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FROM RESEARCH TO INDUSTRY

cea tech

list

# Combining static & dynamic analysis for software verification


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# PLAN

- Subject
- Context
- Problem, Motivations, Solutions
- Overview
- Example
- Conclusion, Perspectives

# SUBJECT

**Combining static & dynamic analysis for software verification**

- Static analysis: abstract interpretation, deductive verification, etc.
  - ✔ complete
  - ✗ imprecise
- Dynamic analysis: test, runtime verification
  - ✔ precise
  - ✗ incomplete

# CONTEXT
# SOFTWARE VERIFICATION AT CEA/LSL

**Frama-C** – framework of modular analysis of C

| Kernel | **ACSL** – specification language |
|---|---|

Plug-ins

| | |
|---|---|
| **Value** | Value analysis |
| **WP** | Deductive verification |
| **PathCrawler** | Tests generation, all-paths coverage |
| **E-ACSL** | Translation from ACSL to C |
| **SANTE** | Collaboration Value + slicing + PathCrawler |

Etc.

# PROBLEM, MOTIVATIONS, SOLUTIONS

**PROBLEM**

- How to verify generic properties like runtime errors not handled by SANTE ?
- And properties specified by the user ?

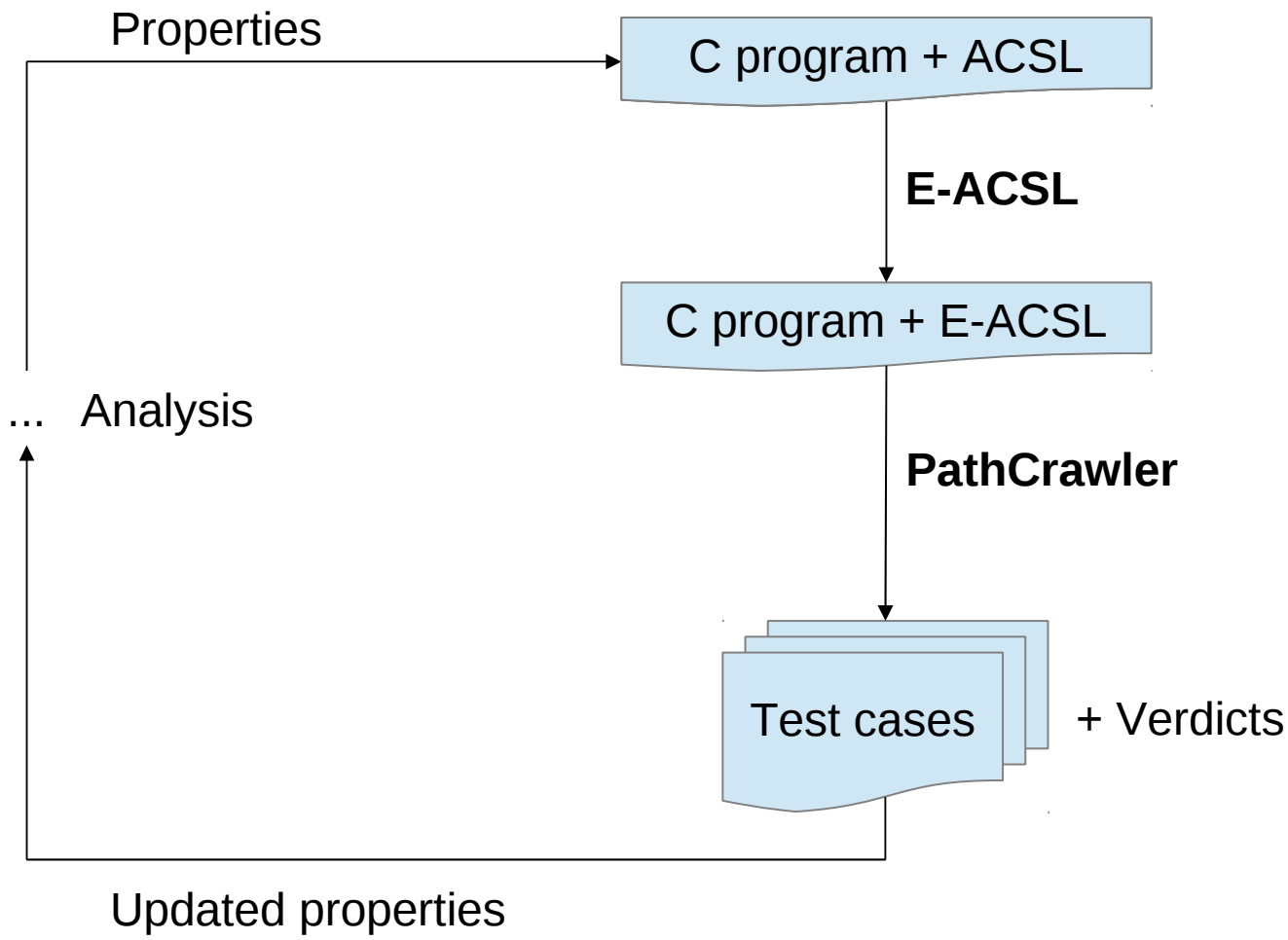
**MOTIVATIONS**

- Automation
- Reliable alarm classification: low « false positives » rate
- Overcome the drawbacks of each method

**SOLUTIONS**

- Combining slicing, static analysis and testing to overcome drawbacks of each method

# OVERVIEW


Properties
C program + ACSL
E-ACSL
C program + E-ACSL
... Analysis
PathCrawler
Test cases
+ Verdicts
Updated properties

# EXAMPLE

(1)

```
int x2 (int i)
{   int k = 2 * i ;
    /*@ assert k > 0 ; */
    return k ; }
```

(2)

```
int x2 (int i)
{   int k = 2 * i ;
    e_acsl_assert(k > 0) ;
    return k ; }
```

(3)

```
void main()
{ int i = -35 ;
  x2 (i) ; }
```

(4)

```
int x2(int i)
{
  int k;
  k = 2 * i;
  /*@ assert k > 0; */ ;
  return k;
}
```

# CONCLUSION, PERSPECTIVES

## CONCLUSION

- Handling ACSL annotations by PathCrawler
  - Safety assertions on overflows, pointers, etc.
- Counter-example generation
  - Updating property status in Frama-C
  - Reusable in other plug-ins

## PERSPECTIVES

- Handling ACSL pre- and post-condition by PathCrawler
- Application, experiments

Thank you

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