ESCAPE 824064

Development Practice

Pierre Aubert

Introduction

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Change mind on **implementation**

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New **Idea**

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New **Idea**

Learning :

- New **Concept**
- New **Language**

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Better view of work to be done

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Good advice of a collegue

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Generaly : **Nice Improvement**

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Better view of work to be done

Good advice of a collegue

So we **change** our way of **implementing** stuff

Generaly : **Nice Improvement**

Sometimes : **Break**

Why :

- Start with an **idea**
- Finish with **another idea**
- But **not compatible**

How ?

How ?

Documentation

How ?

Documentation

Versioning :
- **History** of modifications
- **Restore** previous versions
- **Prepare** future versions

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Unit Tests :
- **Check** if something is wrong
- Can be **automatised**

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Development Method :
- Simplify **new features**
- Ease **bug fix**
- Enhence **reusability**

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Software Architecture :
- Interfaces

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Software Architecture :
- Interfaces

Profiling :
- Time functions

Documentation

readme.md :
- Showcase
- Depedencies
- Installation / Compitation
- Use cases

Development Documentation :
- Doxygen
- Sphinx

Versionning

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Save **all changes** in the project

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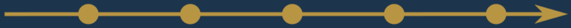
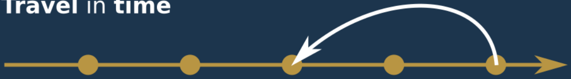


Travel in **time**



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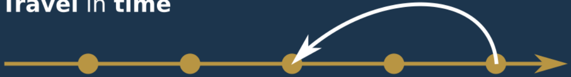

Coherent save of the project
- **As many local** / **remote saves** you need

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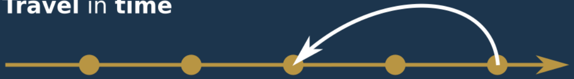

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Prevent breaking projet with **old modification**

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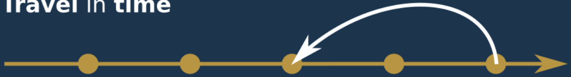

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Travel in **time**

Coherent save of the project
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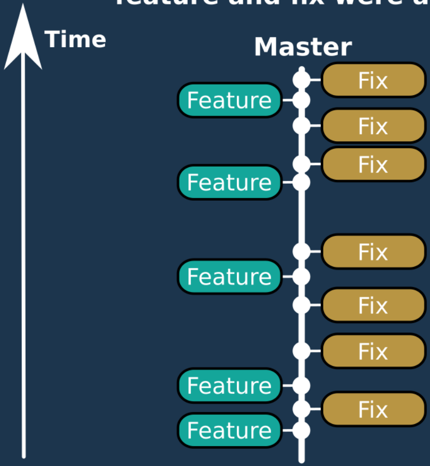
Gitlab

