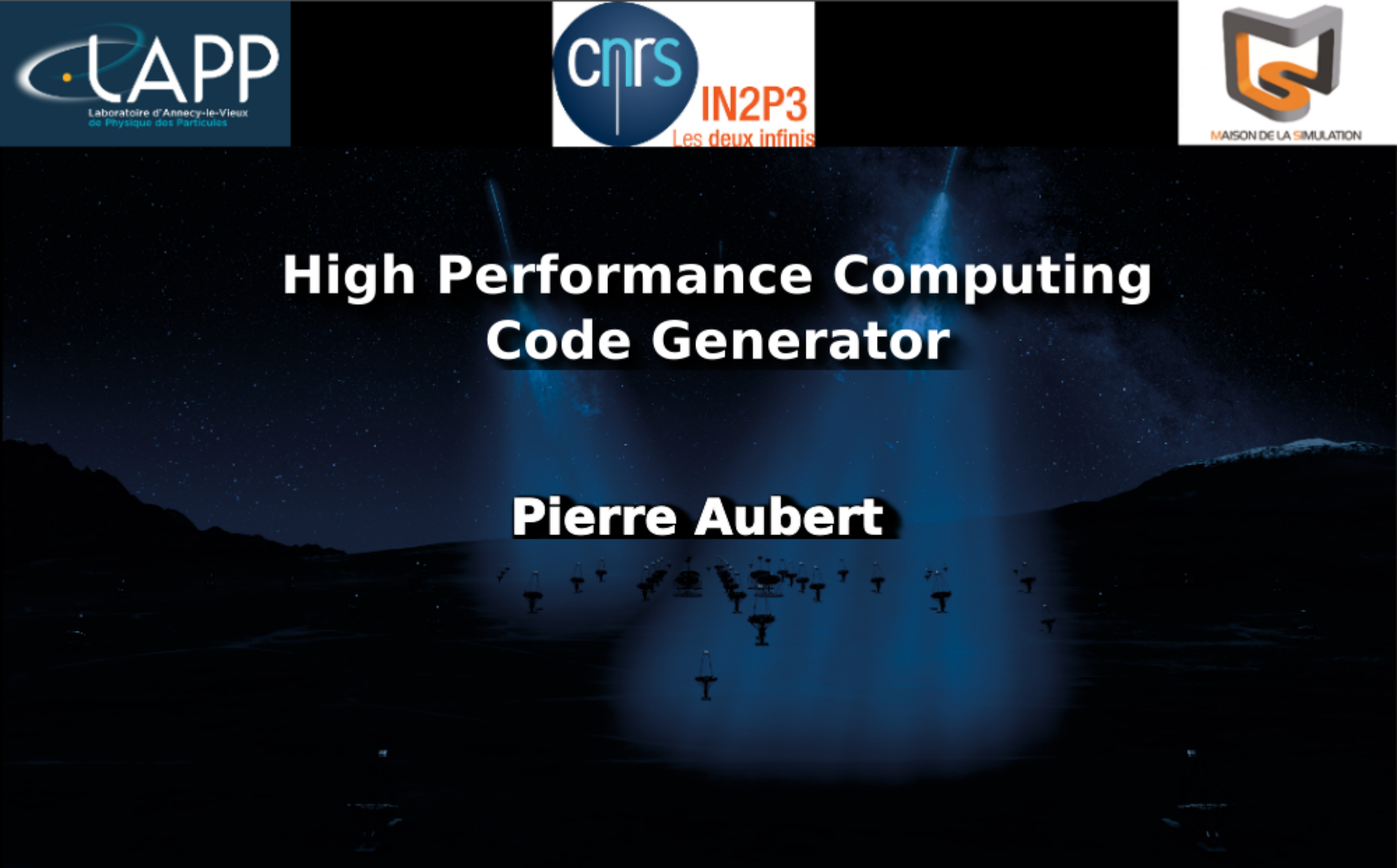


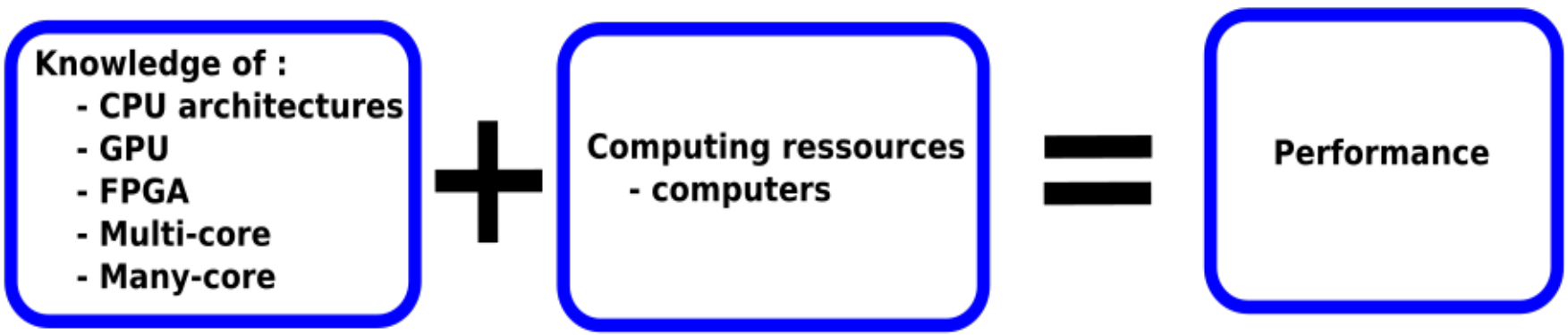
High Performance Computing Code Generator

Pierre Aubert

ASTERICS 653477

High Performance Computing

Get the best performances



Libraries HPC

ATLAS/BLAS

BLAS

Lapack

Lapacke

Eigen

HPX

Armadilo

Libraries HPC

ATLAS/BLAS

BLAS

Lapack

Lapacke

Explicit Function Call

Eigen

HPX

Armadilo

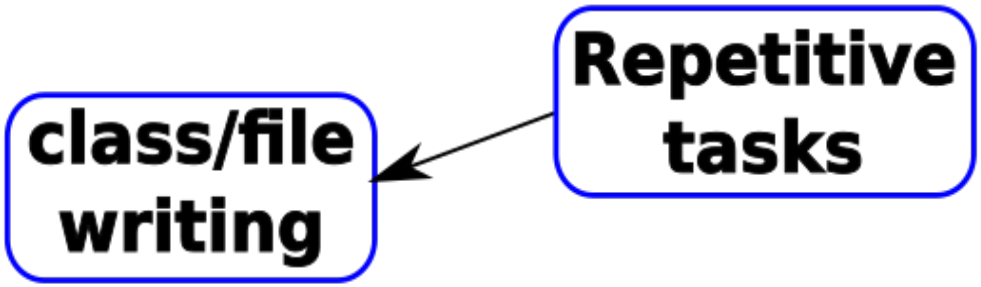
Slow down compilation and High memory comsuption

Code Generator

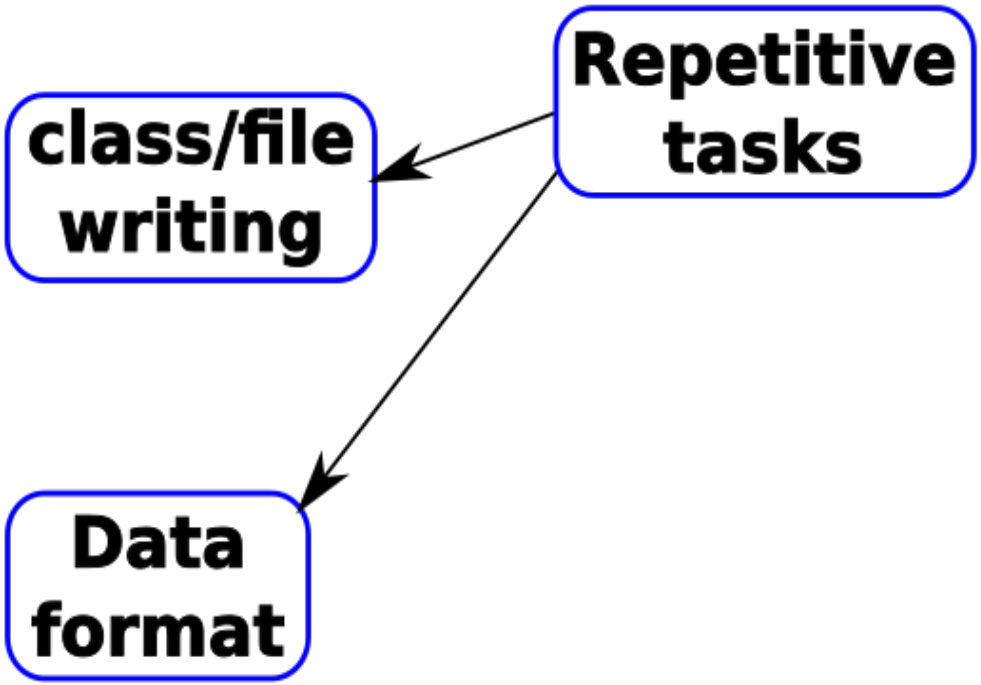
Code Generator

Repetitive tasks

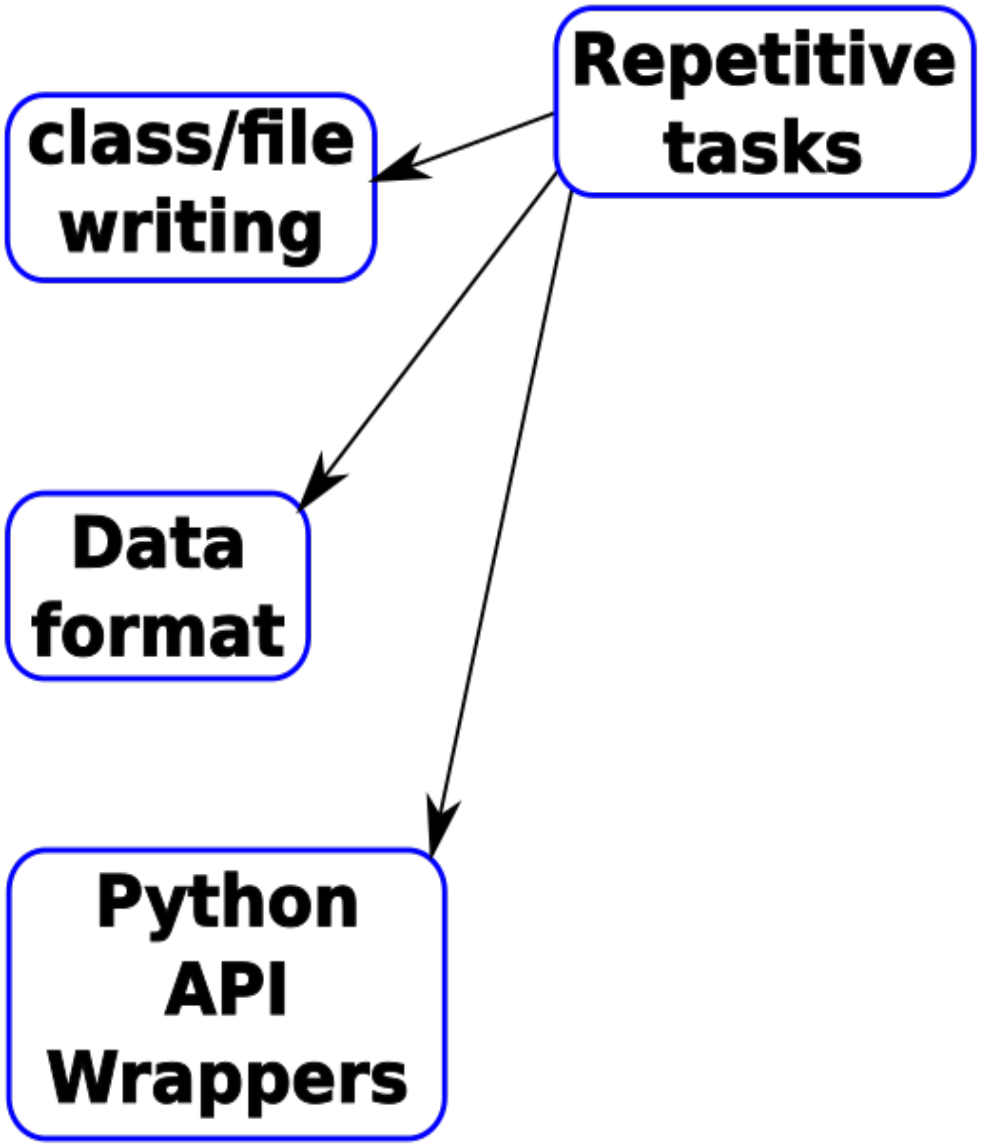
Code Generator



Code Generator



Code Generator



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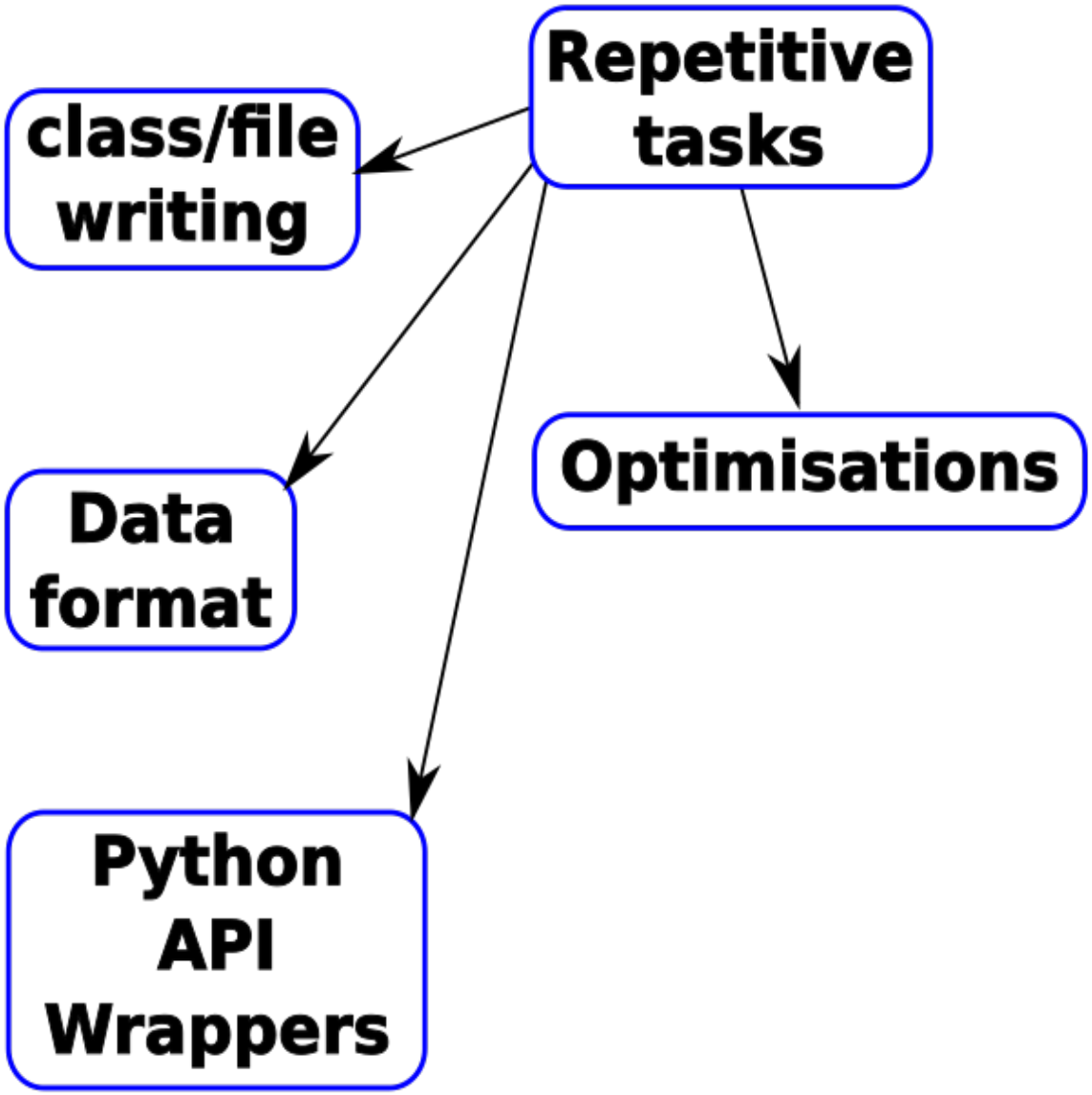

