



# Iterative Compilation

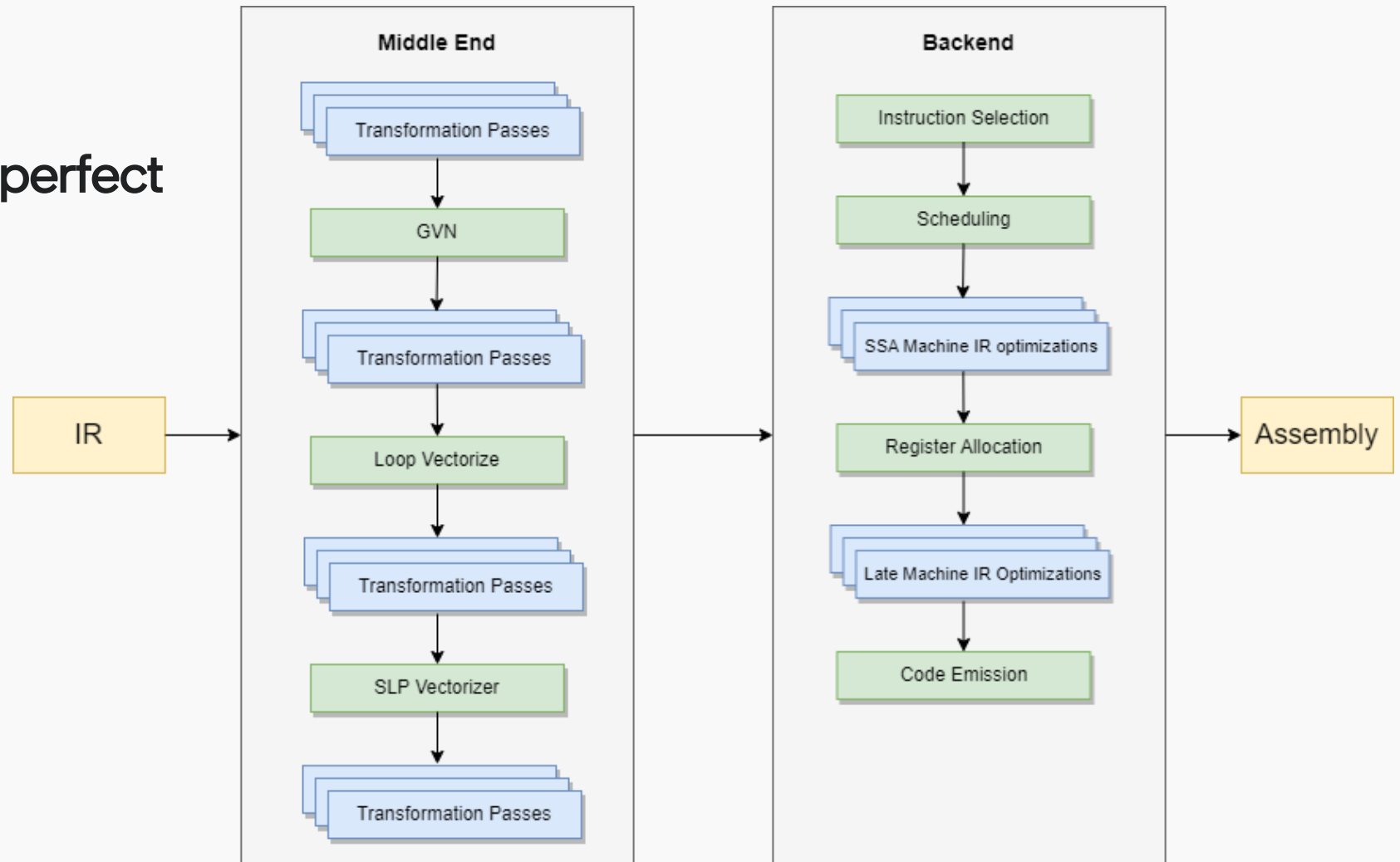
Give The Compiler A Second Chance

Ziv Ben Zion

May 10, 2023

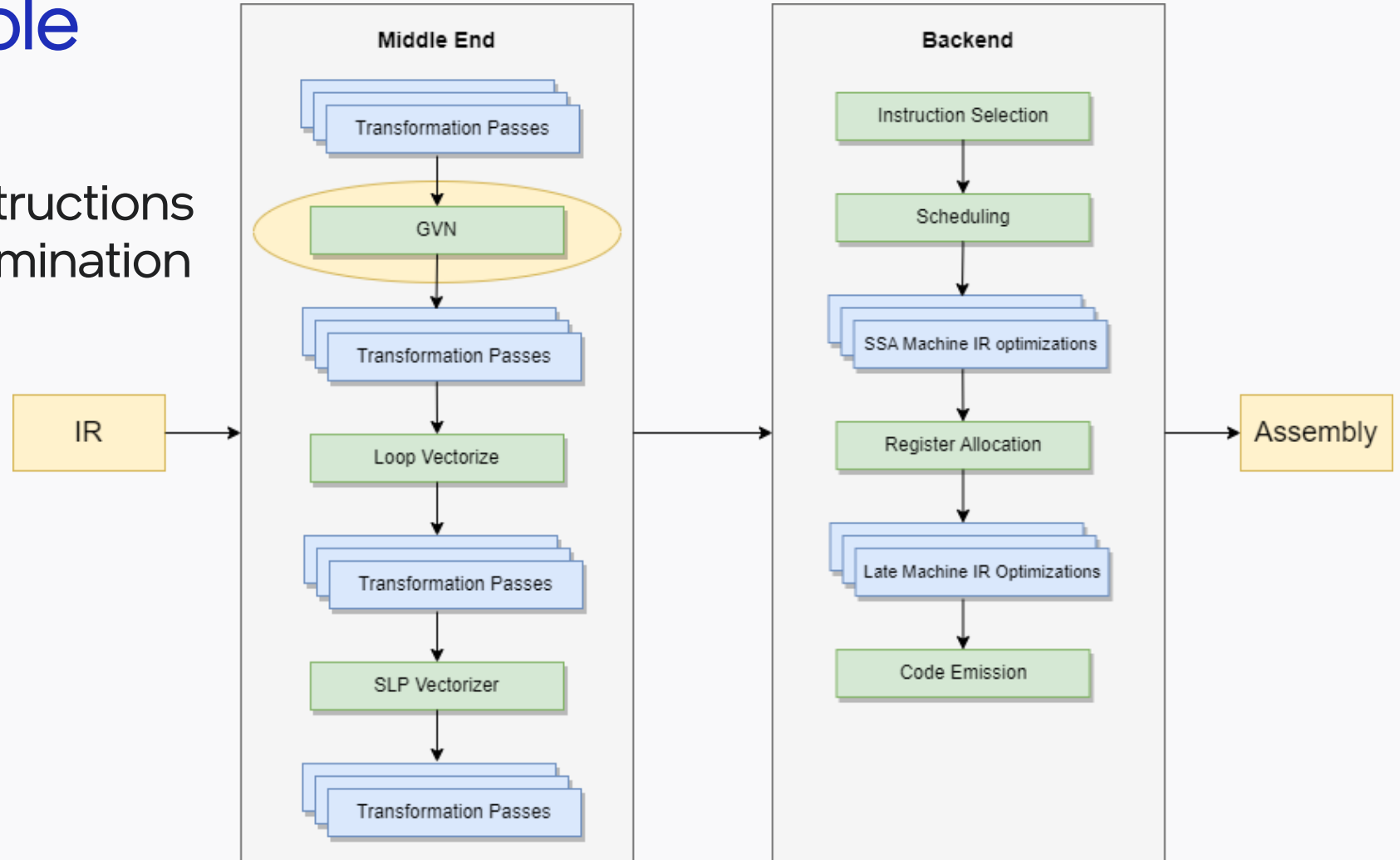
