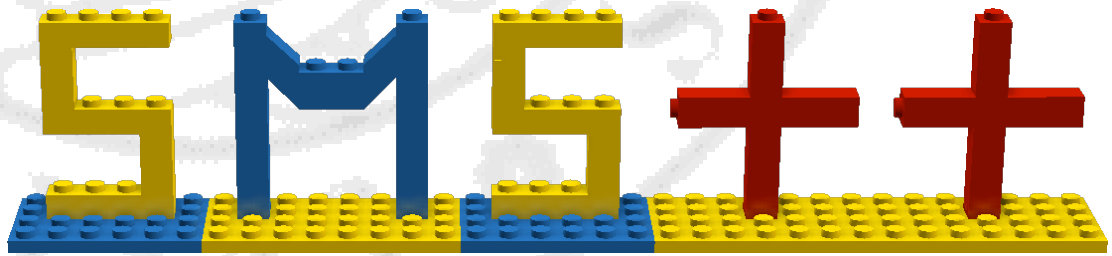
SMS++: a Structured Modelling System with Applications to Everything

Antonio Frangioni[1]

[1]Dipartimento di Informatica, Università di Pisa

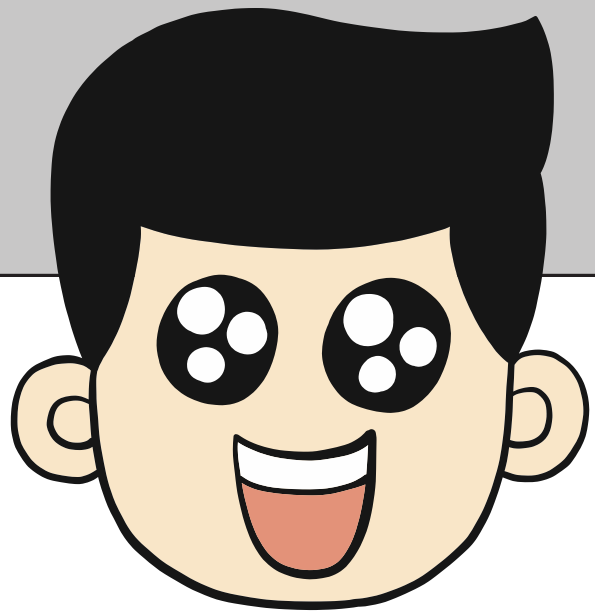
23rd Combinatorial Optimization Workshop
Aussois (France), January 8, 2019



Your favourite structure HERE

. . . you spot your favourite structure!

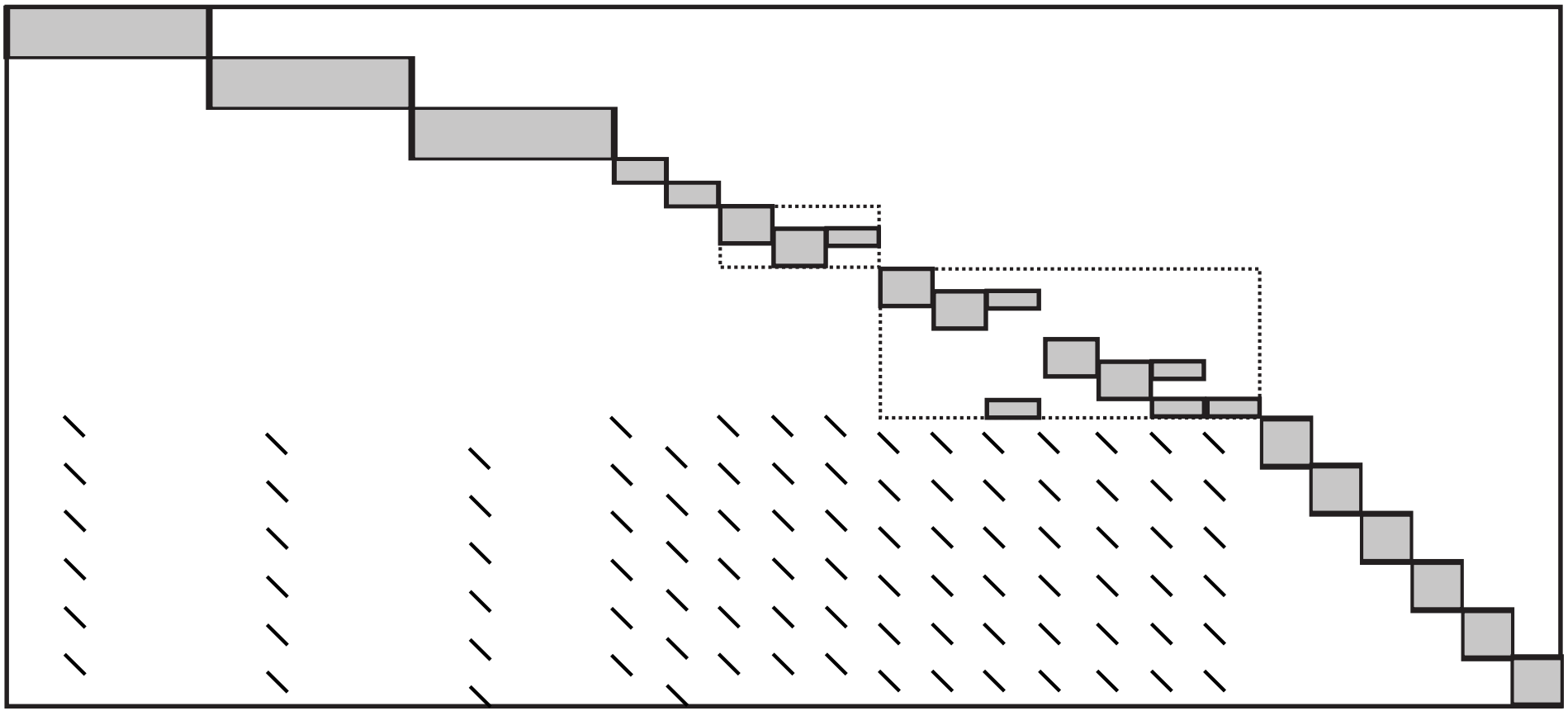
Your favourite structure HERE



. . . you spot your favourite structure!

