MATLAB EXPO 2019
Making Software Safe and Secure with Team Collaboration

Polyspace Presentation for MATLAB Expo
Agenda

1. Making Software Safe and Secure

2. Polyspace Static Analysis

3. Team Collaboration with Polyspace
1. Making Software Safe and Secure
“Program testing can be used to show the presence of bugs, but never to show their absence”

Edsger Dijkstra, Computer Science Pioneer

“Given that we cannot really show there are no more errors in the program, when do we stop testing?”

Brent Hailpern, Head of Computer Science

Dijkstra, “Notes on Structured Programming” (1972)
Using Static Analysis to Make Software Safe and Secure

- Find bugs without code execution
  - Code analyzed without running tests
  - Identify bugs and coding rule violations for MISRA, AUTOSAR, CERT

- Prove absence of critical run-time errors
  - Identify code that will never experience errors regardless of run-time conditions

- Complements dynamic testing
  - Used together, you can find more bugs for higher quality code
When Software Safety and Security Matter

- Industries where safety and security matter
  - Automotive, Aerospace, Medical Device, Industrial Machinery

- Governed by functional safety and other standards
  - ISO 26262, DO-178, IEC 62304, IEC 61508
  - MISRA, CERT, AUTOSAR

- Static analysis provides certification credits
  - For standards such as ISO 26262 and DO-178
2. Polyspace Static Analysis

*For software written in C, C++, and Ada*
Proving Absence of Critical Run-Time Errors

- How many run-time errors are possible?
  1. Divide by zero
  2. Overflow
  3. Uninitialized variables

- How to test all floating point variable combinations?

- How do you prove that this code will not fail?
Proving Absence of Critical Run-Time Errors

Proven by Polyspace that run-time error will not occur

```c
float where_are_errors_float(float input)
{
    float x, y, k, l, limit = 1000.0f;
    if (input <= limit || input > limit) return (-9999.0f);
    k = input / 100.0f;
    x = 2.0f;
    y = k + 5.0f;

    while (x < 10.0f)
    {
        x++;
        y = y + 3.141592f;
    }

    if ((3.0f * k + 100.0f) > 71.0f)
    {
        y++;
        x = x / (x - y);
    }

    return x;
}
```

**Division by zero**

Float division by zero does not occur on type float 32
- left: 10.0
- right: [-31.1328 .. -11.1327]
- result: [-0.89826 .. -0.3212]
Proving Absence of Critical Run-Time Errors with Polyspace
Polyspace Tools

**Bug Finder**
- Produce code metrics
- Check coding standards
- Find defects and vulnerabilities

**Code Prover**
- Proves code Safe and Secure
- 33 most critical run-time checks
- Supports DO-178 and ISO 26262
Polyspace Customer References

KOSTAL Asia R&D Center Receives ISO 26262 ASIL D Certification for Automotive Software

Alenia Aermacchi Develops Autopilot Software for DO-178B Level A Certification

Miracor Eliminates Run-Time Errors and Reduces Testing Time for Class III Medical Device Software
3. Team Collaboration with Polyspace
Workflow with New Polyspace Products in R2019a

1. Developers check-in code into repository, Build Engineer has configured Jenkins to run Polyspace analysis
2. Jenkins initiates Polyspace analysis run on the server (periodically or at program milestones)
3. Once Polyspace analysis run concludes, results are uploaded to Polyspace Access
4. Team Lead/Manager, QA, Developers use web browser to review results, open Jira defects, monitor quality metrics
Bob is the Build Engineer
He has configured Polyspace in a Jenkins CI workflow

Quinn is a Quality Engineer
She is responsible for triaging software defects

Dara is a software developer
She is responsible for writing code and fixing defects

Eric is a Simulink and Embedded Coder user
He is responsible for generating code from models

Martin is a project manager
He is responsible for software quality of the project
Bob is the Build Engineer
He has configured Polyspace in a Jenkins CI workflow
Quinn is a Quality Engineer
She is responsible for triaging software defects

- She received an email notification from last night’s Jenkins initiated Polyspace analysis
- The email indicates several findings were found in her project
- She click on the link in the email to view the findings in Polyspace Access

Polyspace Code Verification: 114 new findings for project Zen
To: Quinn Quality

Polyspace found 114 new findings when analyzing 'xent':
- To view details, check attached file and follow urls.
- To go to directly to project, follow: https://polyspace-access:9443/metrics/index.html?e=review&p=81&r=1998.

You can see the Jenkins log file here: http://jenkins-poly:8080/job/poly_modules/38/console.

Bob Builder
Build Engineer, Tools Group
(508) 647-3027 Builder@mathworks.com
Quinn is a Quality Engineer
She is responsible for triaging software defects
Dara is a software developer
She is responsible for writing code and fixing defects

- Dara has been assigned 2 defect tickets in Jira
- She opens the first JIRA ticket and clicks the Polyspace Access link
Dara is a software developer. She is responsible for writing code and fixing defects.
Eric is a Simulink and Embedded Coder user
He is responsible for generating code from models
Eric is a Simulink and Embedded Coder user. He is responsible for generating code from models.
Martin is a project manager. He is responsible for software quality of the project.
Summary

- Use Polyspace to achieve high quality software with reduced testing effort
  - Prove that your code will not cause safety hazards or security issues

- Polyspace fits software development workflows
  - Jenkins for build automation and Jira for bug tracking

- Supports team based collaboration
  - Results published for web-browser based review by developers and quality engineers
  - Dashboards to show quality metrics for project and safety managers.
End