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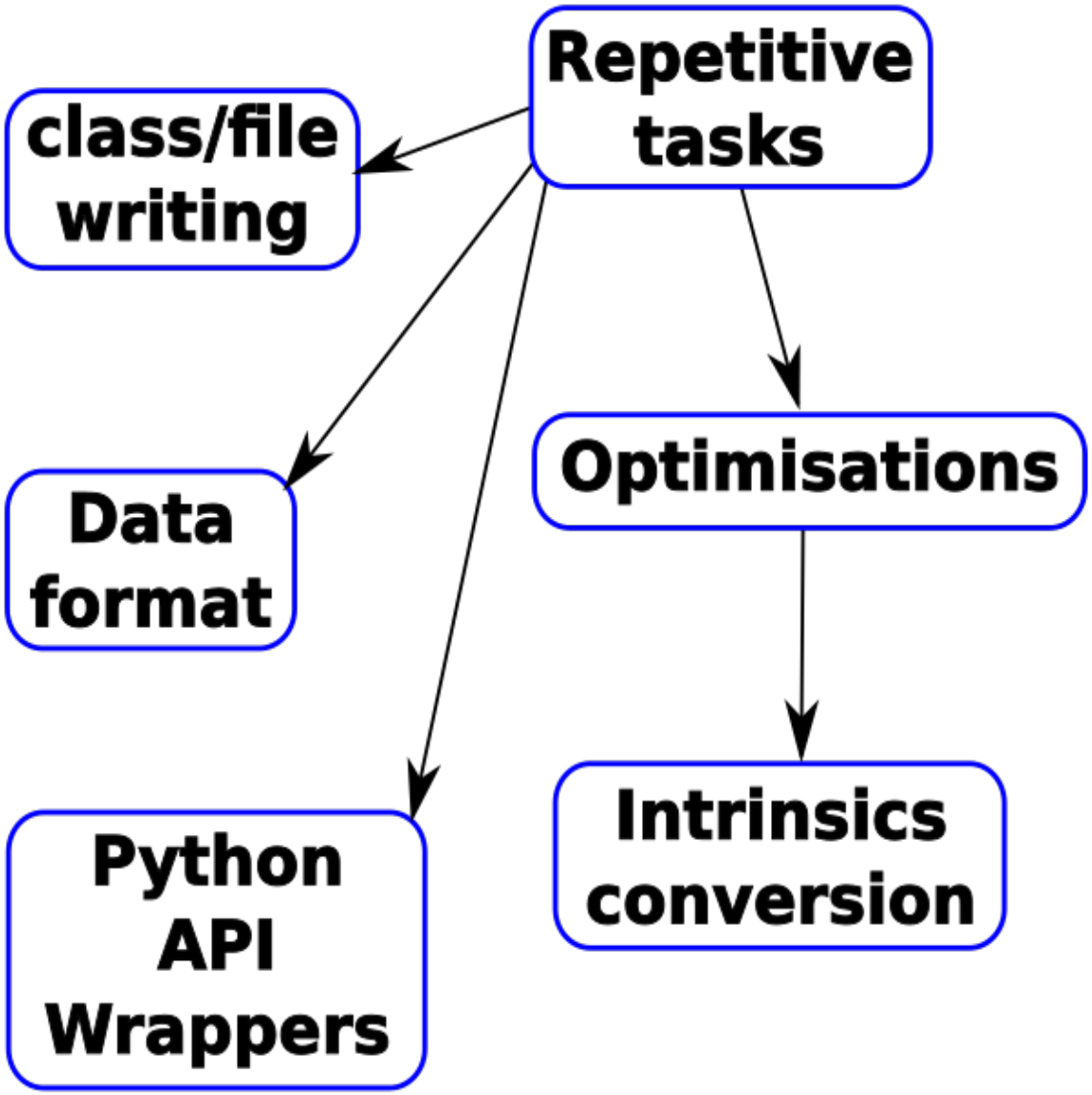

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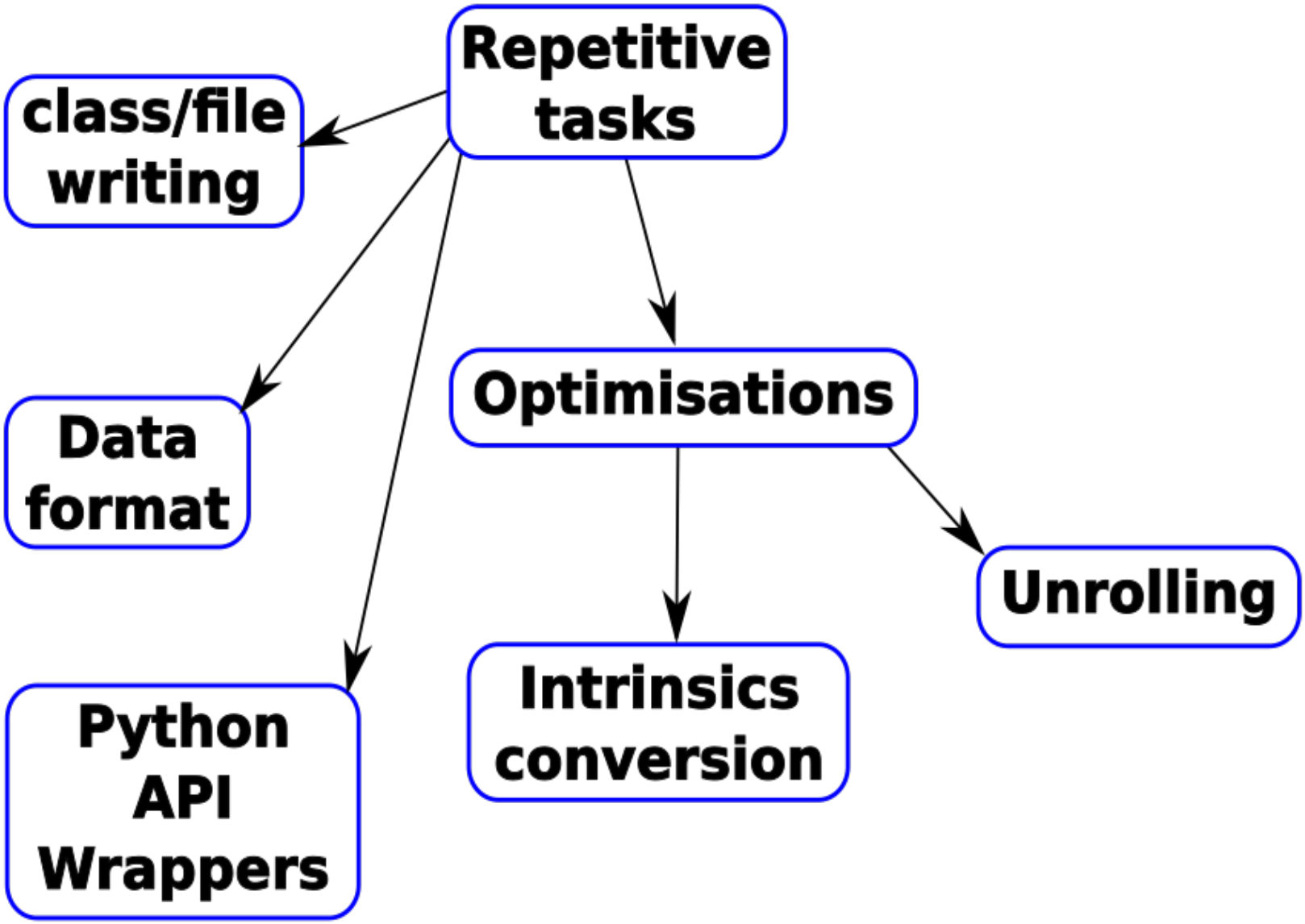

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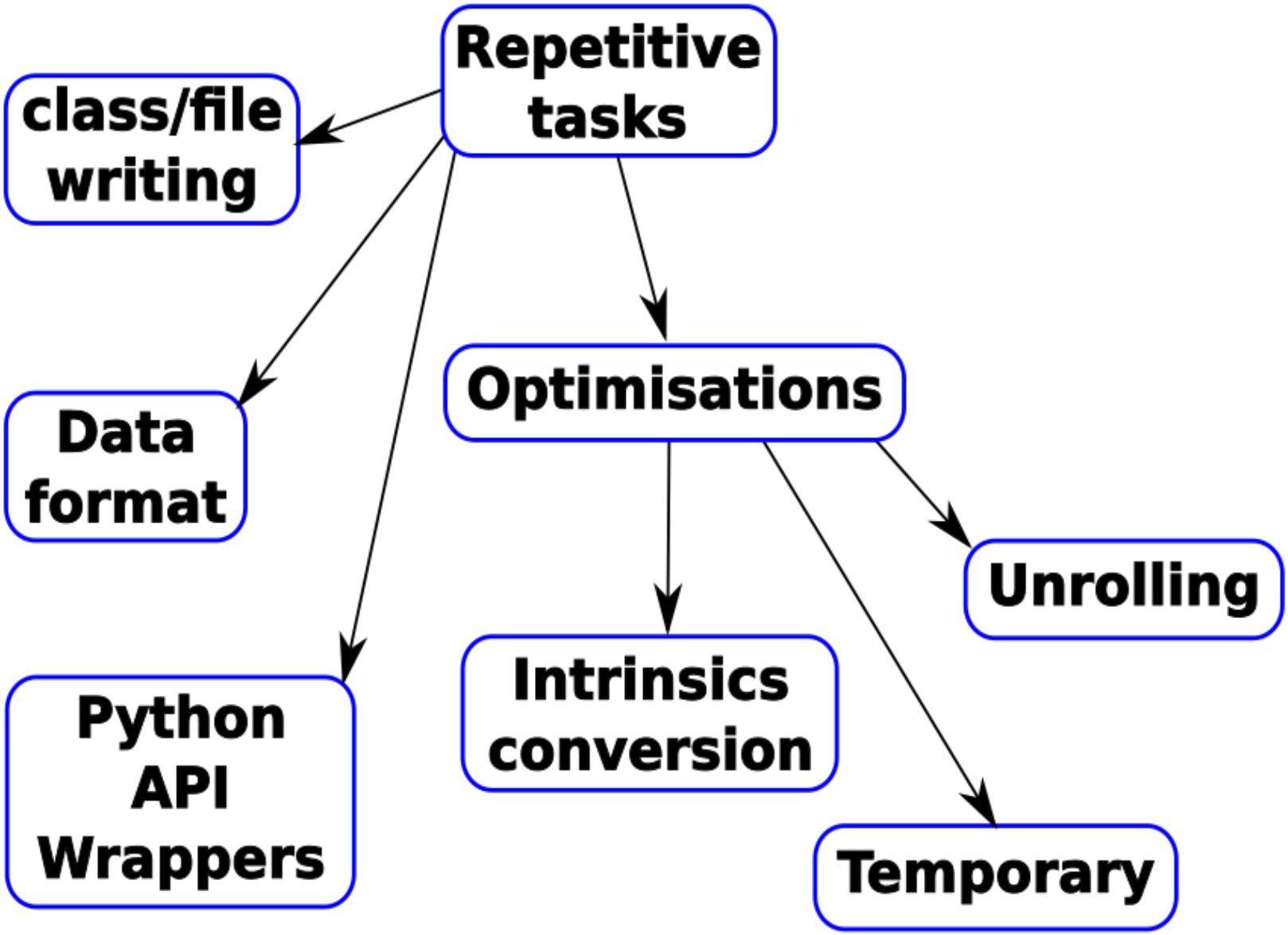
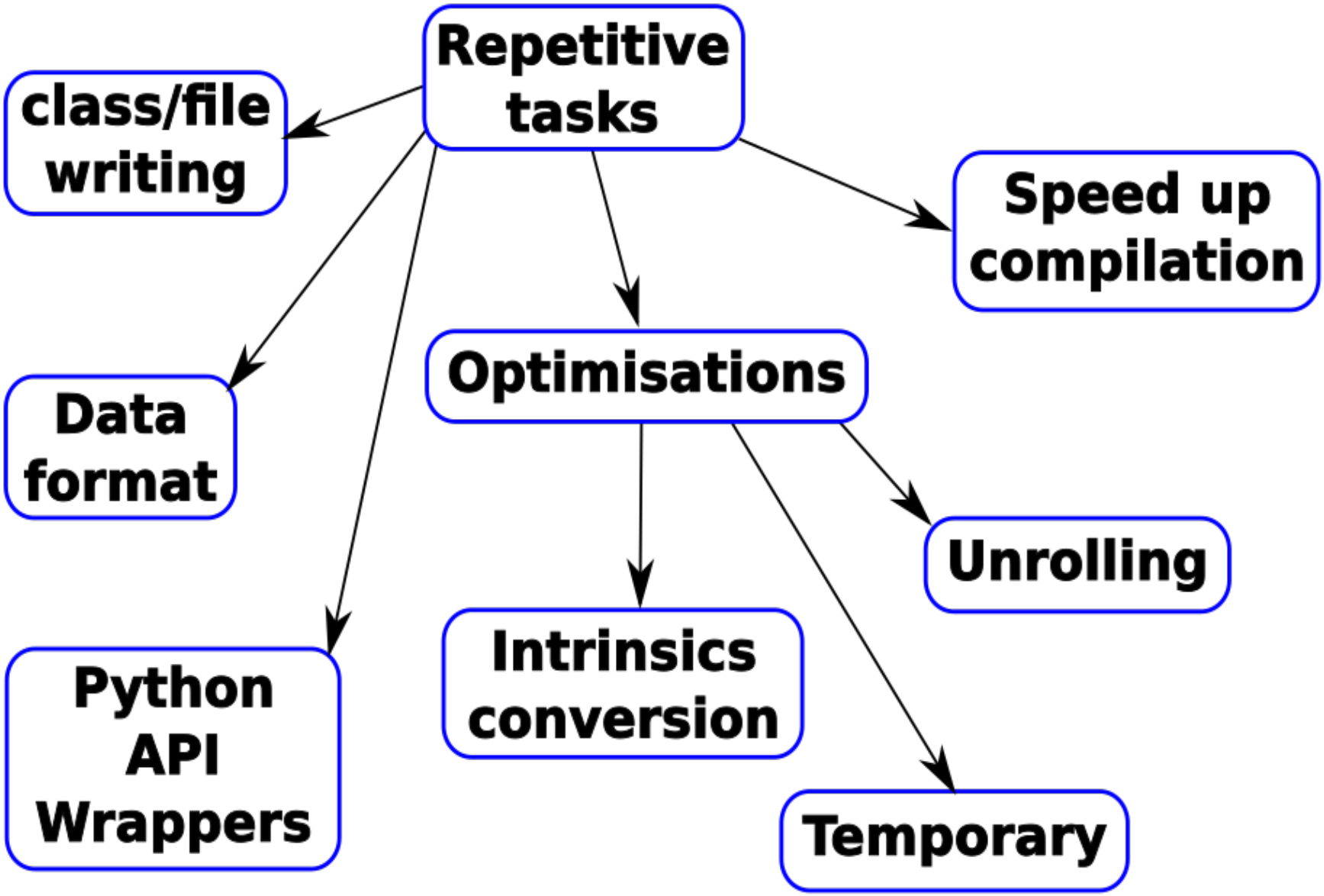
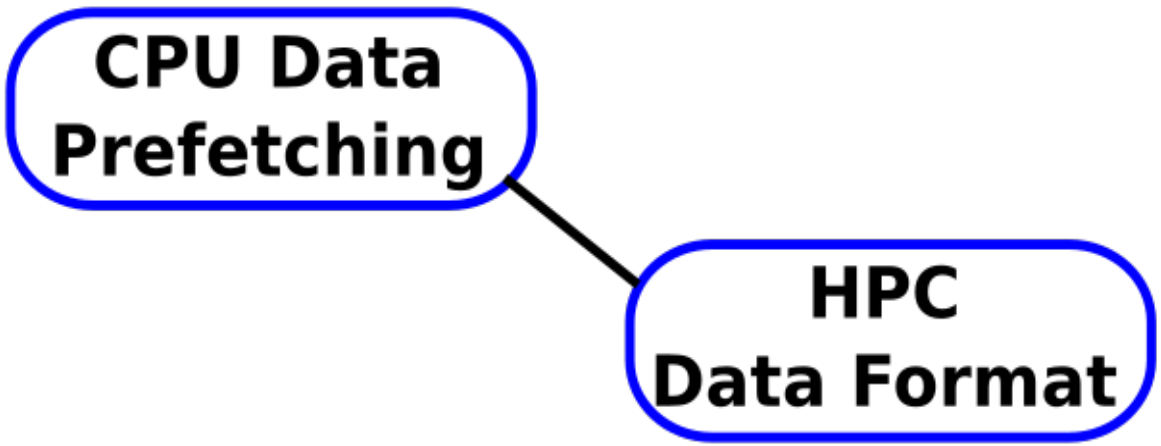


Code Generator



Data format for HPC ?

Data format for HPC ?



