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Binary Analysis Tools in Cyber Testing

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Problem Statement

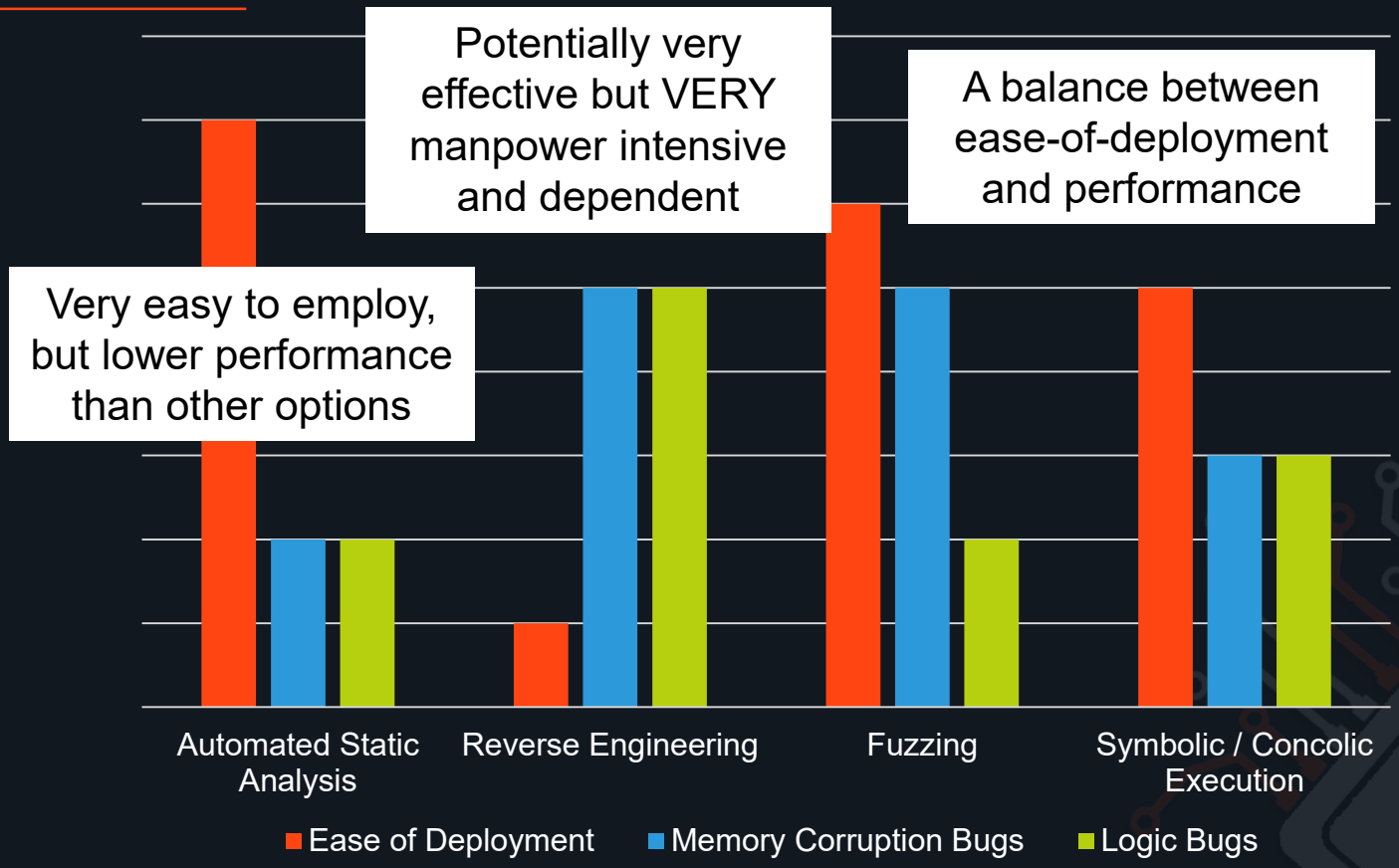
- Lack of source code in cyber engagements drives need for binary analysis tools, however...
- Binary-only analysis tools are limited and less developed than source analysis tools
- Draper has implemented **Modular, Open** software frameworks for static and dynamic analysis of **binary** code:
  - Dynamic analysis – VADER
  - Static analysis – SHREDDER.
- These frameworks allow for shared development and use by a broad contractor community.
- Draper has leveraged the inherent modularity of these frameworks to implement new advanced binary analysis capabilities.