And you are very happy

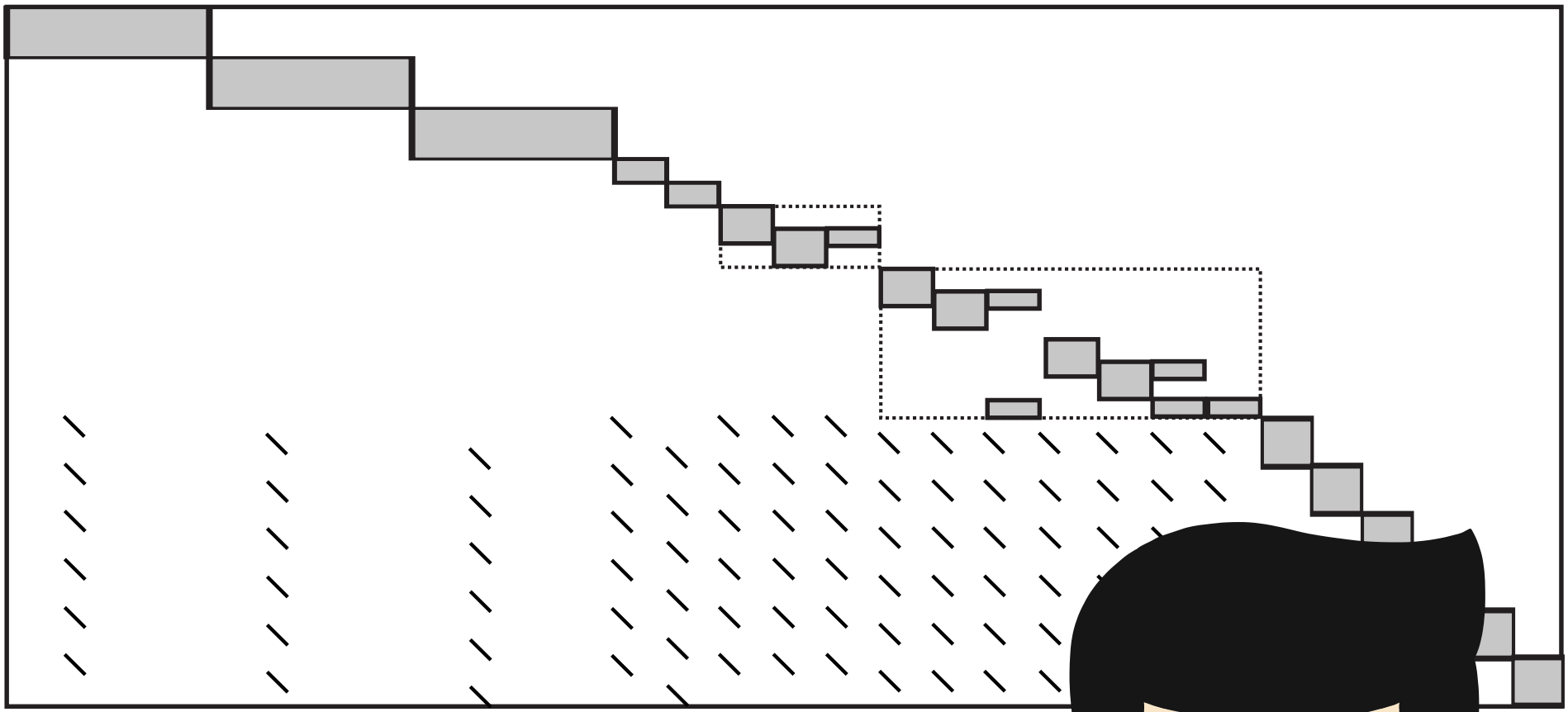
Soon thereafter

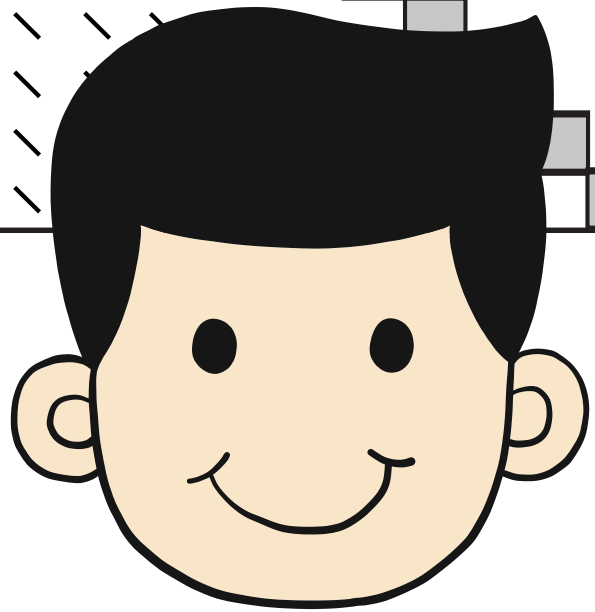


. . . you discover it's there many times,

with linking constraints.