https://gitlab.in2p3.fr

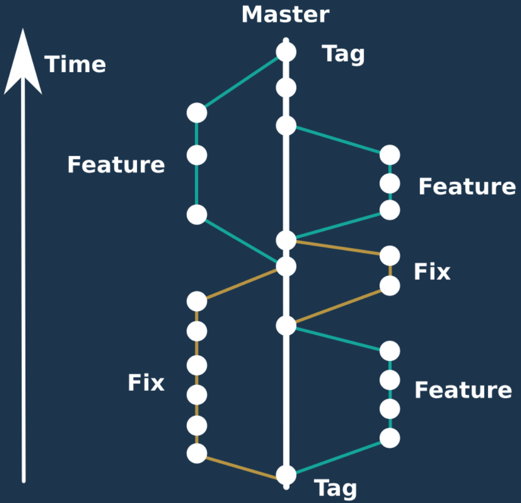
Git History

Tool to know when feature and fix were added



Branches

Classical Workflow



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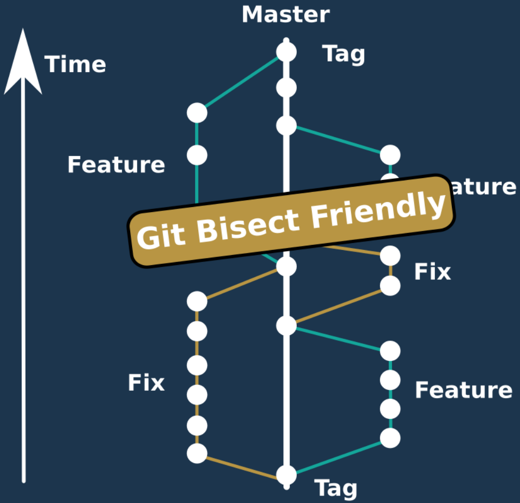

Git Bisect

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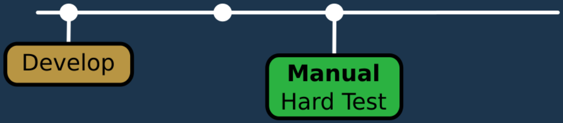

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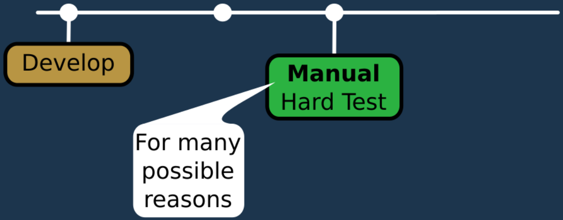

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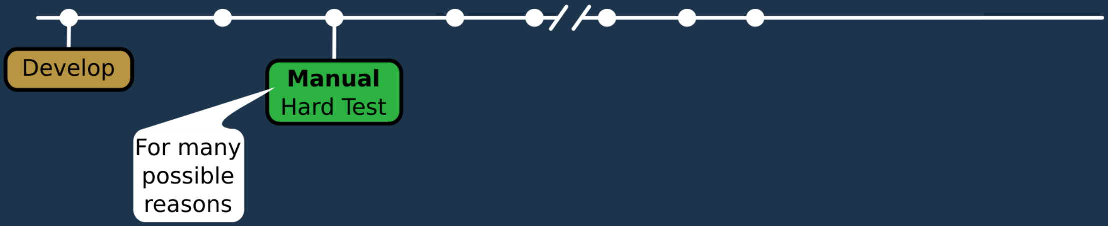

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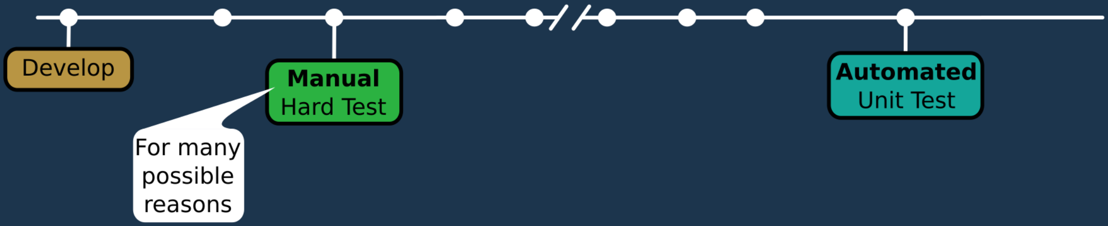
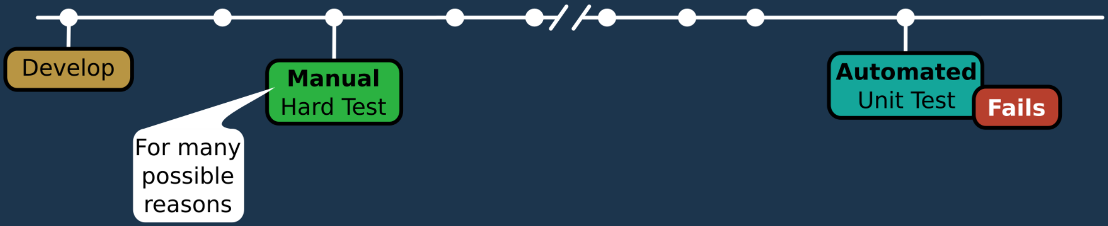