Survey of Example Binary Tools

Tool	Static Analysis		Dynamic Analysis		Usability/Adaptability					
	Automated Static Analysis	Reverse Engineering	Fuzzing	Symbolic / Concolic Execution	Multi-Platform	User Plugins	Automated	Open	Modular	Joint Use
CodeSonar	✓				✓		✓			
IDA		✓			✓	✓				
Ghidra		✓			✓	✓		✓	✓	
Binary Ninja		✓				✓				
AFL			✓				✓	✓		
Angr				✓	✓	✓	✓	✓		
Mayhem				✓	✓		✓			

Binary analysis tools exist BUT
- Few are open AND modular
- None are designed for joint use

Qualitative Comparison of Binary Tools

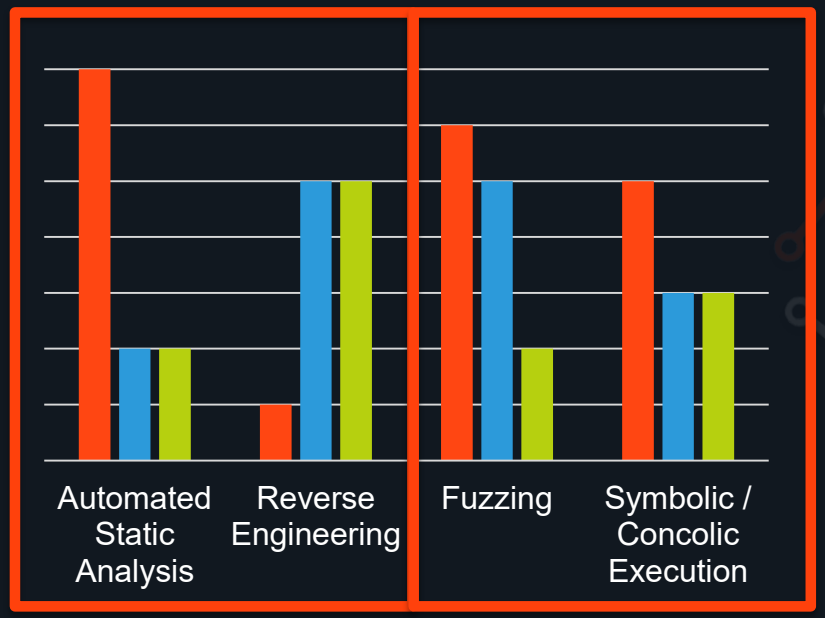


We need a means to efficiently leverage all techniques AND facilitate more rapid binary tool development and maturation.

Draper's Approach For Rapid Tool Development

- Rapid, robust tool development and maturation requires a 2-step approach
- Step 1: Develop a **modular**, **open**, **automated** framework
  - Automation: easy deployment
  - Modular and Open: easy development of new features
- Step 2: Rapidly develop and integrate novel techniques