Soon thereafter



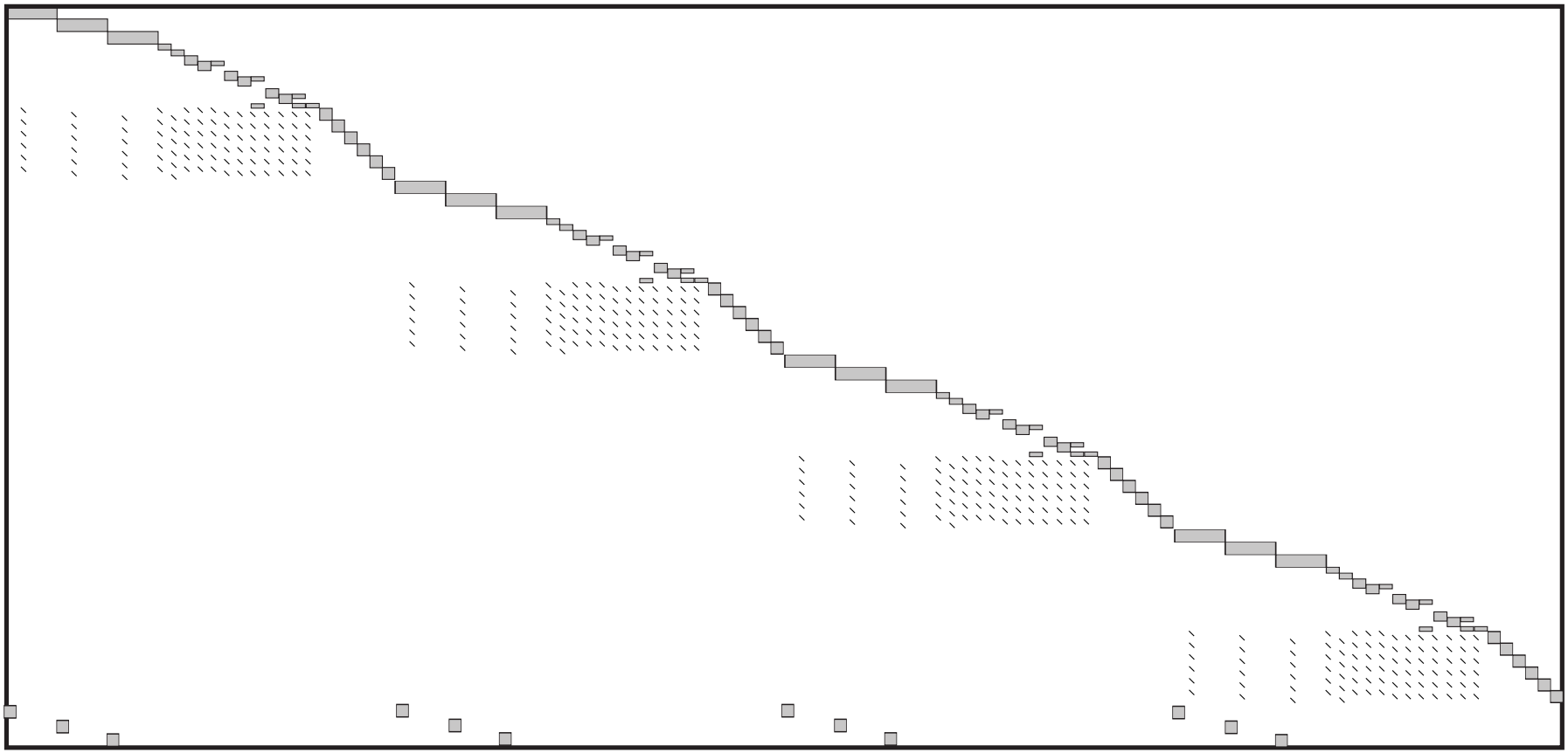


. . . you discover it's there many times,

with linking constraints.