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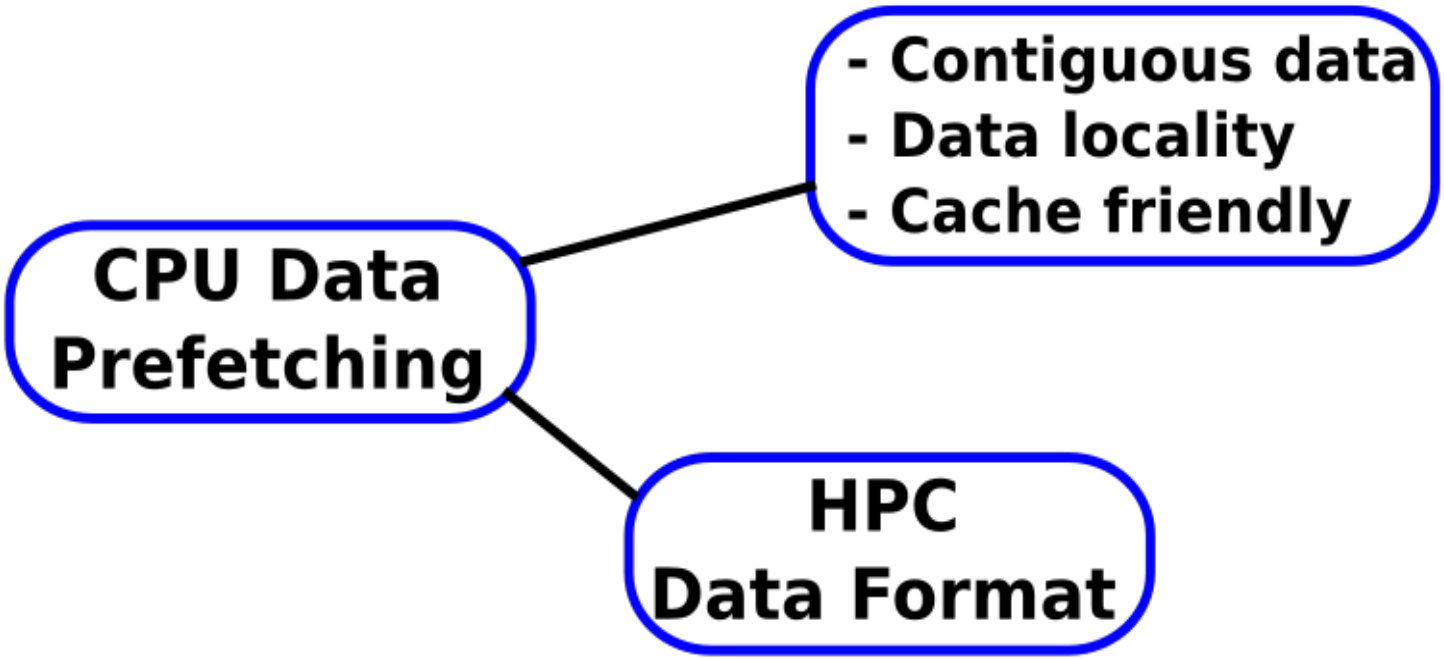

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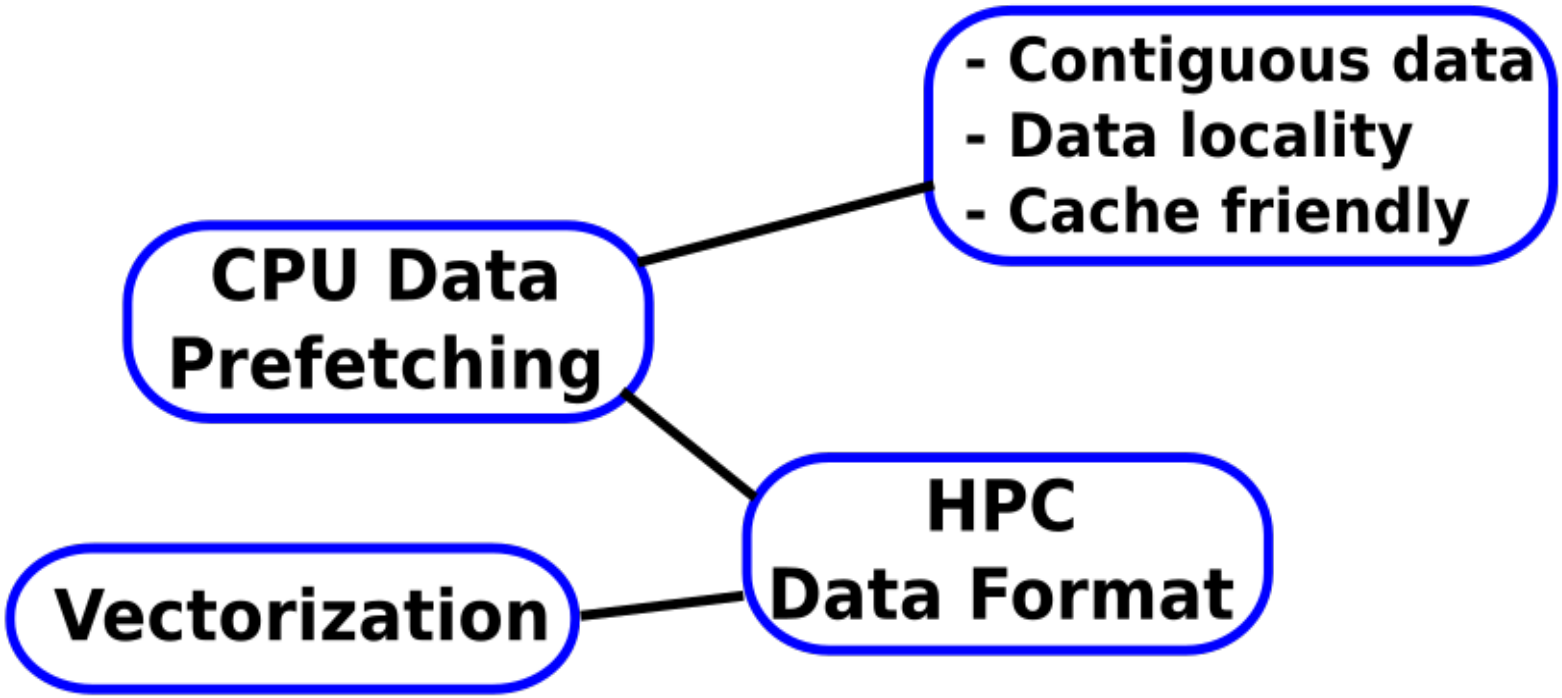

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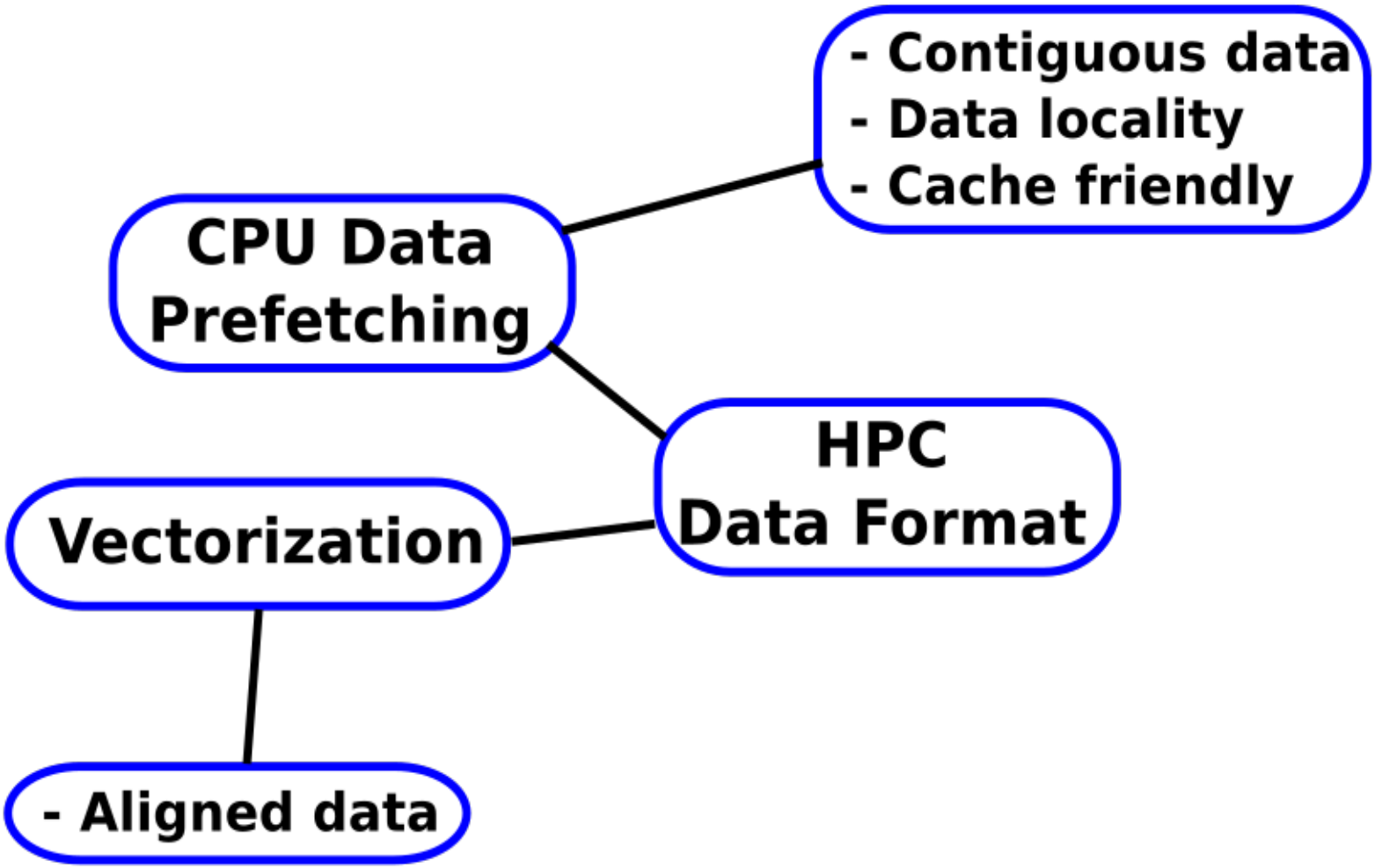

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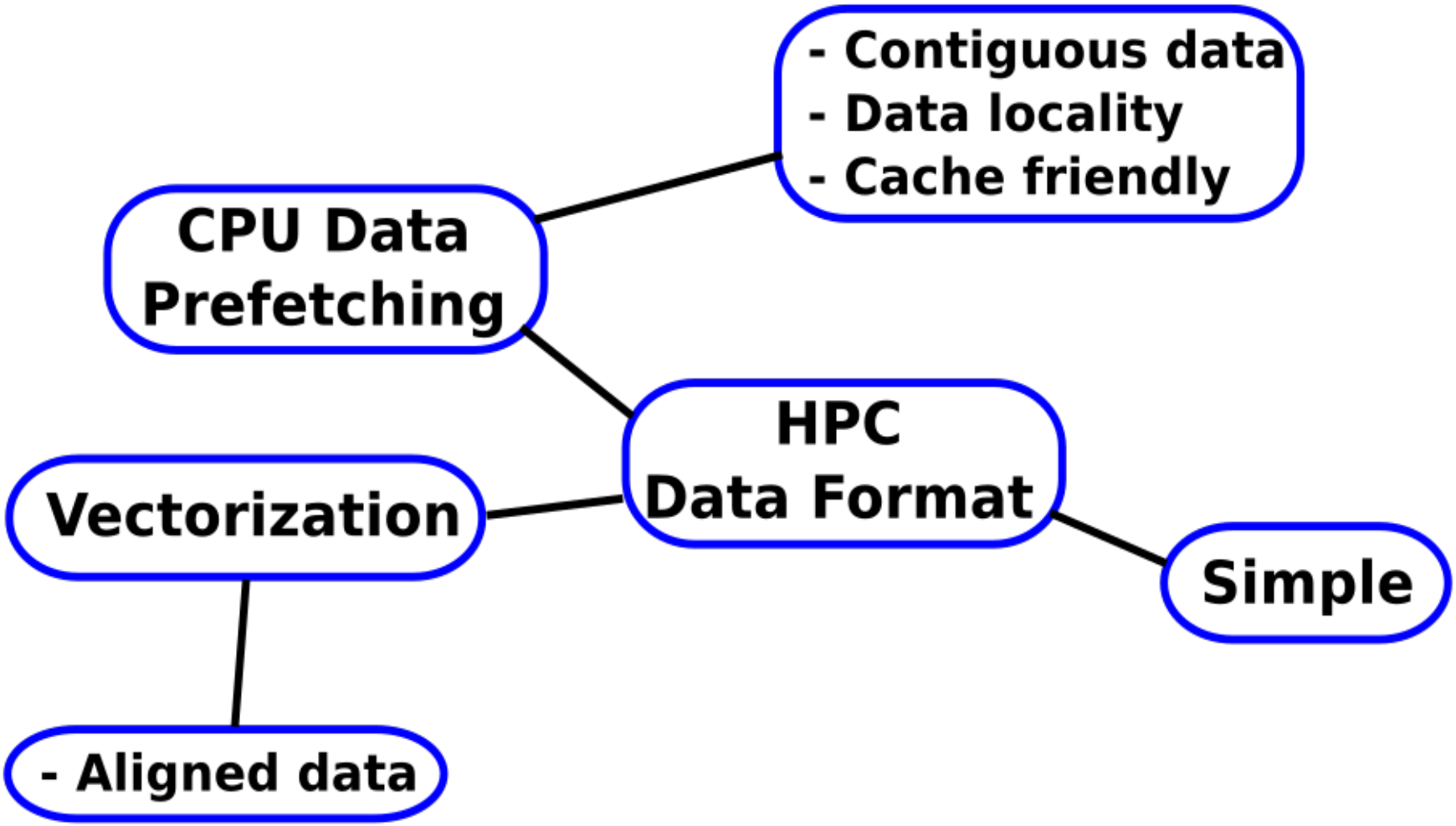

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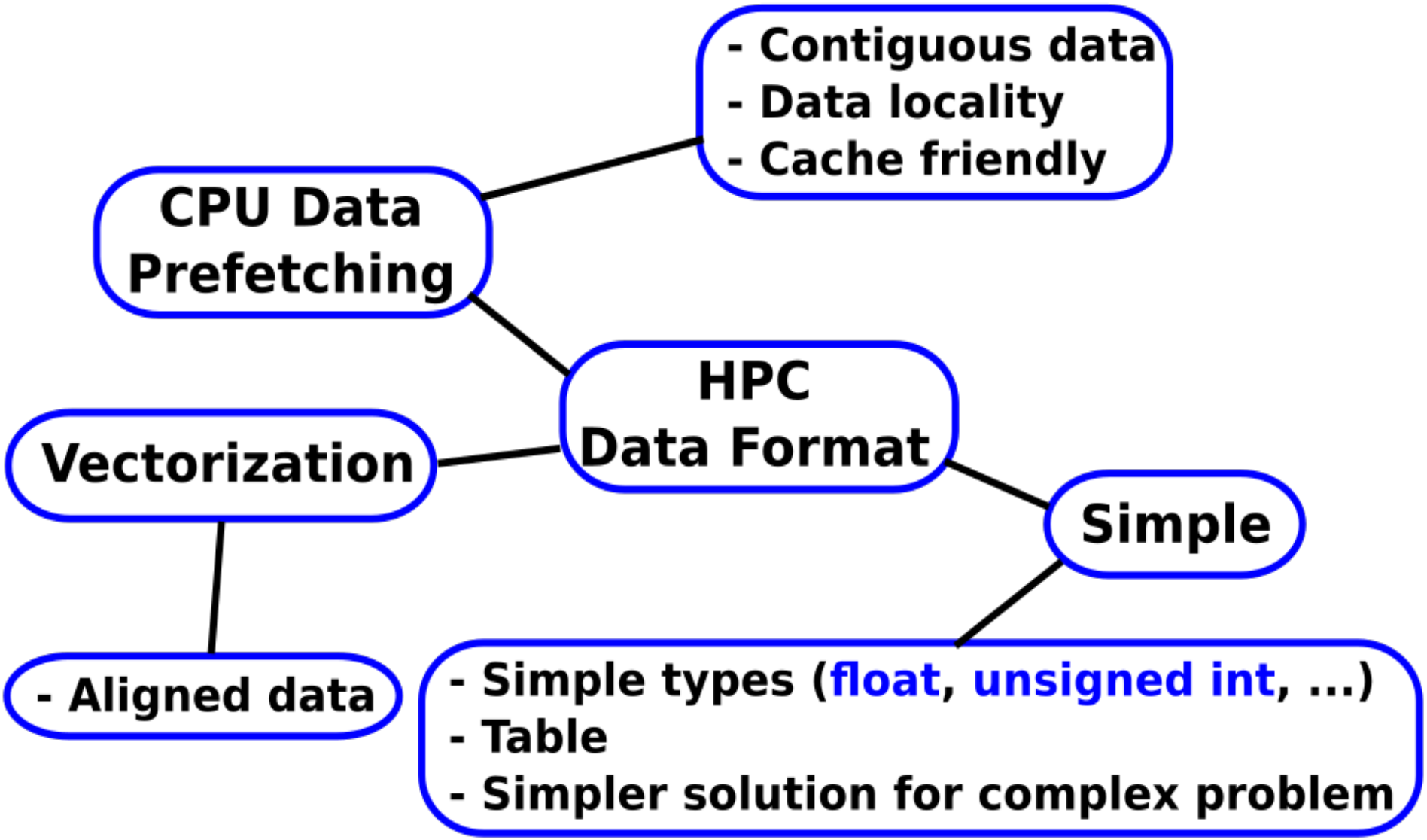
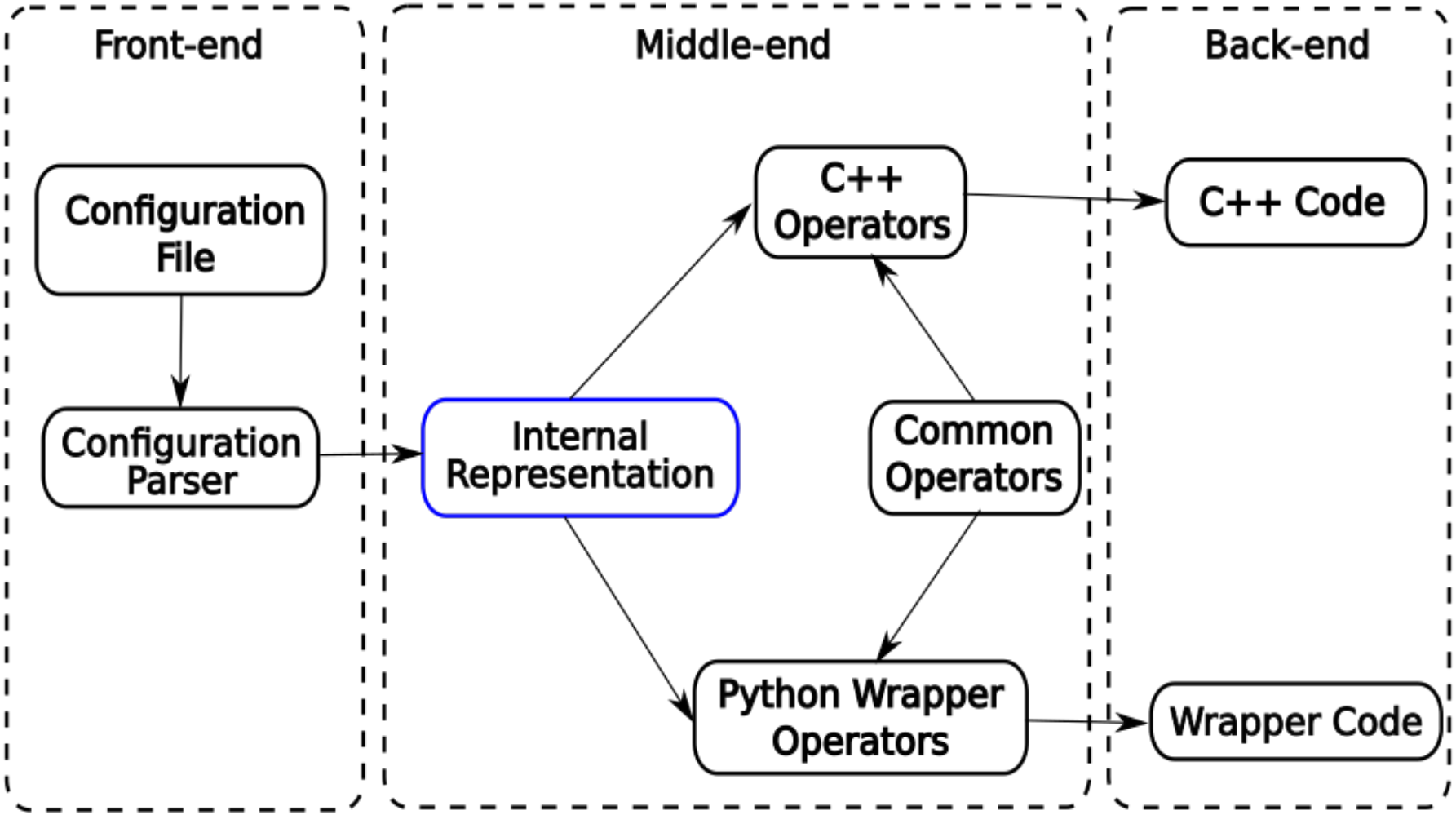