SHREDDER
Static Analysis



VADER
Dynamic Analysis

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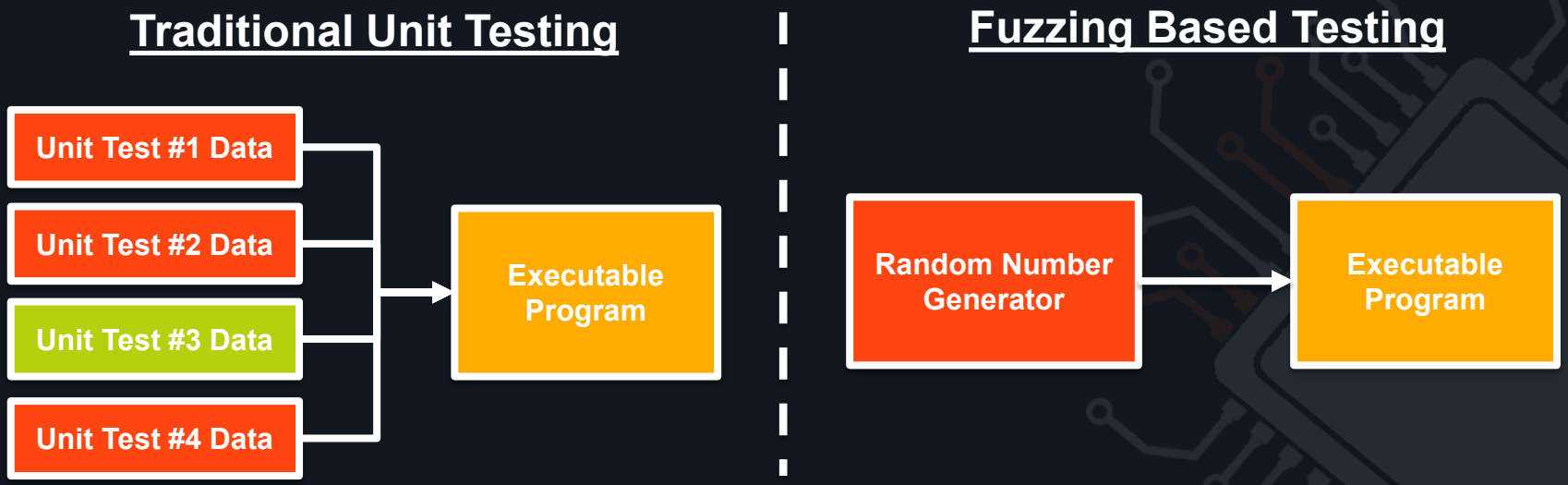
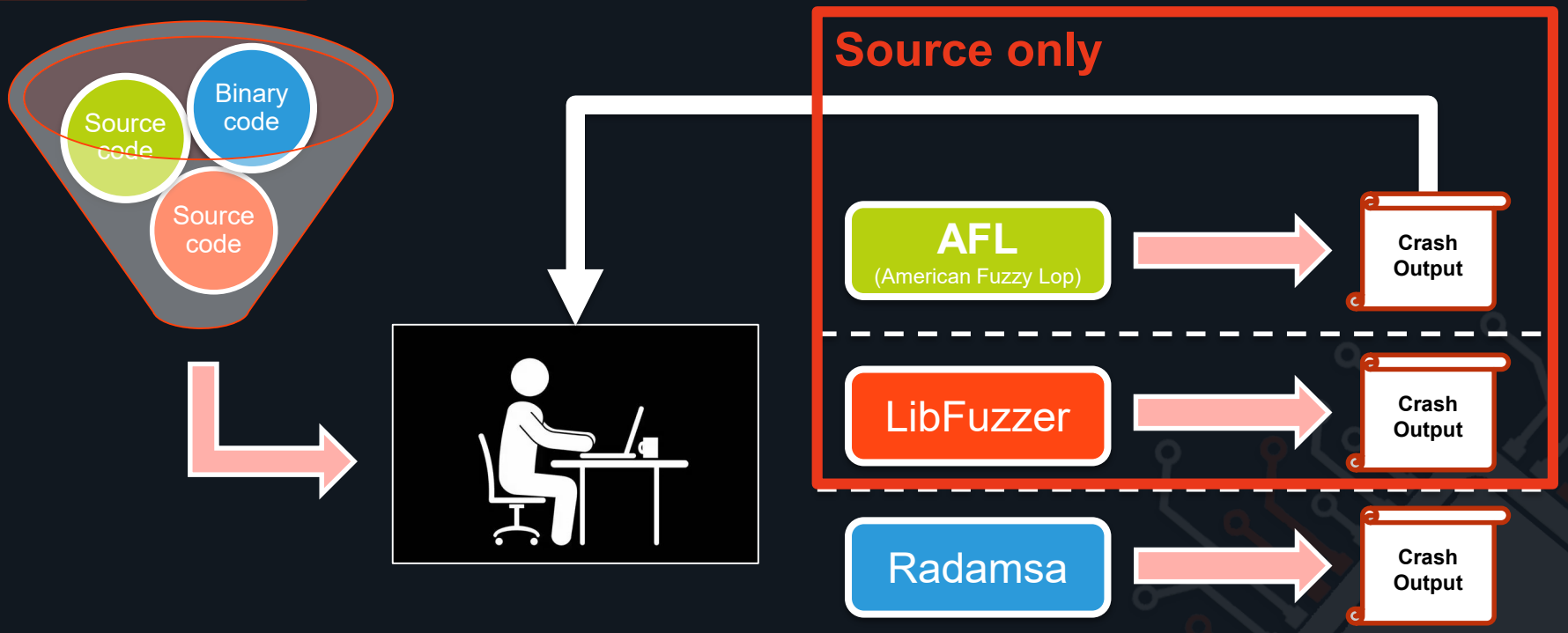
VADER Dynamic Analysis

What is Fuzzing.....