But you still are quite happy

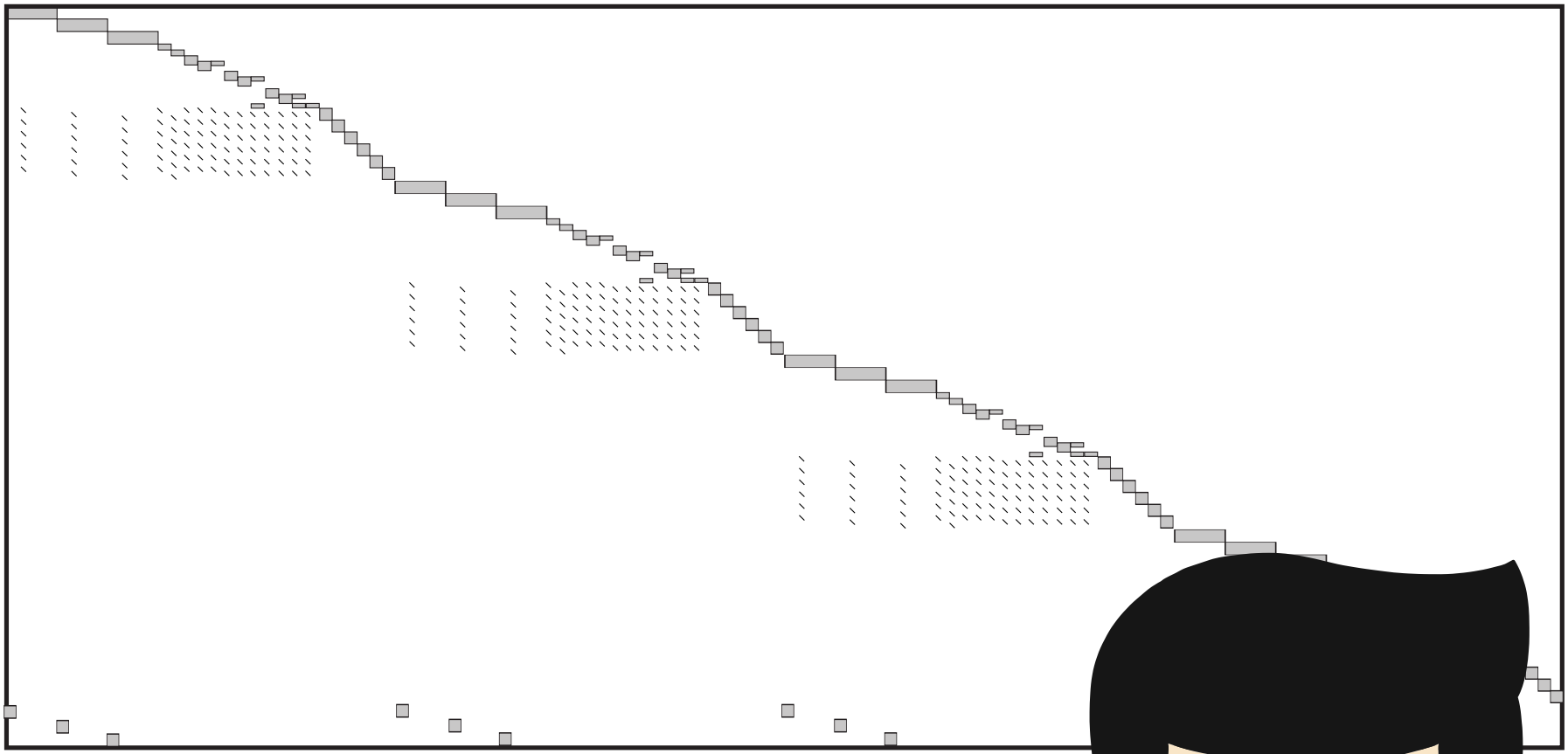
Then they tell you

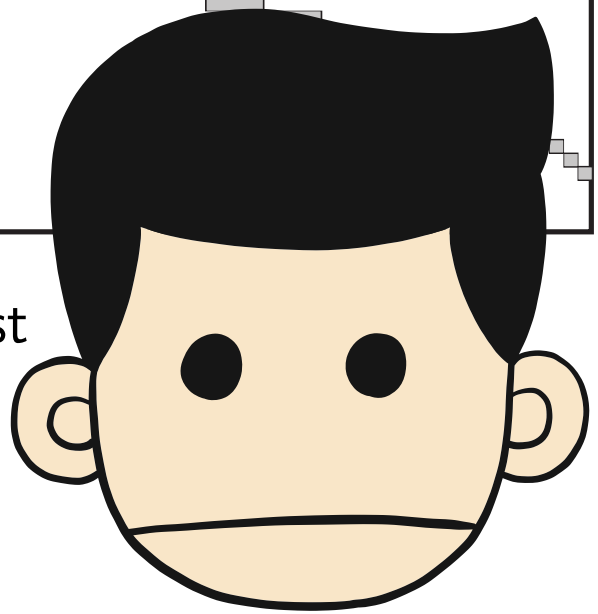


. . . that was the operational problem but you must

solve the tactical one $\equiv$ that many time over

Then they tell you



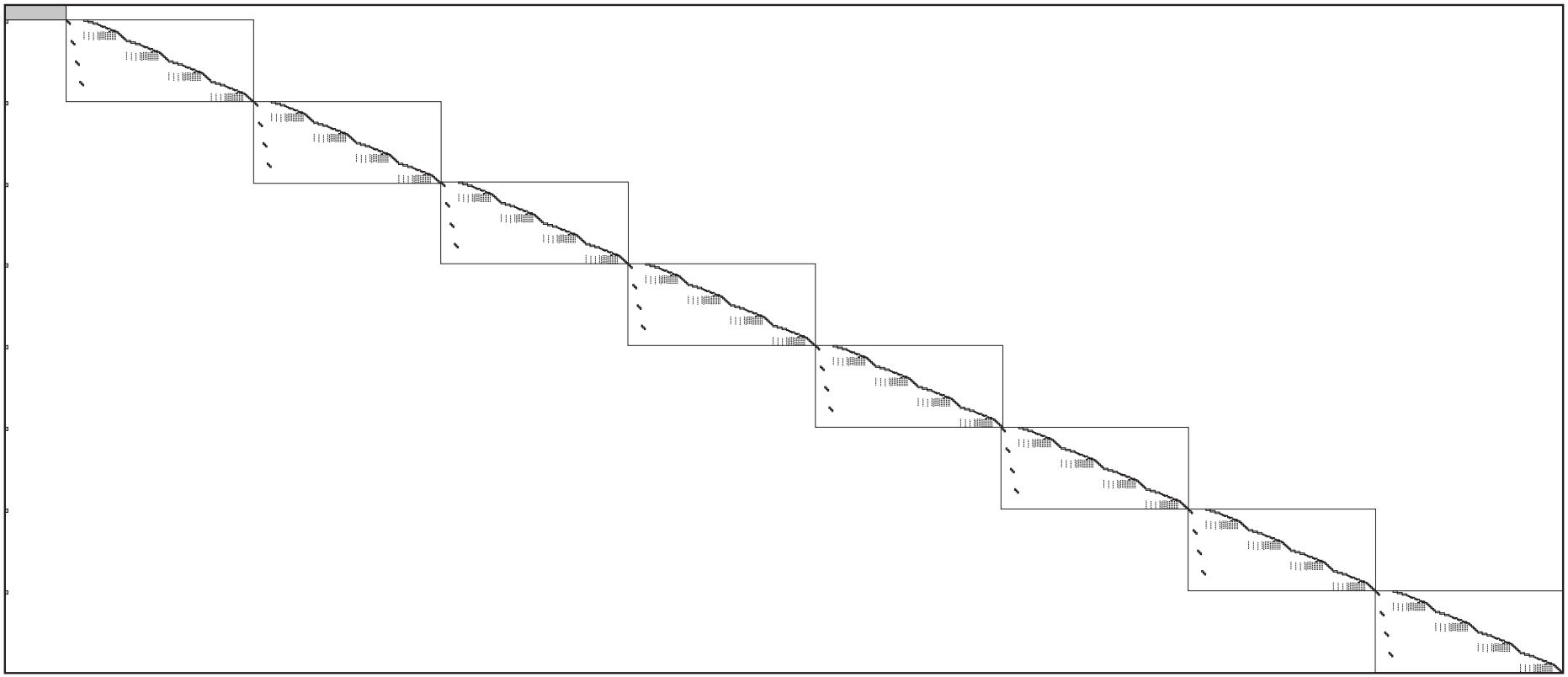