# Motivation

Compiler decisions aren't perfect



# Motivation - Example

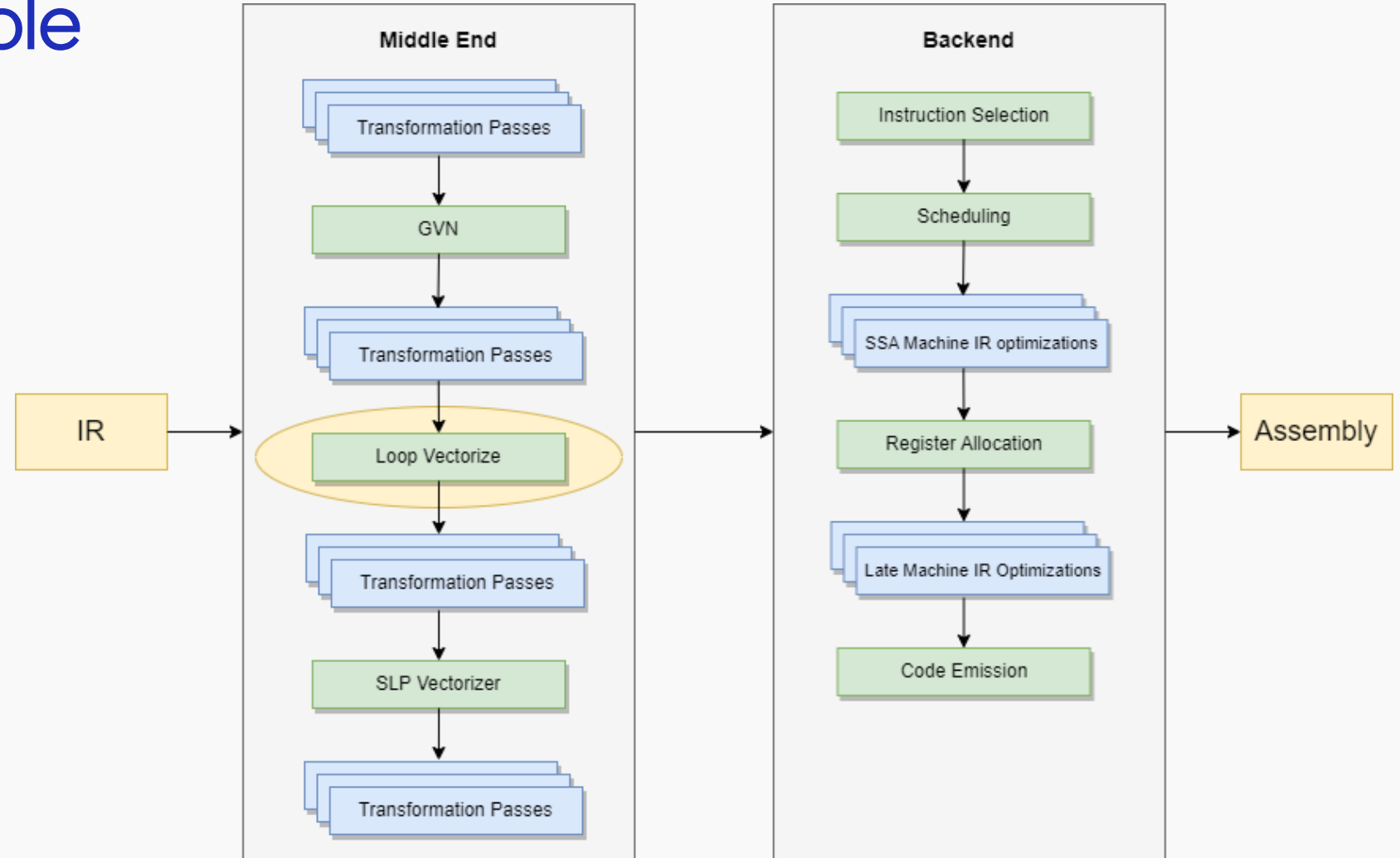
- Data Reuse – Loop Instructions  
Partial Redundancy Elimination