Traditional software testing handles known edge cases. Fuzzing, in contrast, attempts to expose unknown edge cases through randomly generated tests.



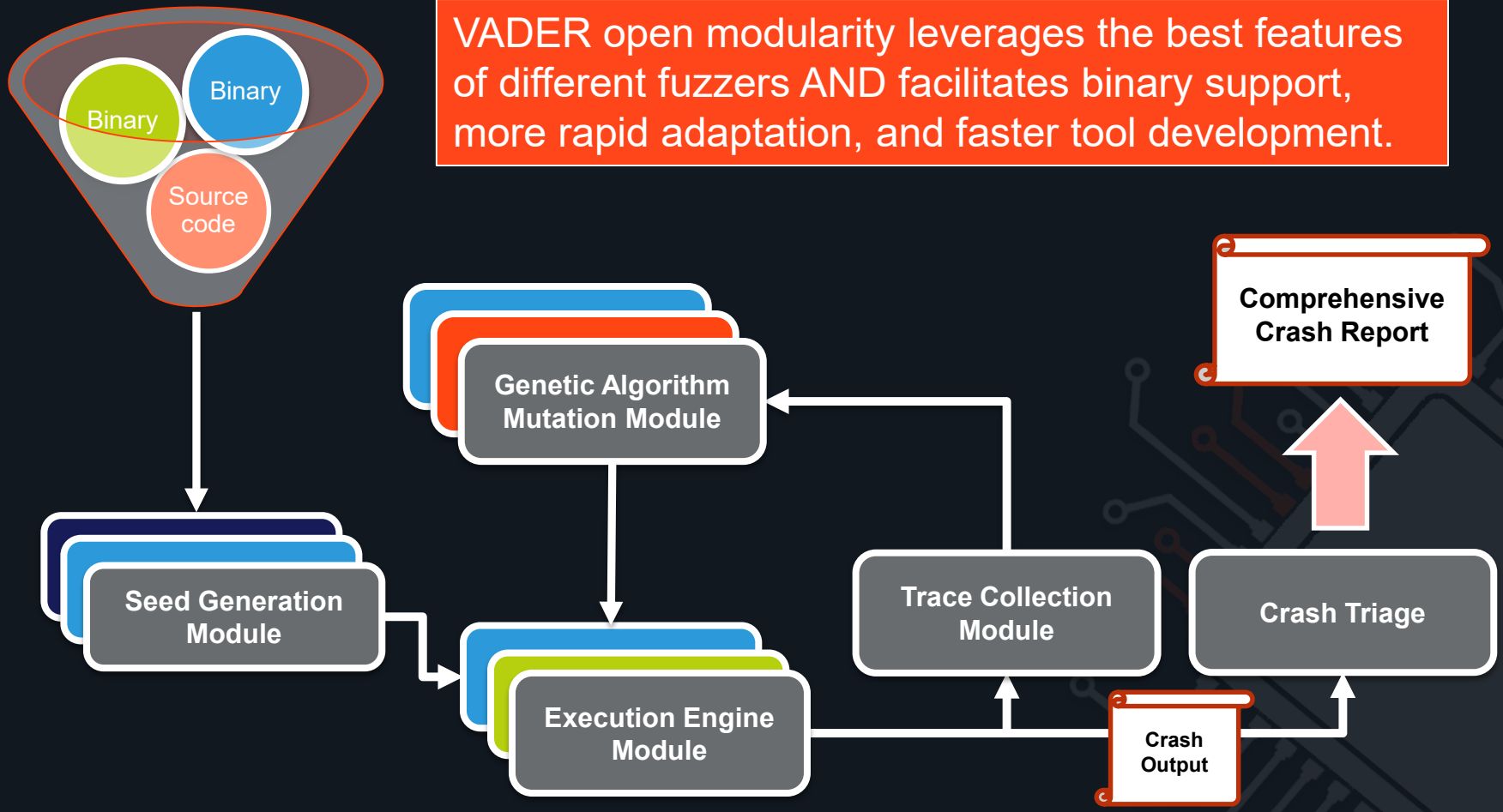
Traditional Fuzzing Limitations



Fuzzers have tended to focus on source code, and the monolithic nature of available options limits innovation and advanced features.