. . . that was the operational problem but you must

solve the tactical one $\equiv$ that many time over

you are not so sure you are still happy.

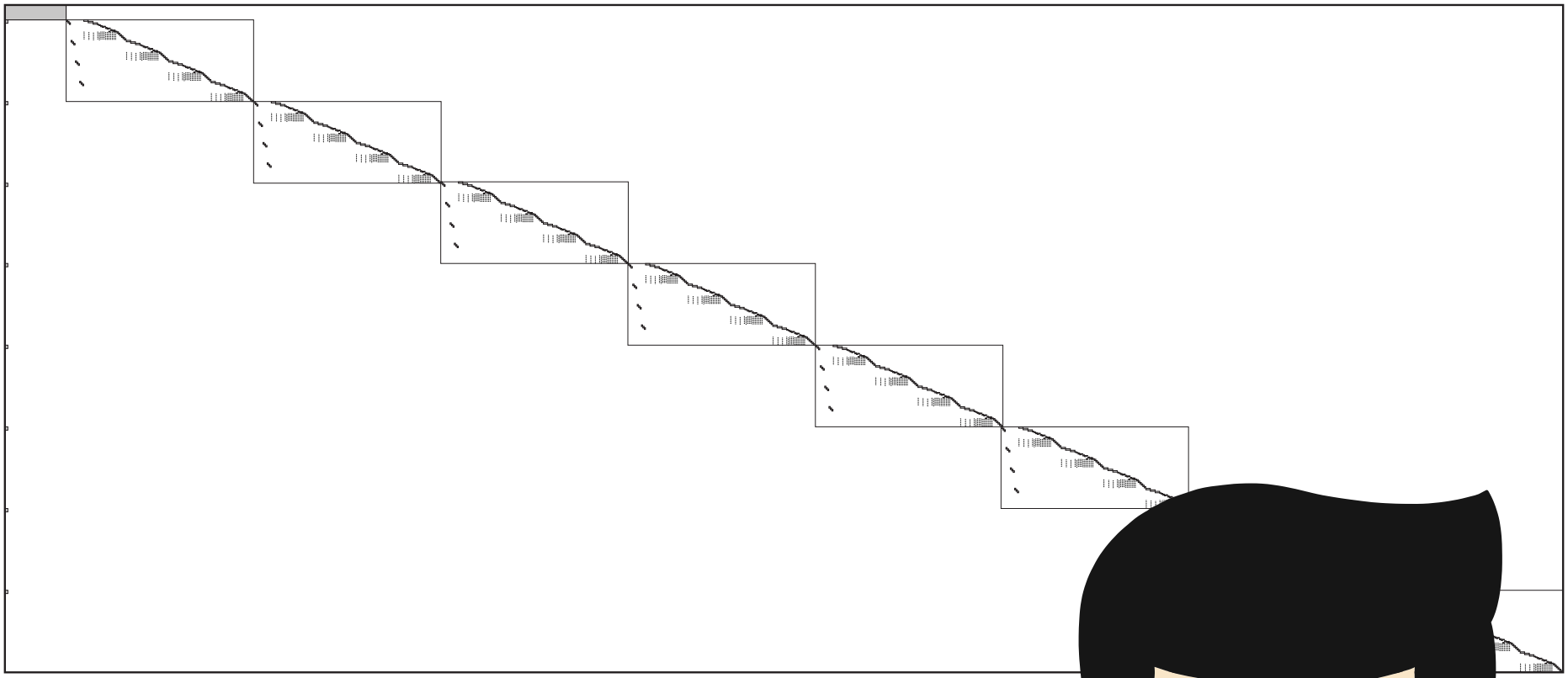
And then it turns out

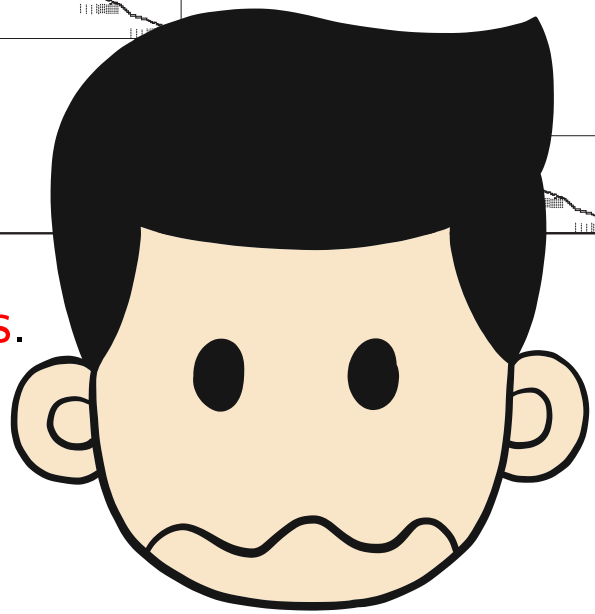


. . . There's uncertainty and you must do scenarios.