Data Format Generator Architecture

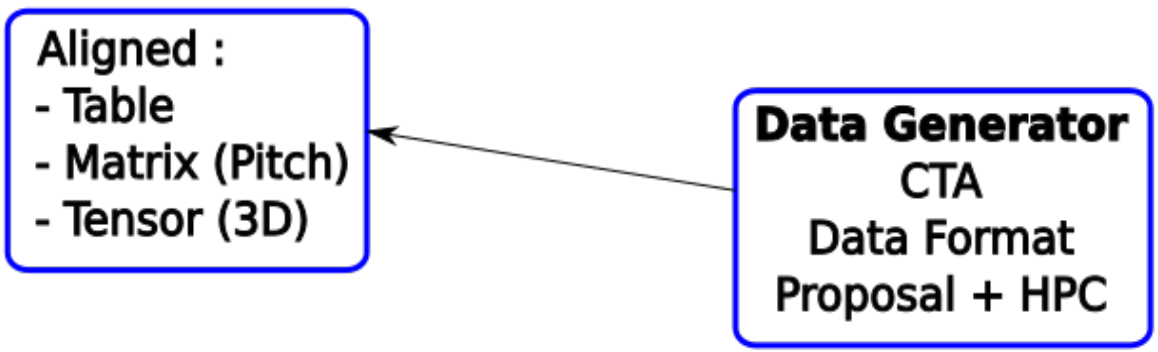


For C++ and Python

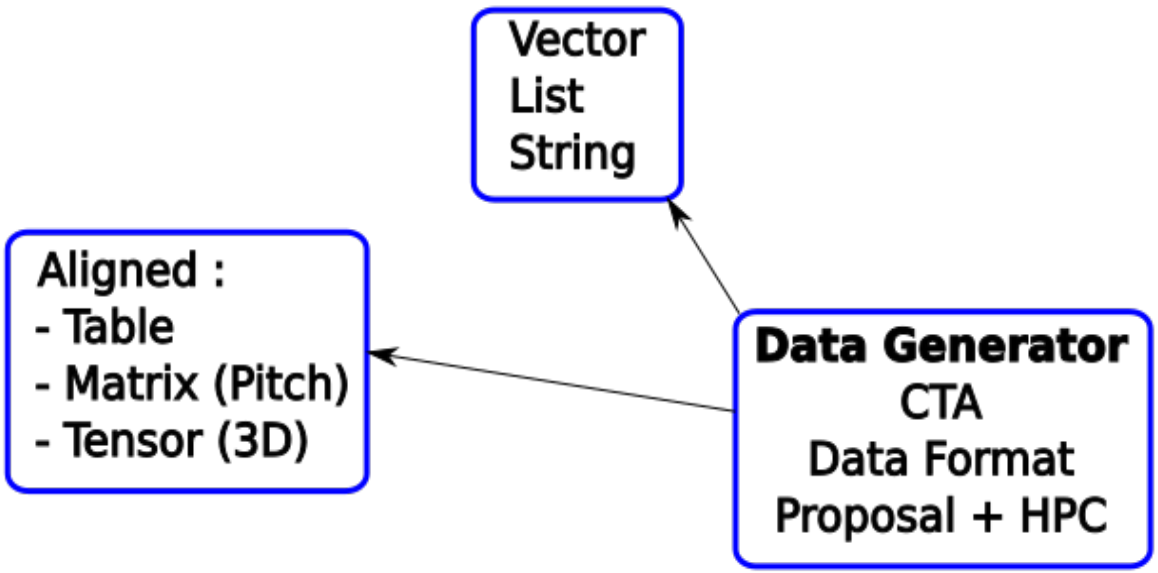
For C++ and Python

Data Generator
CTA
Data Format
Proposal + HPC

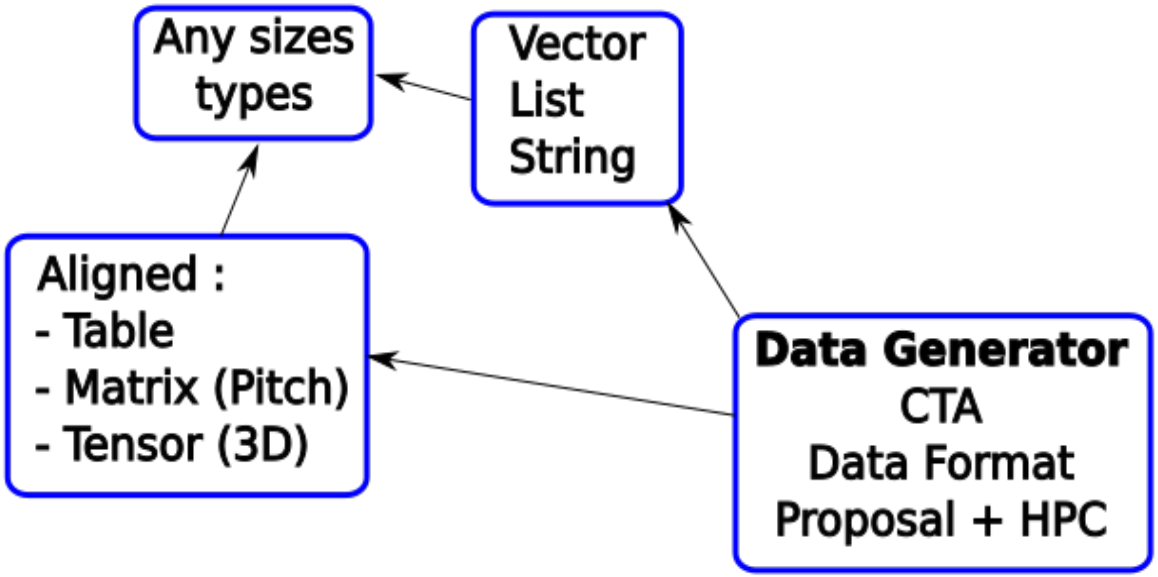
For C++ and Python



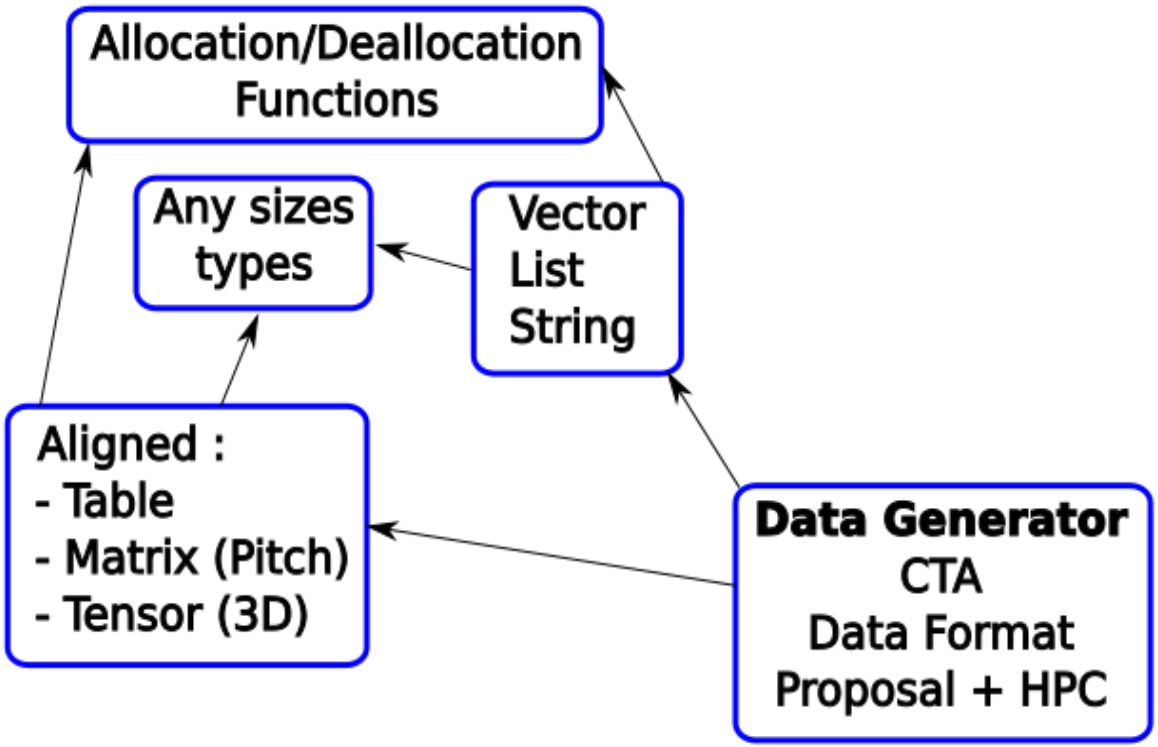
For C++ and Python



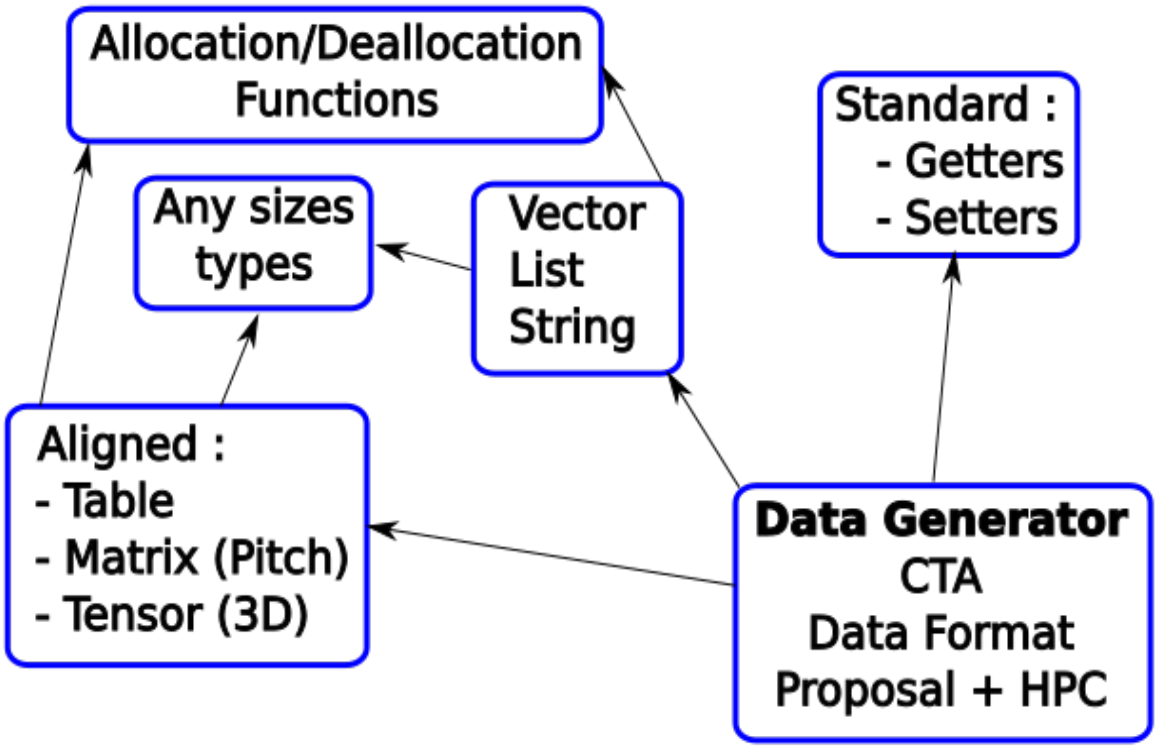
For C++ and Python



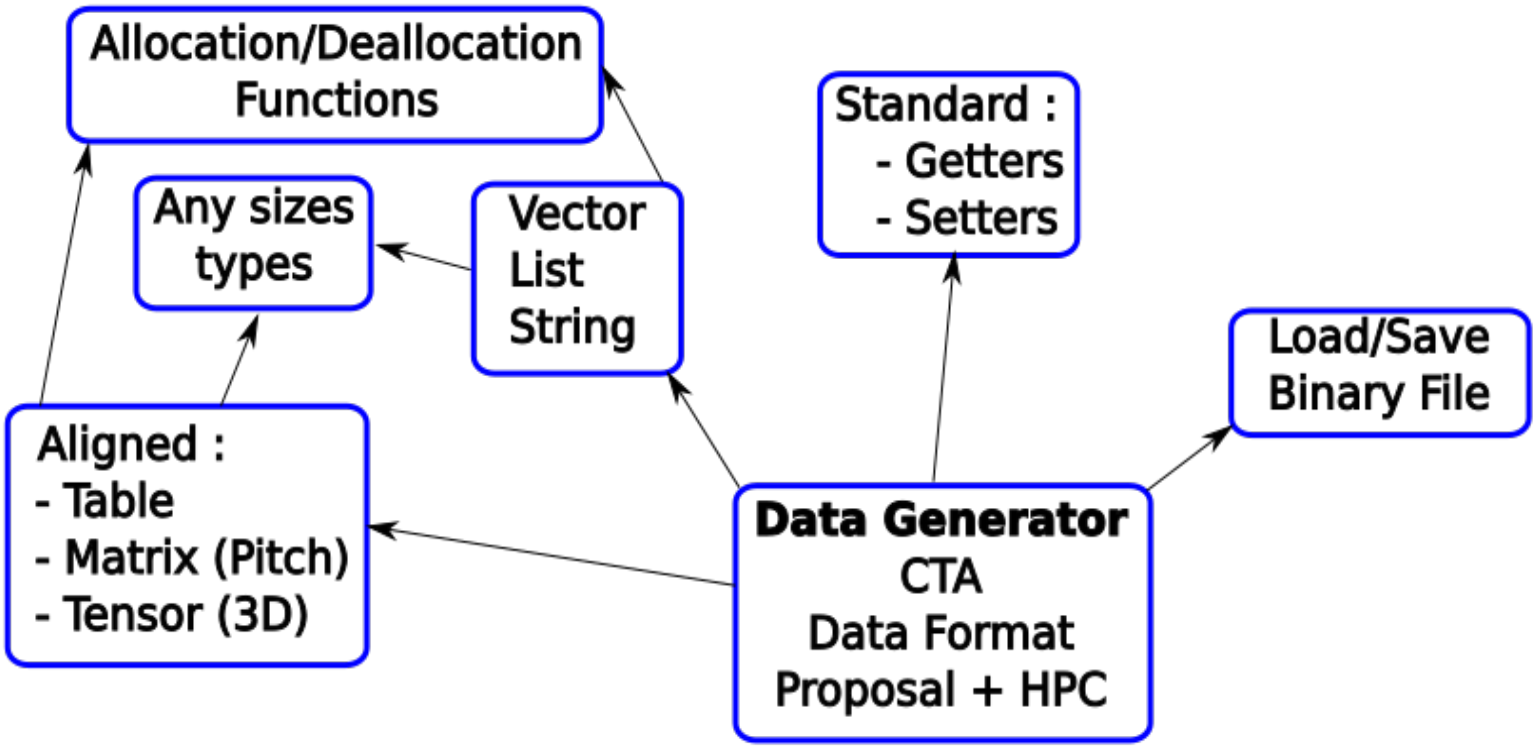
For C++ and Python



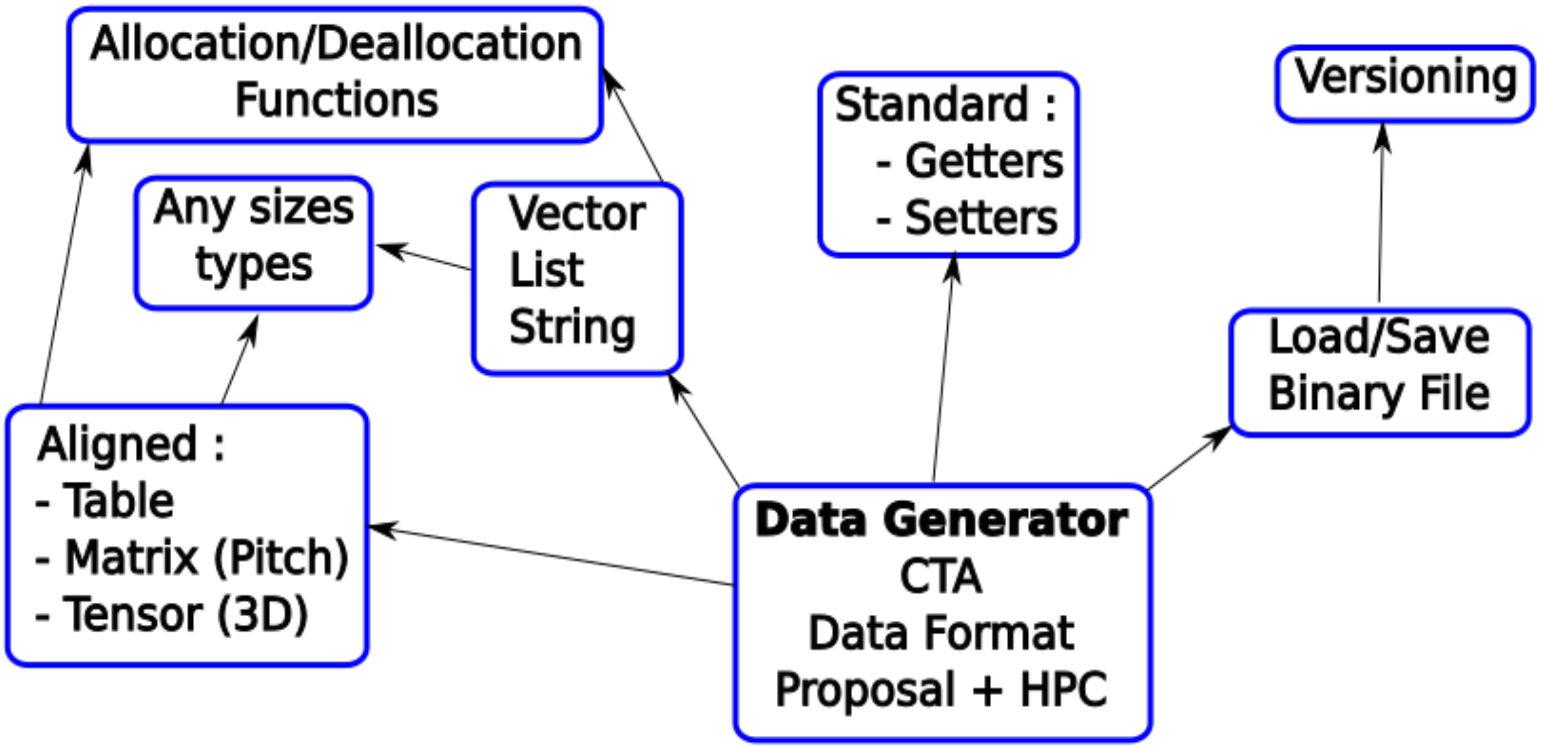