VADER Modular Open Fuzzing Framework

VADER open modularity leverages the best features of different fuzzers AND facilitates binary support, more rapid adaptation, and faster tool development.



VADER Current Features

- Modular support for many existing open-source fuzzers
  - AFL
  - Radamsa
  - Domato
- Automated sample generation and crash triage
- Draper developed capabilities leveraging open modularity:
  - Custom Black Box **Taint Tracking** subsystem
    - Ability to traverse complex code paths
    - Full support for binary code
  - Real time, automated fuzzer **switching** - faster AND deeper code search

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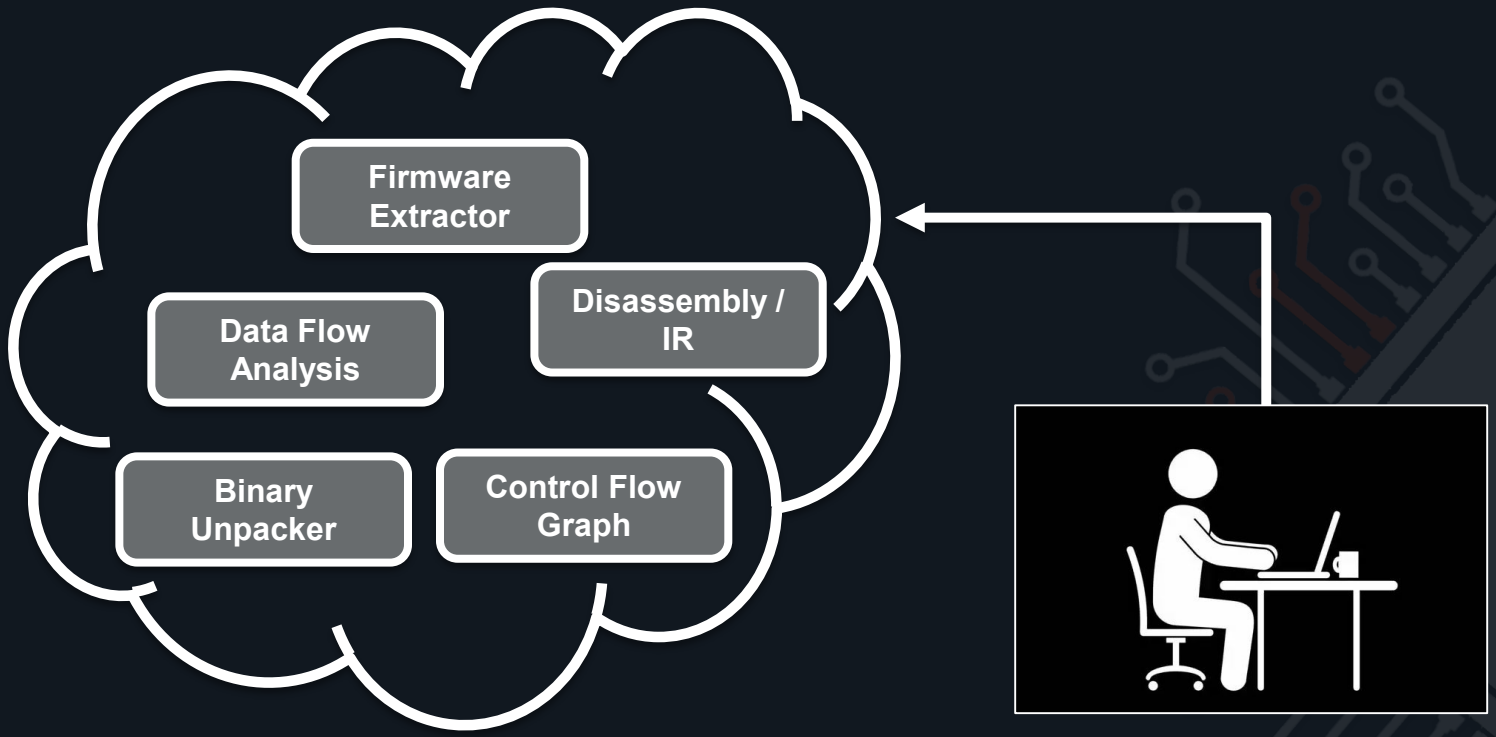
SHREDDER Static Analysis

