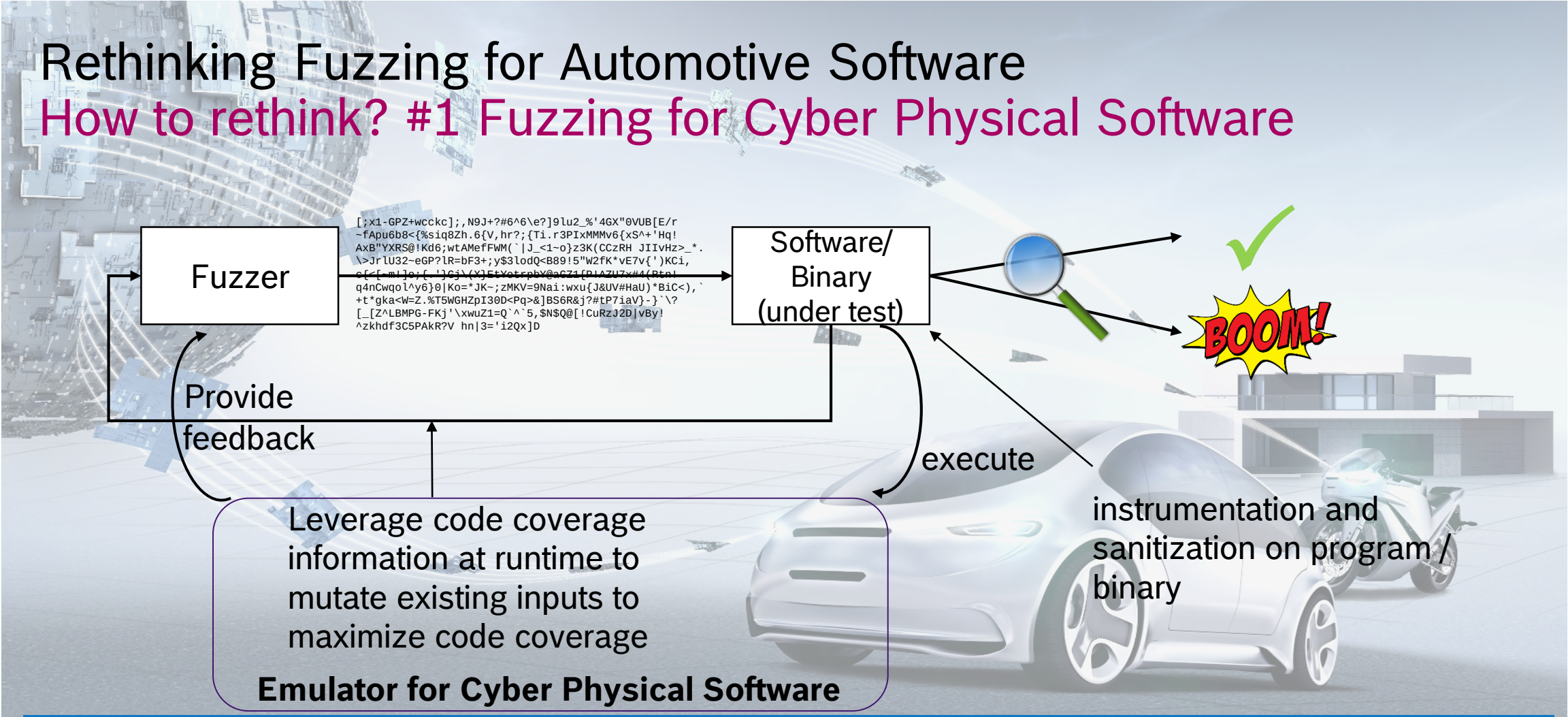
How to rethink? #1 Fuzzing for Cyber Physical Software



Systematic approaches required to enable fuzz testing for Cyber Physical Software

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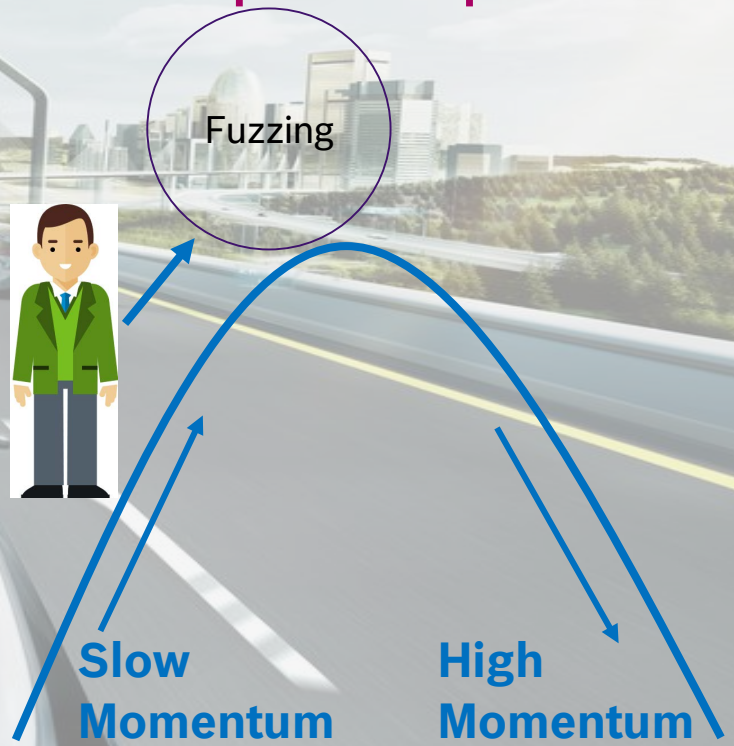
How to rethink? #2 Anchor fuzzing into SW development process

You could excel in building a fuzzing platform

BUT ...

