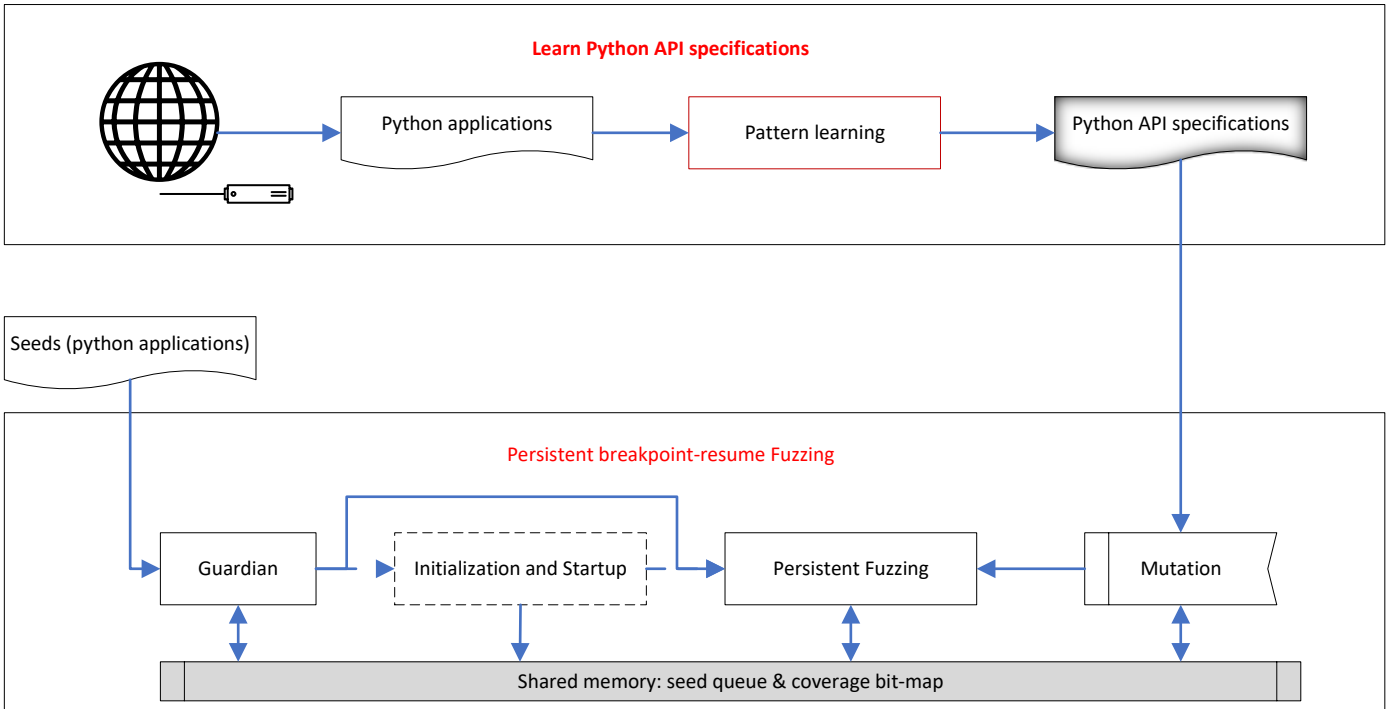
Overview



Challenge 1: How to generate python applications with correct syntax and meaningful semantic?