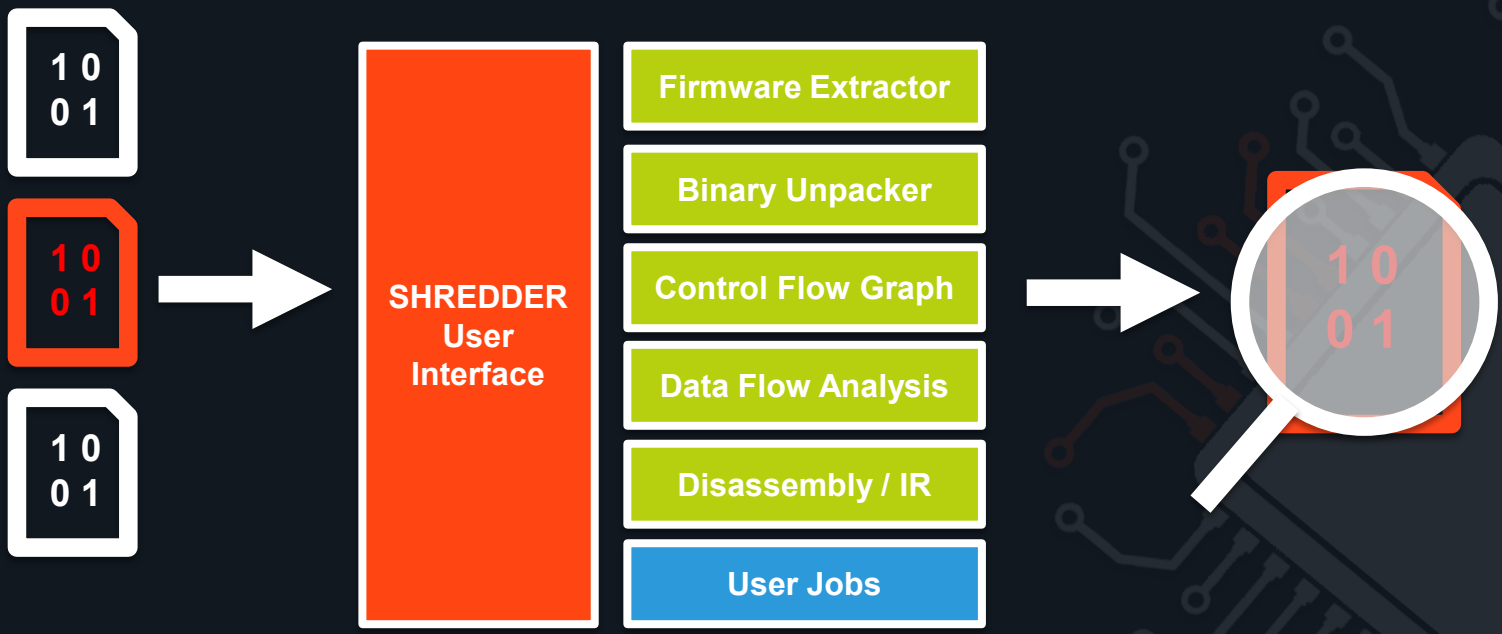
Limitations to Reverse Engineering

Reverse engineering is a time-consuming task involving numerous steps of information gathering. Many of these steps can be automated; however, the means to do so are limited.



SHREDDER – STATIC ANALYSIS FRAMEWORK

The SHREDDER framework automates a large collection of common reverse engineering tasks and provides a simple interface for user extensions.



SHREDDER CURRENT FEATURES

- Integration of numerous static analysis jobs
- IDA / Binary Ninja plugin support
- Draper developed capabilities leveraging open modularity:
  - Library Identification capability
    - Precise signature detection for library versions in binary
    - Correlation with CVE database

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