Anchoring Fuzzing into our SW development activities is crucial for sustaining the momentum



Make fuzzing a part of CI/CD and anchor it to become an integral part of SW development

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Wrap Up

Why fuzz automotive software?

- Intrinsic motives
- Extrinsic motives

How is automotive software different?

- High entry barrier for fuzzing
- Stateful software
- Native binaries complicating fuzzing

Why rethink?

- Effectiveness over efficiency

How to rethink?

- Fuzzing Cyber Physical Software
- Anchor Fuzzing into SW development

Cyber Physical Software – Fuzzing's next frontier!

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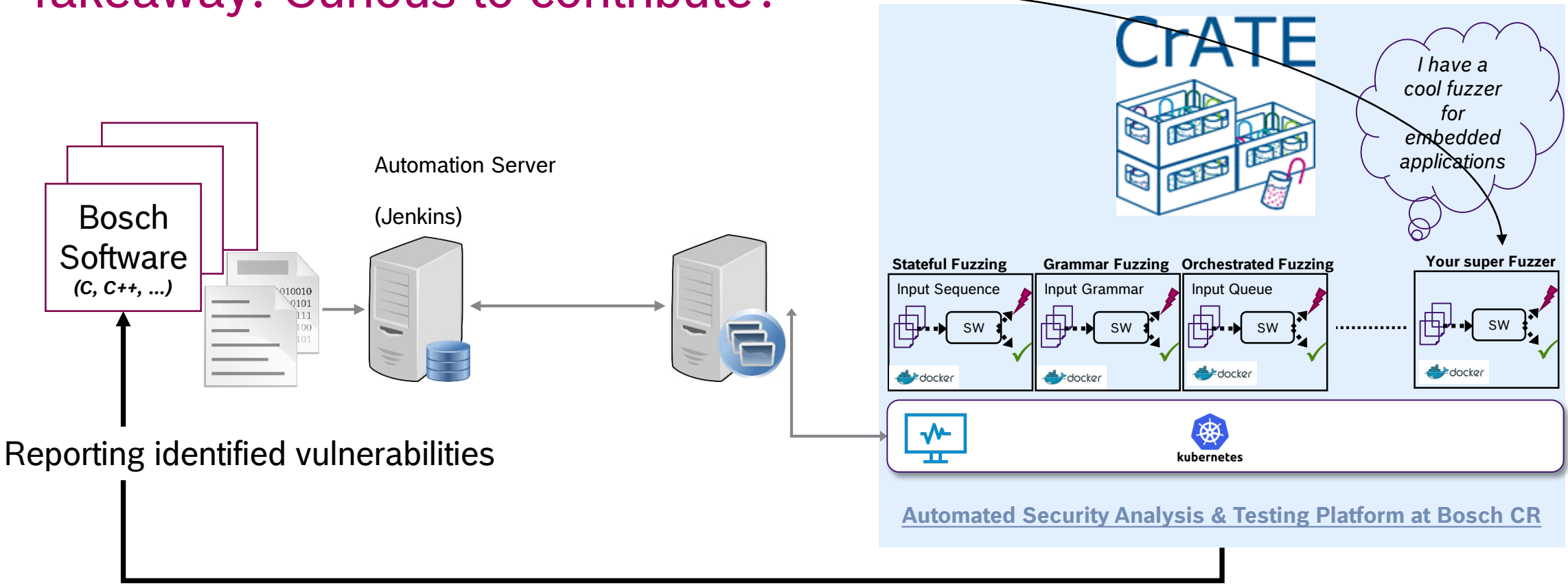
Takeaway: Curious to contribute?



Extensible platform enables contributions from the fuzzing community

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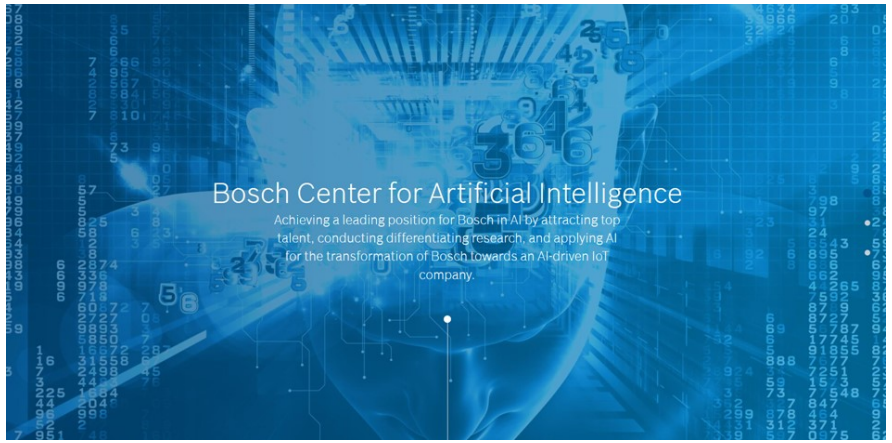
Time for Questions



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