You might still get to Benders'/Lagrange, but

And then it turns out



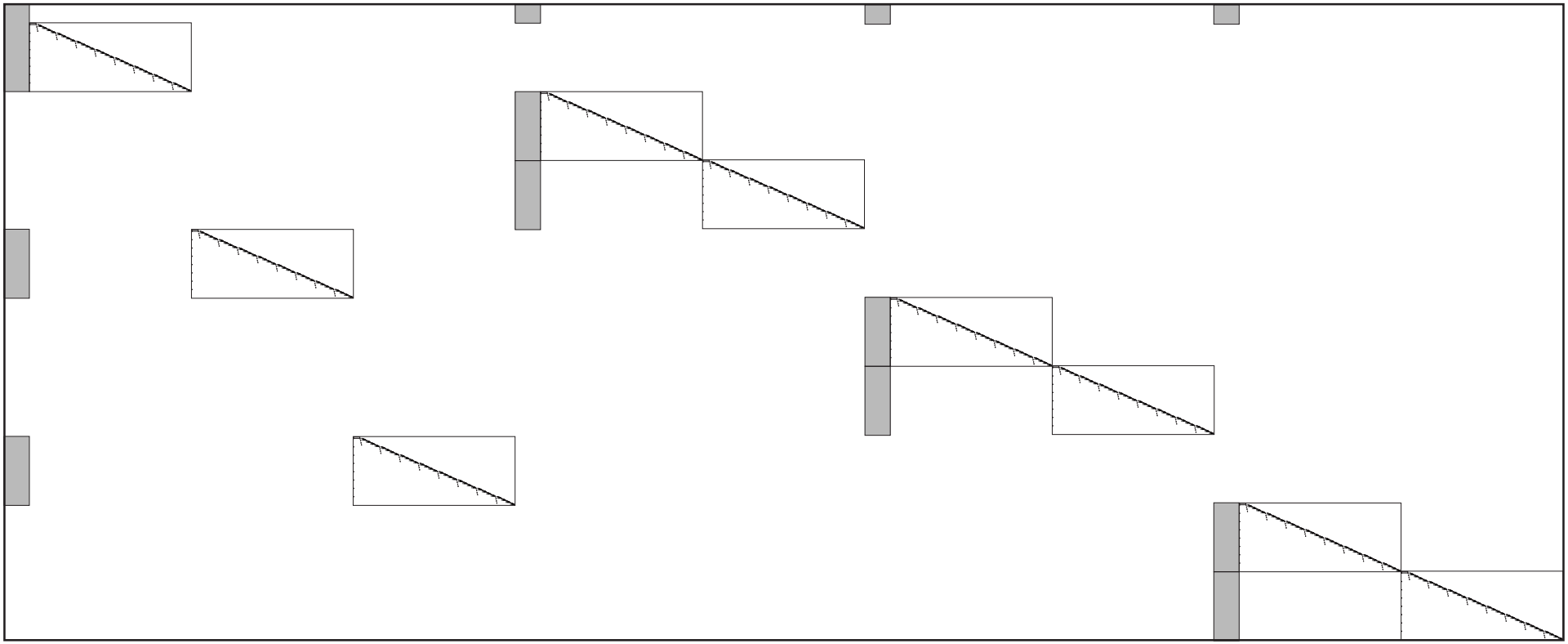


. . . There's uncertainty and you must do scenarios.

You might still get to Benders'/Lagrange, but

. . . you are most definitely not so very happy.