Develop
Manual Hard Test
For many possible reasons
Automated Unit Test

Git Bisect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Fails

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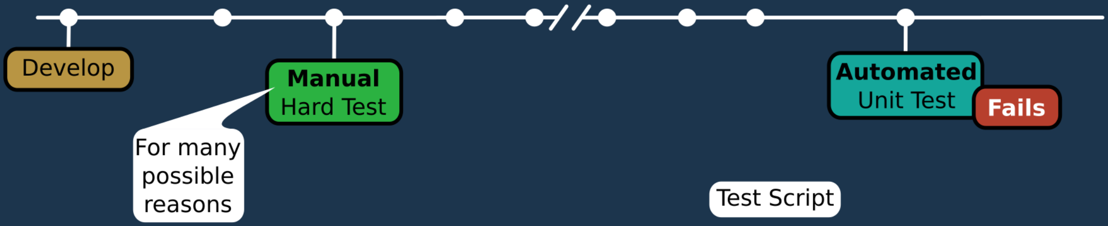
Develop
Manual
Hard Test
For many possible reasons
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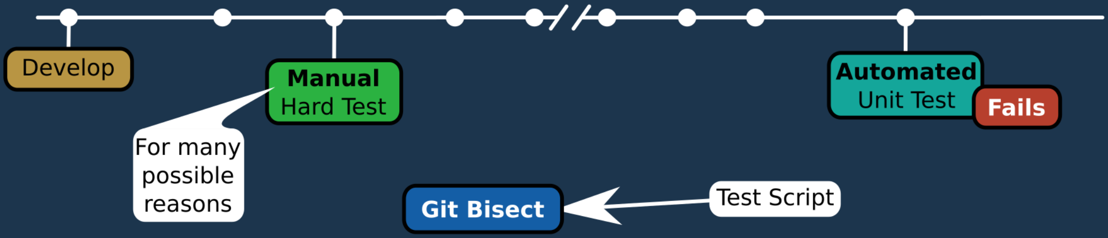
Unit Test
Fails
Test Script

Git Bisect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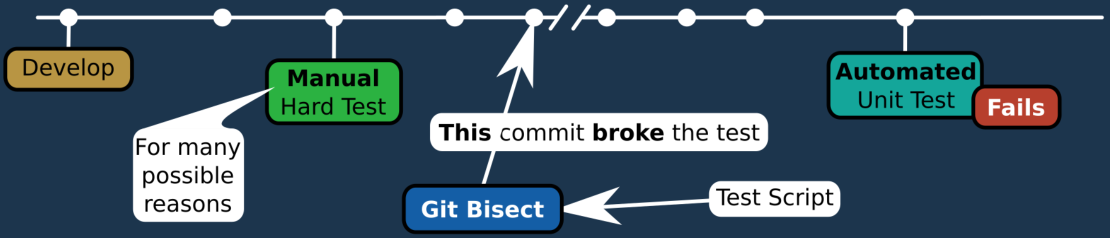
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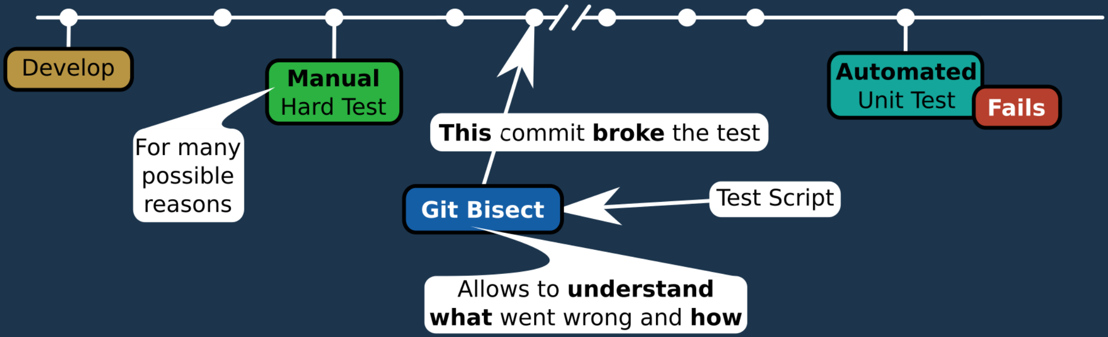
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Allows to understand what went wrong and how

