Pleiad

Programming Languages and Environments for Intelligent, Adaptable and Distributed systems

Departamento de Ciencias de la Computación
UNIVERSIDAD DE CHILE

FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS UNIVERSIDAD DE CHILE

A Semantics for Execution Levels with Exceptions

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University of Chile - Chile

2011

Aspects and Exceptions

Researchers have studied exception handling as a crosscutting concern

Lippert and Lopez (ICSE '00)

Castor *et.al.* (SIGSOFT '06, ICSM '07, SPE '09)

Coelho *et.al.* (PLoP '08, ECOOP '08)

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Confusion with Exceptions and Aspects

```
class A {
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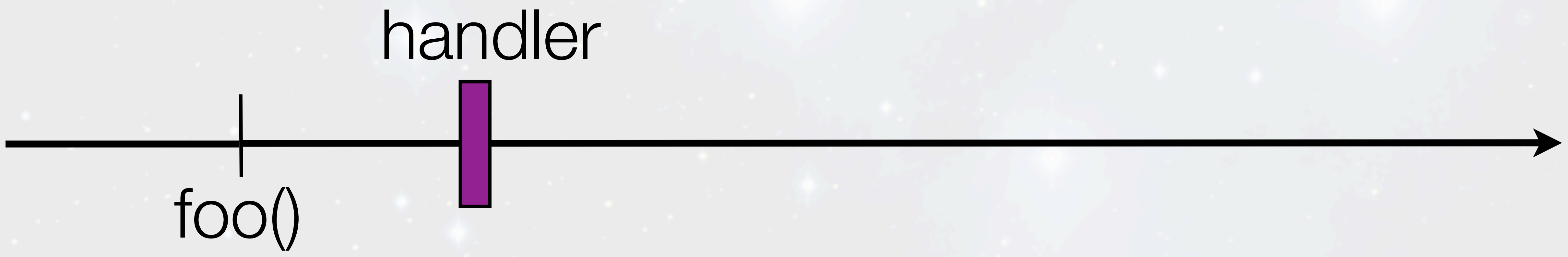

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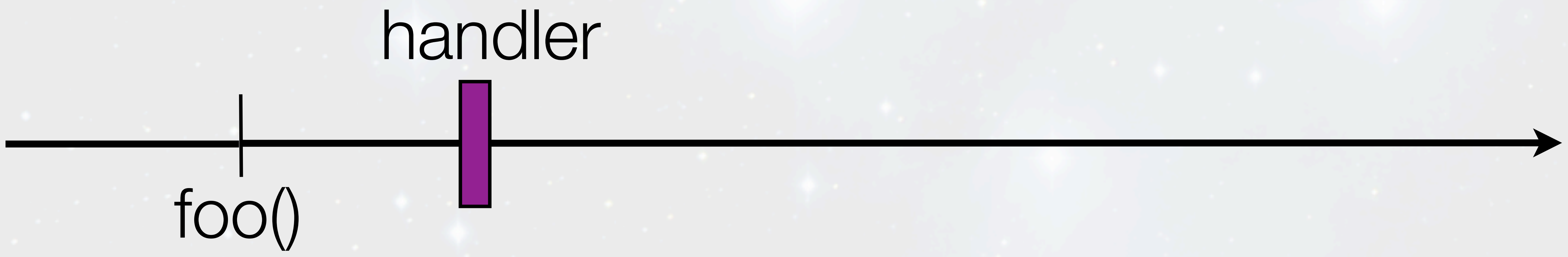

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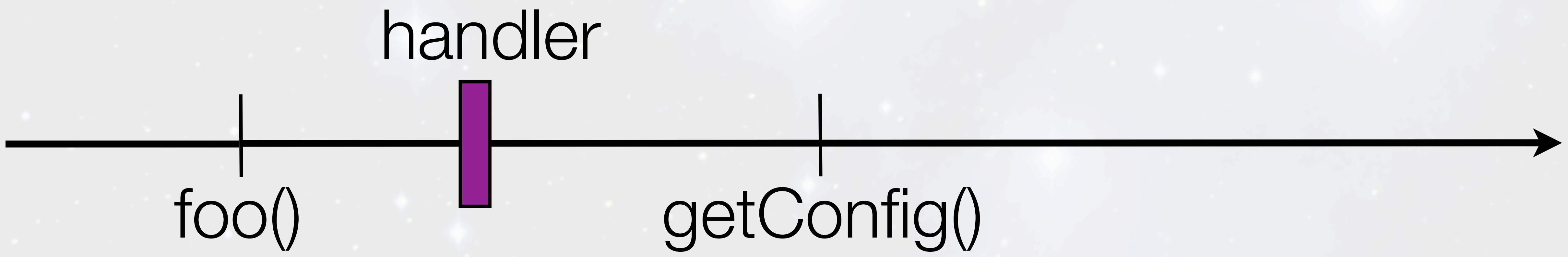

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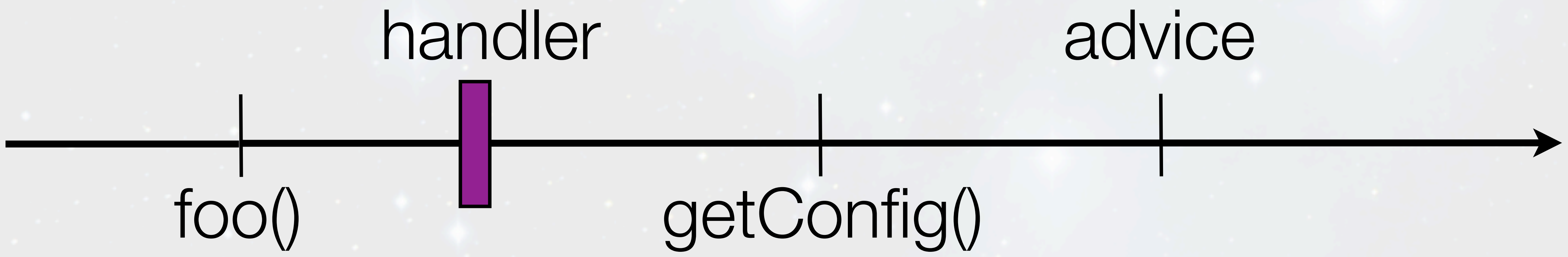

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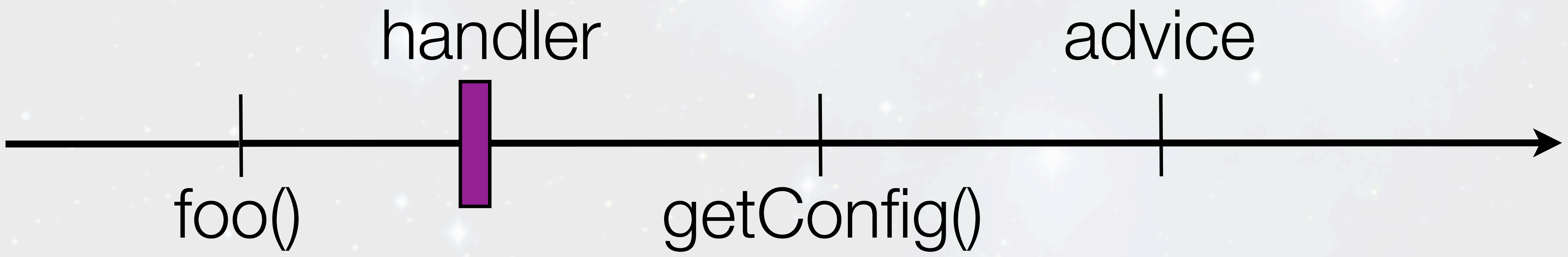

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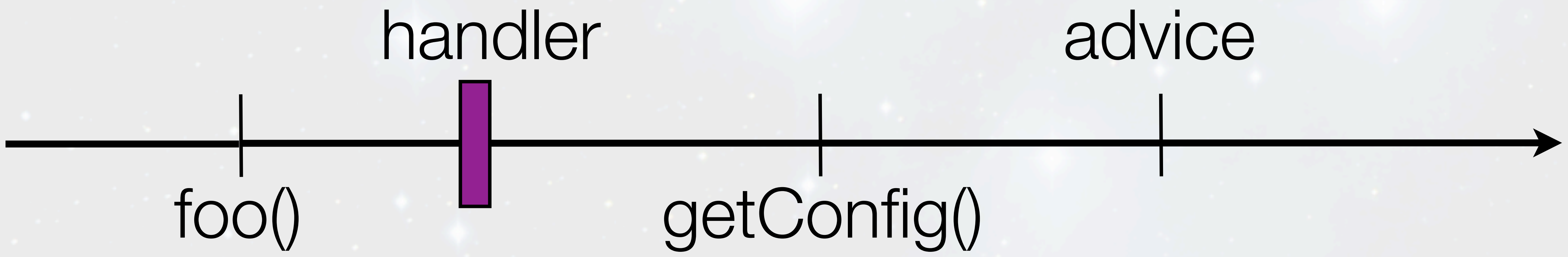

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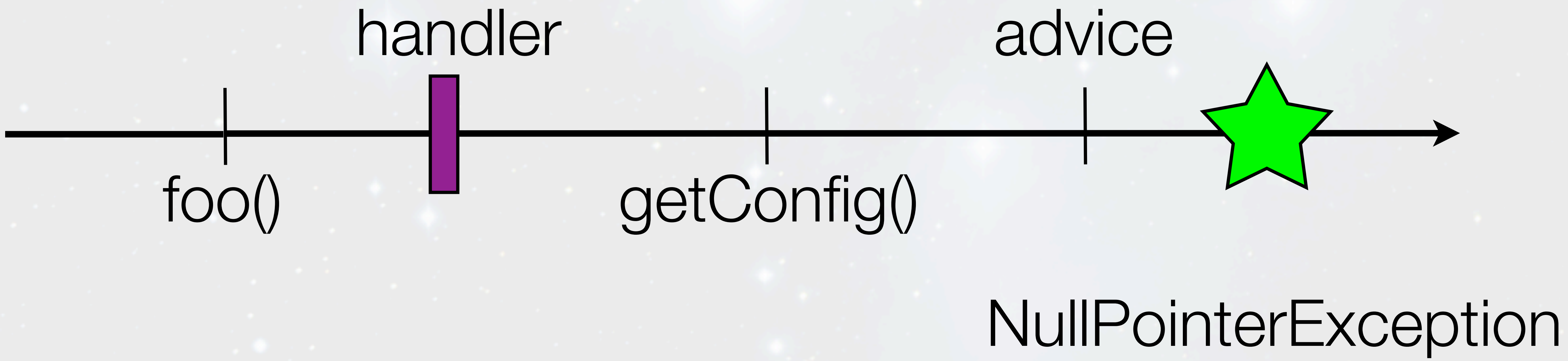

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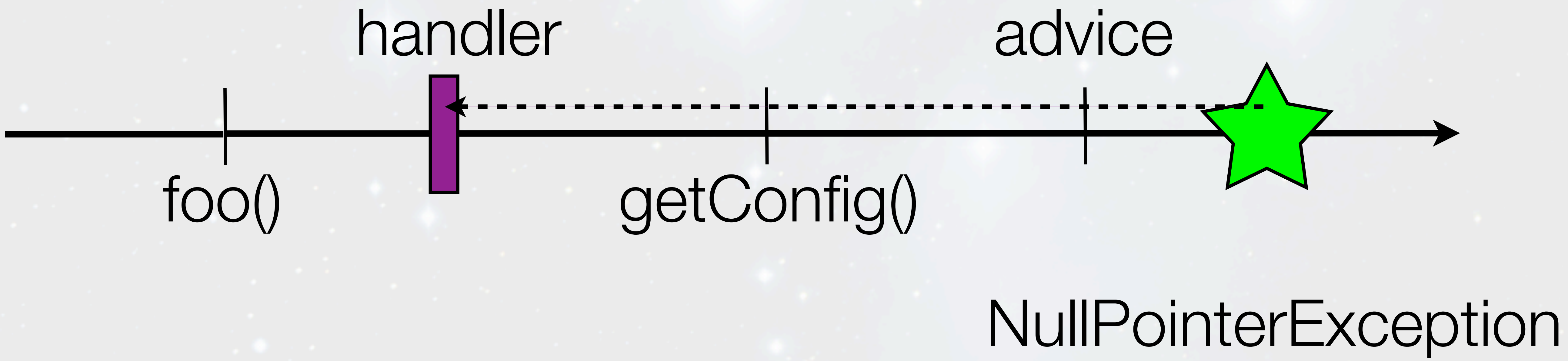

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```
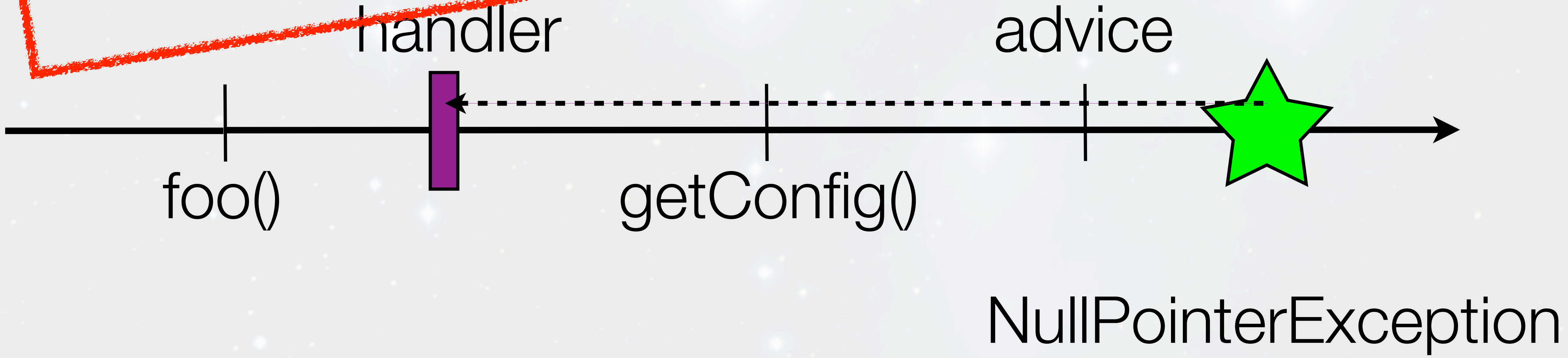

Default value used! even if getConfig returns OK!