-> pattern learning for python API specifications

Challenge 2: Efficiency

2.1 Why not AFL++

-> TOO low efficiency with large coverage bit-map (over 1500 K)

-> Only support non-persistent mode for Python, which means it will cost much time during startup phase (import libraries)

2.2 Why not Atheris

-> No global status for recovery after exiting triggered by error happens

-> Persistent mode for python applications, not support for python interpreter

-> Not support path coverage

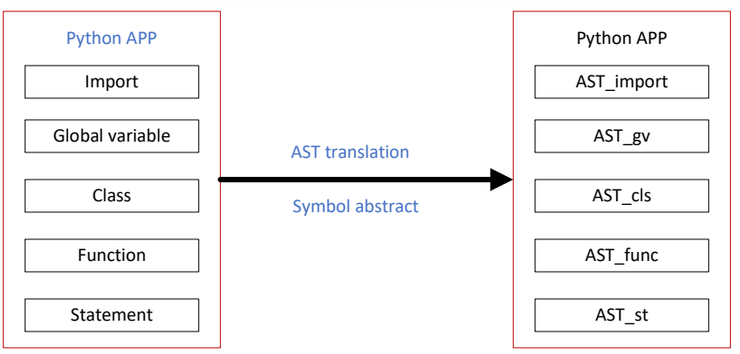
-> Persistent fuzzing with breakpoint resume & path coverage & optimization of bit-map summary algorithm

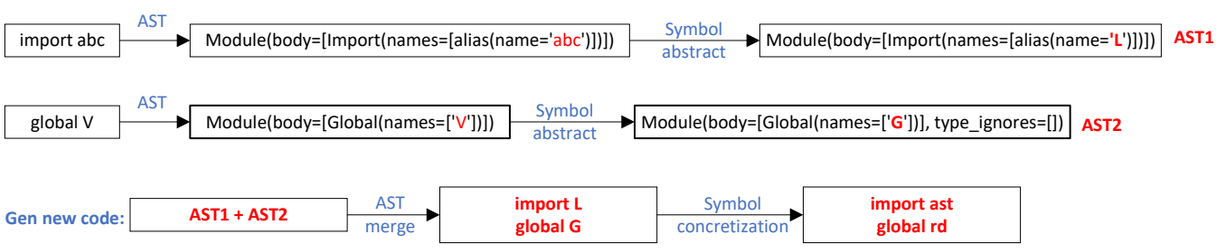
Python APP generation

1 **General python APP generation**

1. Learn the grammar from Python applications
   - translate APP into ASTs
   - for each type of element, **learn** the patterns and normalize the format through abstract symbol