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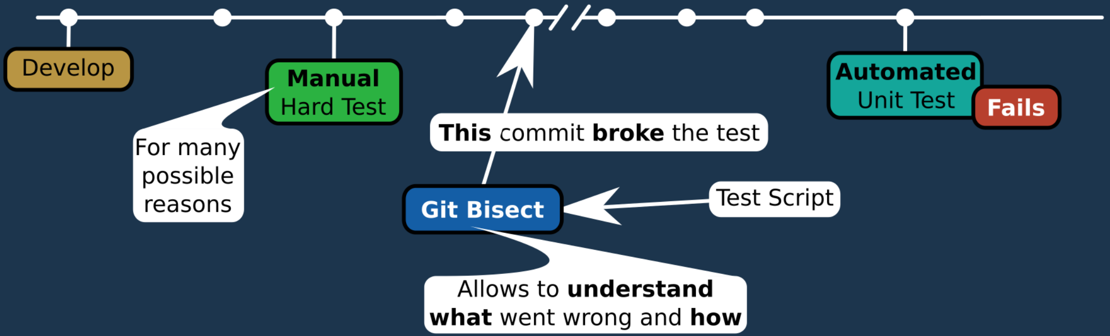
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Development :
- **Not only** about adding **features** and finding **bugs**
- **Understanding why** a bug appeared and **how** to prevent it

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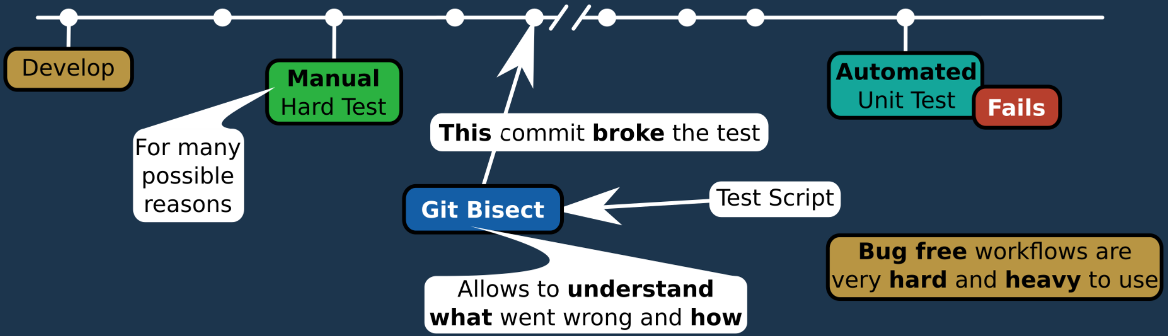
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Bug free workflows are very hard and heavy to use