# Motivation - Example

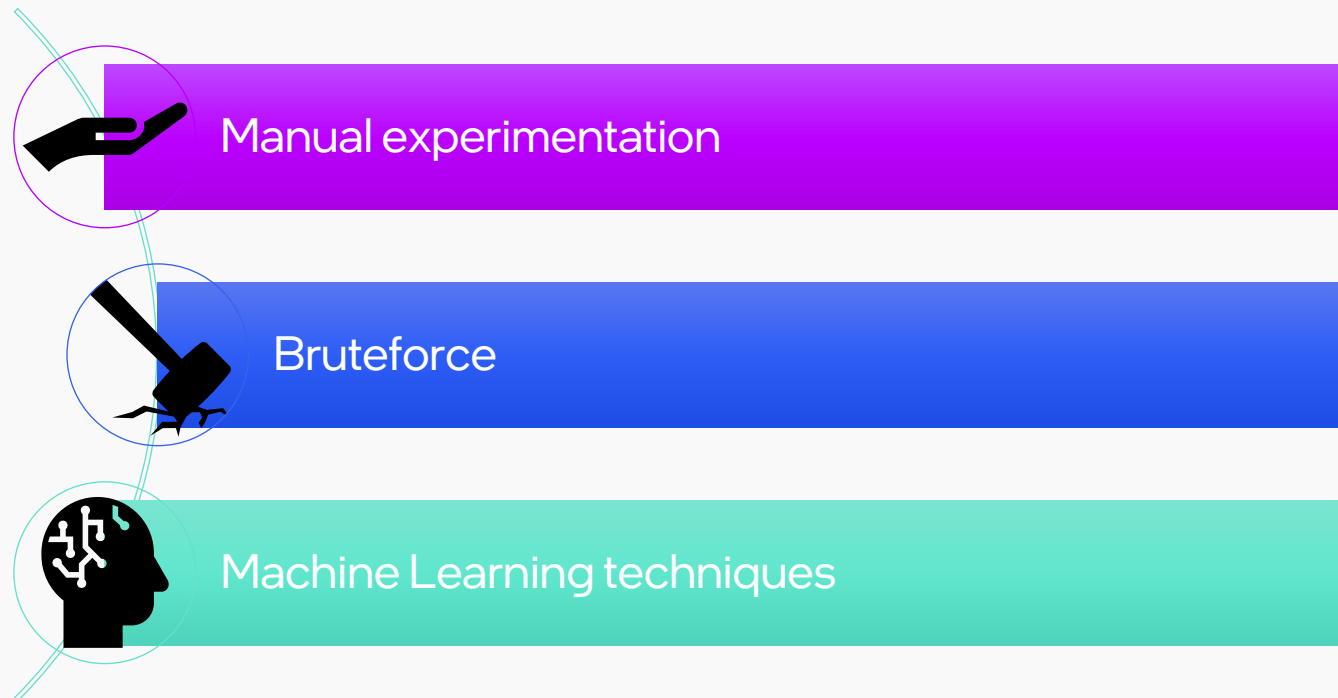
Two main decisions:

- VF – Vectorization Factor
- UF – Unroll Factor



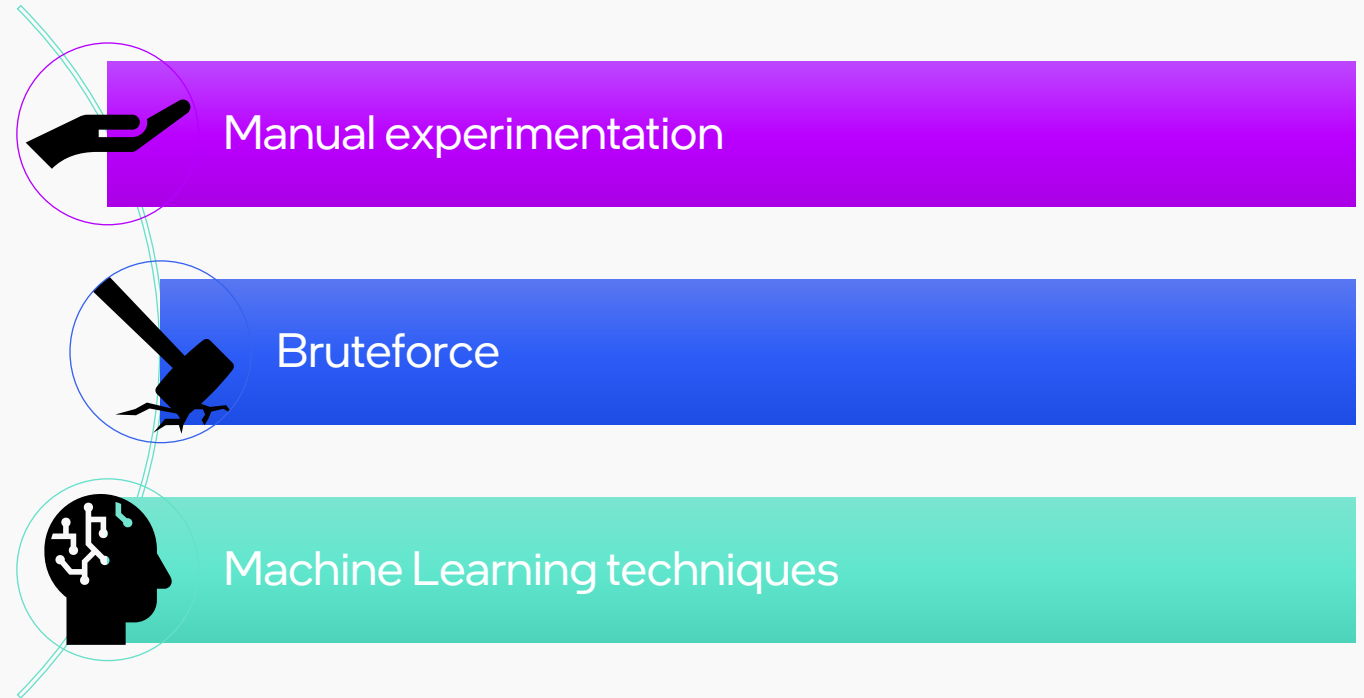
# Iterative Compilation

## Navigating the search space



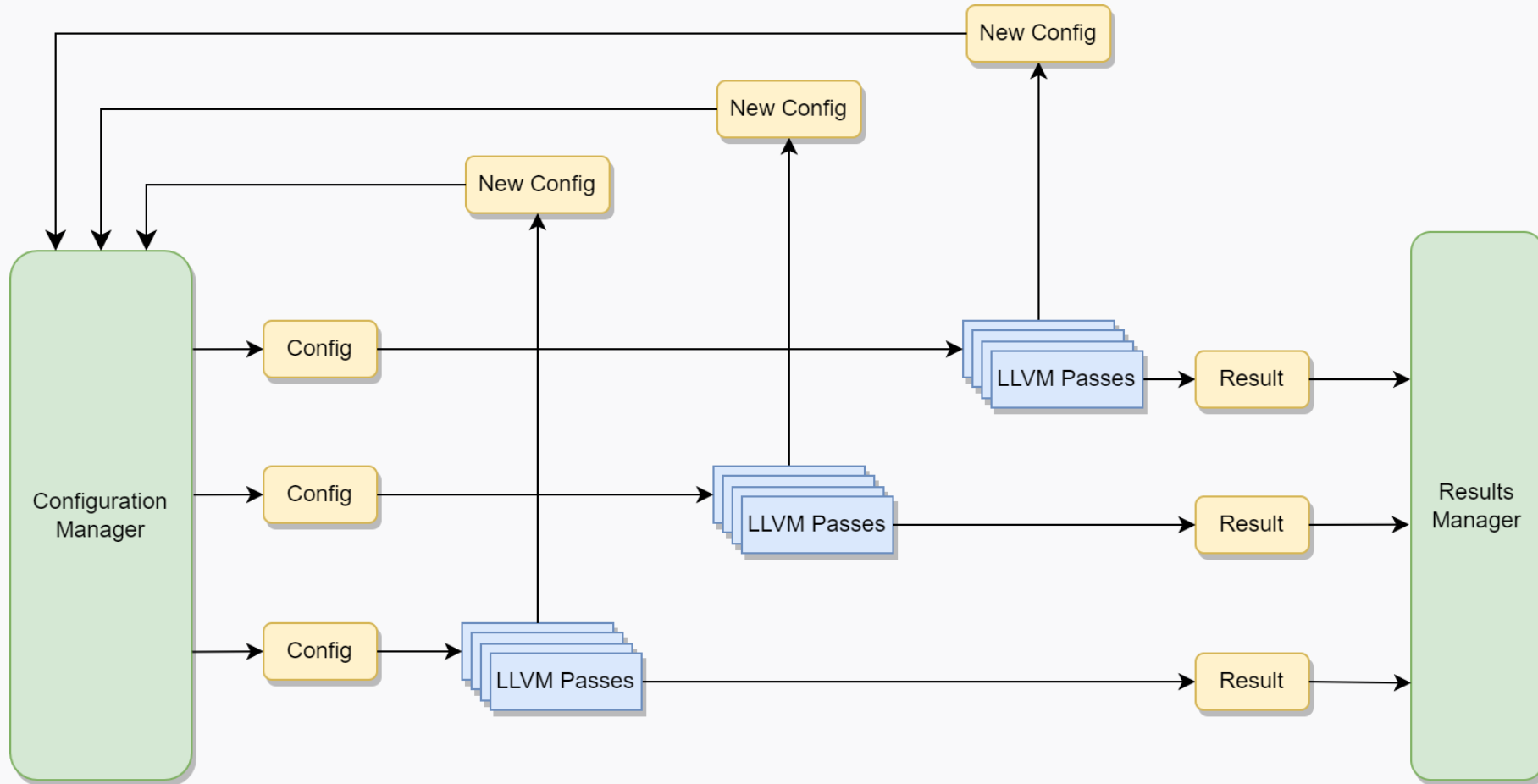
# Iterative Compilation

## Navigating the search space



*Why not let the compiler decide?*

# Implementation



# LLVM API

```
void IterativeComp::registerDecision(const std::string &ID, IterativeConfig &Config);
```

```
Optional<int> IterativeComp::getDecision(const std::string &ID, DecisionType Ty);
```

```
void IterativeComp::setResult(int Result);
```