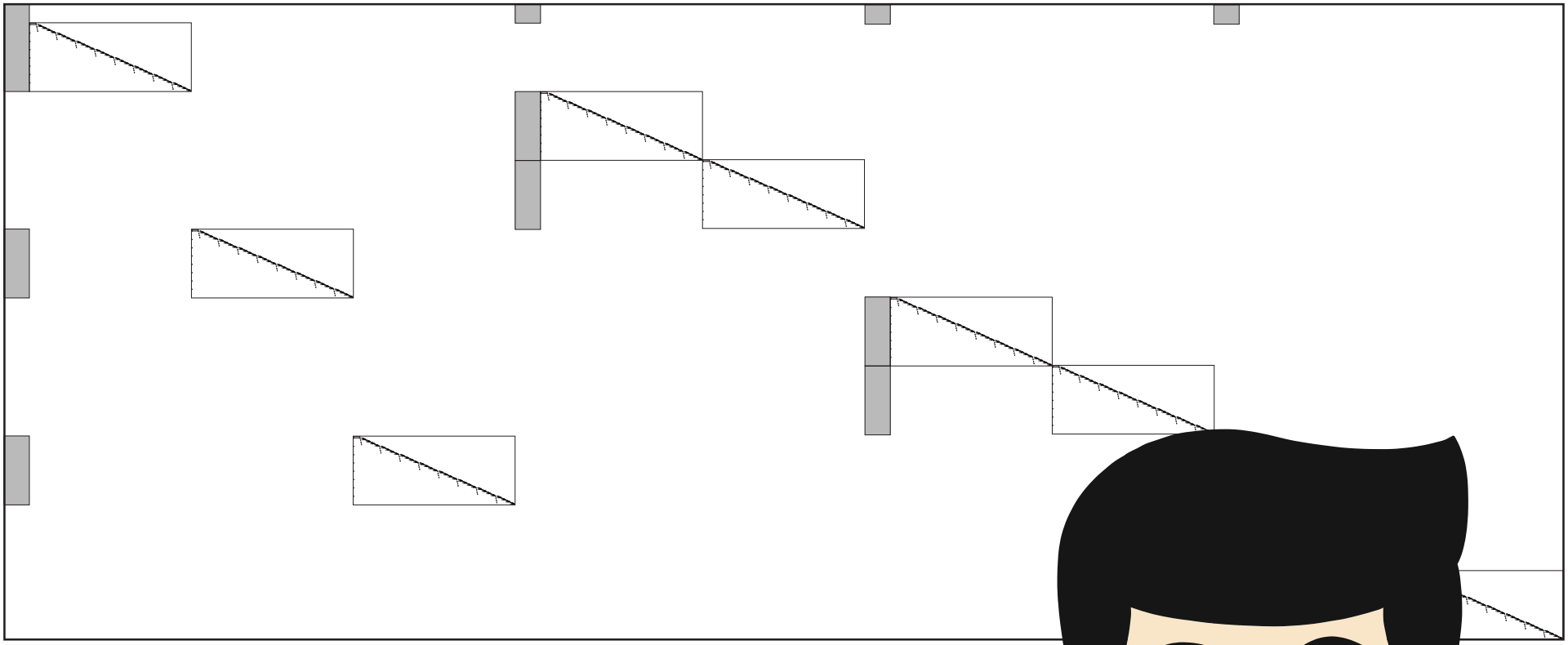
And finally

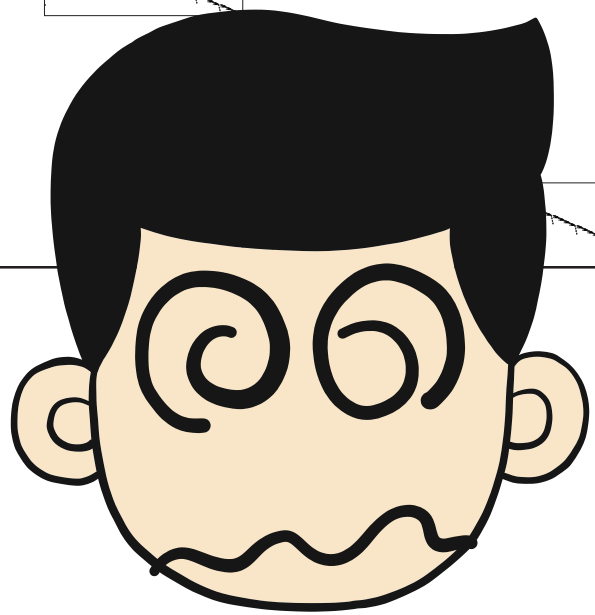


Of course what they really want to solve is the

strategic problem $\equiv$ that many time over again

And finally



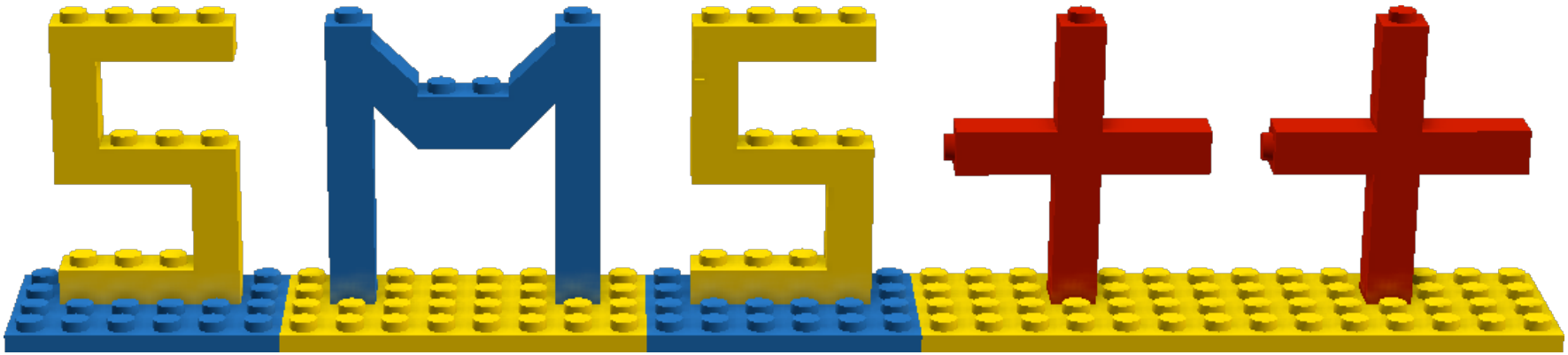


Of course what they really want to solve is the

strategic problem $\equiv$ that many time over again

You are positively desperate.

Who Ya
Gonna
Call?