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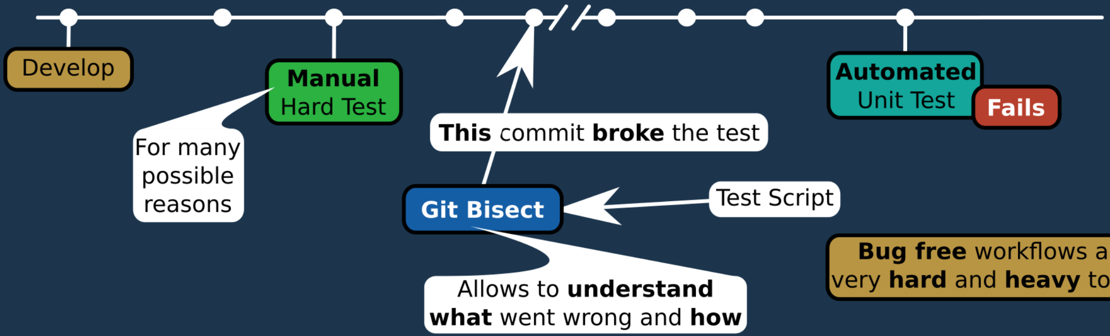
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Allows to **understand** **what** went wrong and **how**

Bug free workflows are very **hard** and **heavy** to use

Some workflows can **fasten** bugs **research** and **fix**

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- **Not only** about adding **features** and finding **bugs**
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Interfaces

Interface : Border

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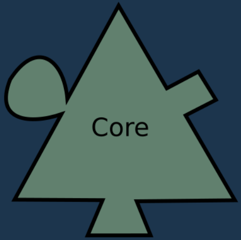

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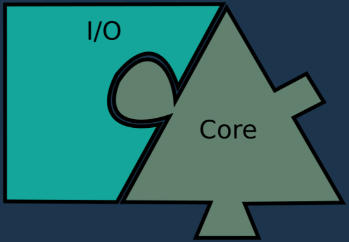

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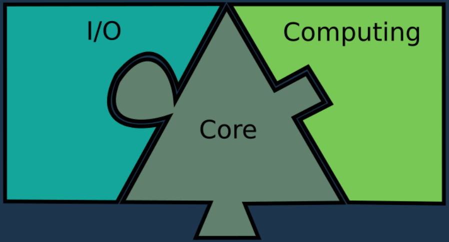

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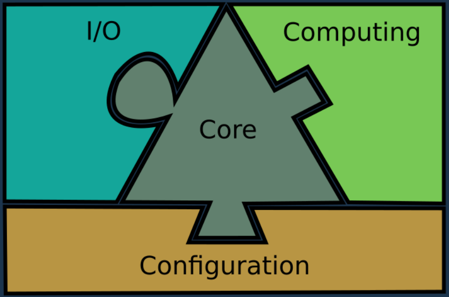

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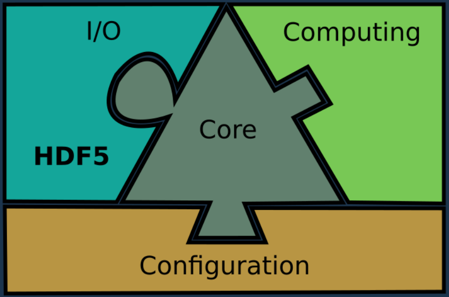

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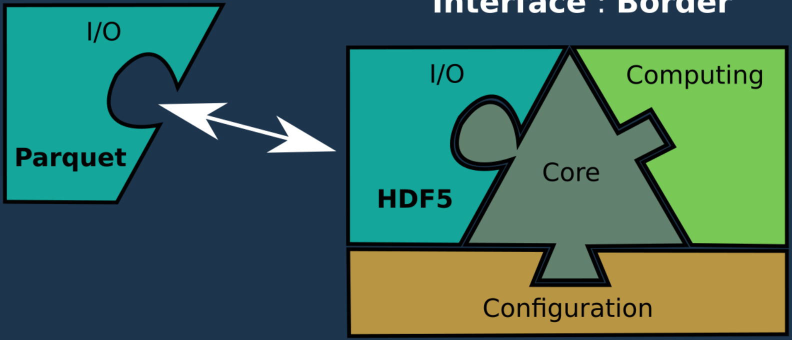