Confusion with Exception-Handling Aspects

Aspect exception was handled as a base exception

Confusion with Exceptions and Aspects

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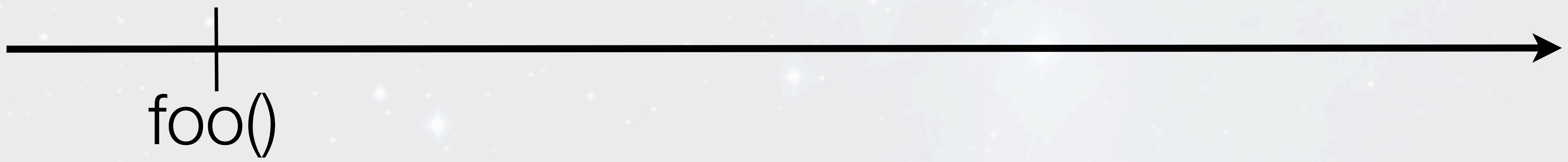

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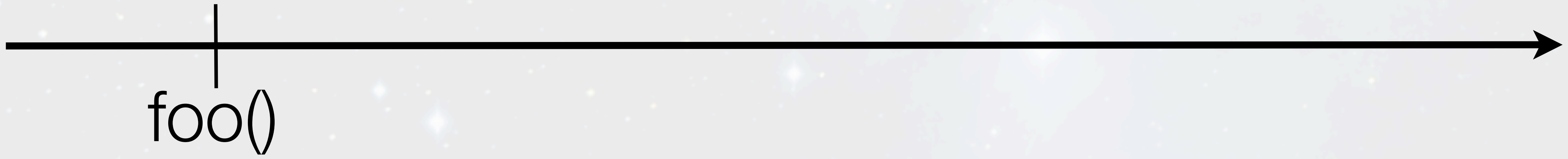

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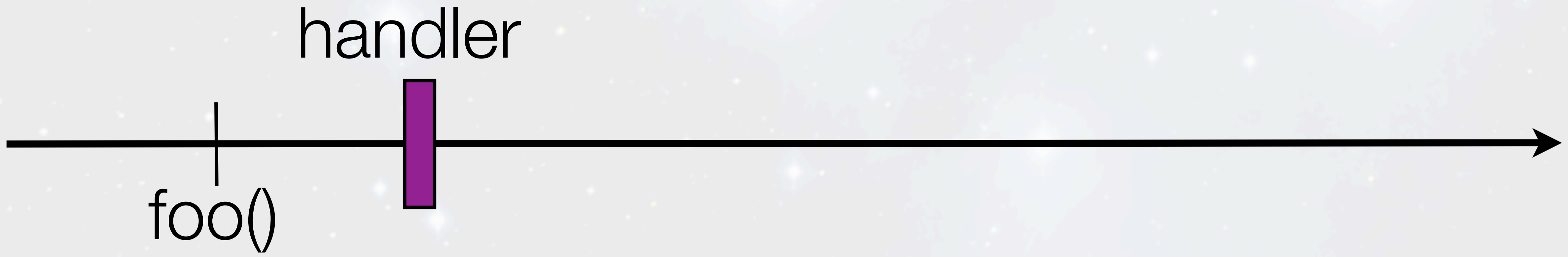

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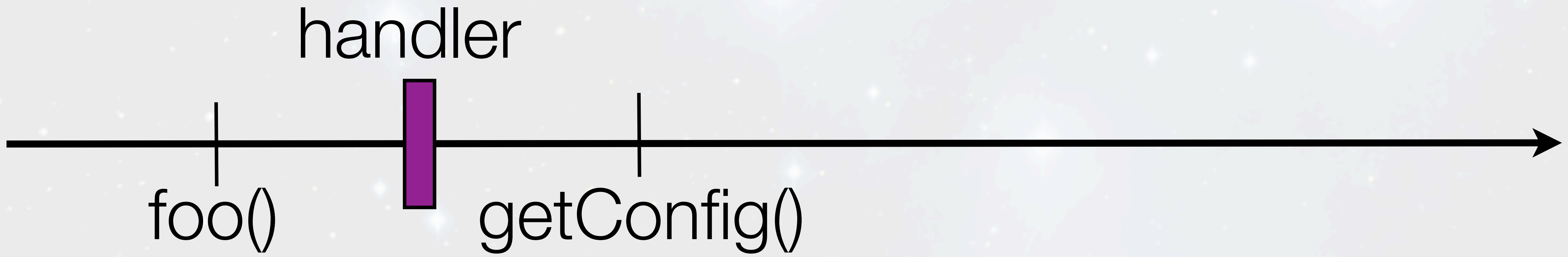

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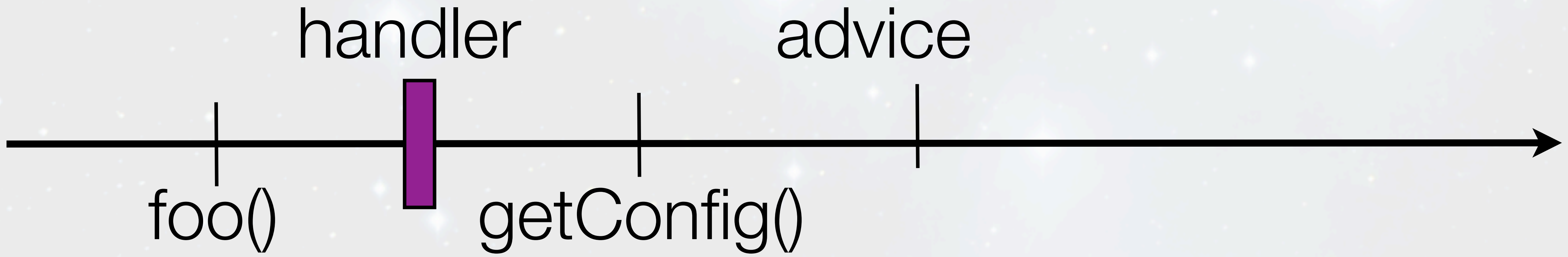

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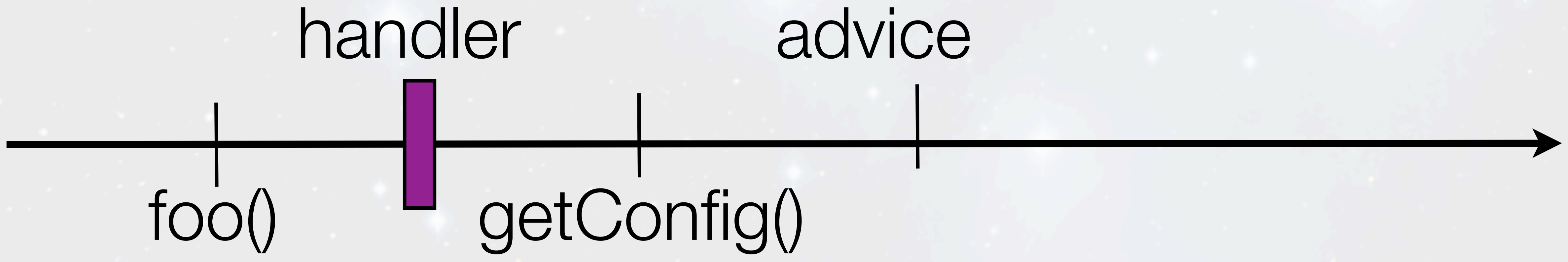

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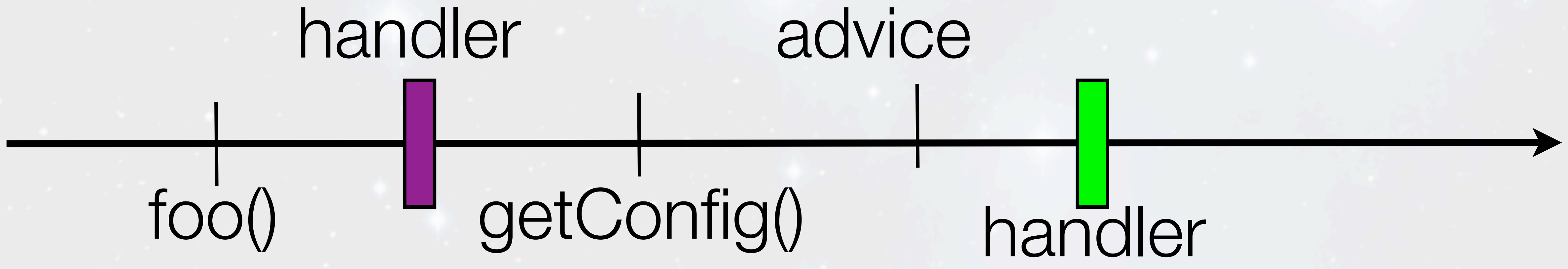

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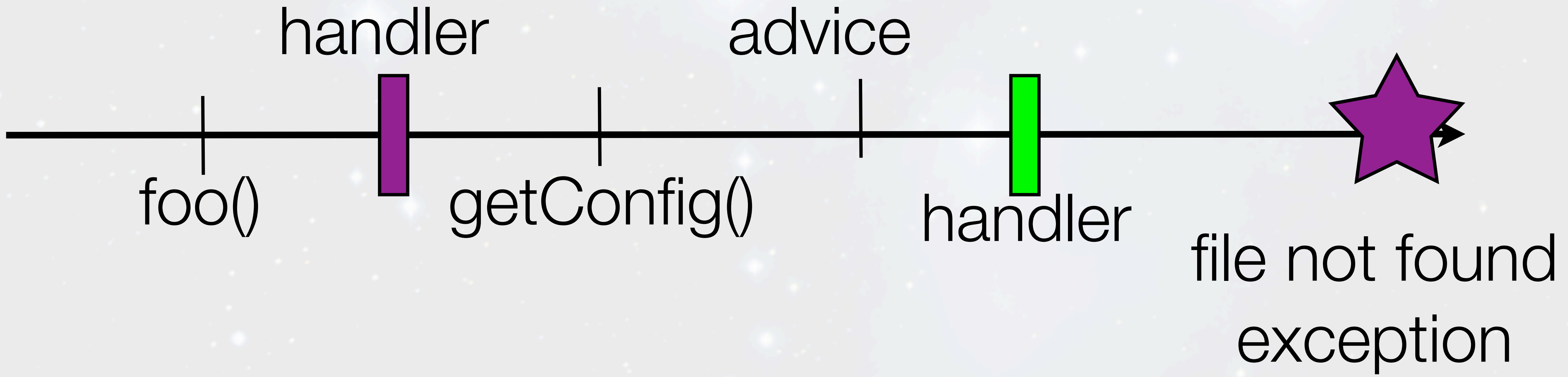

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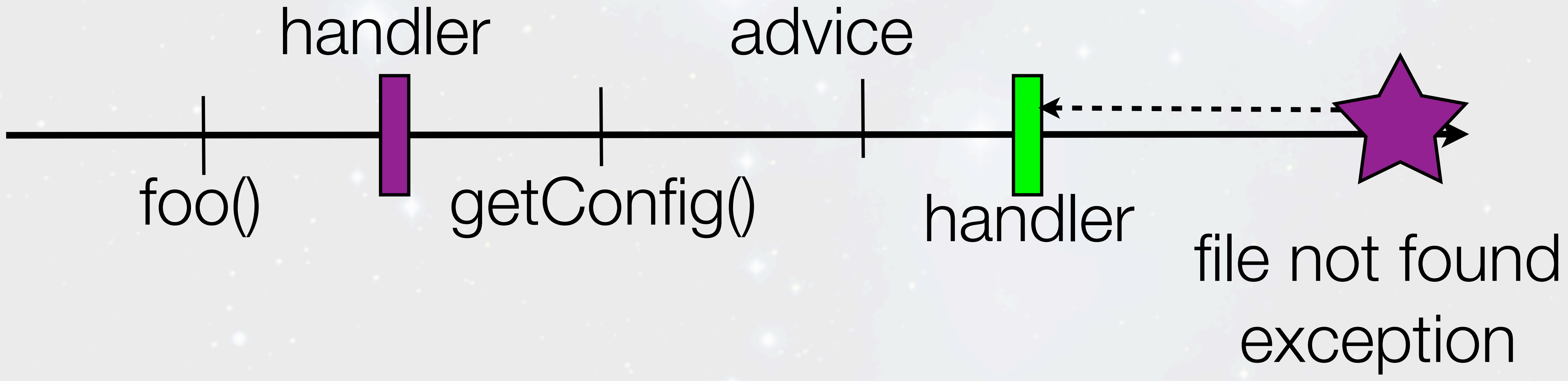

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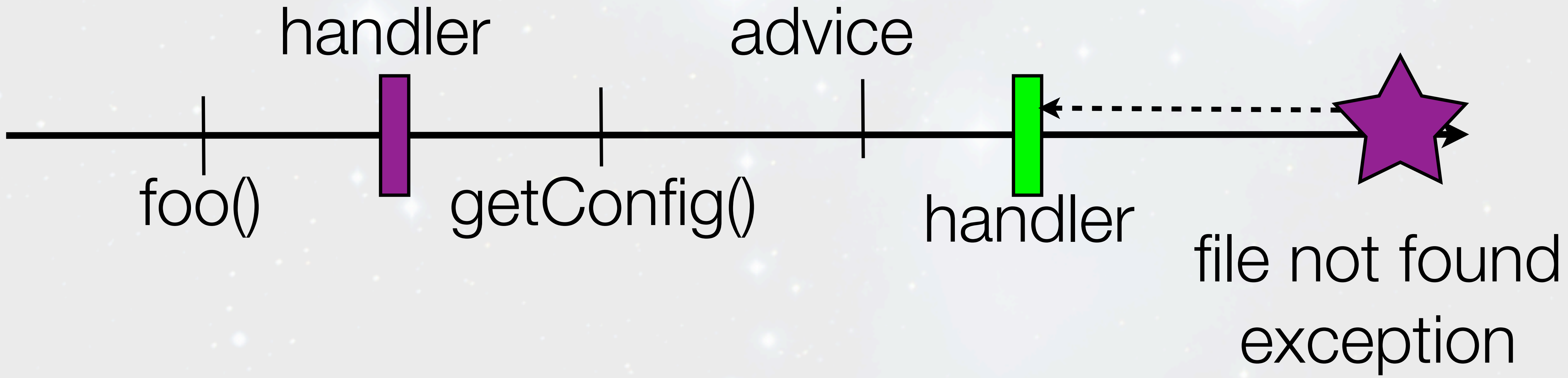

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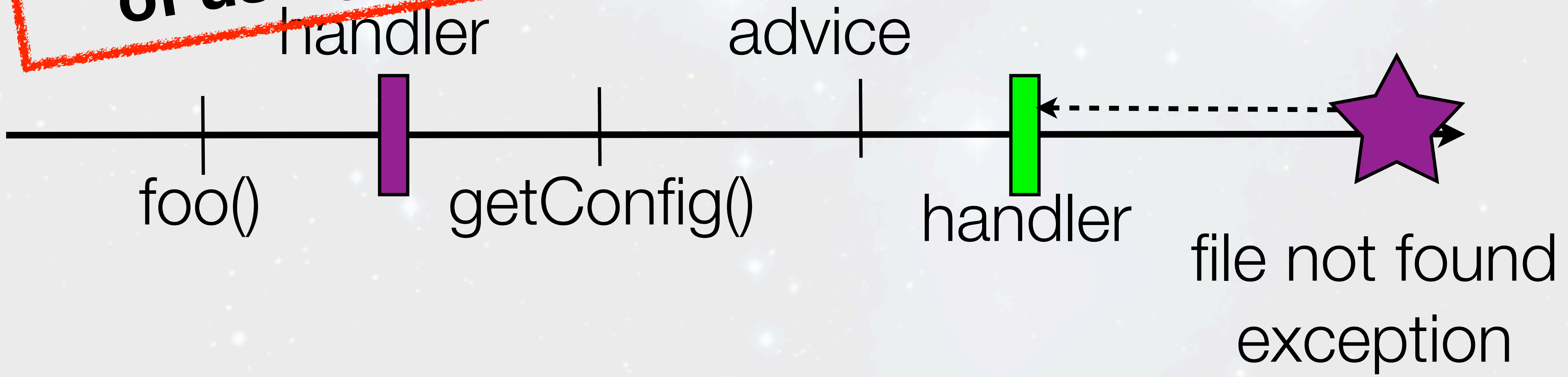
Program aborted instead of using default value!



