Simplification of Mixed Boolean-Arithmetic Obfuscated Expression

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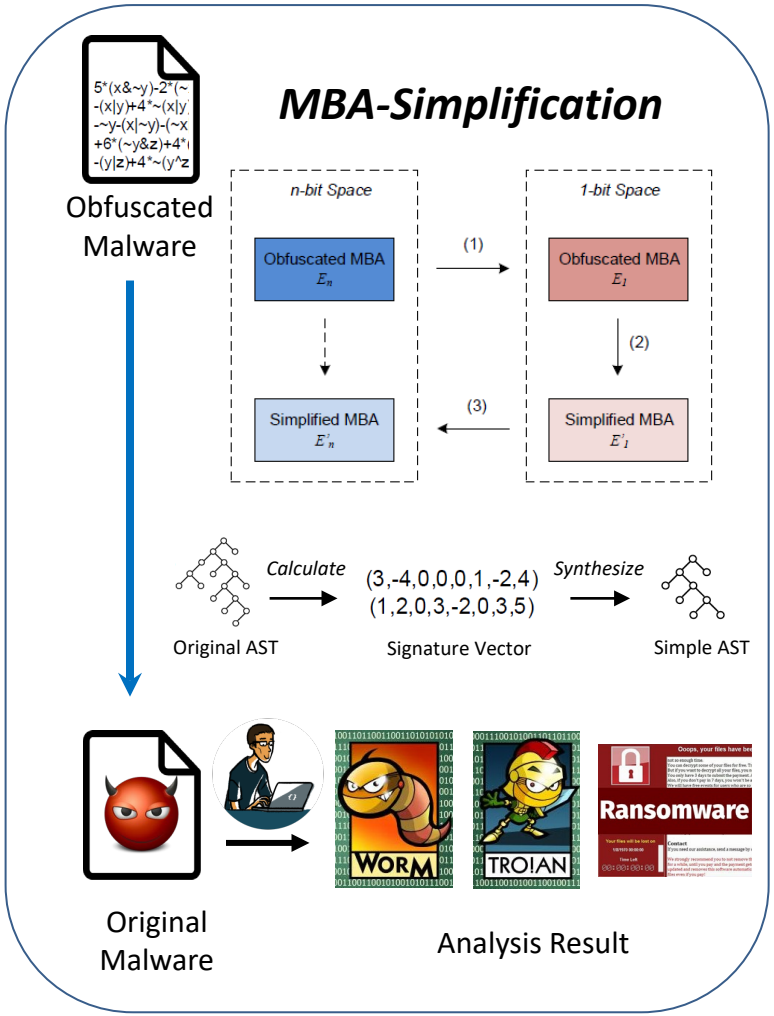
Challenge:

- Many malware packers and obfuscators use Mixed-Boolean-Arithmetic (MBA) expressions
- Existing simplification methods cannot handle MBA

$$x+y \rightarrow 2(x \vee y)-(\neg x \wedge y)-(x \wedge \neg y)$$

Solution:

- Discover important math features: n-bit to 1-bit equivalent transformation
- Semantic preserving translation to reduce MBA-alternation



Scientific Impact:

- Help malware analyzers understand packed malware
- Largely advance the security community's understanding of MBA's inner mechanism
- Boost SMT solver's performance on solving MBA expressions

Broader Impact and Broader Participation:

- Fight against malware
- Open-source
- Research methods and findings have been used in GenCyber K-12 summer camp and university courses

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