For C++ and Python



For C++ and Python



For C++ and Python



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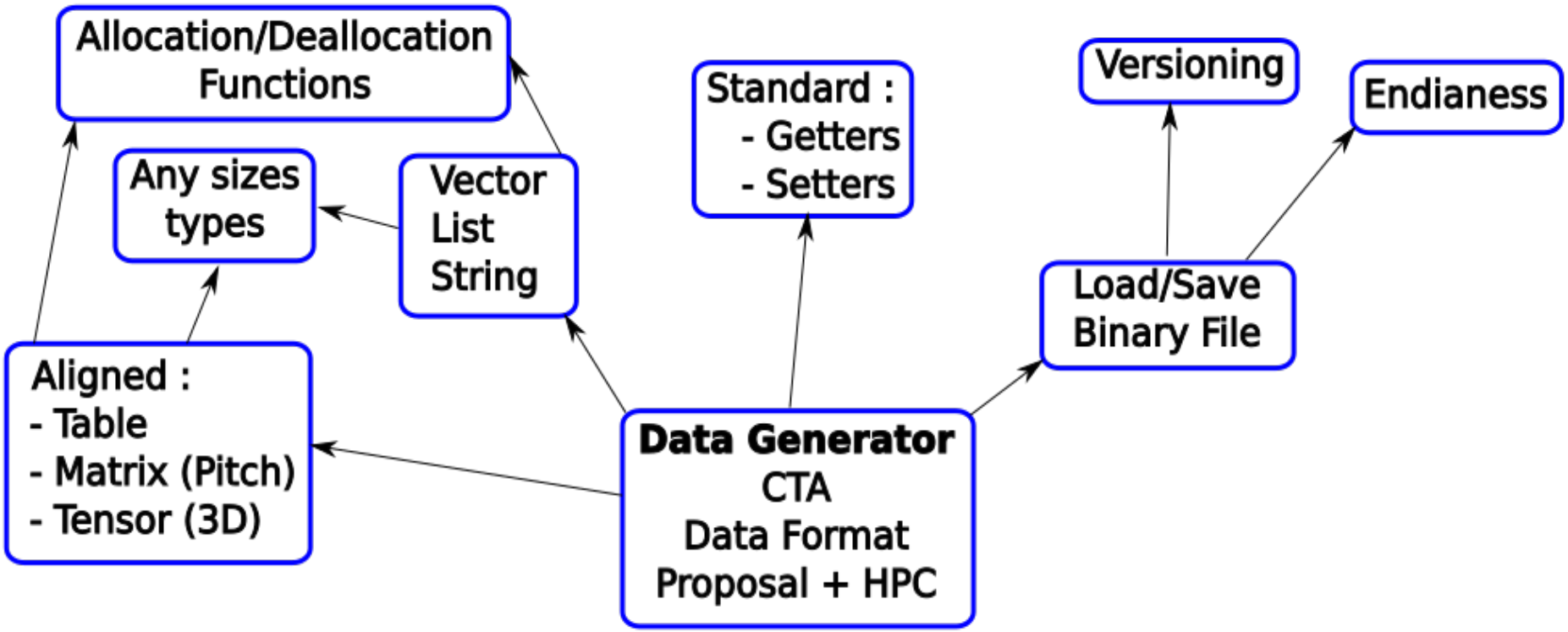

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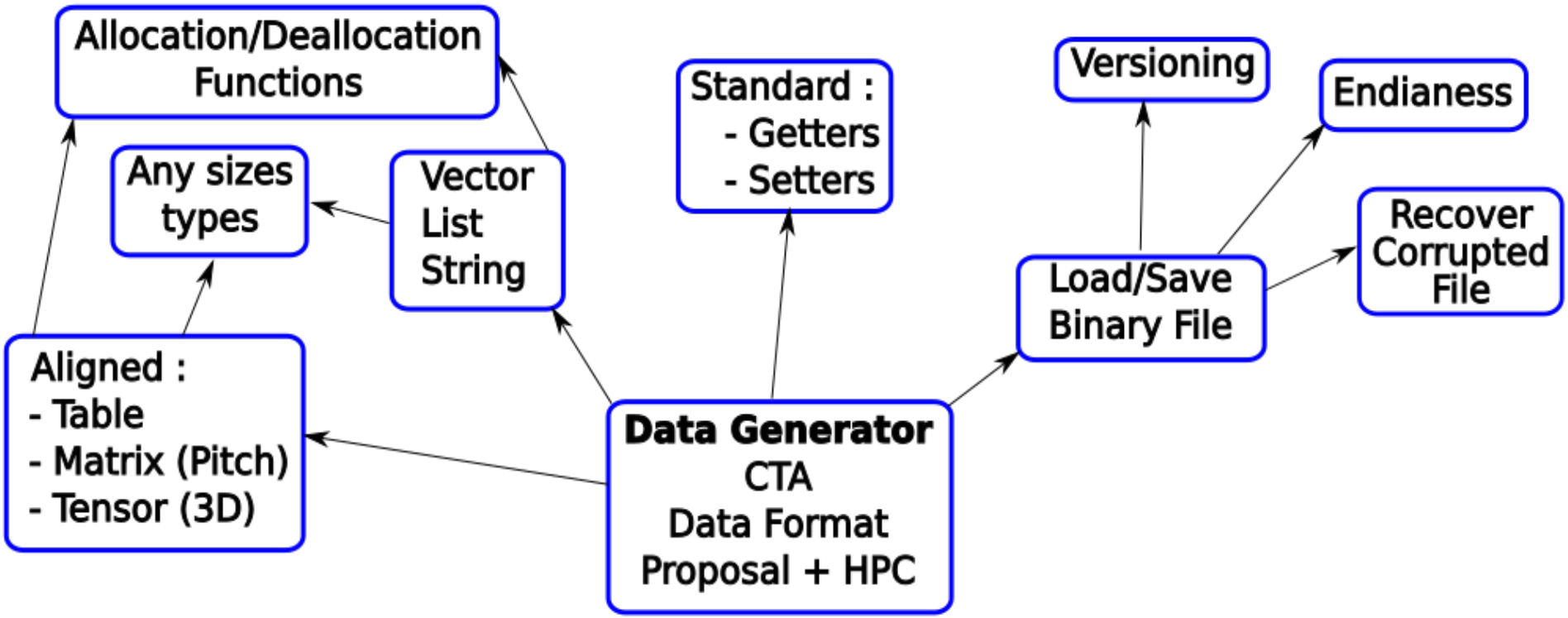

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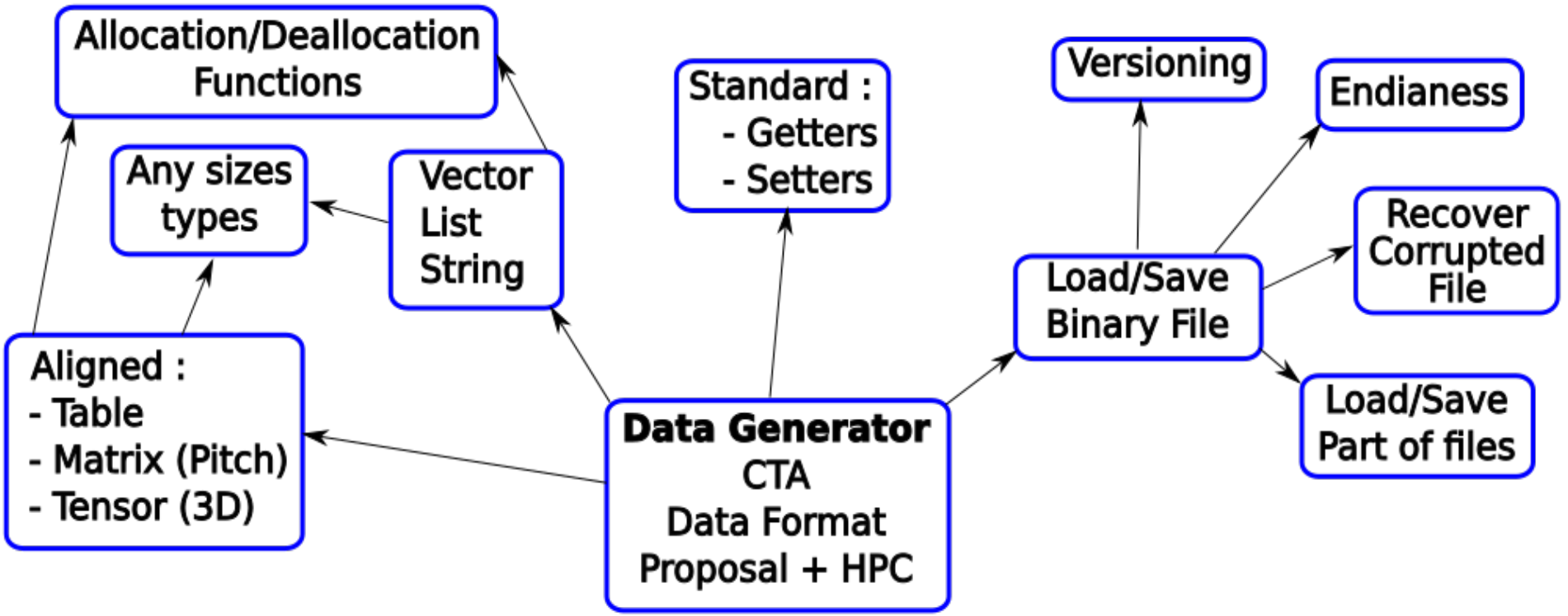

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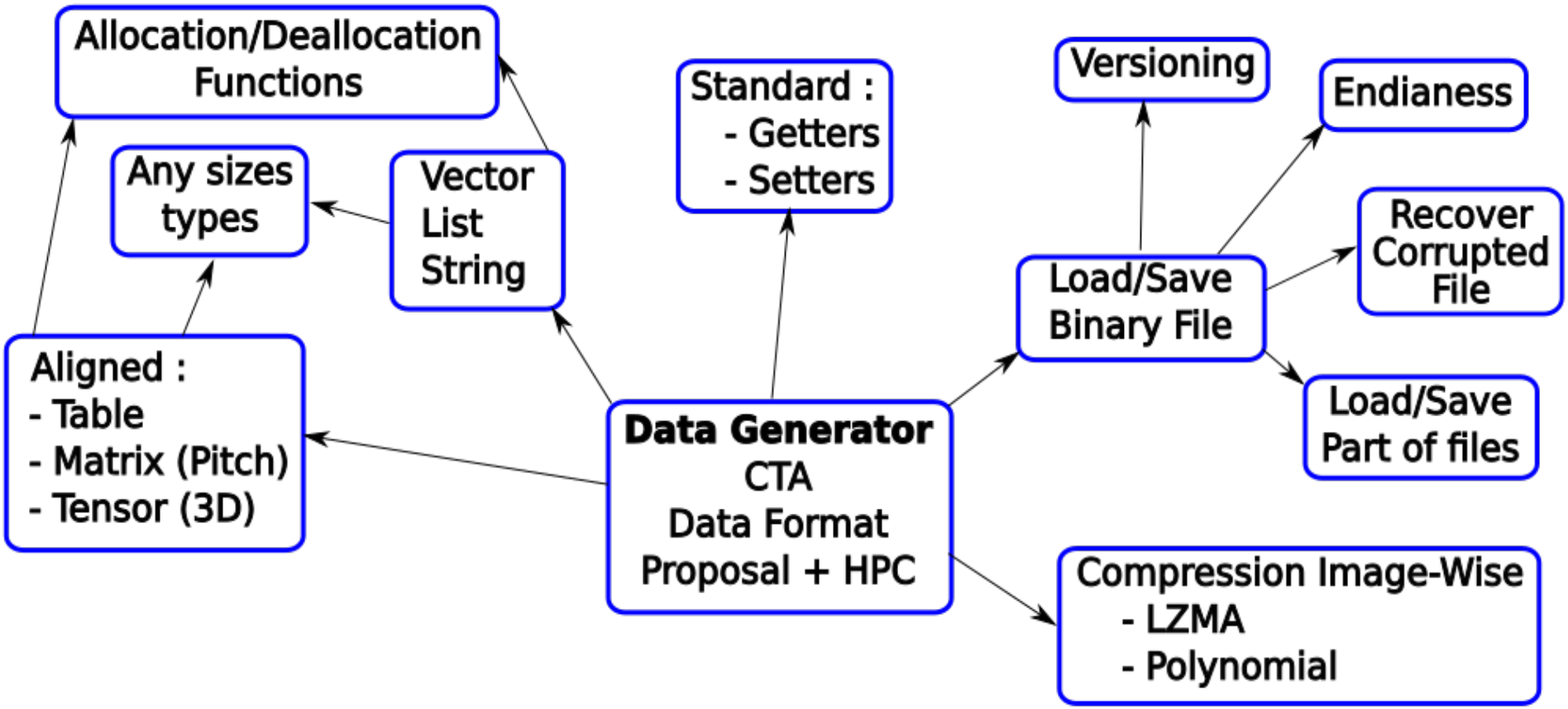
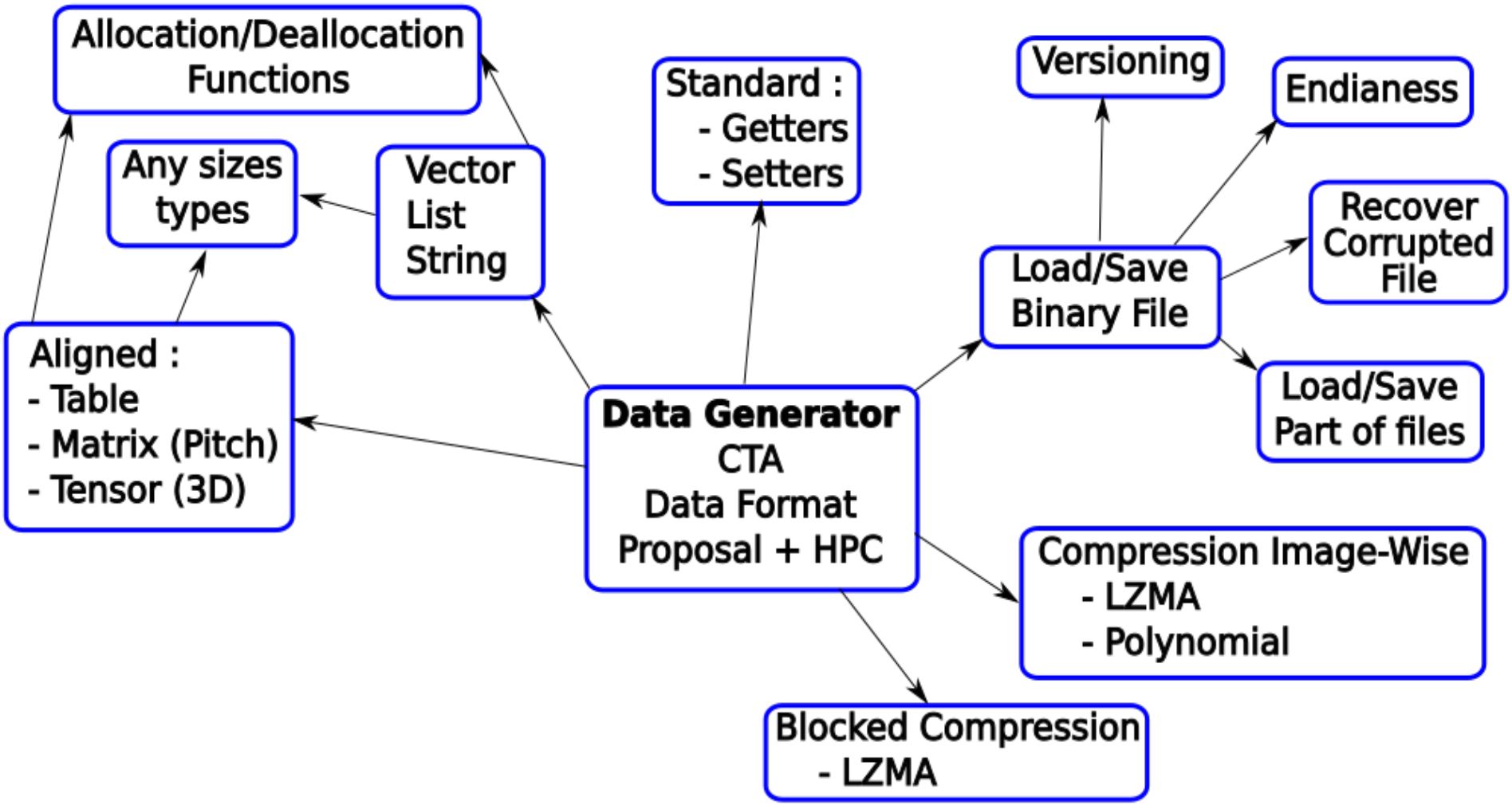