2. Gen new APP through operation (ADD/DEL/MERGE/RECURSIVE...) of ASTs





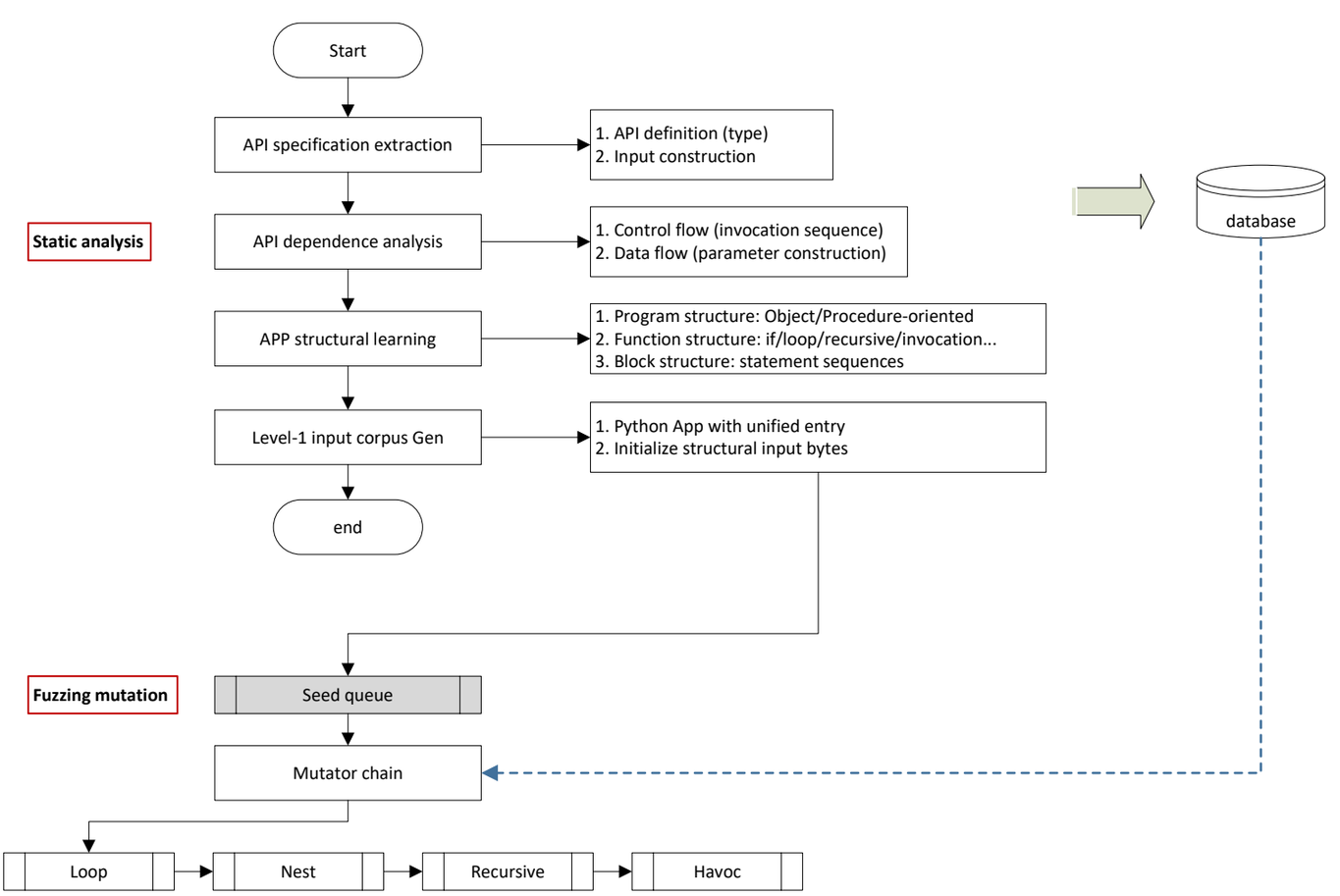
2 **Python APP generation focusing on usage of runtime libraries**

The usage of API is in form of call statement, hence we only need to learn all the possible call statements of these APIs and store them as ASTs

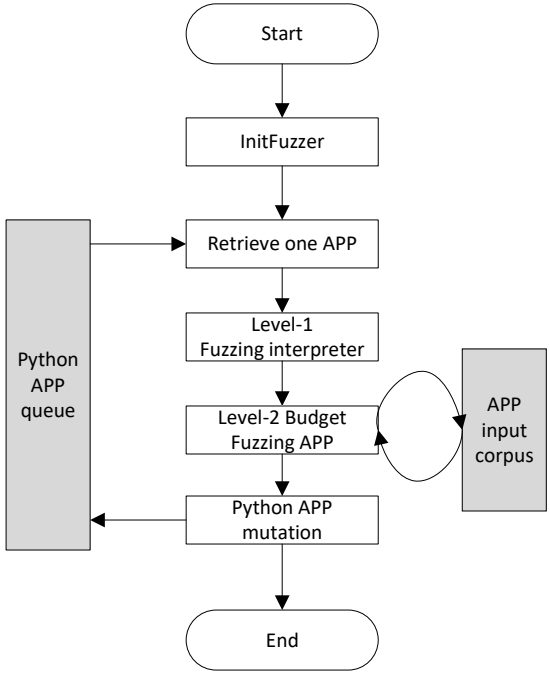
3 **Possible dependencies of runtime library APIs**

For possible dependencies among APIs, we can learn from the real world programs through static slicing

Software design



Two-level Fuzzing



Level-1 Fuzzing: Targeting interpreter Core. We use infinite budget at level-1.

Level-2 Fuzzing: Targeting runtime libraries. We use finite budget at level-2 until no favored path/block/feature found.