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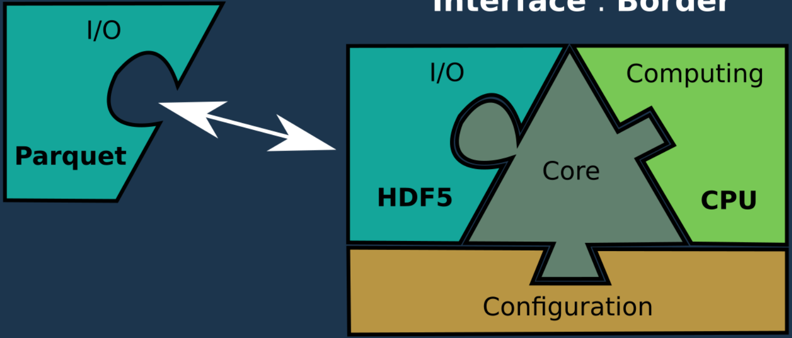

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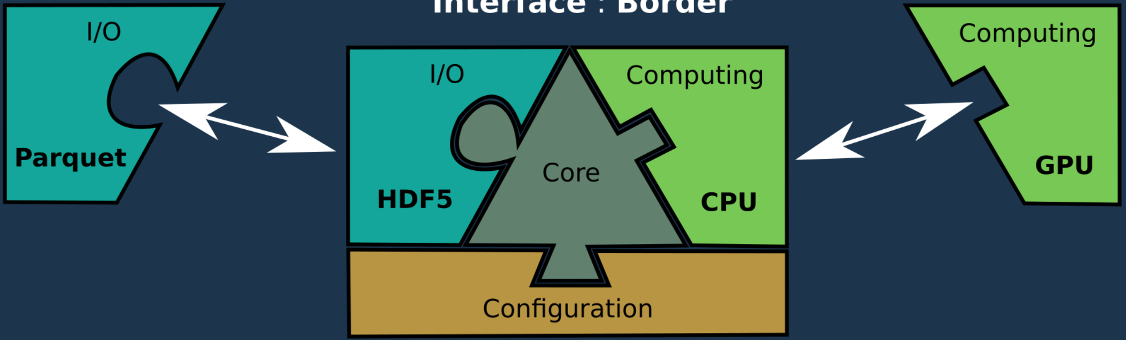

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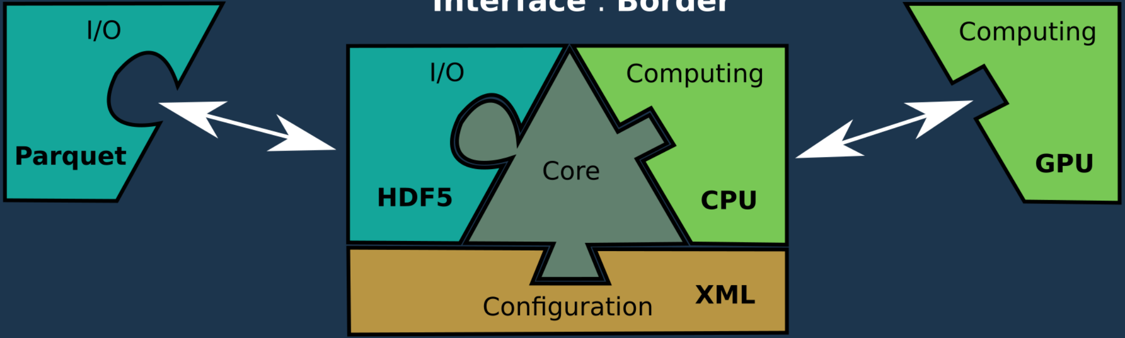