Confusion with Exception-Handling Aspects

Base exception was handled as an aspect exception

Exception Conflation Problem

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Exception handling mechanism merges aspect and base handlers and exceptions in a flat control flow

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Based on Coelho *et.al.* bug patterns (PLoP ’08)

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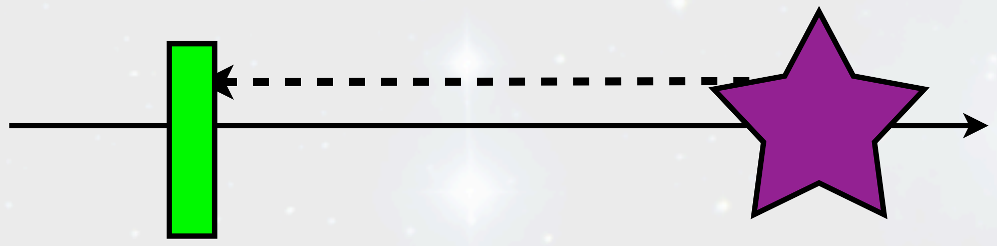

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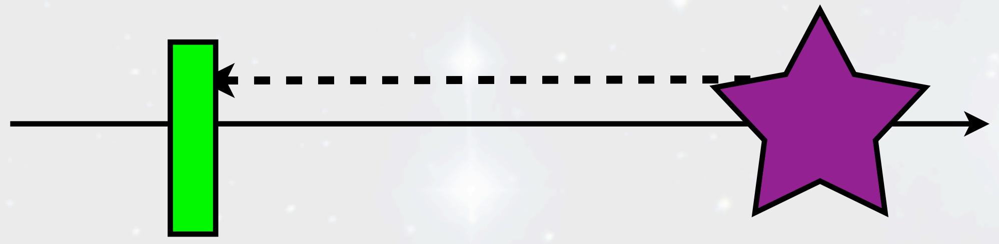

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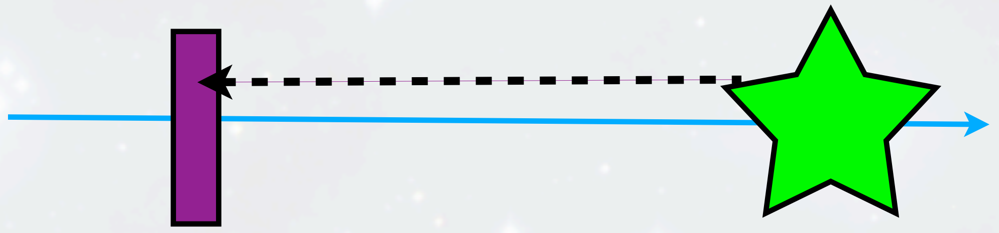

aspect exception/base handler

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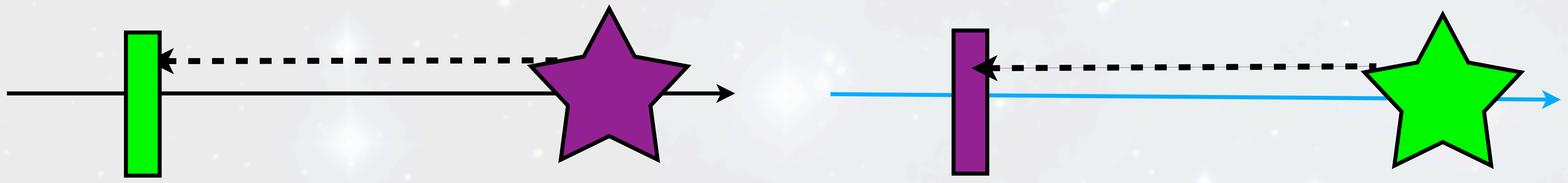

base exception/aspect handler **aspect exception/base handler**

Inadvertent execution of unintended handlers

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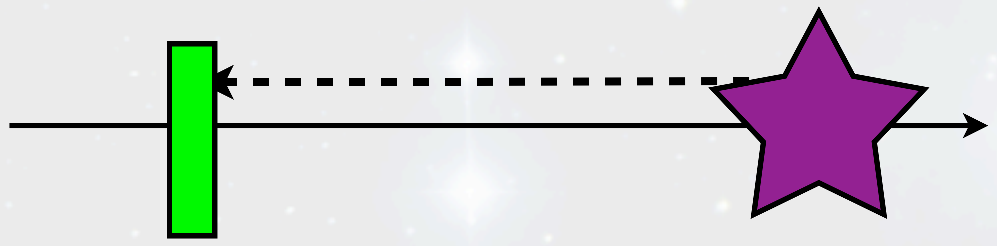