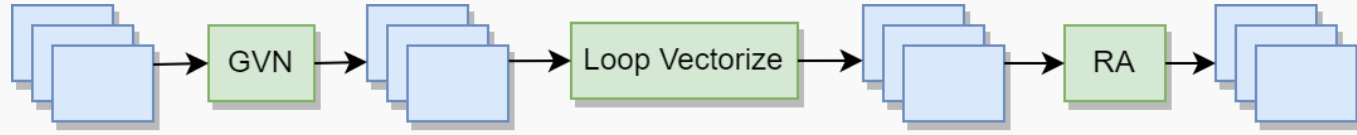
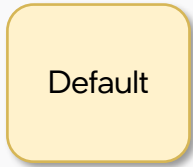


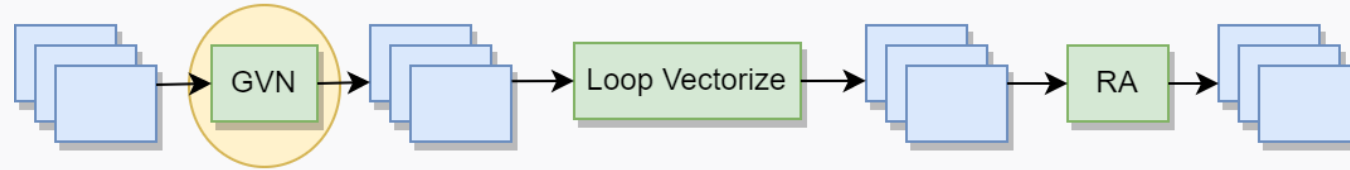
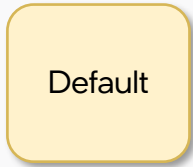
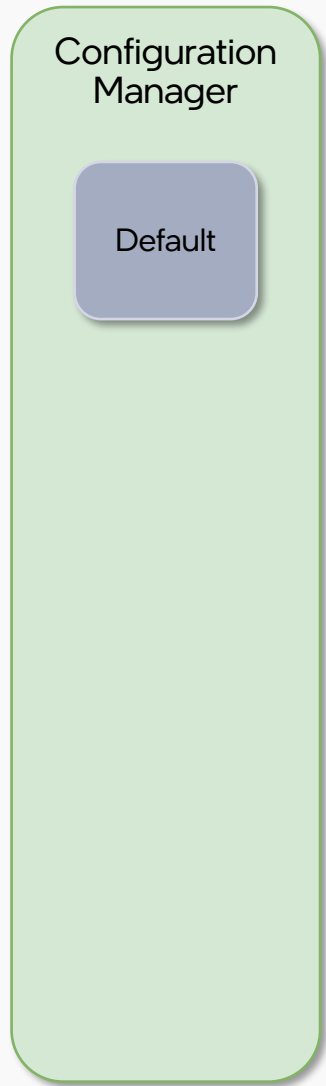
Configuration  
Manager