For C++ and Python



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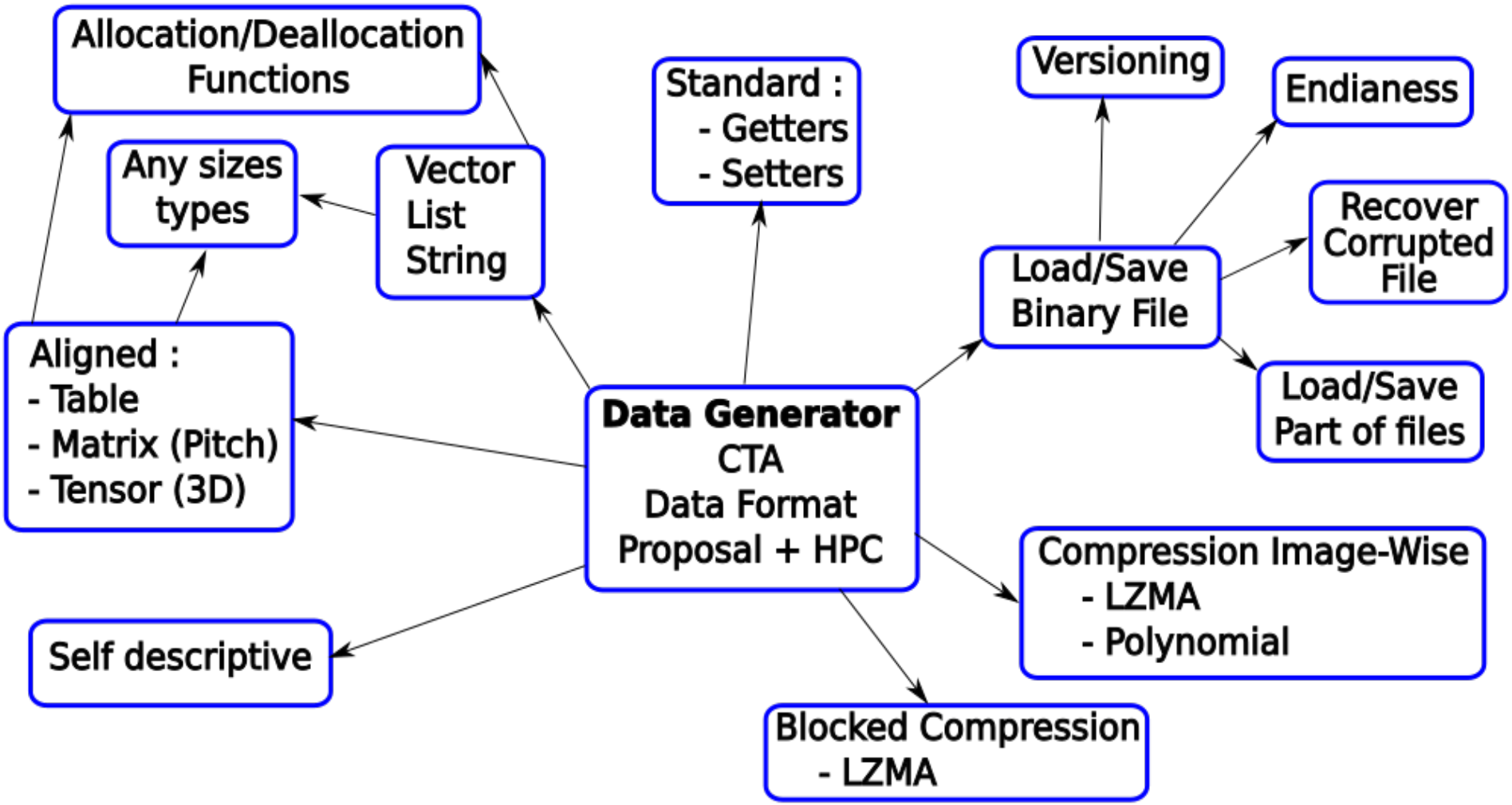
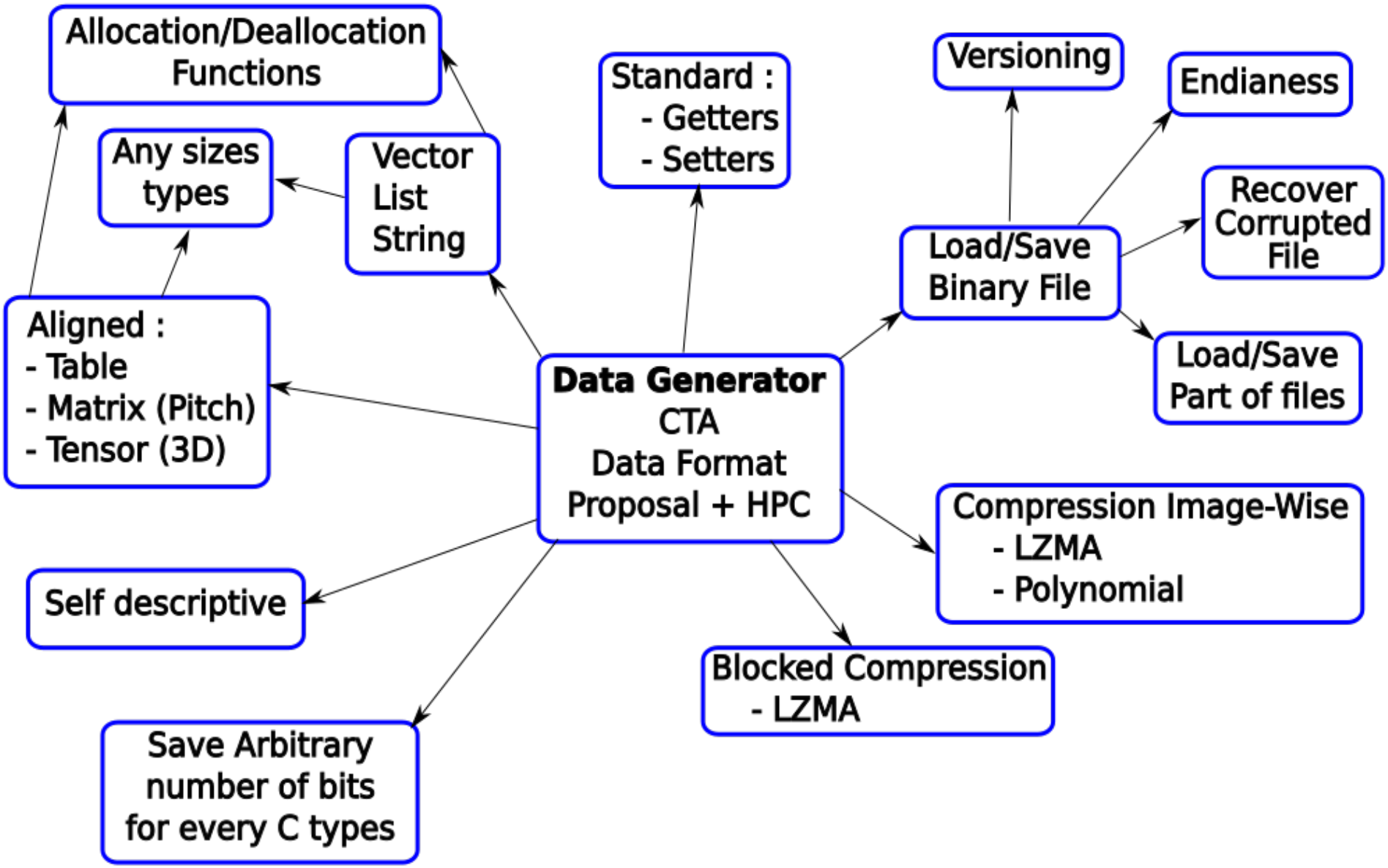


For C++ and Python



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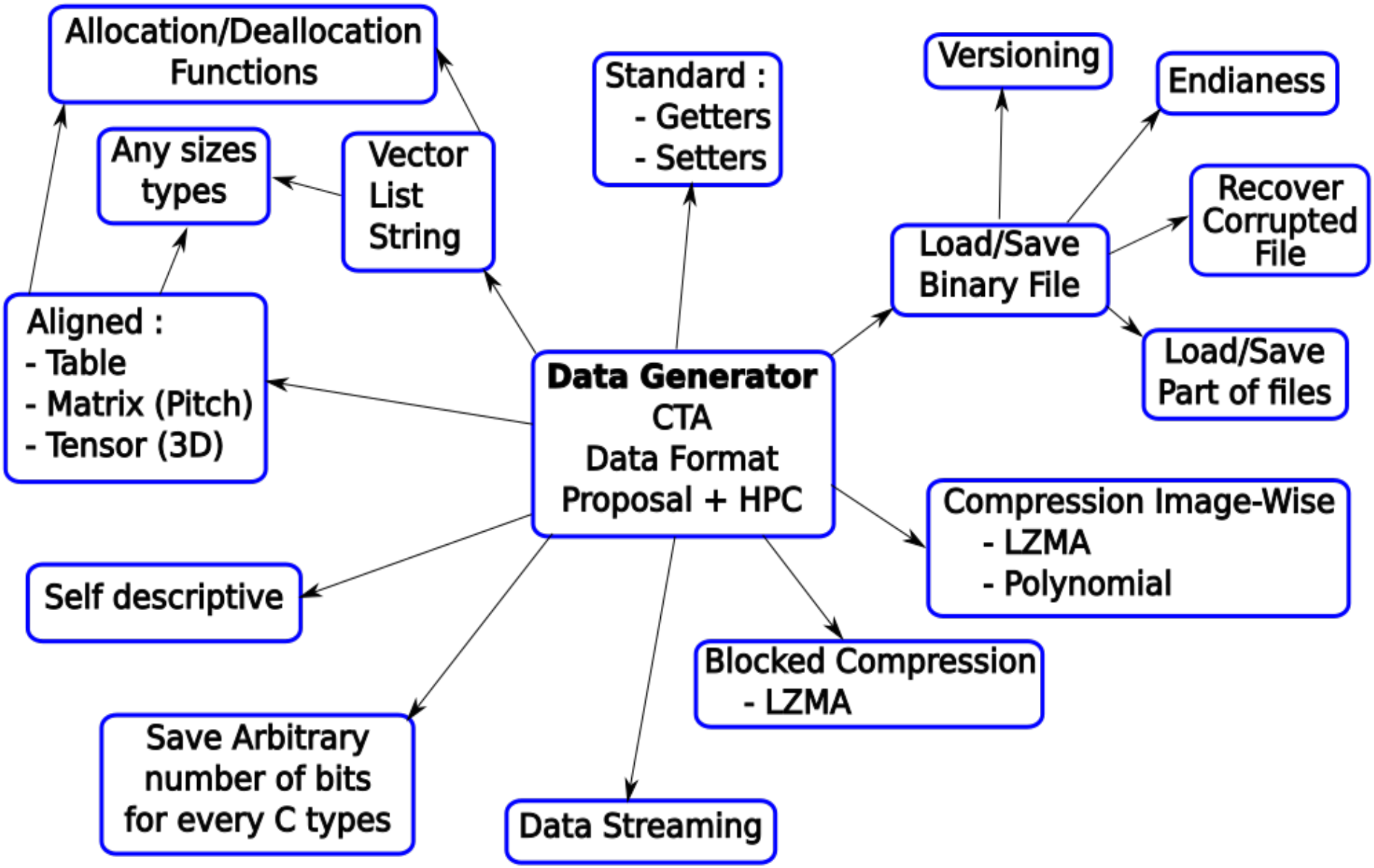
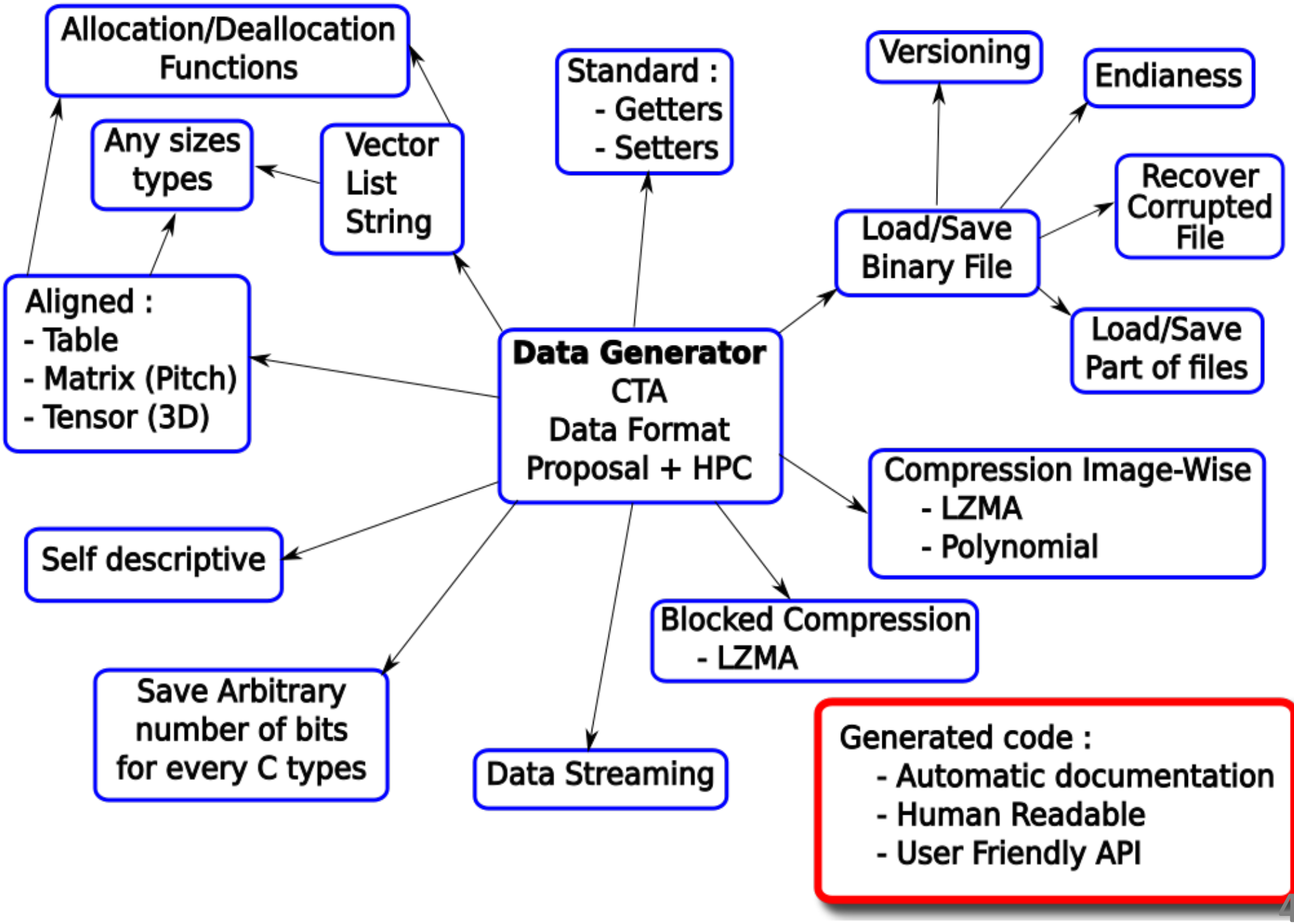


For C++ and Python



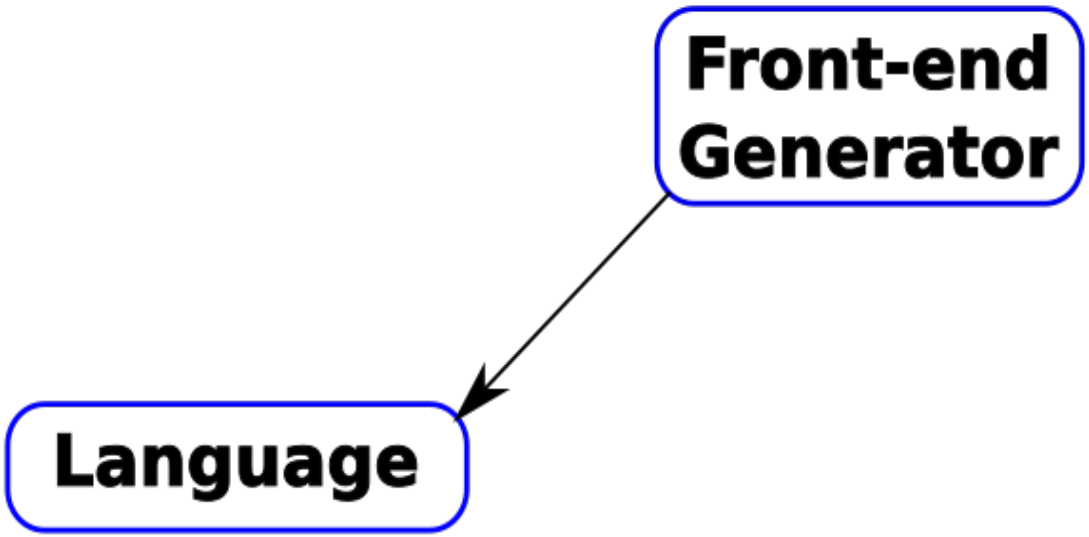
Generated data format performances (use case of CTA)

	dd	Generated Format C++	Generated Python	Generated Python wrapper
Read (RAM)	1494 MB/s	1861 MB/s	481.93 MB/s	2302.58 MB/s
Read(RAM) write(SSD)	120.68 MB/s	376.13 MB/s	11.39 MB/s	258.30 MB/s
Write (SSD)	131.29 MB/s	471.37 MB/s	11.66 MB/s	290.94 MB/s