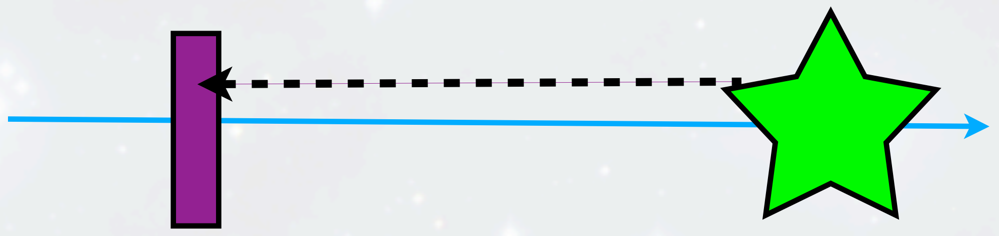

base exception/aspect handler **aspect exception/base handler**

Inadvertent execution of unintended handlers

Programmers can not state the desired interaction

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Our Solution

Use Execution Levels to control Exception Conflation

Execution Levels in a Nutshell

Tanter (AOSD ’10)

Execution Levels in a Nutshell

Tanter (AOSD '10)

Level 2

Level 1

Level 0 **...getConfig(..)..**

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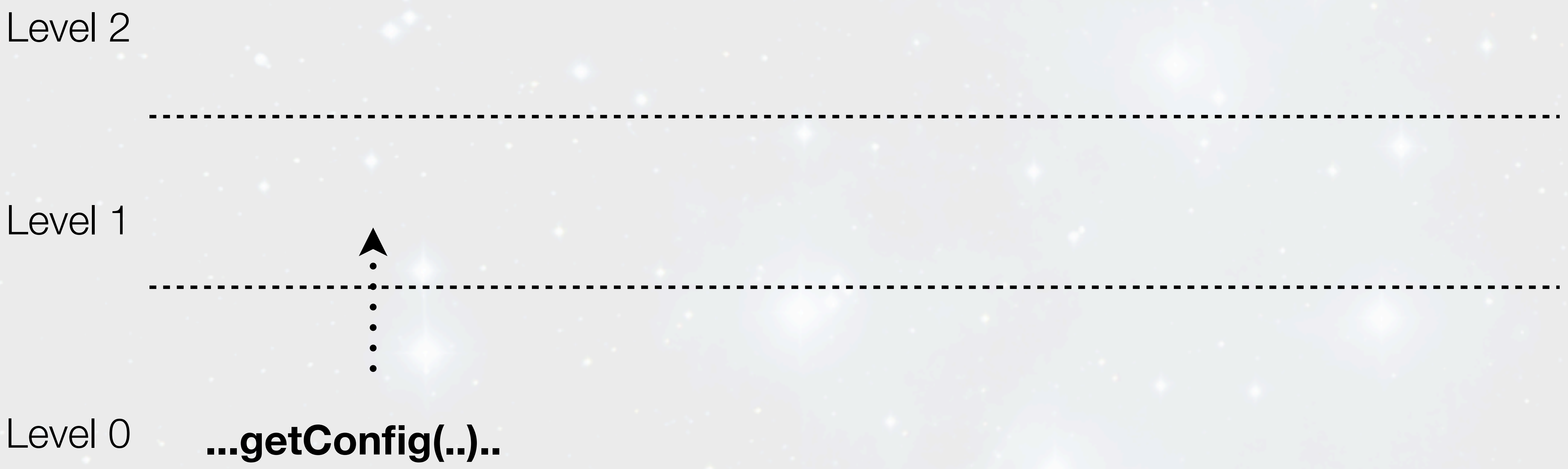
Execution Levels in a Nutshell

Tanter (AOSD ’10)



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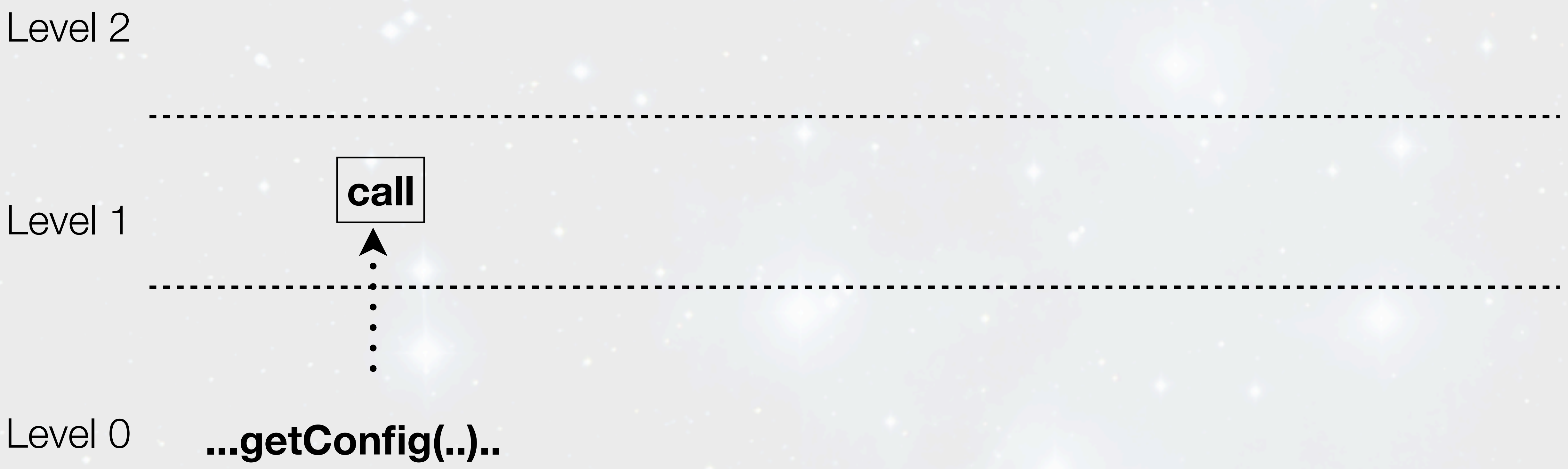

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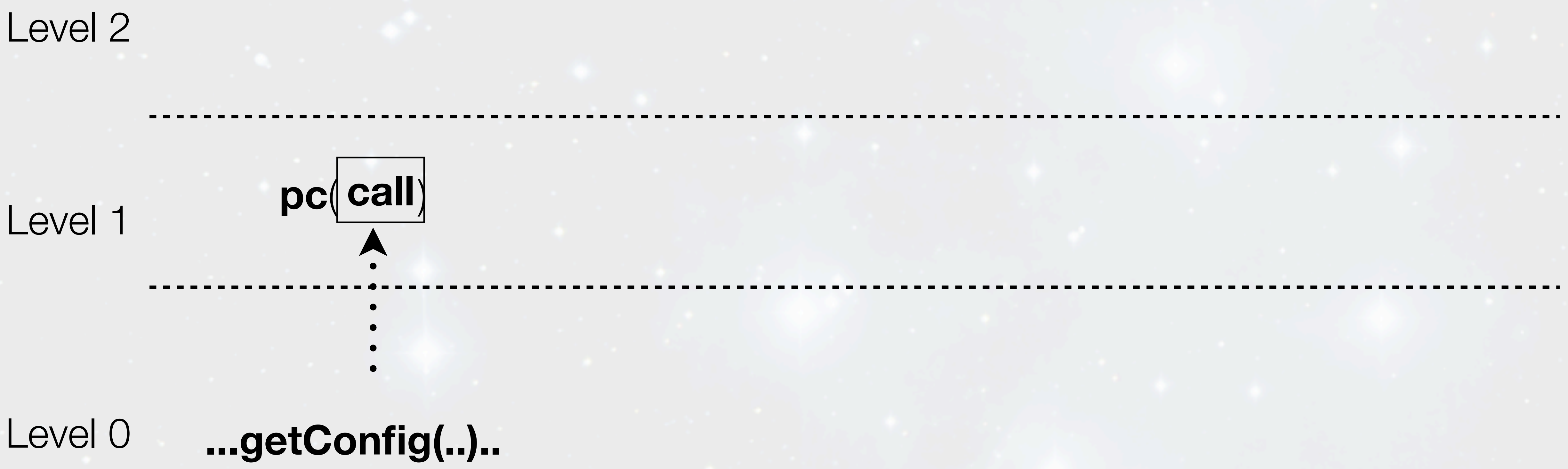

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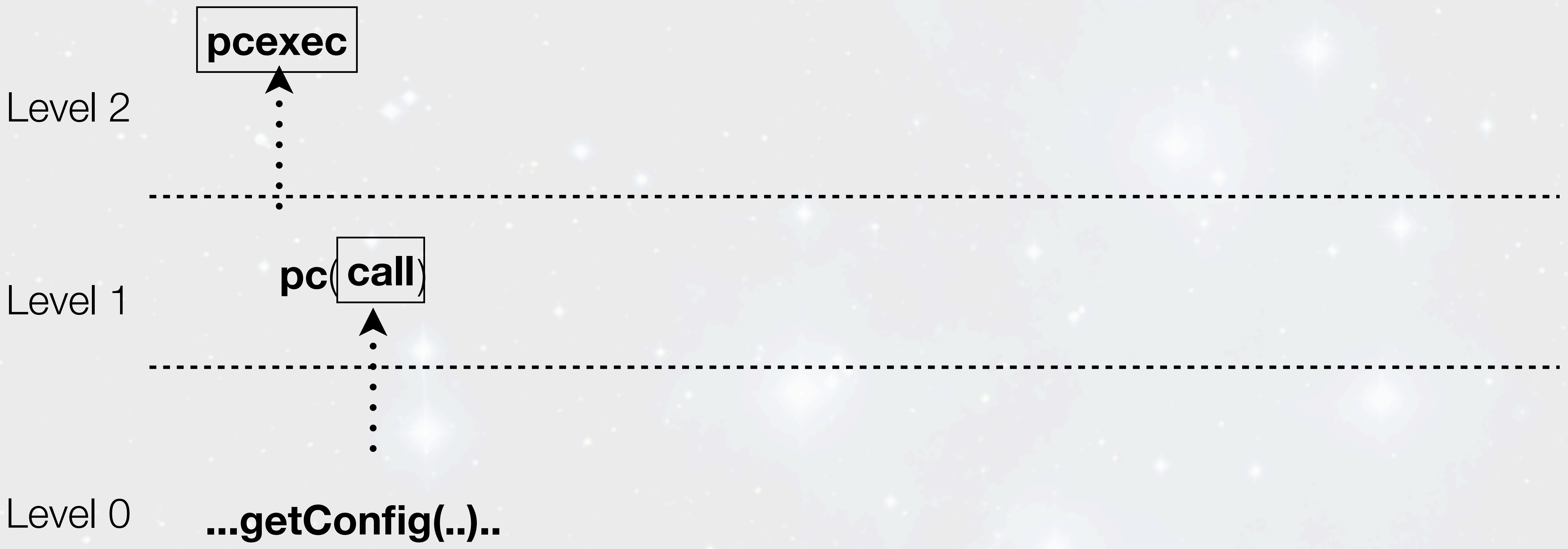

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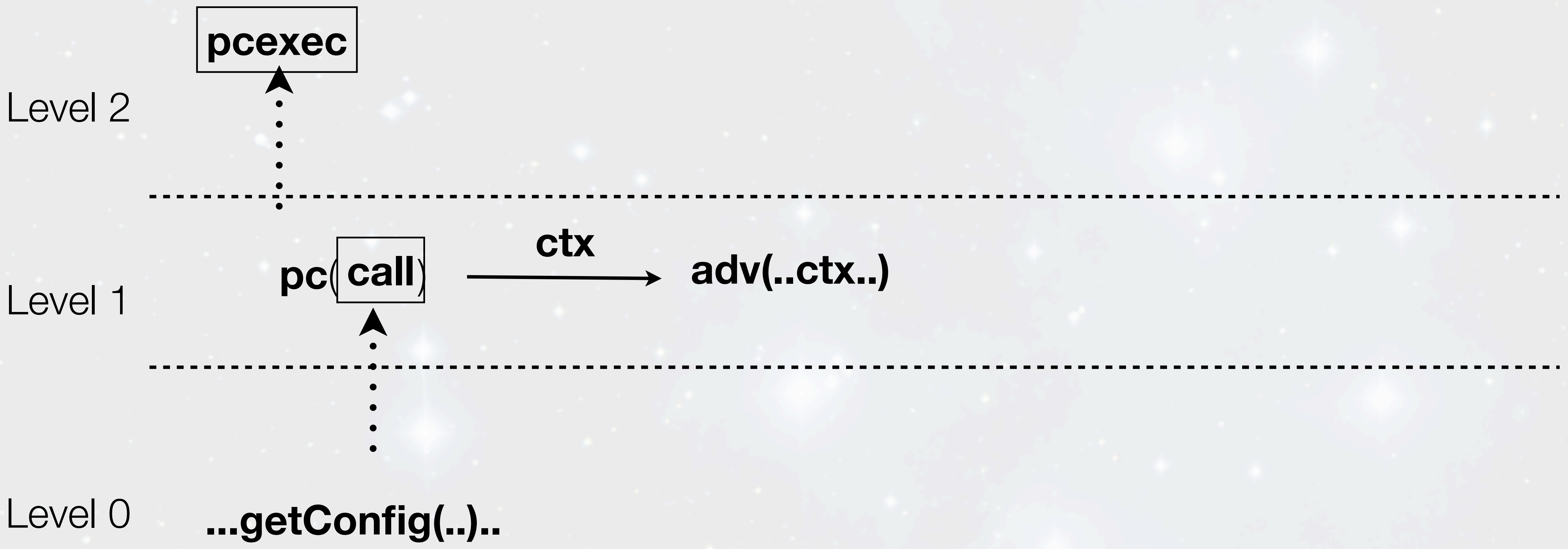

