Attack Model: Graph based Attack Representation and Taxonomy

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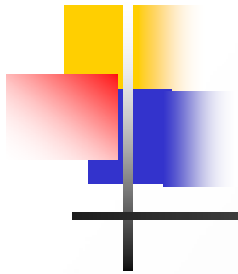
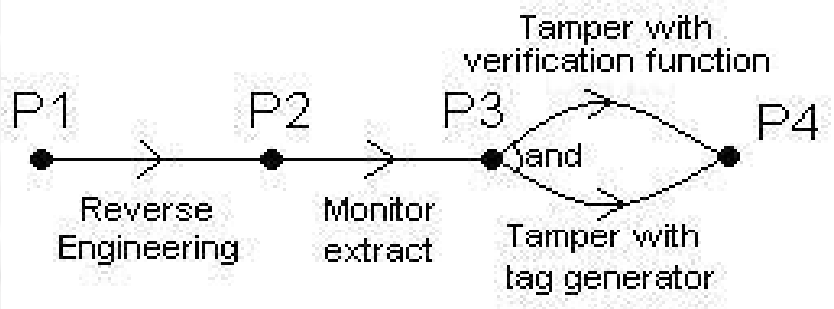


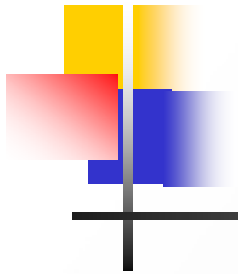
Introduction

- It is important to find a formal presentation of attack
- Our approach is based on oriented graph representation which uses program state notion and action one
- There are a lot of graph and tree based attack model representations in computer security field. Our model is aimed to take into account ReTrust specific features

Graph based attack representation (1/3)

- Attack is presented by oriented graph
  - Vertexes – states of target program
  - Arcs – adversary actions on the target program
- Attack model has
  - Initial state – an initial untampered program
  - Final state – a broken one
- Graph may have two types of branches
  - OR – it is sufficient to execute one option only
  - AND – it is needed to execute all options





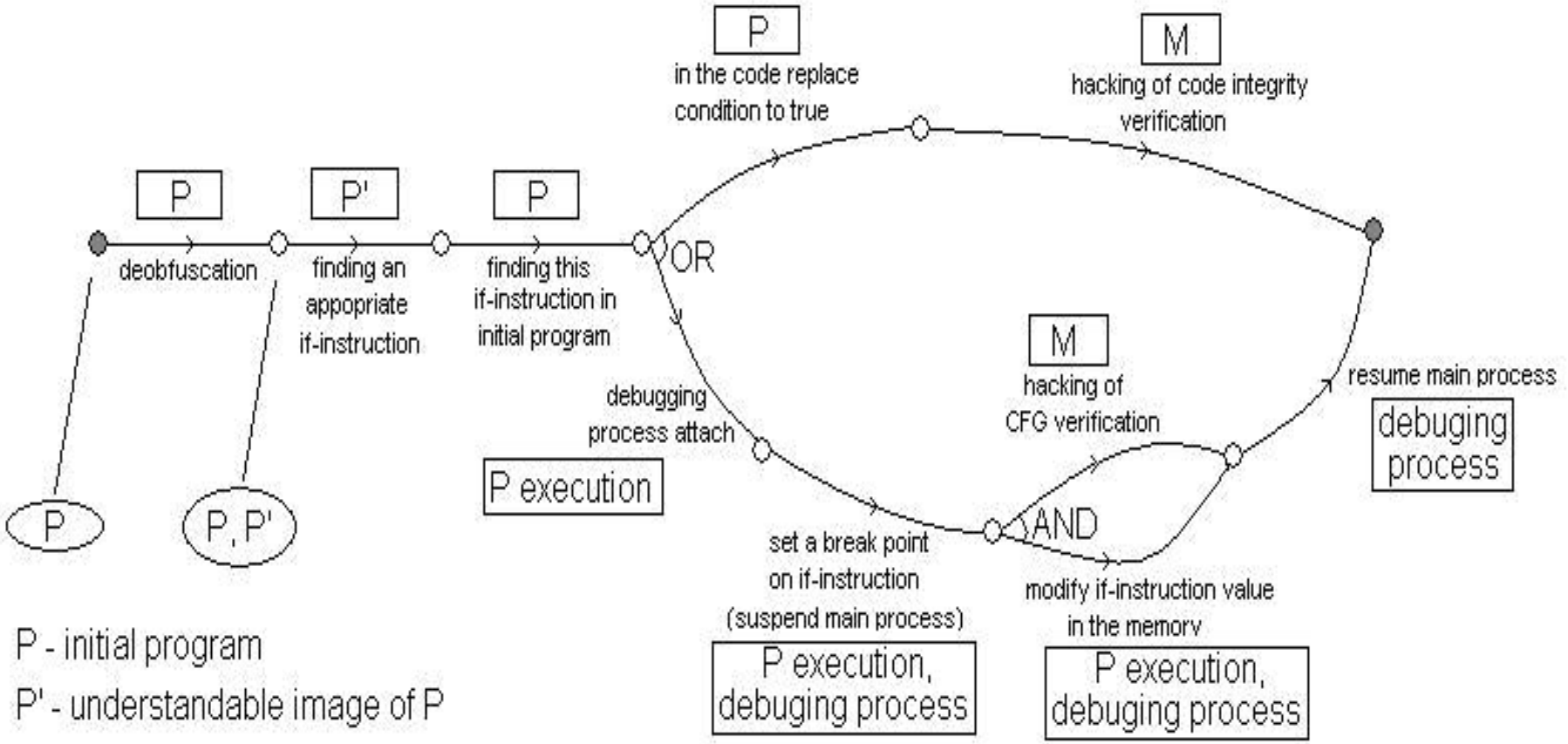
Graph based attack representation (2/3)