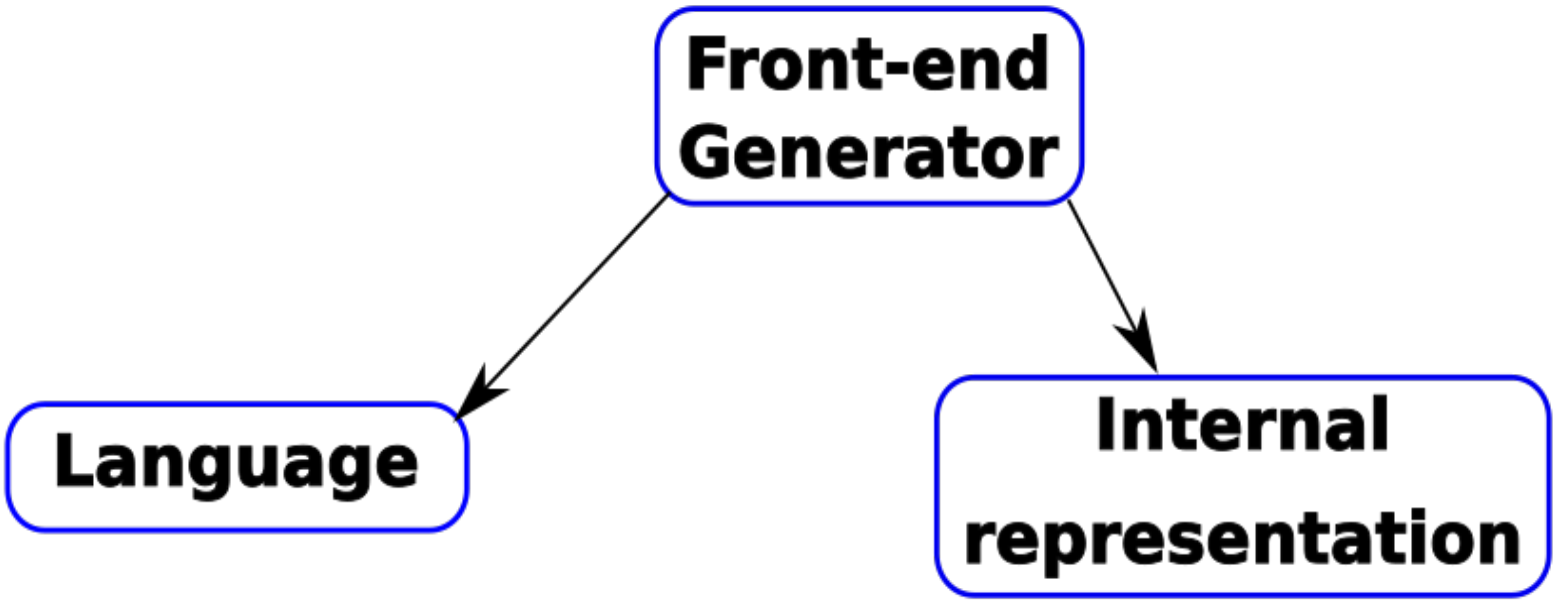
Parser generator

Parser generator

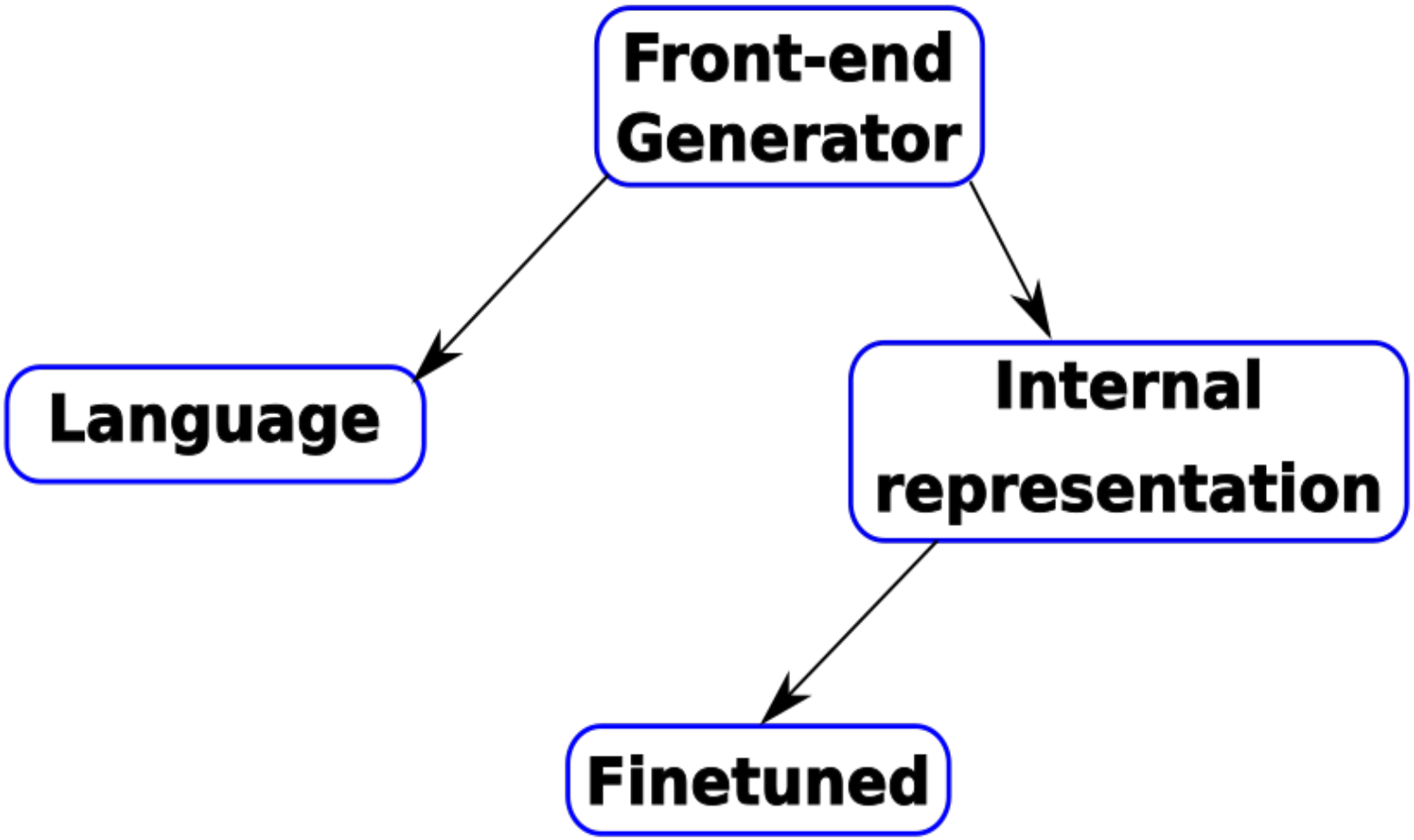
Parser generator



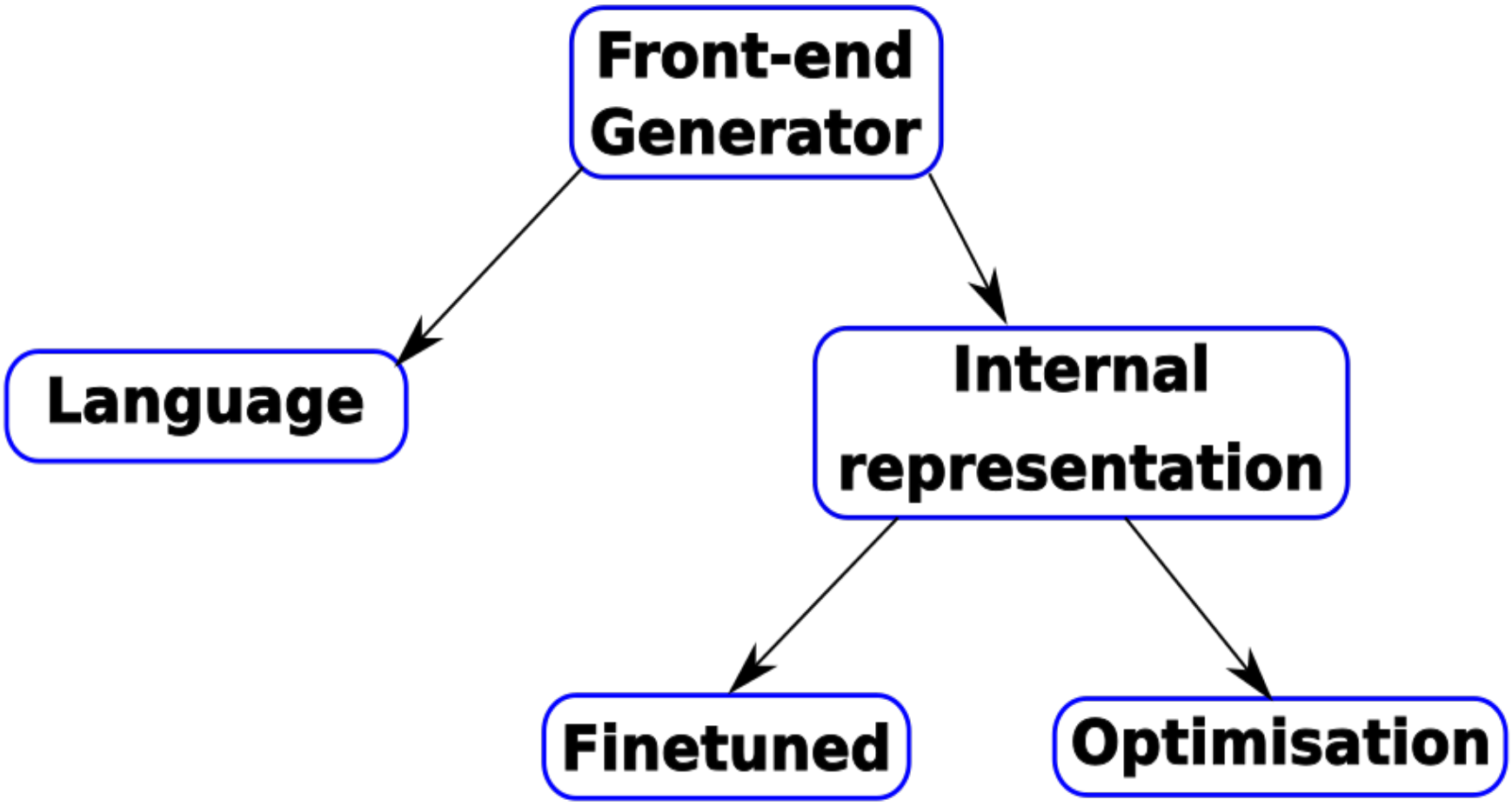
Parser generator



Parser generator



Parser generator

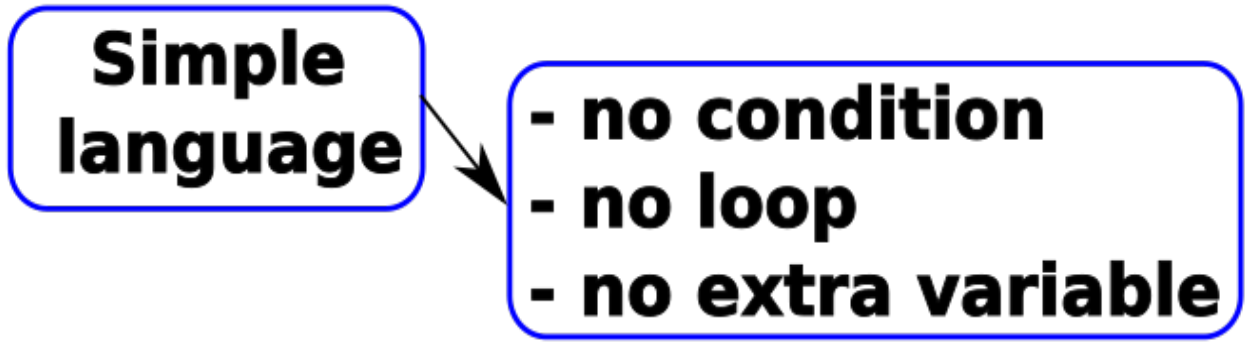


Kernel Generator

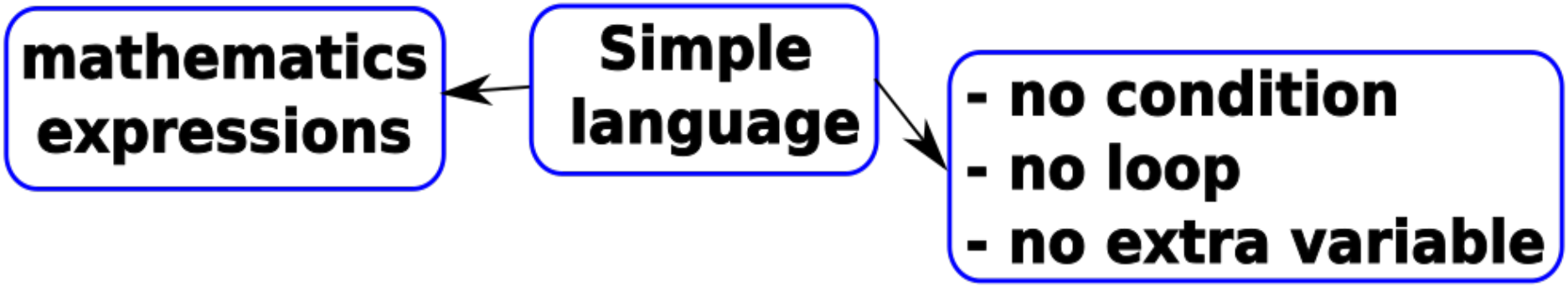
Kernel Generator

Simple language

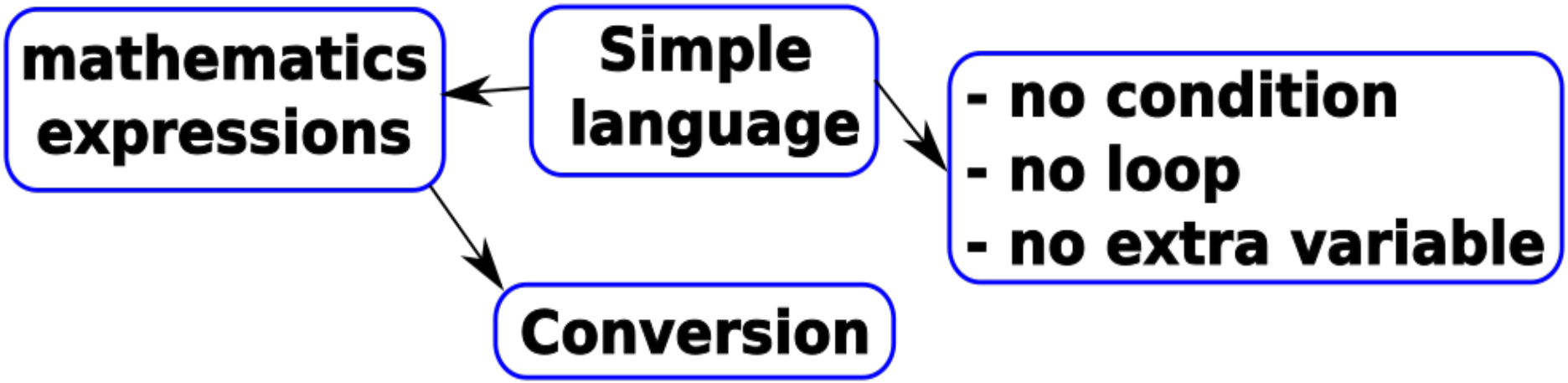
Kernel Generator



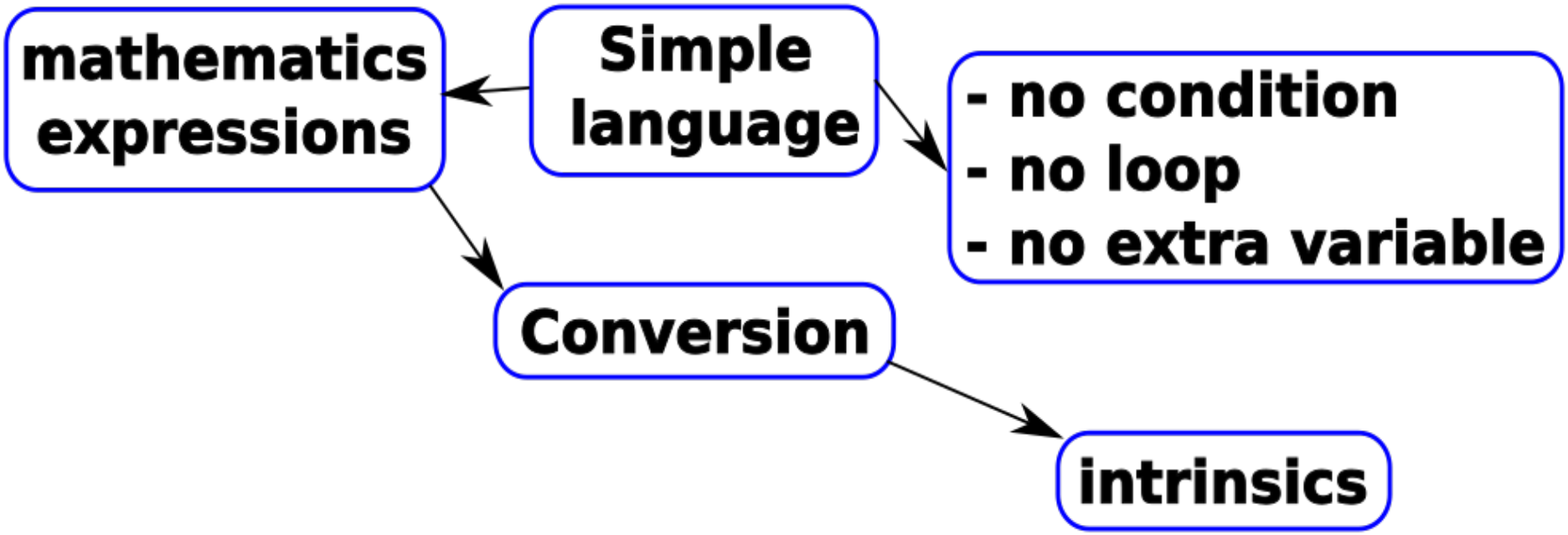
Kernel Generator



Kernel Generator



Kernel Generator



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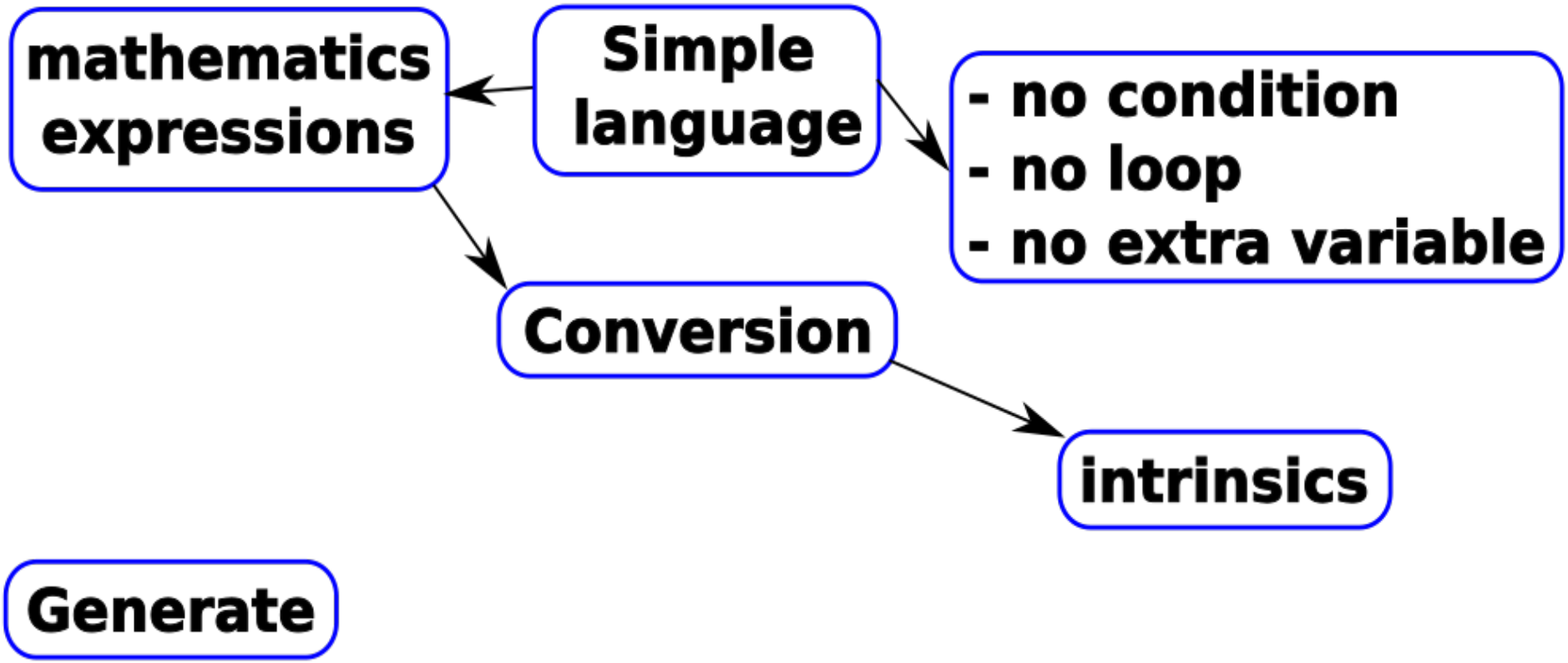