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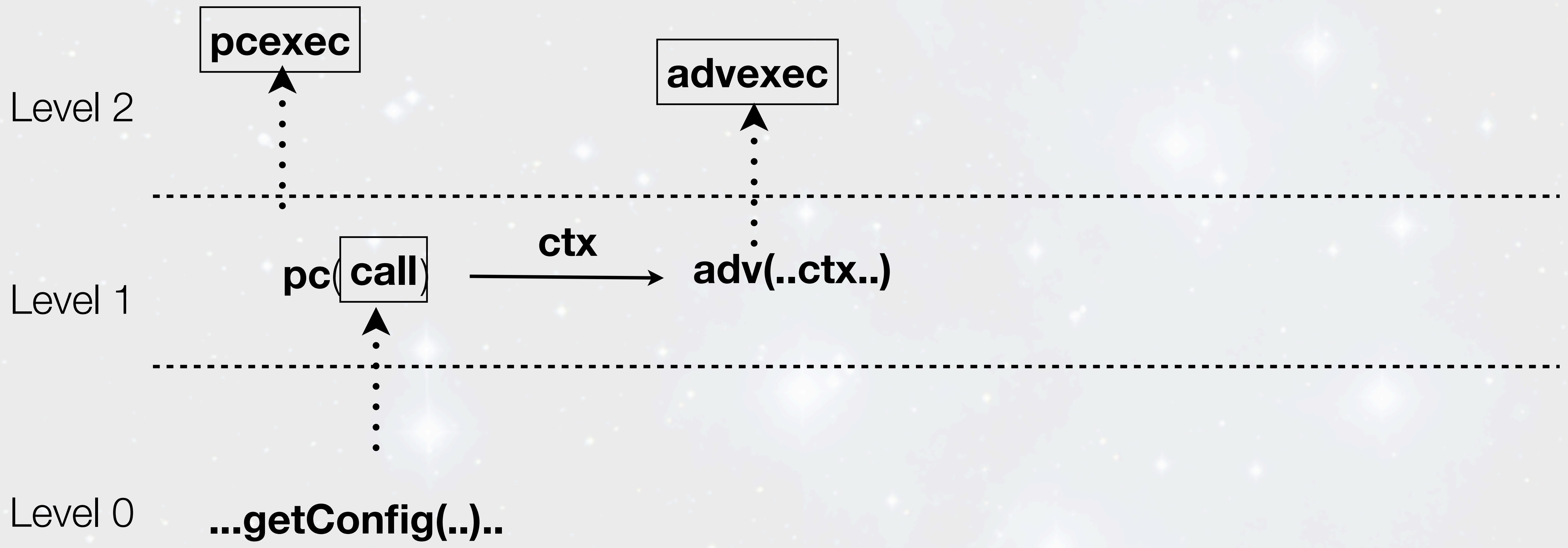

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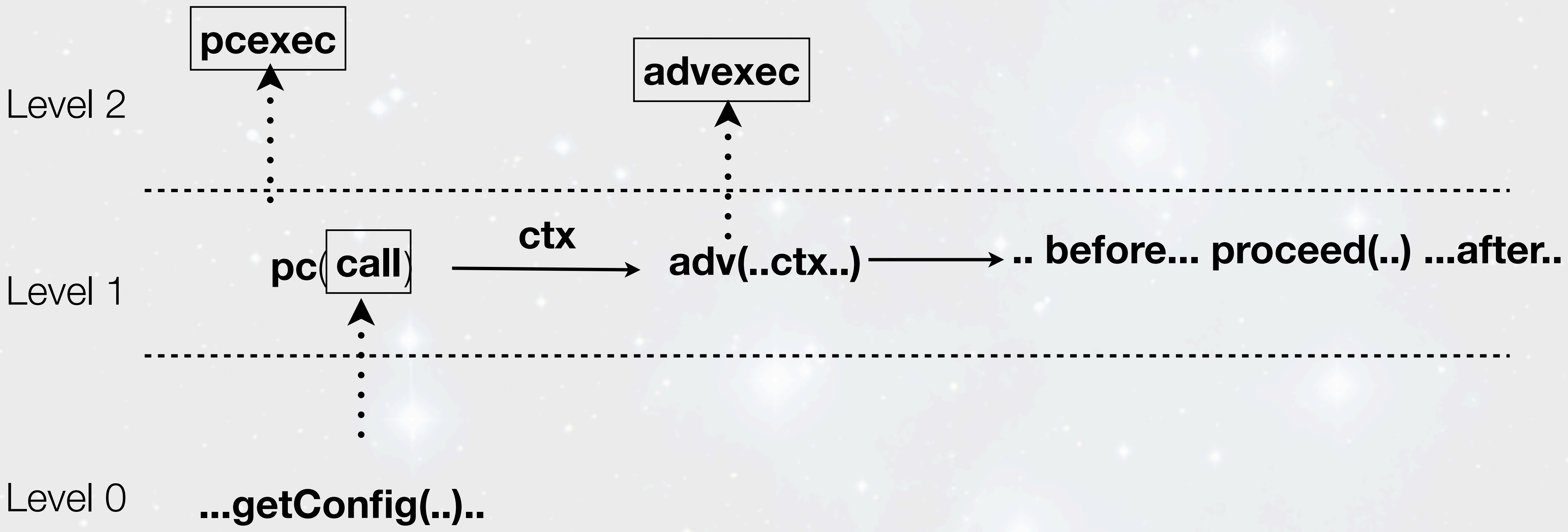

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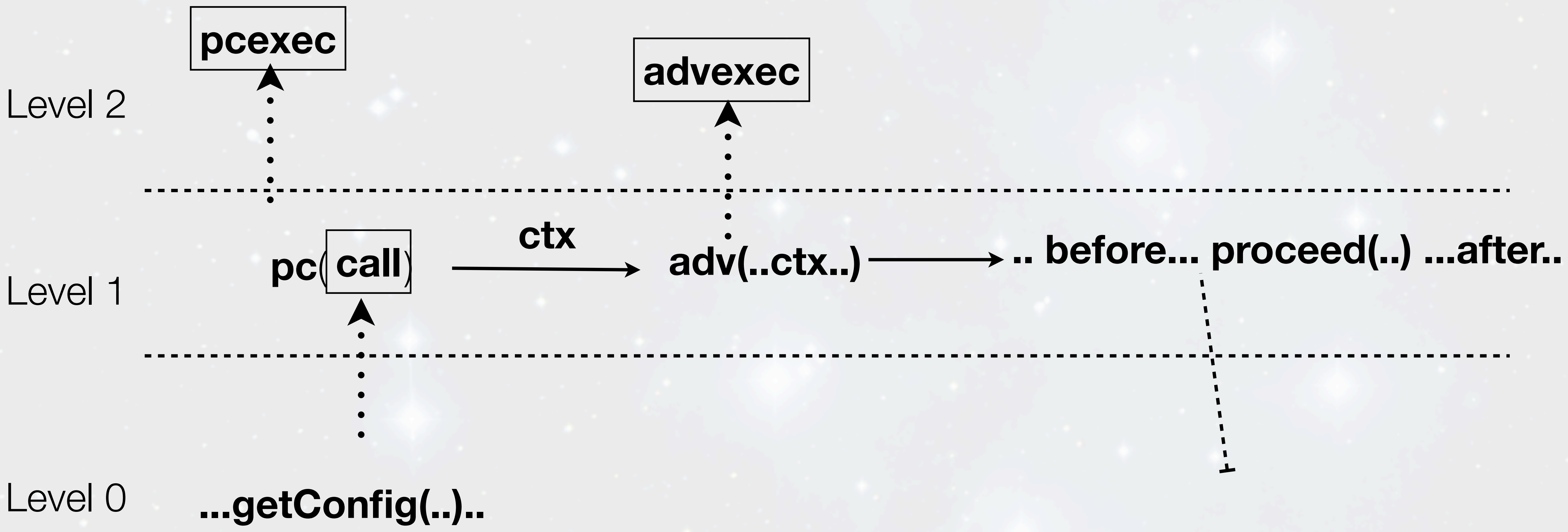

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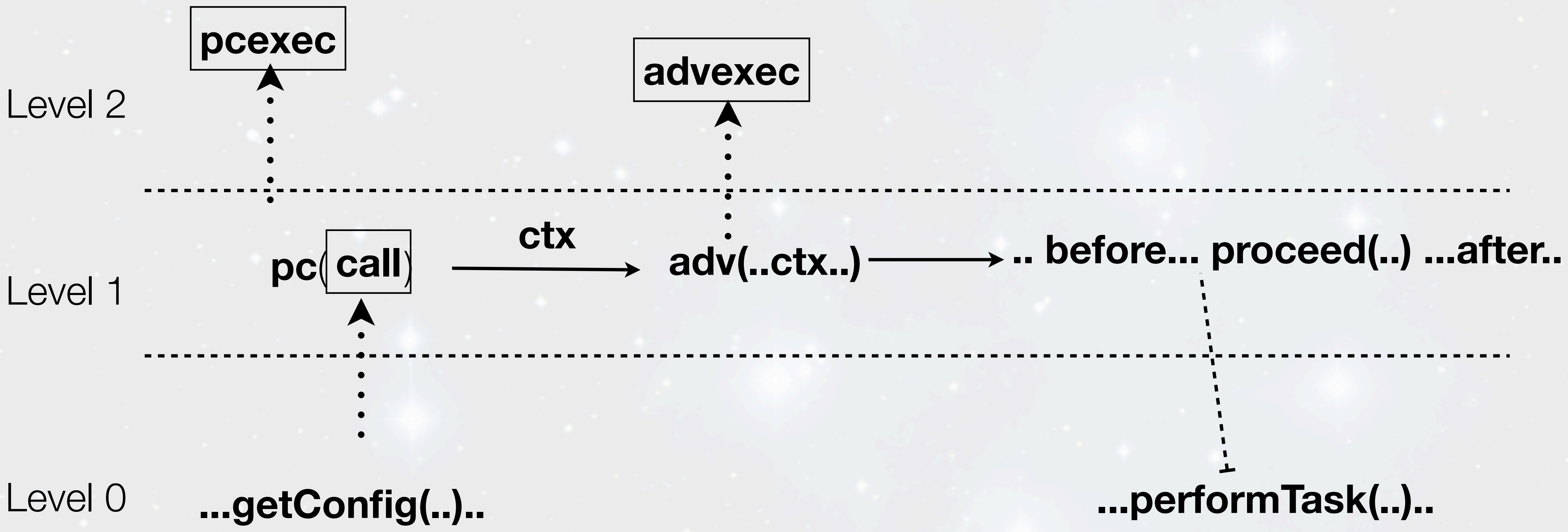

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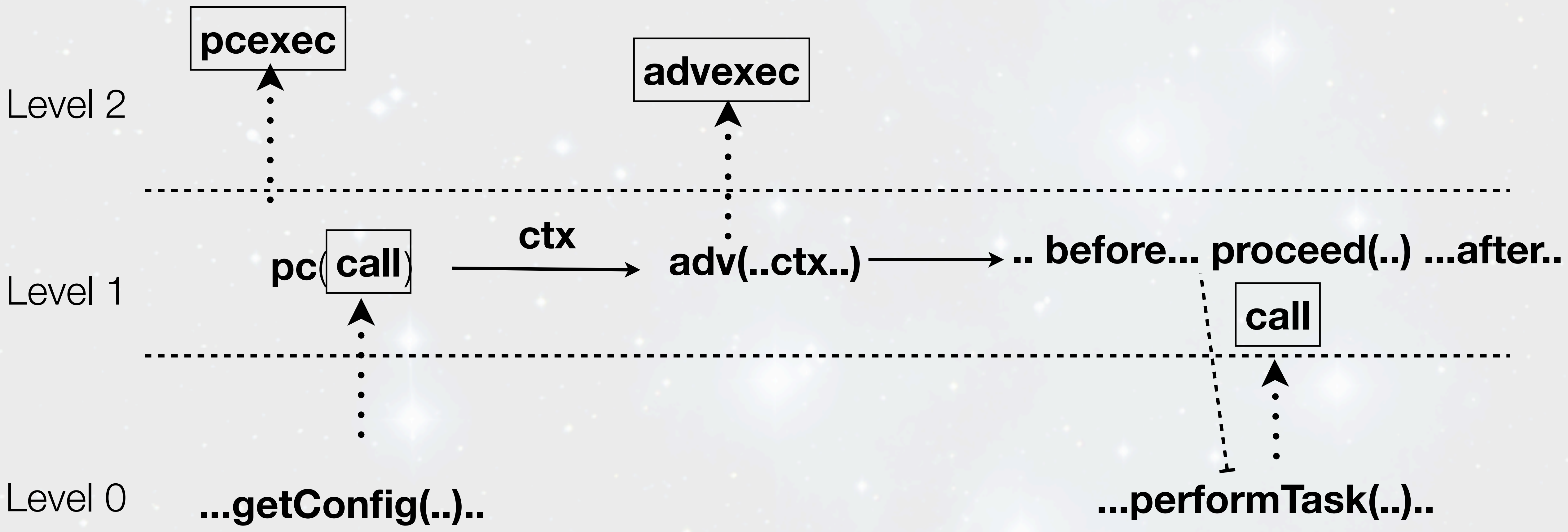

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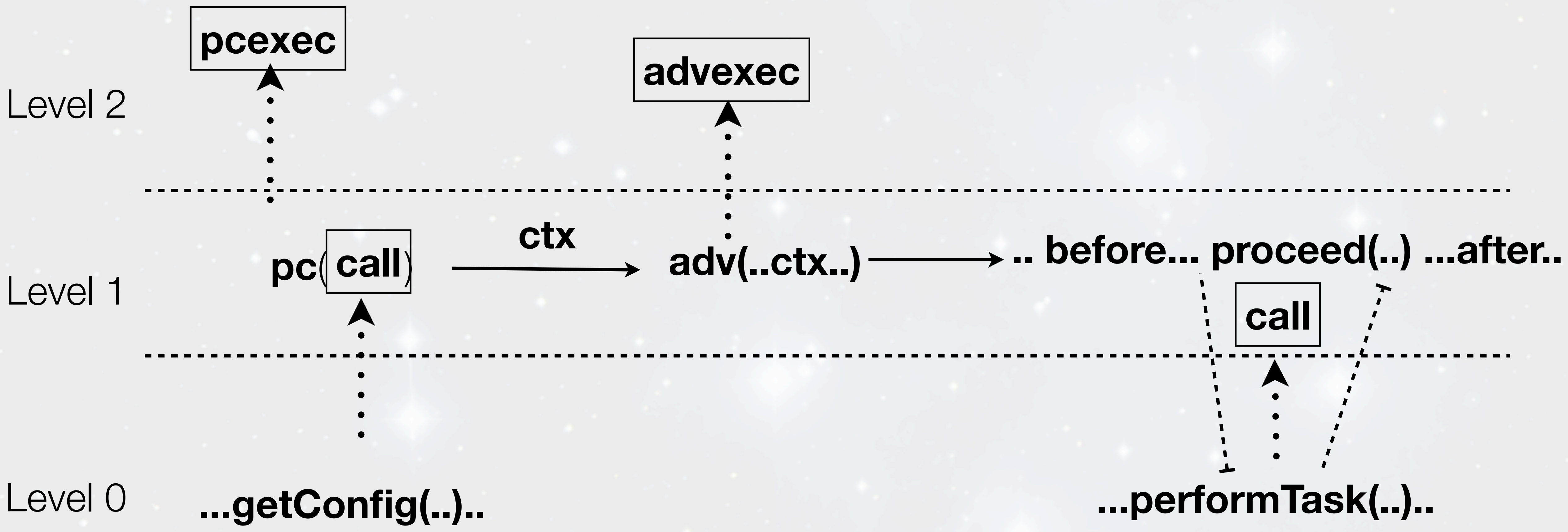

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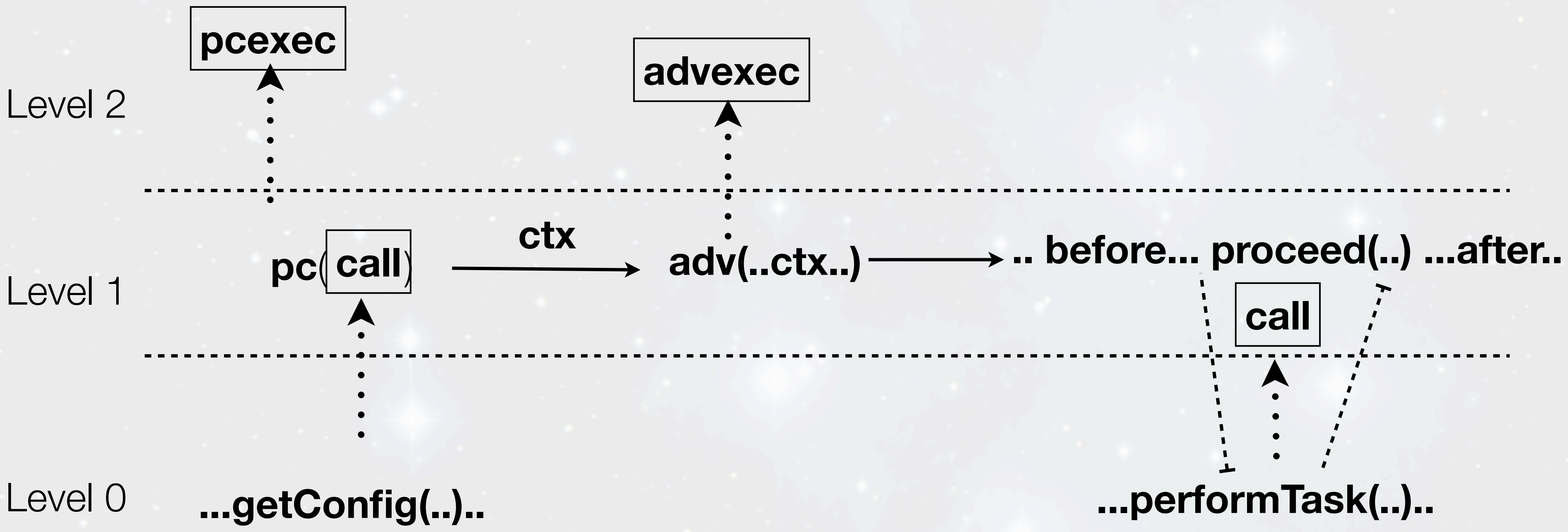
Tanter (AOSD '10)

We can have as many levels as needed



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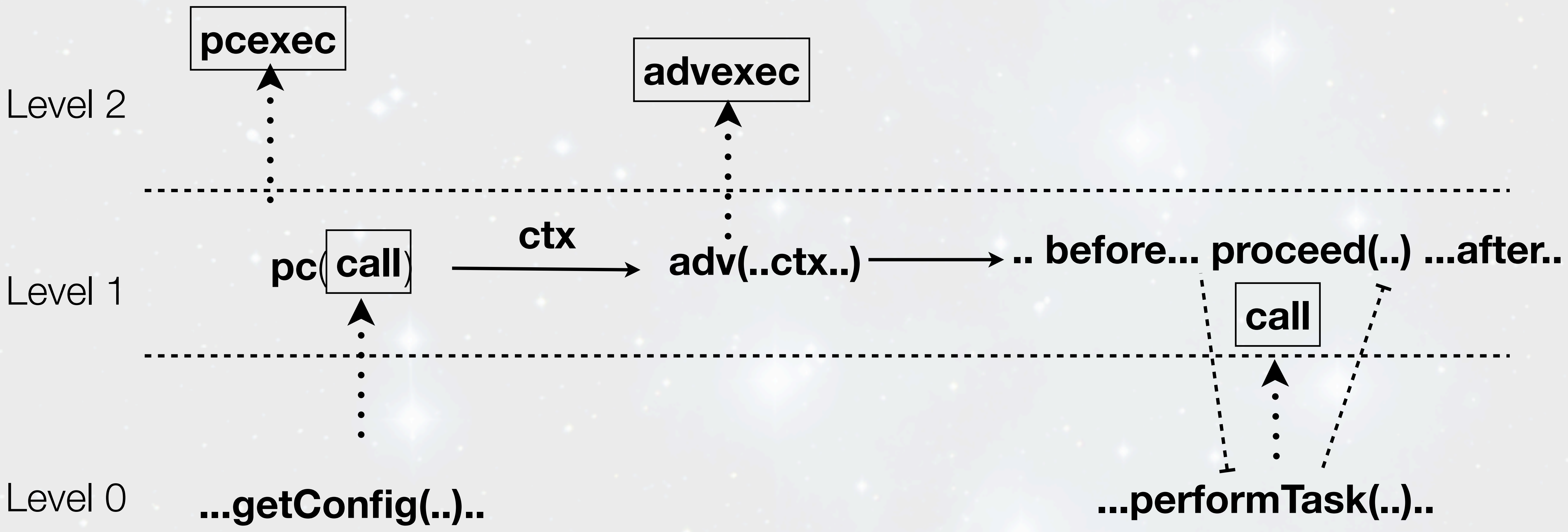
Tanter (AOSD '10)

We can have as many levels as needed
e.g. composition of dynamic analysis aspects (Tanter *et.al.*,GPCE '10)



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up and **down** operators to explicitly shift level