Default

Results  
Manager



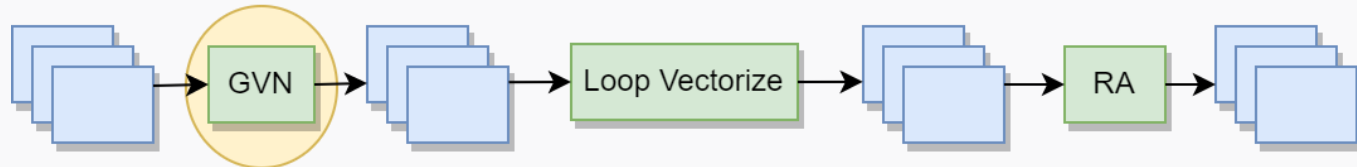




Configuration Manager

Default

LDR: on



Results Manager

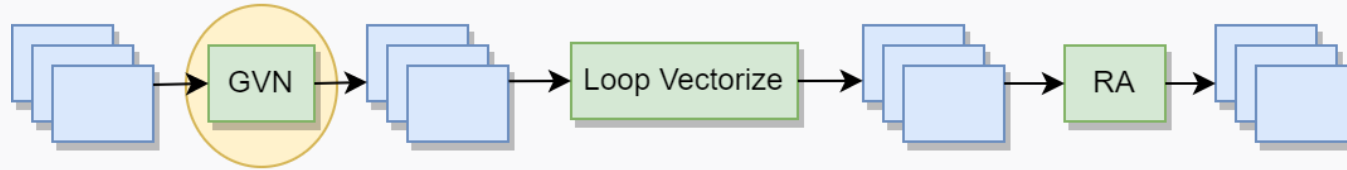
Configuration Manager

Default

LDR: off

LDR: on

LDR: on



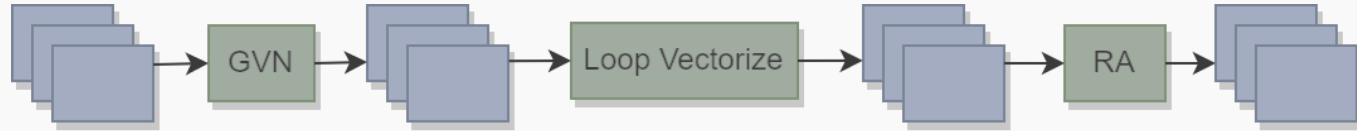
Results Manager

Configuration Manager

Default

LDR: off

Default



Results Manager

LDR: on

-----

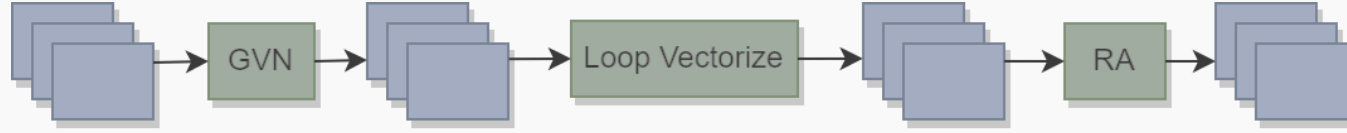
Result: 3

Configuration Manager

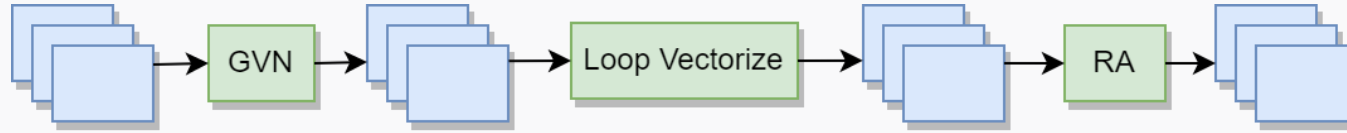
Default

LDR: off

Default



LDR: off



Results Manager

LDR: on

-----

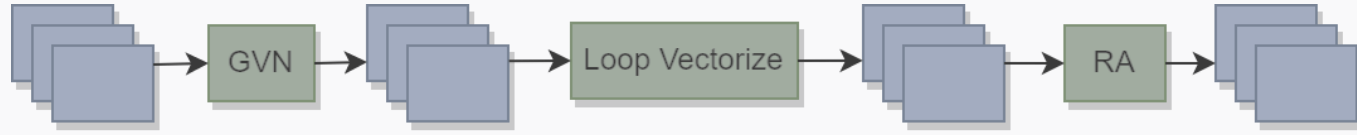
Result: 3

Configuration Manager

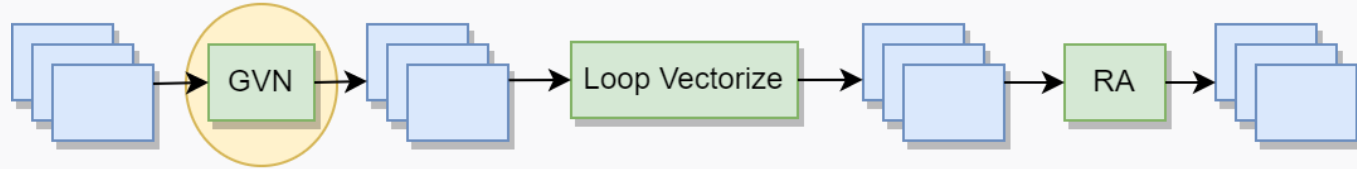
Default

LDR: off

Default



LDR: off



Results Manager

LDR: on

-----

Result: 3



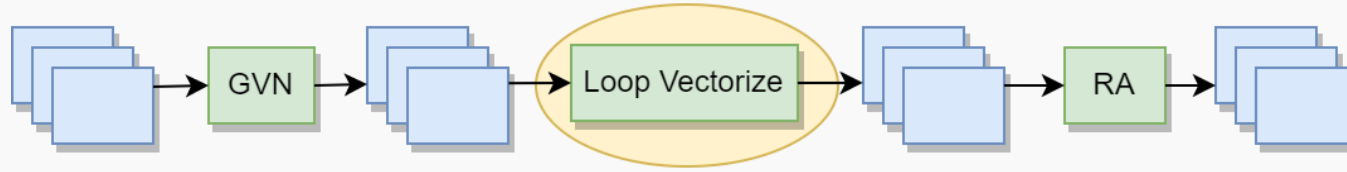
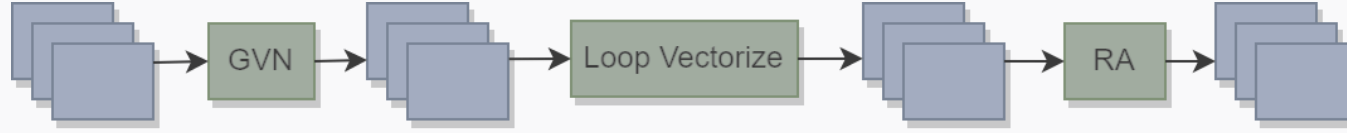
Configuration Manager