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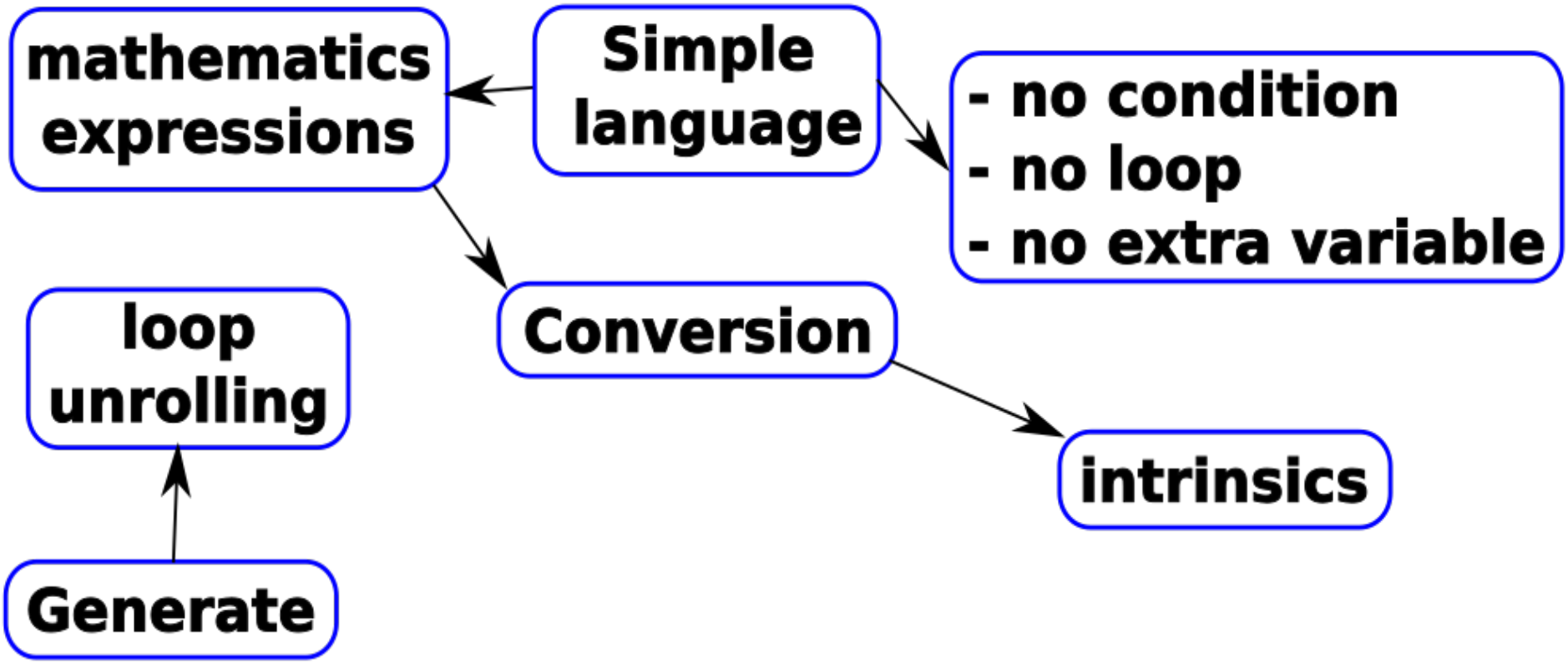

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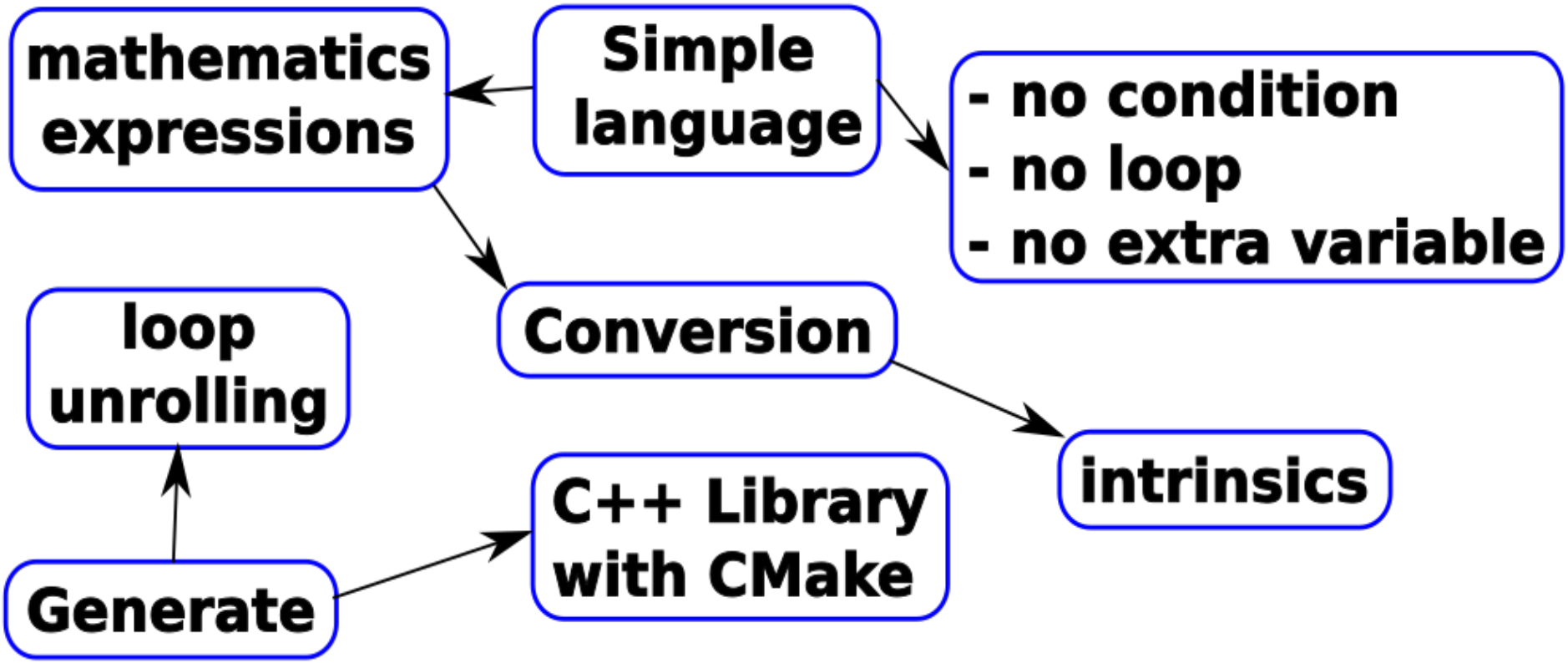
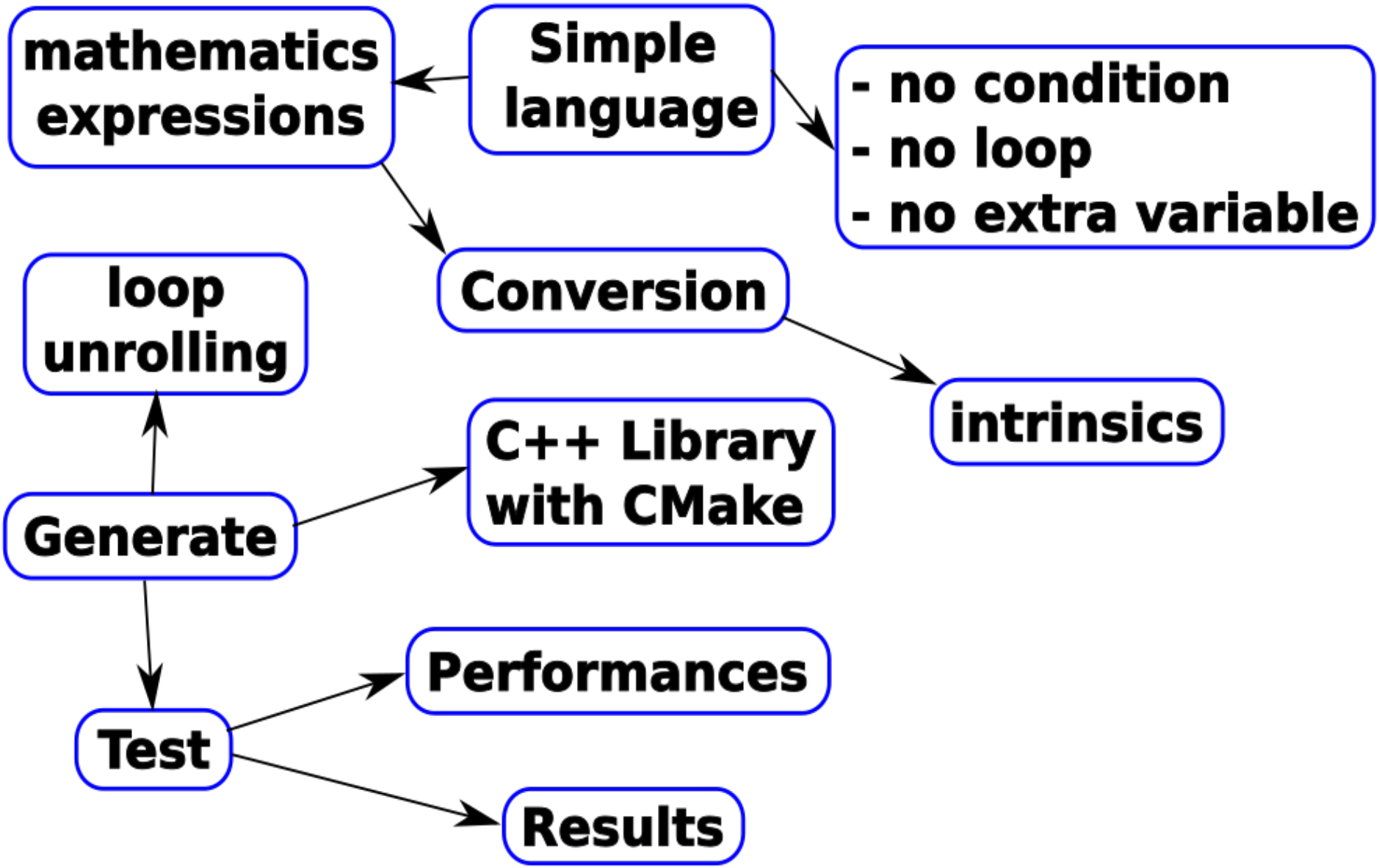
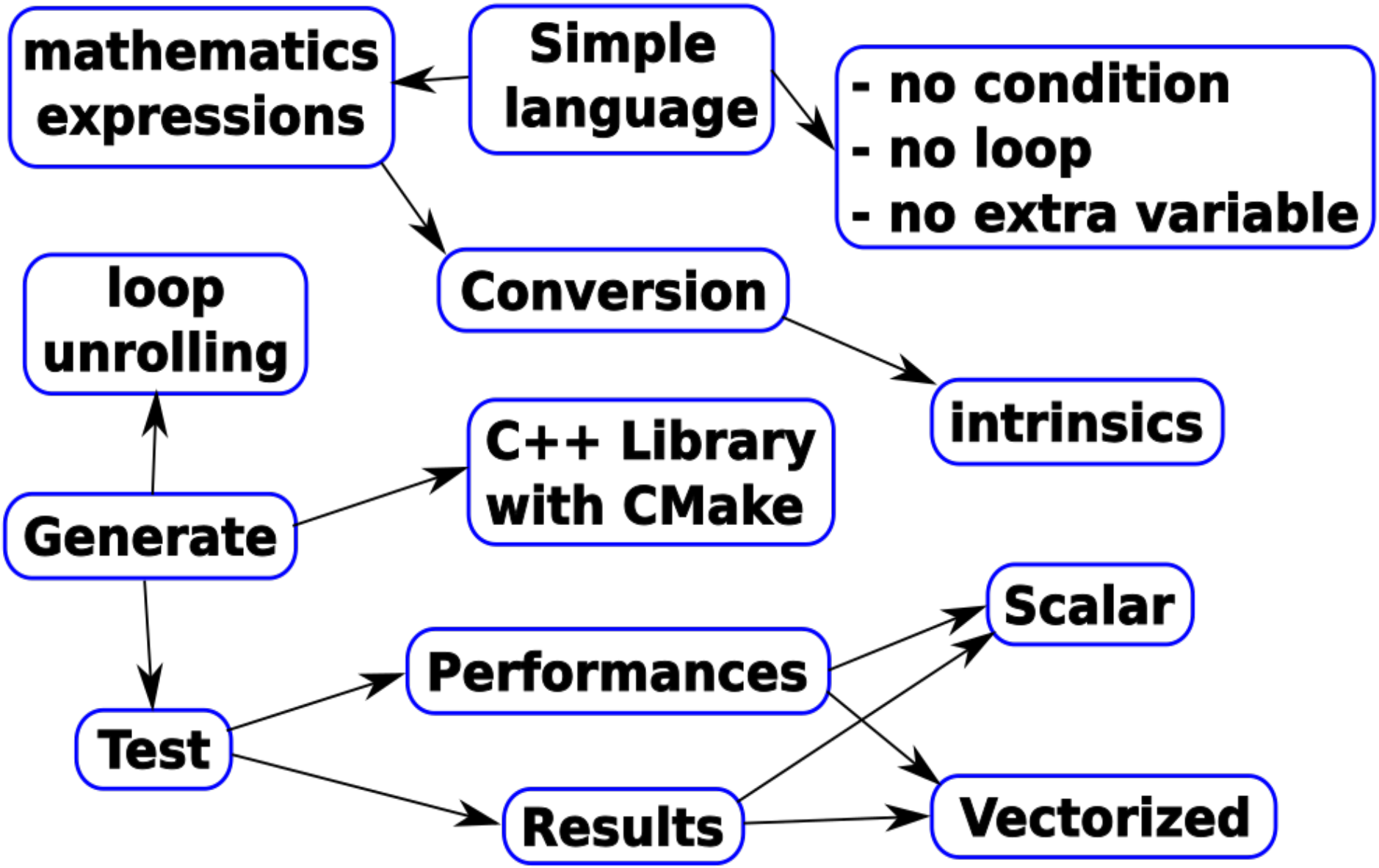


Kernel Generator



Kernel Generator



Conclusion

- code generator
  - automate repetitive tasks
    - class/file/data format writing
    - optimisations
      - intrinsics conversion
      - loop unrolling
      - temporary
- data format generator (C++/Python wrappers)
- kernel generator
  - exploring optimisations
    without compiler limitations