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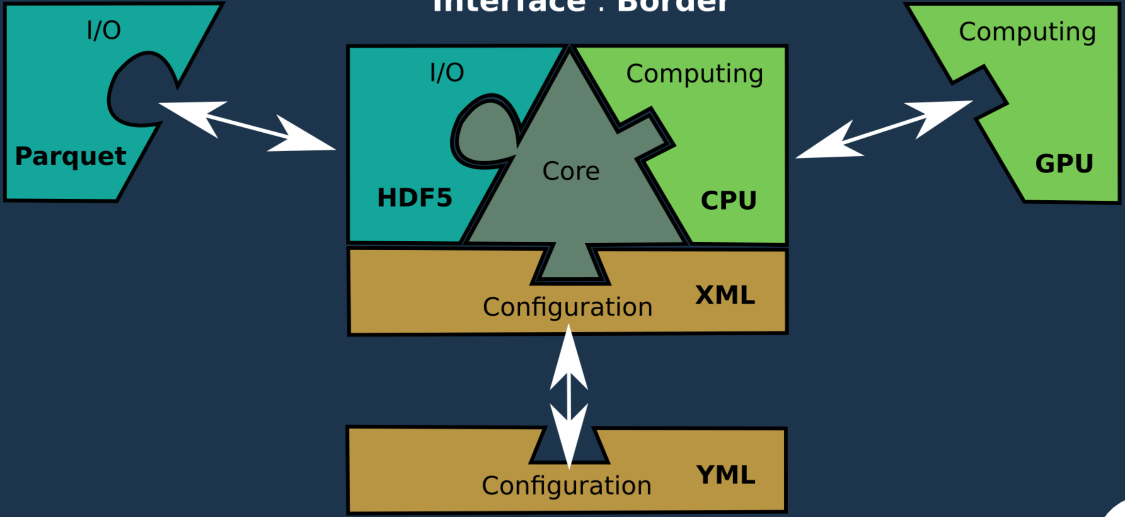

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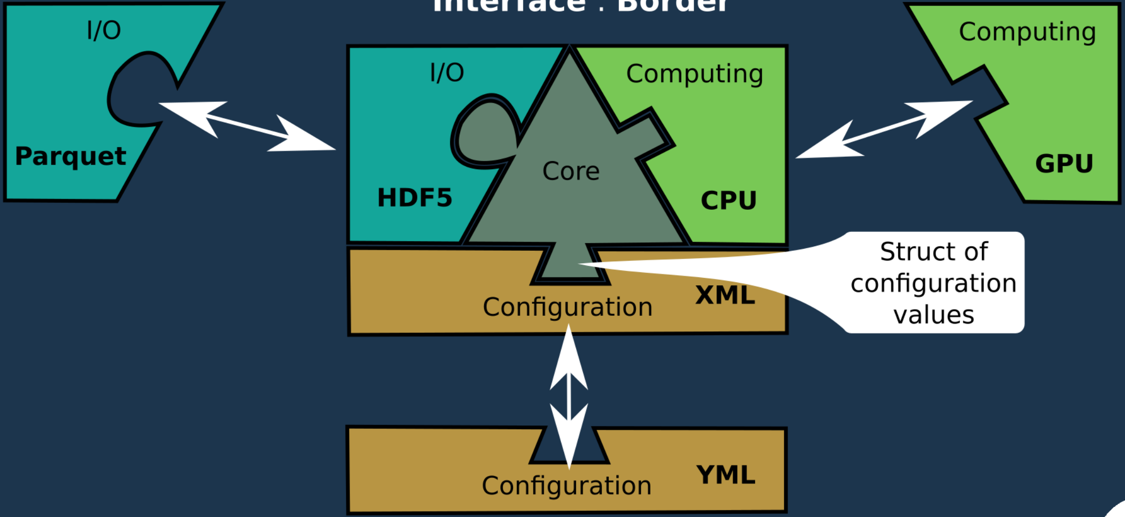