Default

LDR: off

Default

LDR: off



Results Manager

LDR: on

-----

Result: 3

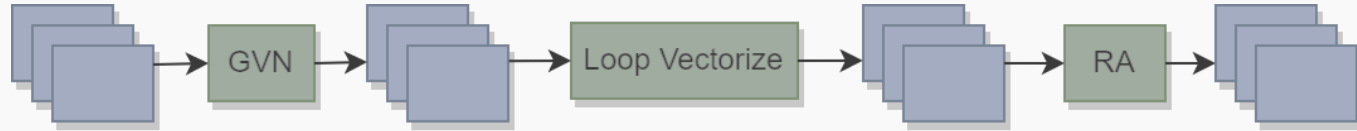
Configuration Manager

Default

LDR: off

Default

LDR: off  
VF: 8  
UF: 2



Results Manager

LDR: on

-----

Result: 3

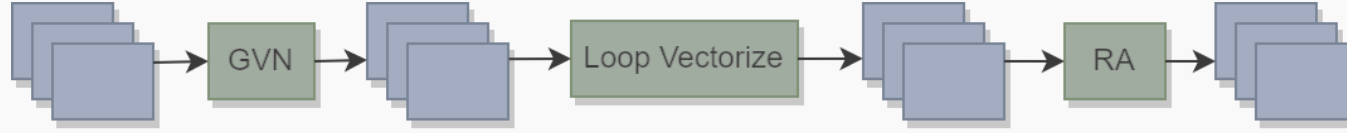
**Configuration Manager**

Default

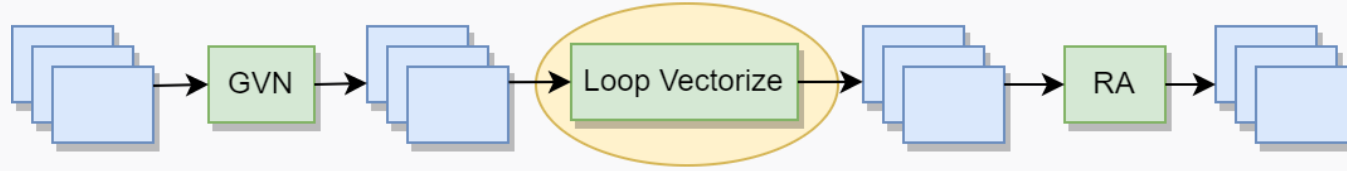
LDR: off

LDR: off  
VF: 16  
UF: 1

Default



LDR: off  
VF: 8  
UF: 2



**Results Manager**

LDR: on

-----

**Result: 3**

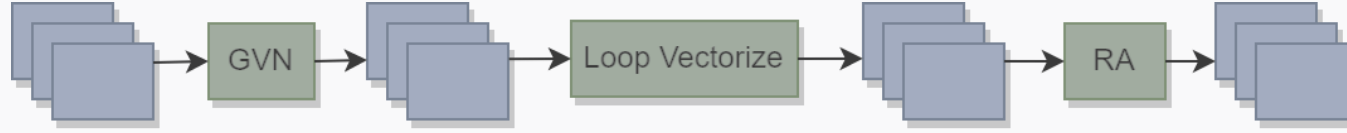
**Configuration Manager**

Default

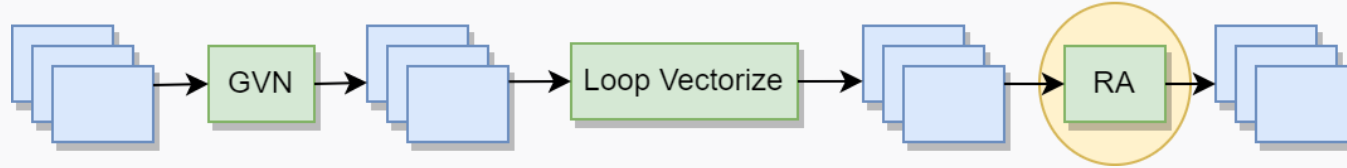
LDR: off

LDR: off  
VF: 16  
UF: 1

Default



LDR: off  
VF: 8  
UF: 2



**Results Manager**

LDR: on

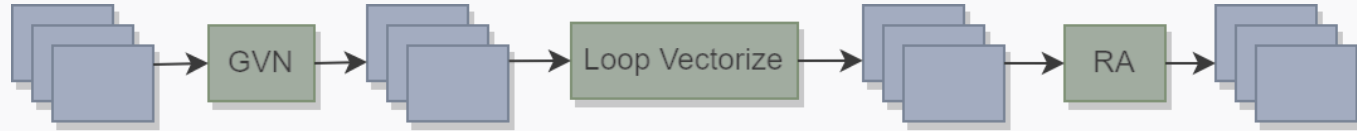
-----

**Result: 3**

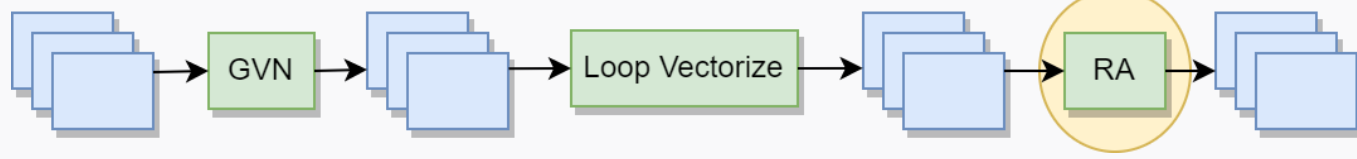
### Configuration Manager

- Default
- LDR: off
- LDR: off  
VF: 16  
UF: 1
- LDR: off  
VF: 8  
UF: 1

Default



LDR: off  
VF: 8  
UF: 2



### Results Manager

LDR: on

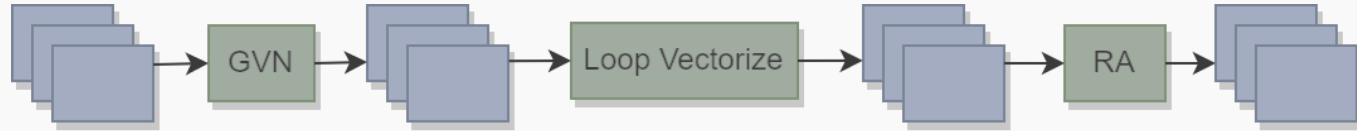
---

**Result: 3**

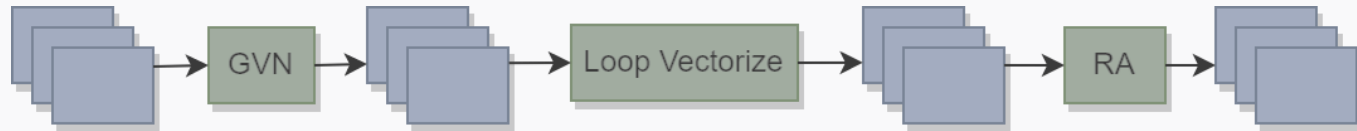
**Configuration Manager**

- Default
- LDR: off
- LDR: off  
VF: 16  
UF: 1
- LDR: off  
VF: 8  
UF: 1

Default



LDR: off  
VF: 8  
UF: 2



**Results Manager**

- LDR: on  
-----  
**Result: 3**
- LDR: off  
VF: 8  
UF: 2  
-----  
**Result: 5**