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a **level-capturing function** always evaluate at their **definition-time level**

New Exceptions Semantics

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In essence:

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bind exceptions and handlers
at the level they originated at

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flexibility using level-shifting operators

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Recall our first example

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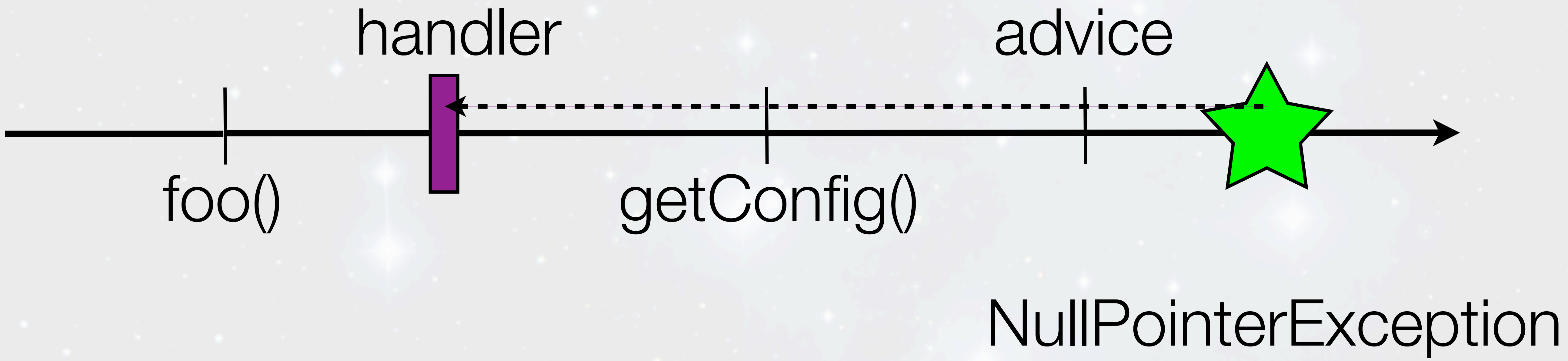

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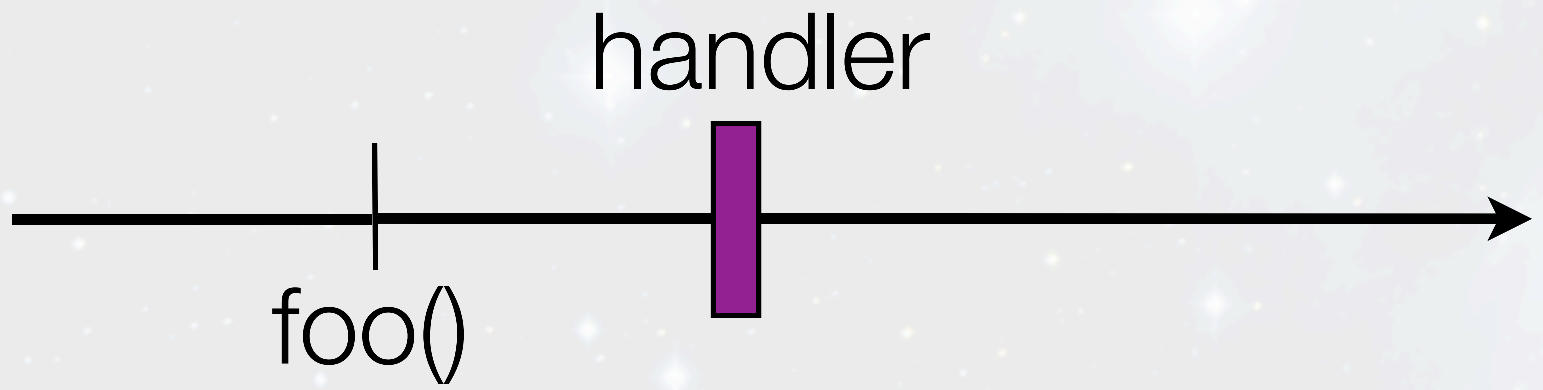

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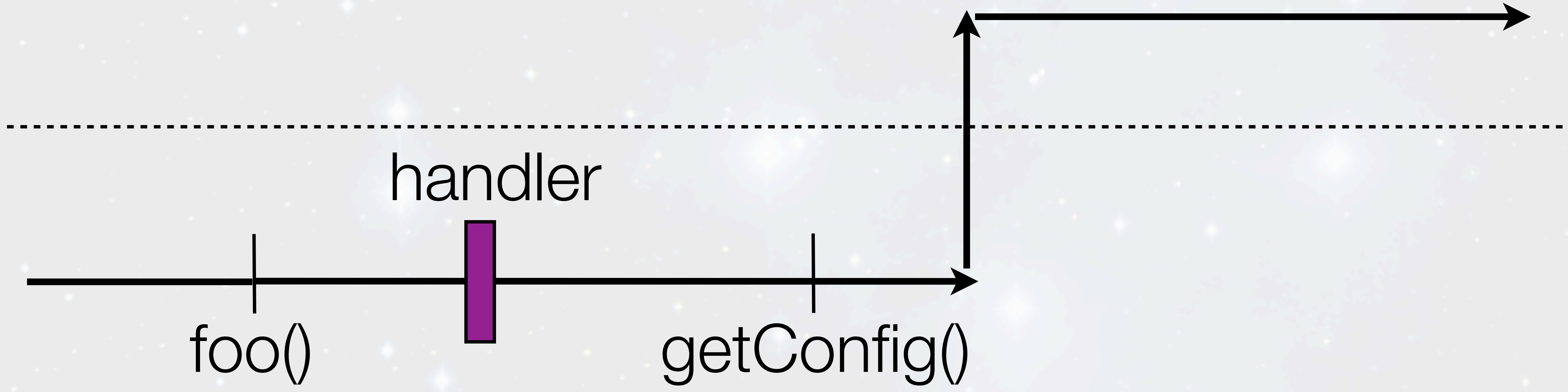

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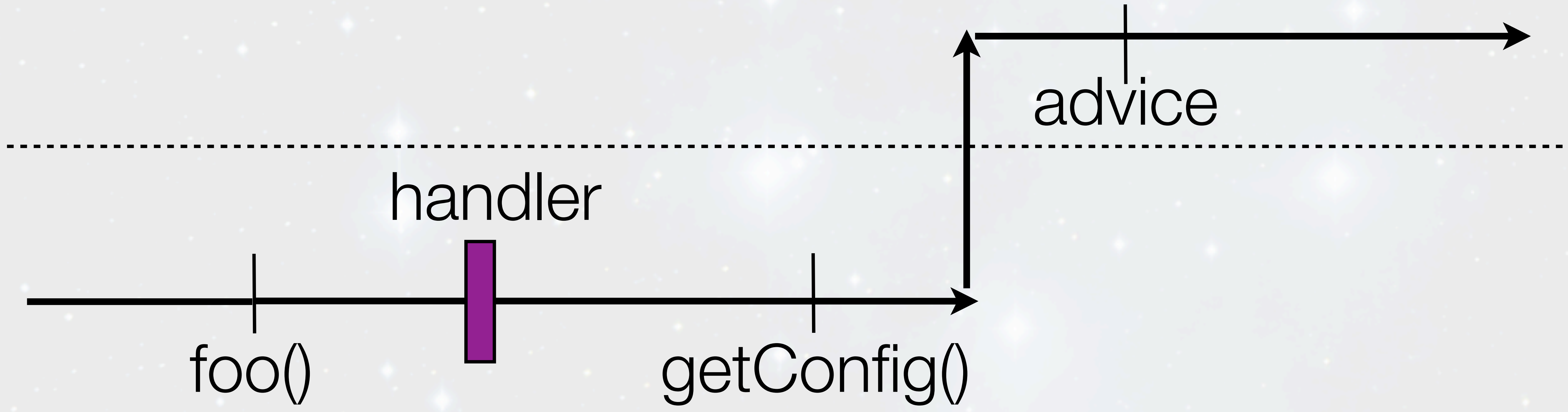

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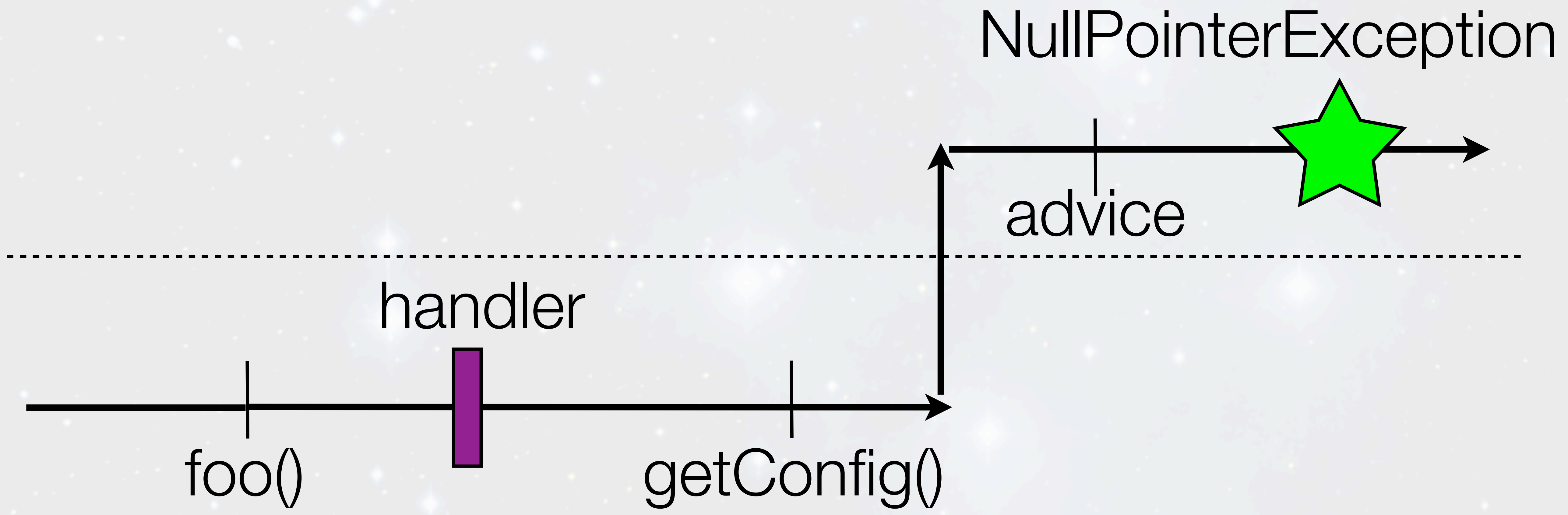