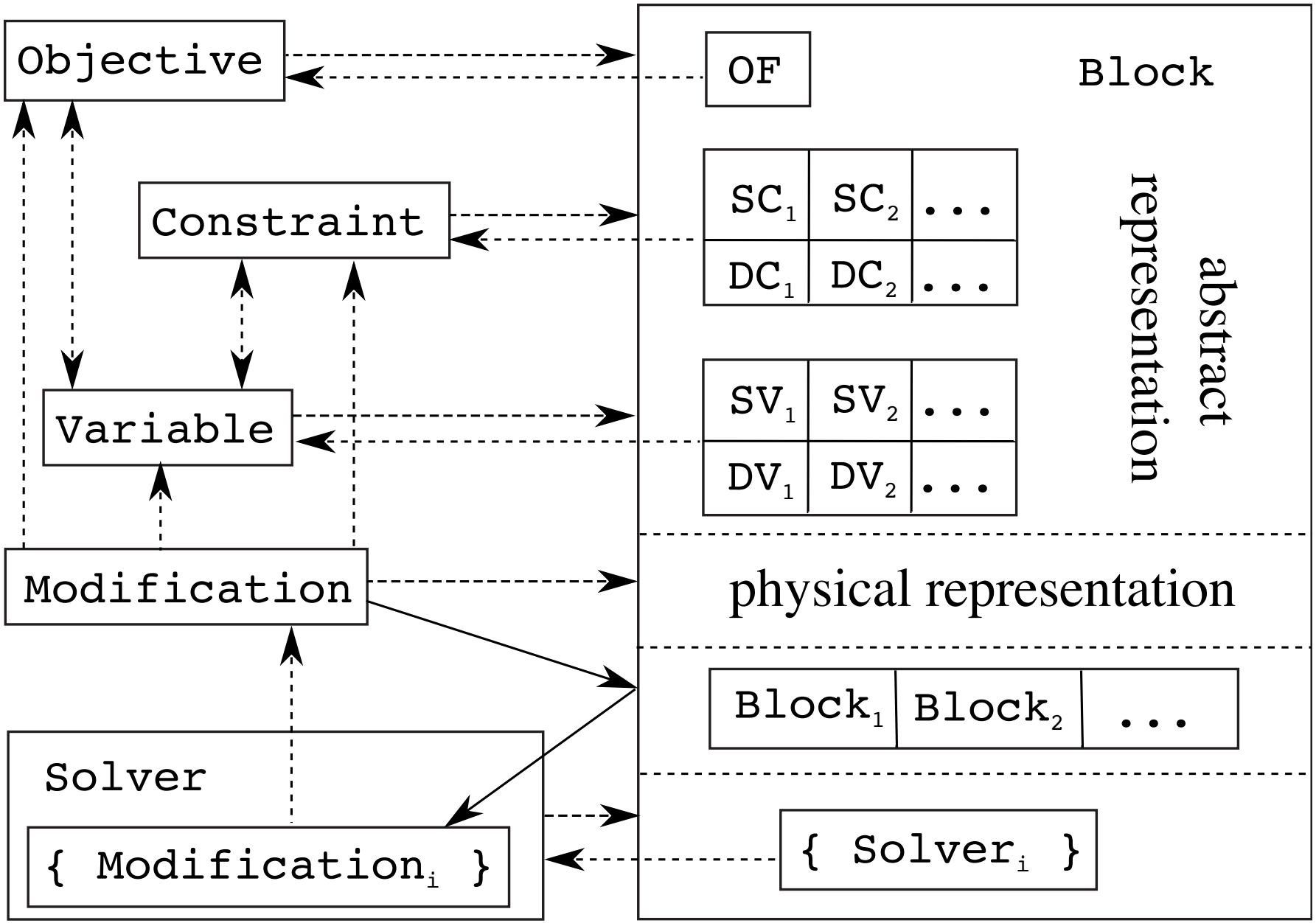

SMS++

What's that?

A set of C++ classes implementing a modelling system that:

- explicitly supports the notion of block $\equiv$ nested structure
- separately provides "semantic" information from "syntactic" details (list of constraints/variables $\equiv$ one specific formulation among many)
- allows exploiting specialised solvers on blocks with specific structure
- manages dynamic changes in the model beyond "just" generation of constraints/variables
- manages reformulation/restriction/relaxation
- does parallel (almost) from the start
- should be able to deal with almost anything (bilevel, PDE, ...)

What does it look like



What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more

What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more

- A way to make multi-level, heterogeneous decomposition possible
  $\Longrightarrow$ increase a lot the addressable market of decomposition

What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more
- A way to make multi-level, heterogeneous decomposition possible
  $\Longrightarrow$ increase a lot the addressable market of decomposition
- A way to solve more challenging real-world application
  $\Longrightarrow$ increase our own relevance in the real world

What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more
- A way to make multi-level, heterogeneous decomposition possible
  $\Longrightarrow$ increase a lot the addressable market of decomposition
- A way to solve more challenging real-world application
  $\Longrightarrow$ increase our own relevance in the real world
- Lots of implementation fun

What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more
- A way to make multi-level, heterogeneous decomposition possible
  $\Longrightarrow$ increase a lot the addressable market of decomposition
- A way to solve more challenging real-world application
  $\Longrightarrow$ increase our own relevance in the real world
- Lots of implementation fun

What we want/envision/hope

- A way to make our own model/algorithms readily available to others
  $\Longrightarrow$ be used a lot more
- A way to make multi-level, heterogeneous decomposition possible
  $\Longrightarrow$ increase a lot the addressable market of decomposition
- A way to solve more challenging real-world application
  $\Longrightarrow$ increase our own relevance in the real world
- Lots of implementation fun

Coming Soon

to a GitLab repository near you

Acknowledgements

Copyright © PLAN4RES Partners 2018, all rights reserved.

This document may not be copied, reproduced, or modified in whole or in part for any purpose without written permission from the PLAN4RES Consortium. In addition, an acknowledgement of the authors of the document and all applicable portions of the copyright notice must be clearly referenced.

This document may change without notice.

The content of this document only reflects the author's views. The European Commission / Innovation and Networks Executive Agency is not responsible for any use that may be made of the information it contains.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773897