# Configuration Manager

Default

LDR: off

LDR: off  
VF: 16  
UF: 1

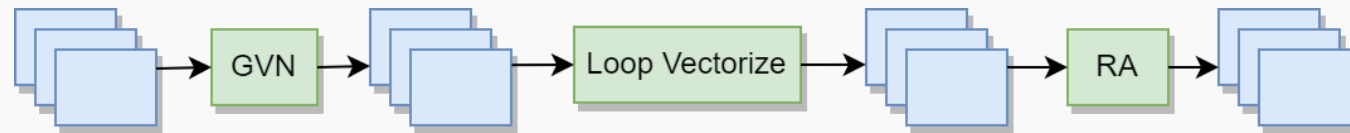
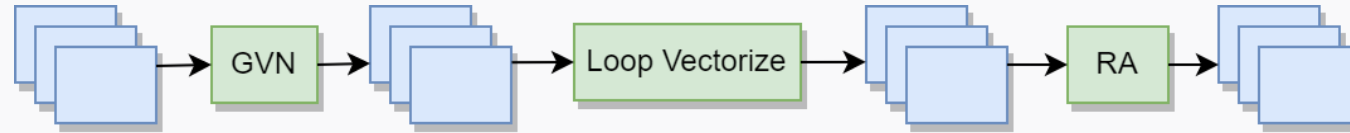
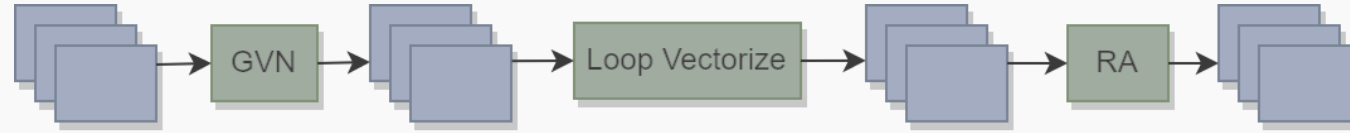
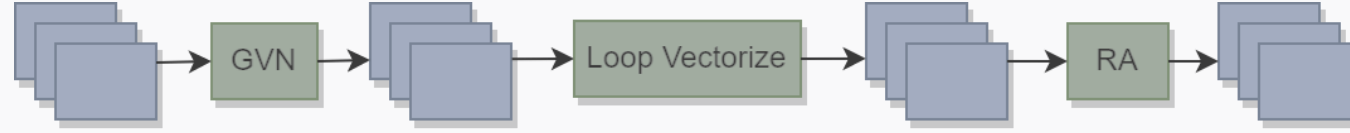
LDR: off  
VF: 8  
UF: 1

Default

LDR: off  
VF: 8  
UF: 2

LDR: off  
VF: 16  
UF: 1

LDR: off  
VF: 8  
UF: 1



# Results Manager

LDR: on

-----  
Result: 3

LDR: off  
VF: 8  
UF: 2

-----  
Result: 5

# Configuration Manager

Default

LDR: off

LDR: off  
VF: 16  
UF: 1

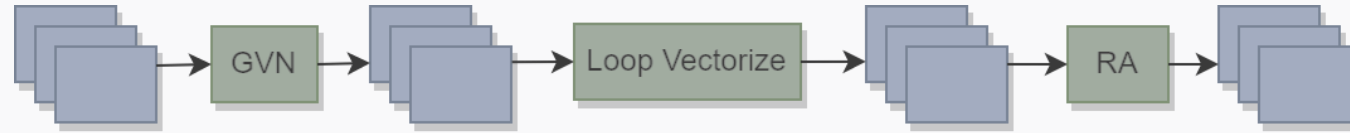
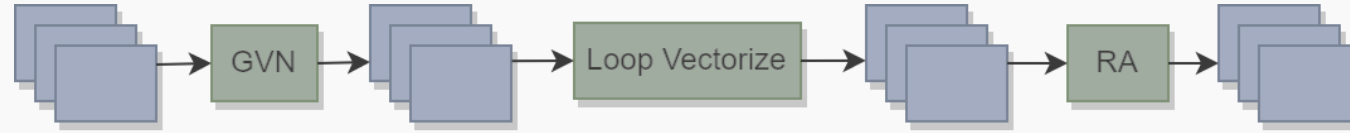
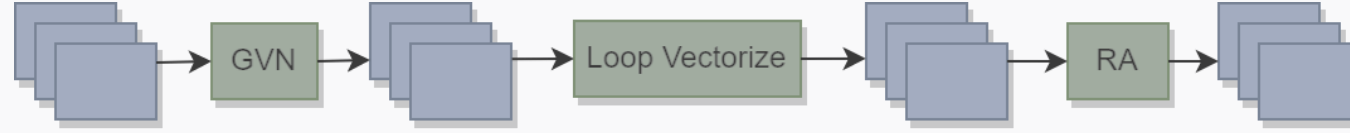
LDR: off  
VF: 8  
UF: 1

Default

LDR: off  
VF: 8  
UF: 2

LDR: off  
VF: 16  
UF: 1

LDR: off  
VF: 8  
UF: 1



# Results Manager

LDR: on

-----  
**Result: 3**

LDR: off  
VF: 8  
UF: 2

-----  
**Result: 5**

LDR: off  
VF: 16  
UF: 1

-----  
**Result: 9**

LDR: off  
VF: 8  
UF: 1

-----  
**Result: 6**





# Conclusion

- Utilize compiler knowledge in iterative compilation
- Easy to use
- Simple implementation



Thank you!

Ziv Ben Zion

[zbenzion@mobileye.com](mailto:zbenzion@mobileye.com)