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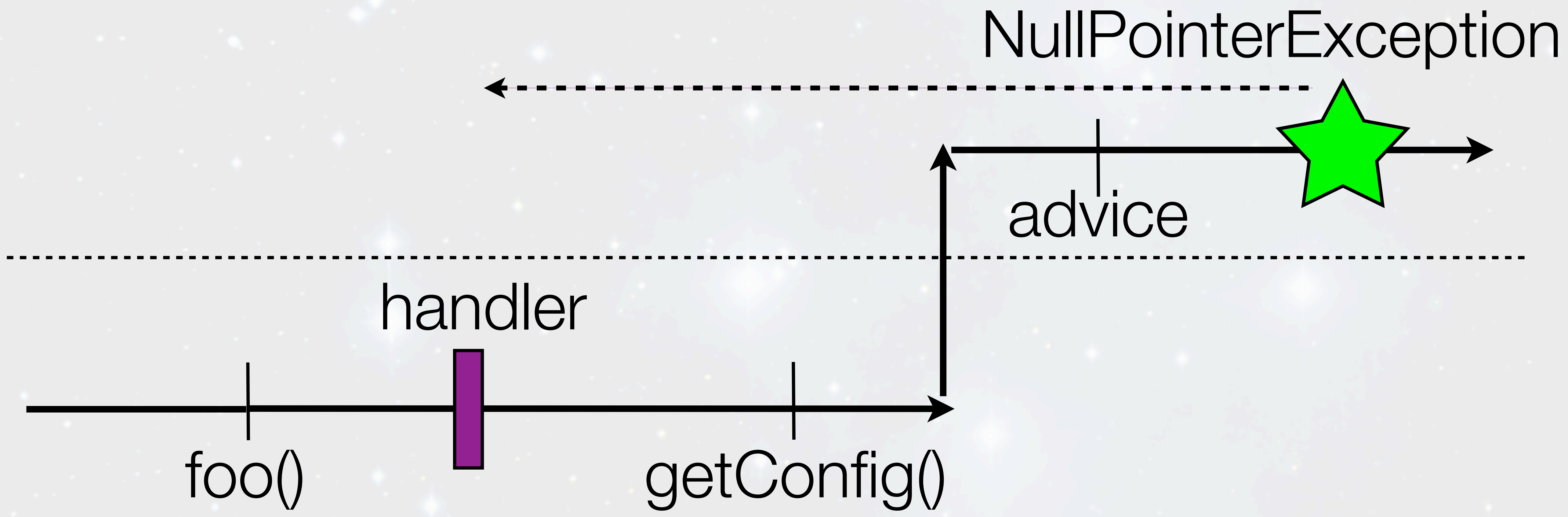

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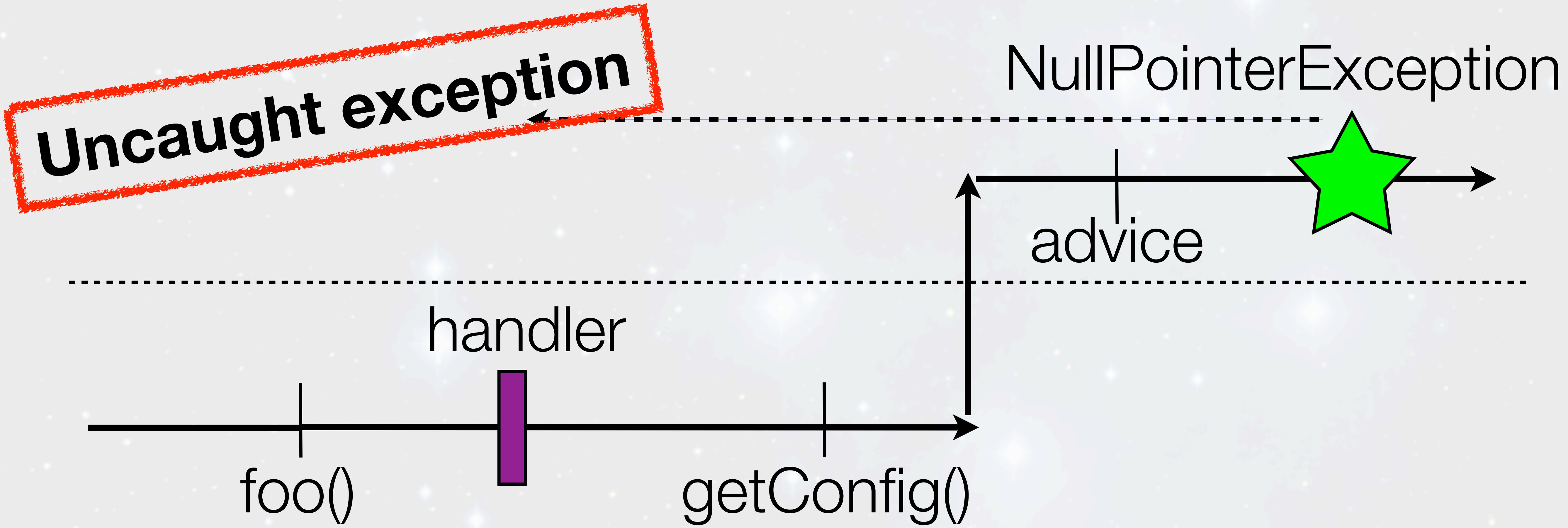

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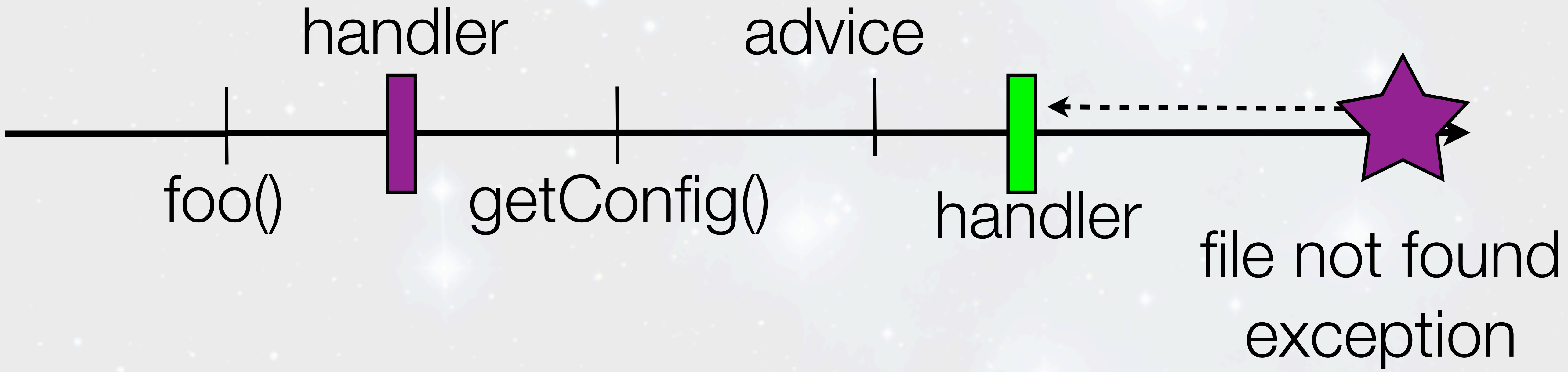

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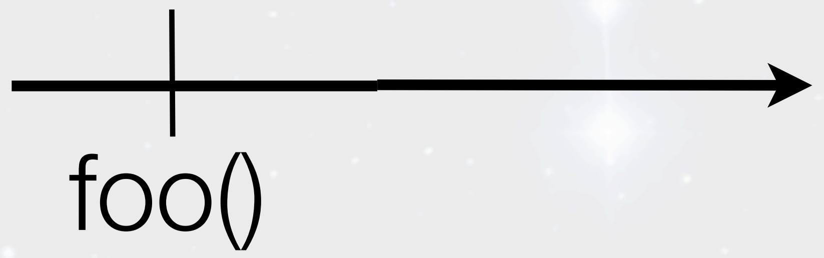

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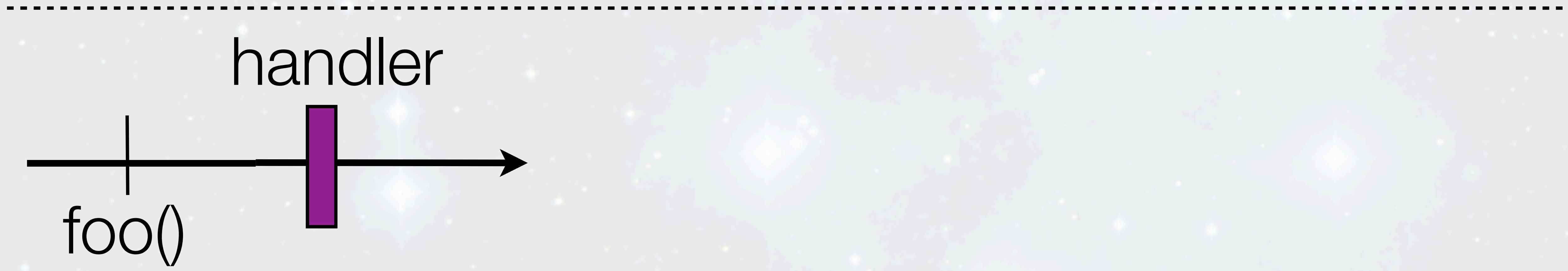

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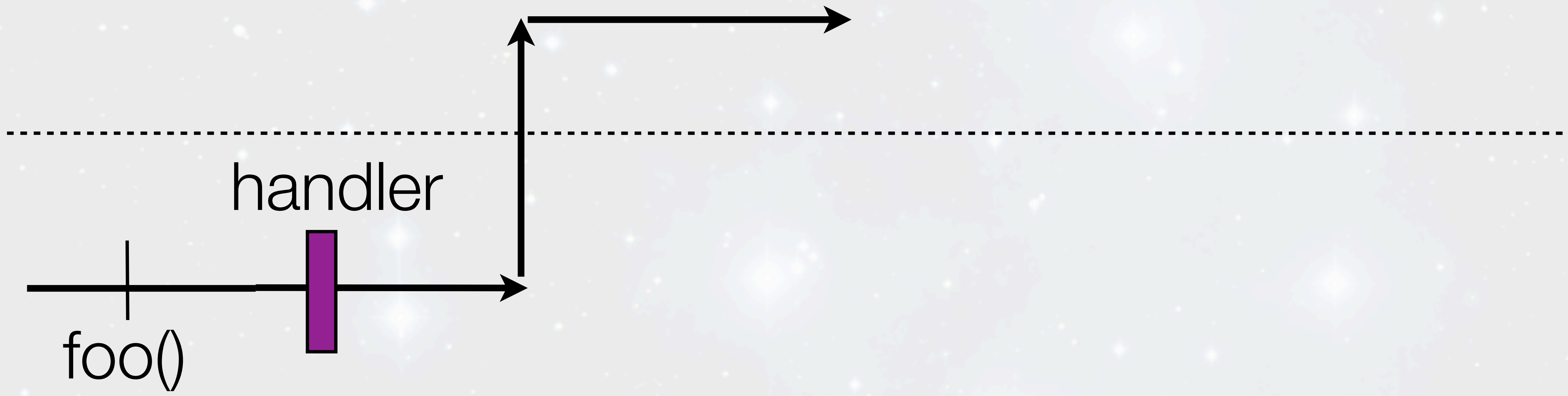

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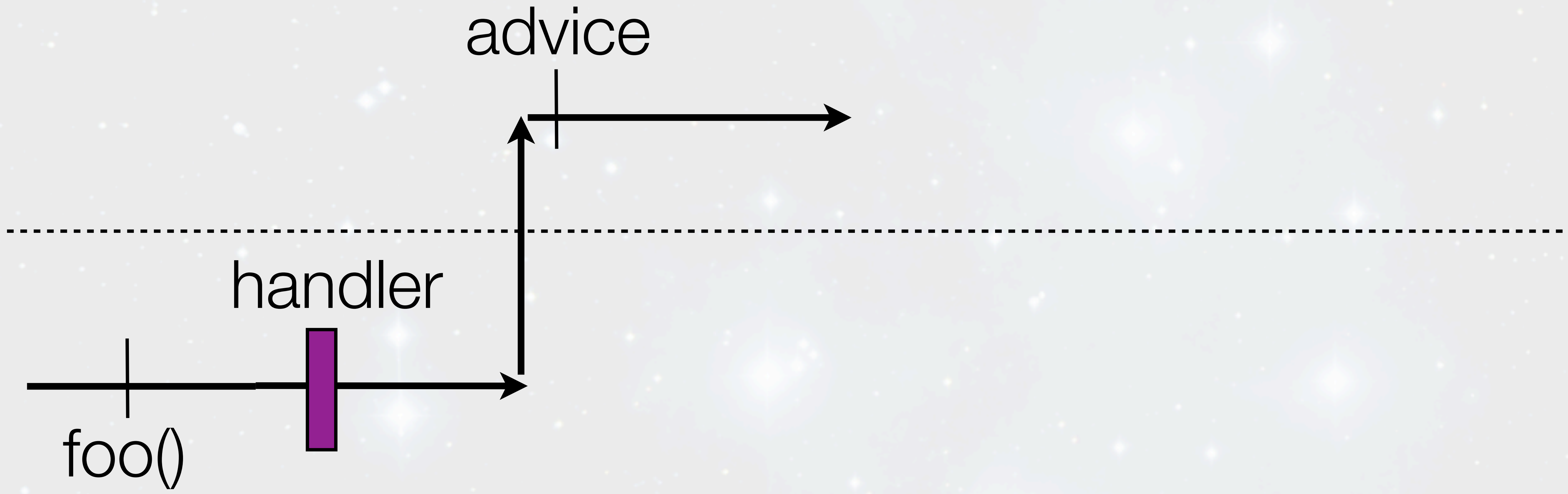

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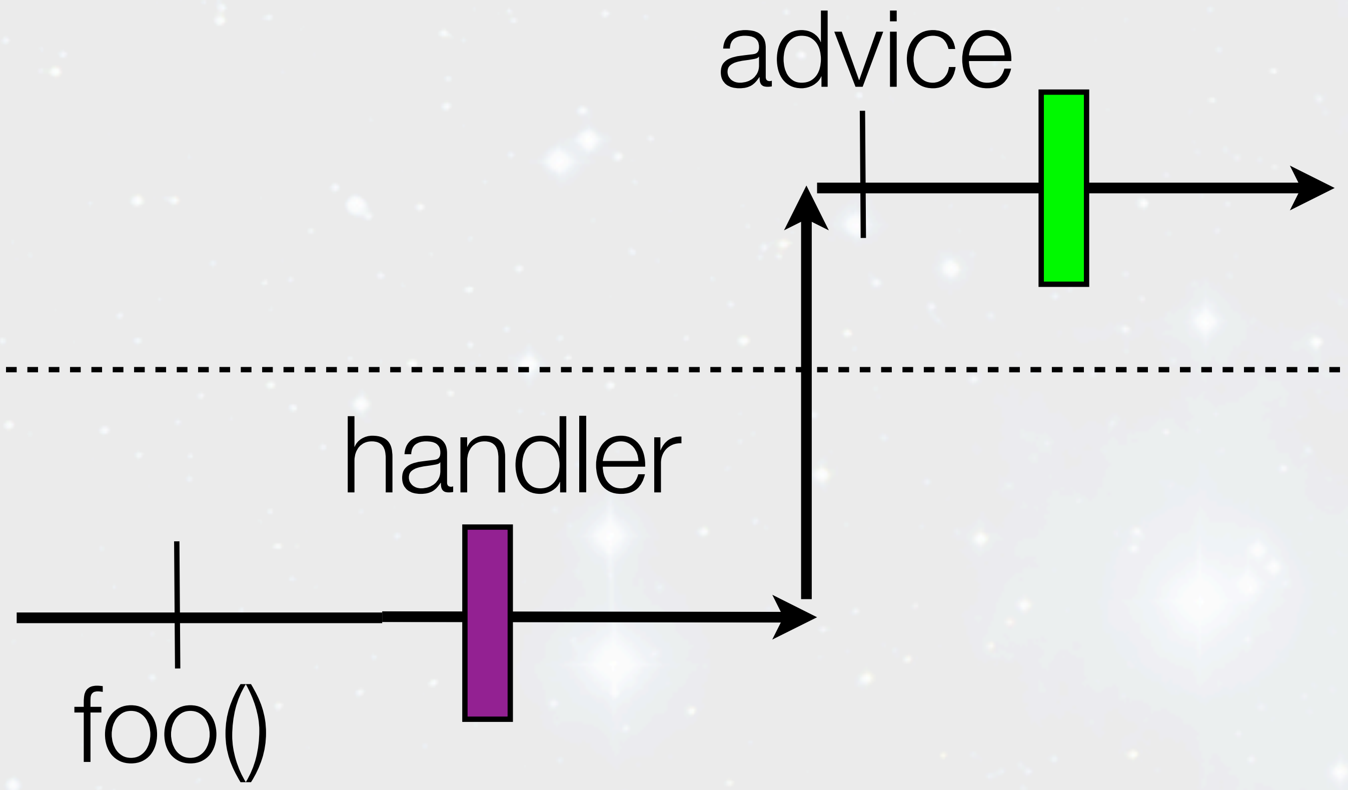

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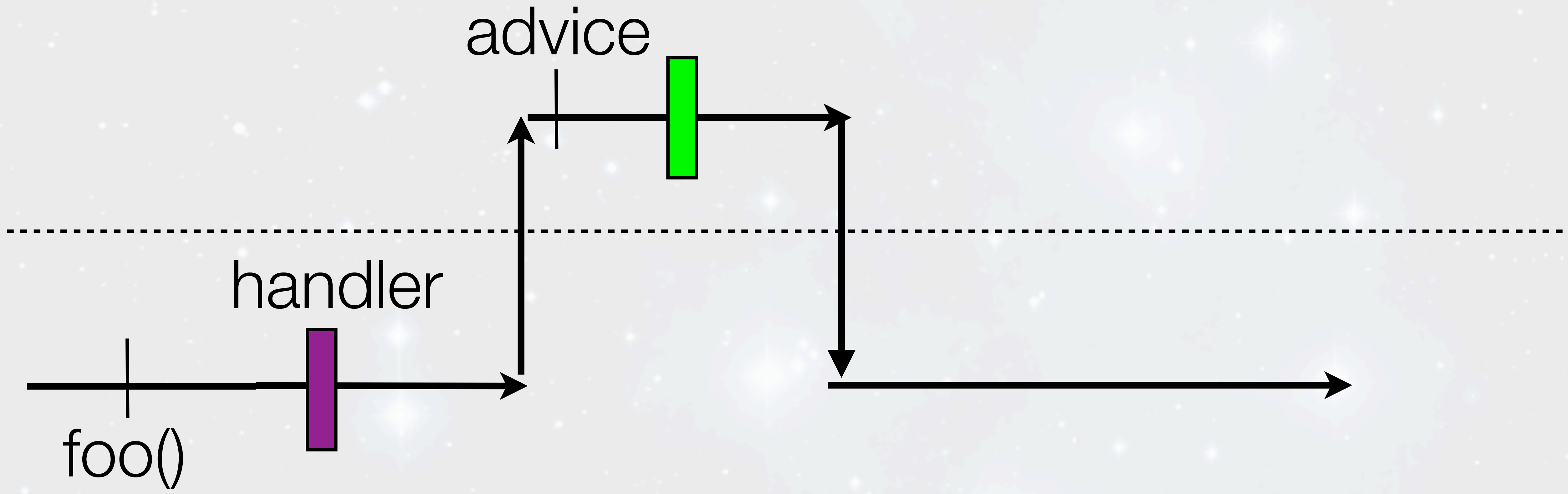

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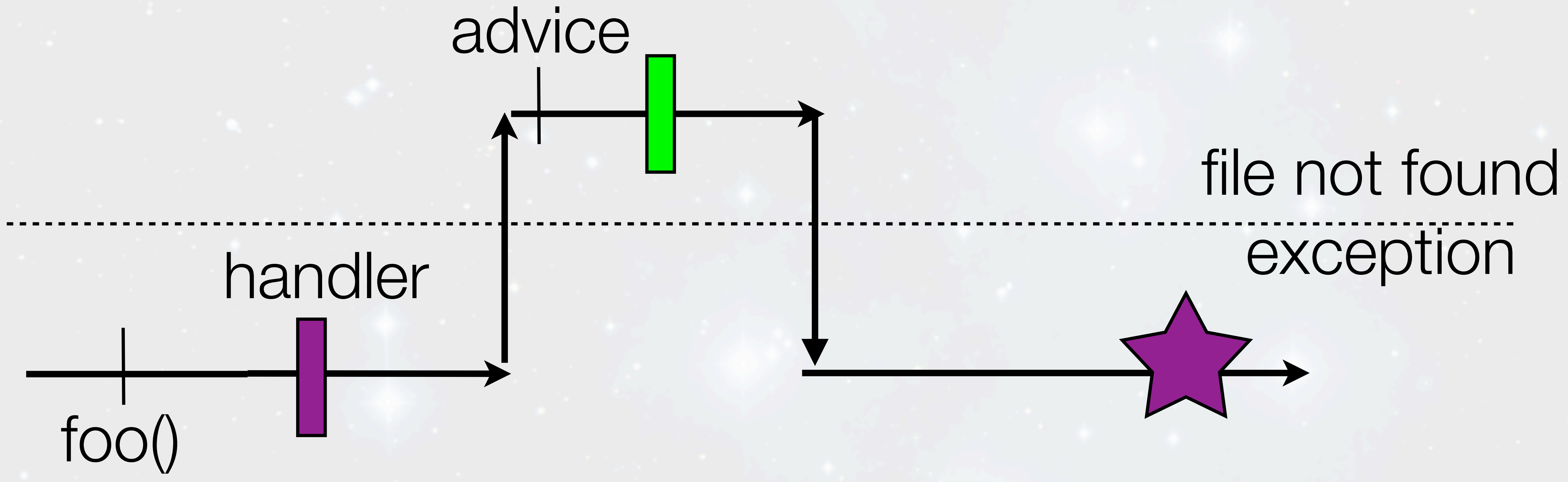

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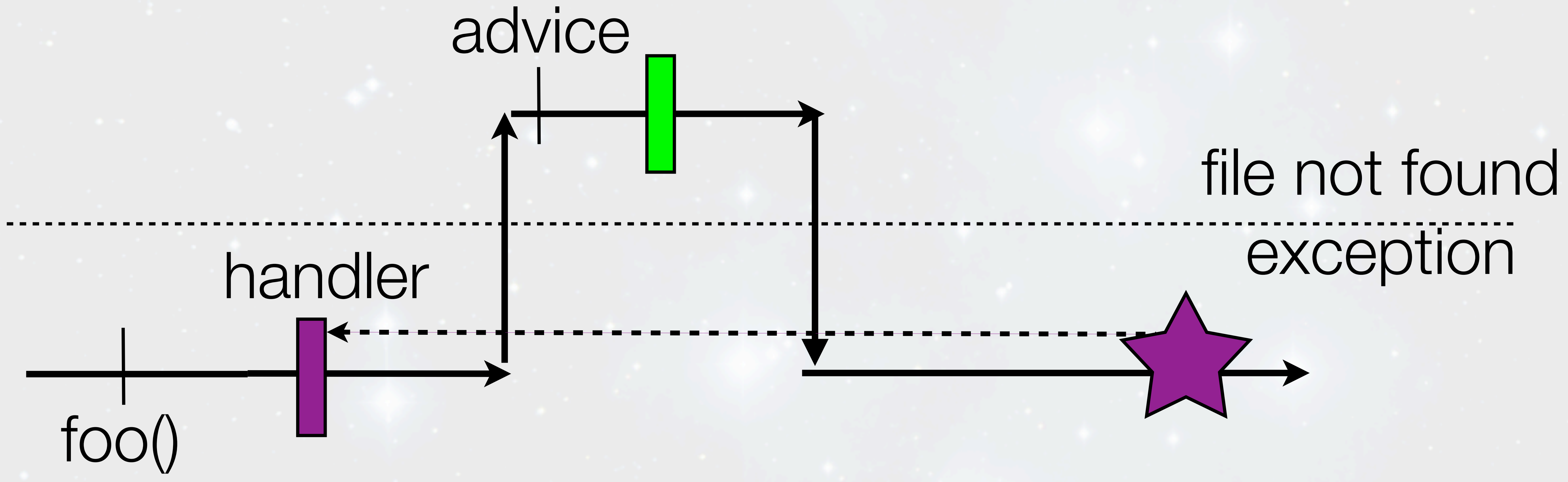