- Program state is described by
  - Program attributes, e.g.
    - (non-), (de-) obfuscated
    - Presence or absence of a secret key in a program
  - Additional objects and data extracted from the program earlier or from outside, e.g.
    - Monitor, signature generator, secret key
  - Modified program parts or modules and modification type

Graph based attack representation (3/3)

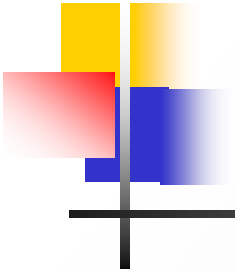
- Actions
  - Action description
  - A set of objects which a the subject of action
- Two kinds of actions
  - Modification of program or its part
    - e.g. deobfuscation, code modification, embed debugging process, etc
  - Analysis of program or its part
    - e.g. search of specific code instruction, monitor analysis
- An action may be detailed to some set of sub-actions
  - e.g. concrete reverse engineering techniques, extracting monitor methods, specific modification methods, etc

An example of program tampering attack



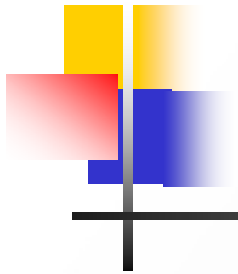
Advantages of suggested attack representation

- Attack representation obviousness
- Demonstration of action relationships In time
  - e.g. possible parallelism of actions
- It helps to estimate computational complexity of an attack fulfillment
- It helps to reveal the way of attack effectiveness, e.g.
  - Parallel execution of several actions
  - To eliminate repeated fulfillment of already executed intermediate computation or same data search



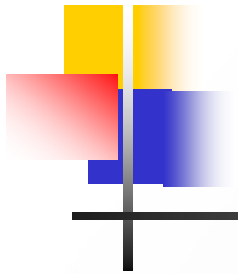
Estimation of attack realization time

- Estimation of machine time for breaking the certain program component or the execution of some actions
- Human factor



Preliminary attack model taxonomy

- Attack
  - Attack graph
    - program states
      - program attributes
      - additional objects and data
    - actions
      - modifications
      - analysis
    - AND/OR branches
- General attack classification
- Attackenv
- Attacktext
- Attackload
- Attackrun
- Main kinds of attacks
  - Riverse engineering attack
  - Clonning attack
  - Differential analysis attack
  - Separation attack



Conclusion

- In the future:
  - To extend and detail the introduced notions of attack models
  - To create the complete attack model taxonomy
- And in particular
  - To detail the notion of program state
  - To develop methods to estimate computational complexity of attacks
  - How to estimate human factor?