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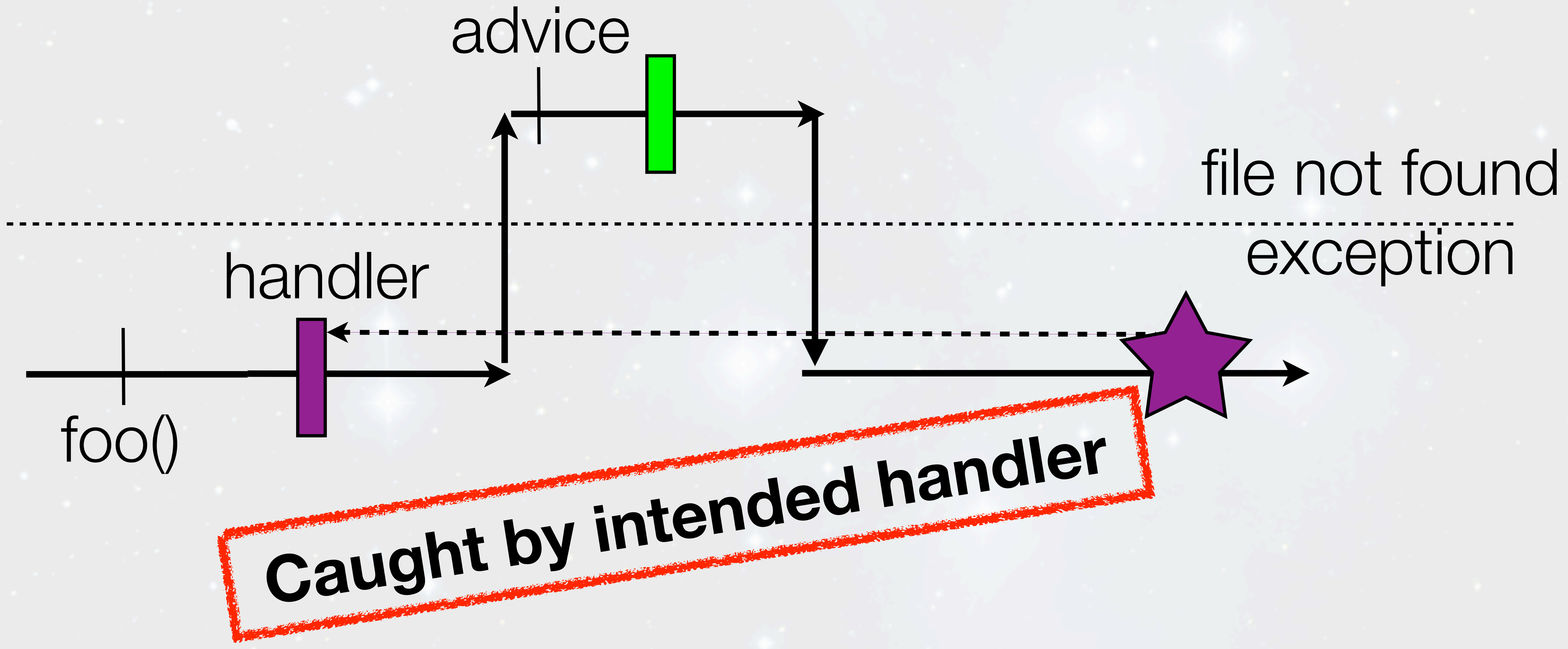
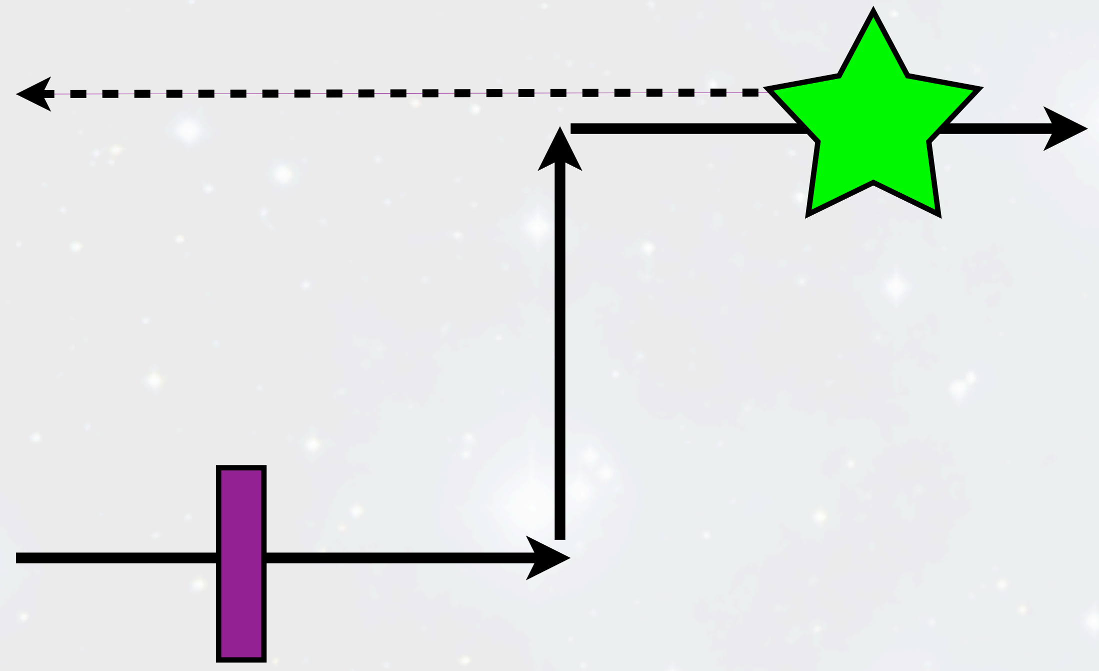


Interaction Patterns



No interference of aspect exception with base handler

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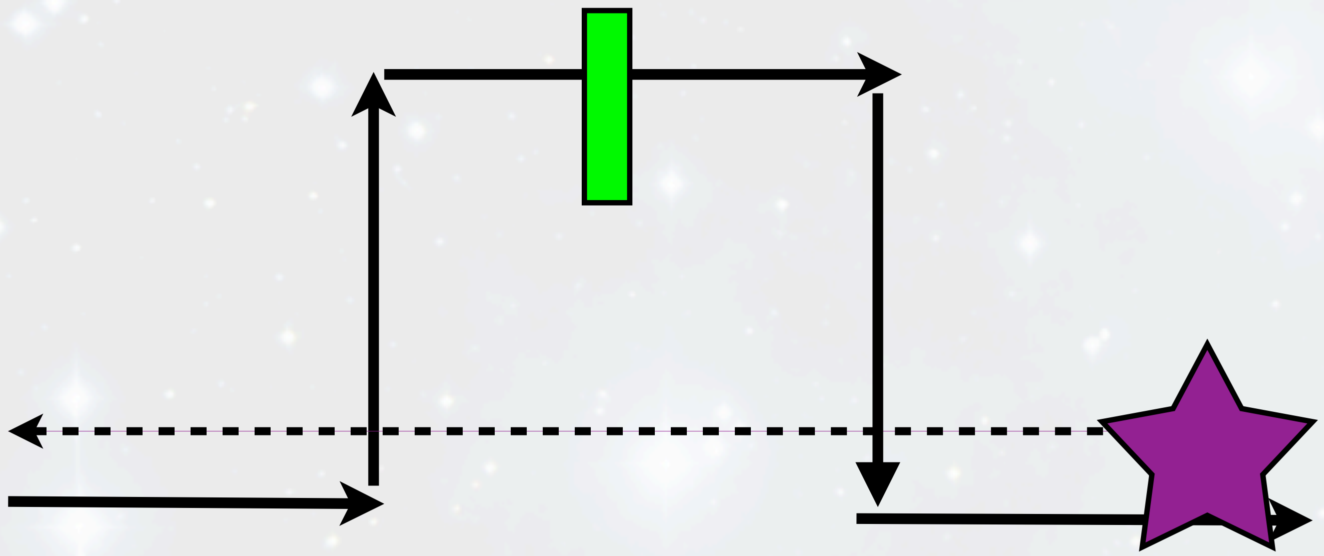

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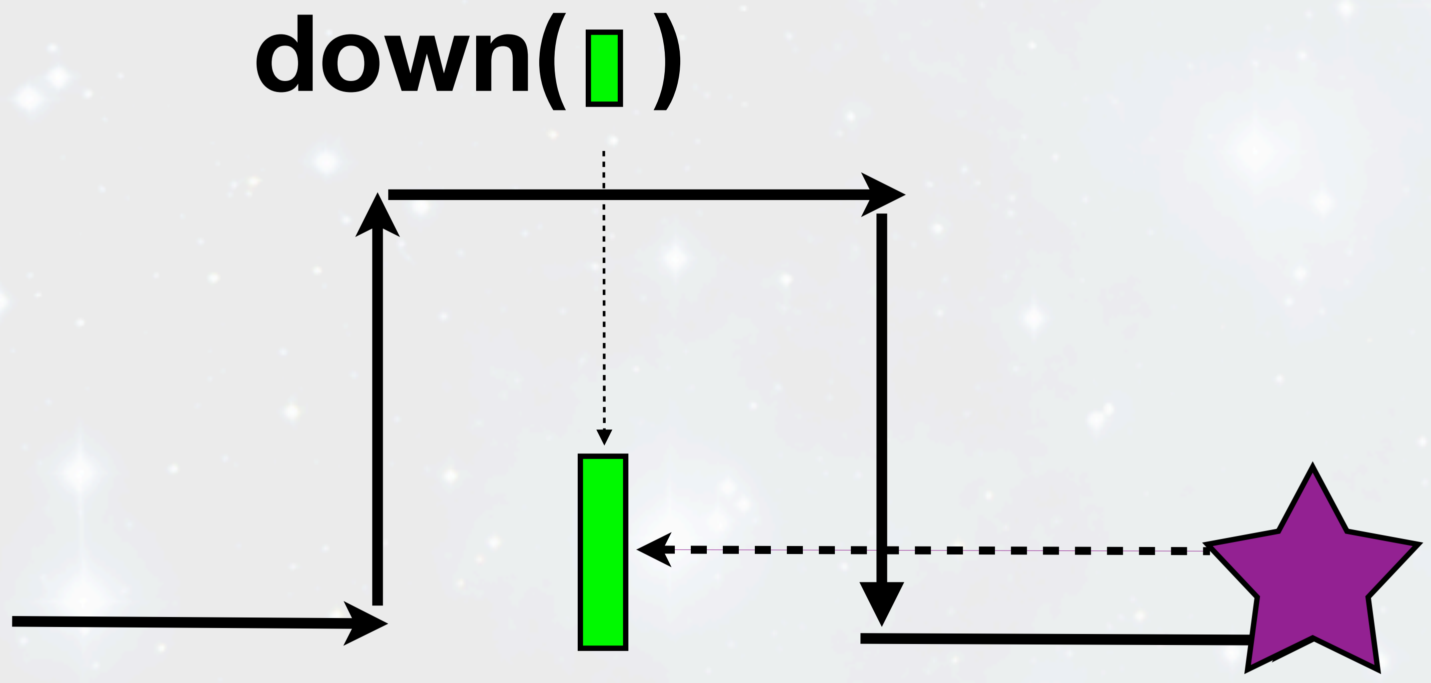

down operator to catch base exception

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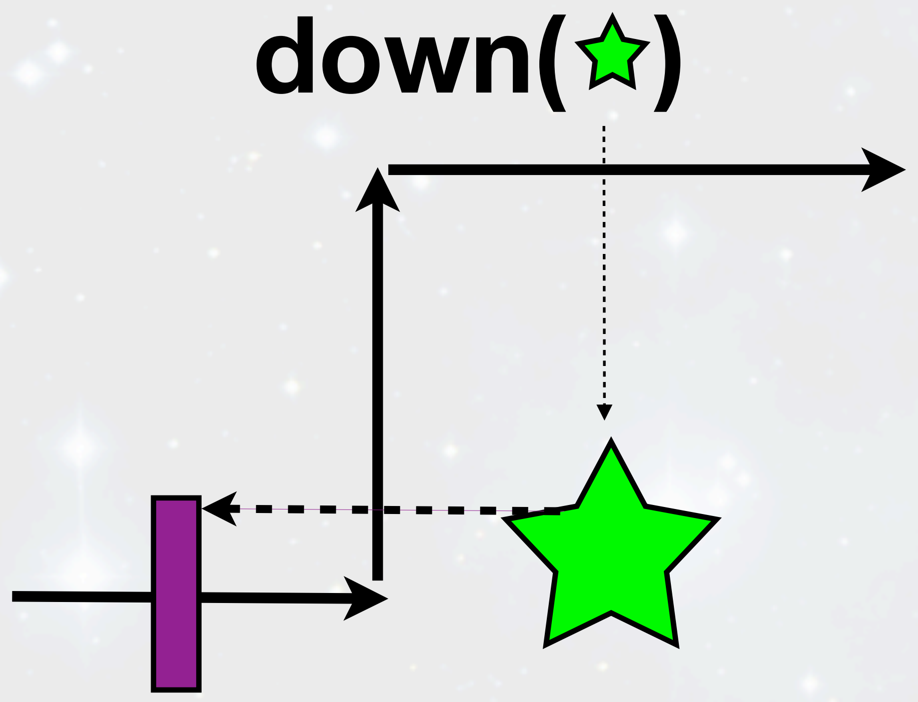

down operator to throw aspect exception at base level

Contributions

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Exception Conflation Problem

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Core calculus of execution levels + exceptions (see paper!)

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Implementation using PLT Redex

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Dealing with *finally* blocks