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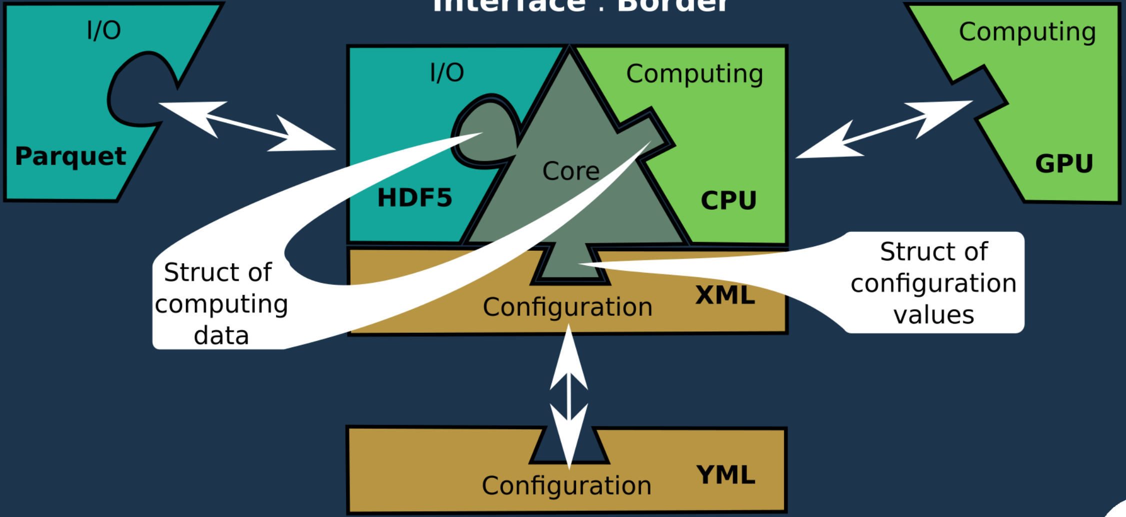

Constellation of projects

Increase **reusability** of projects

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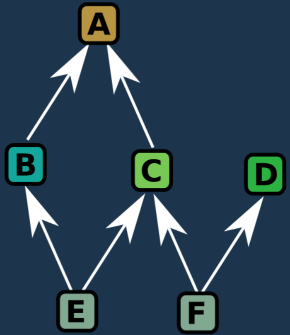

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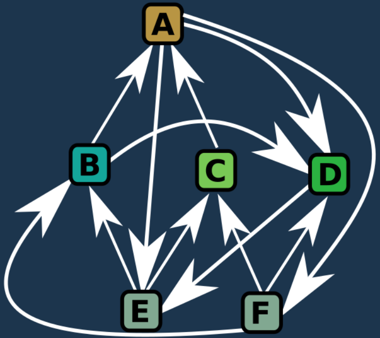

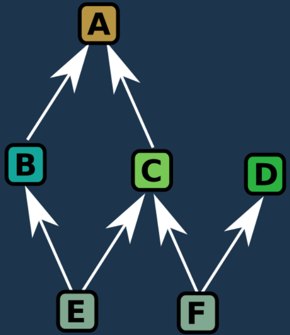

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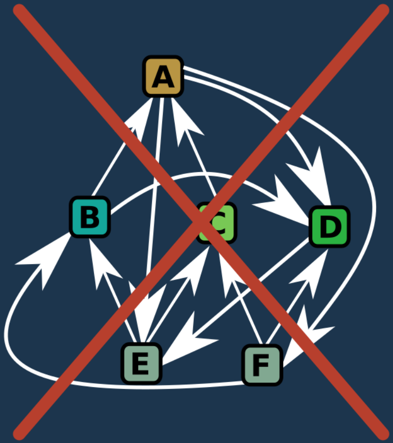
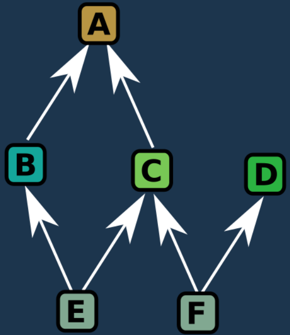
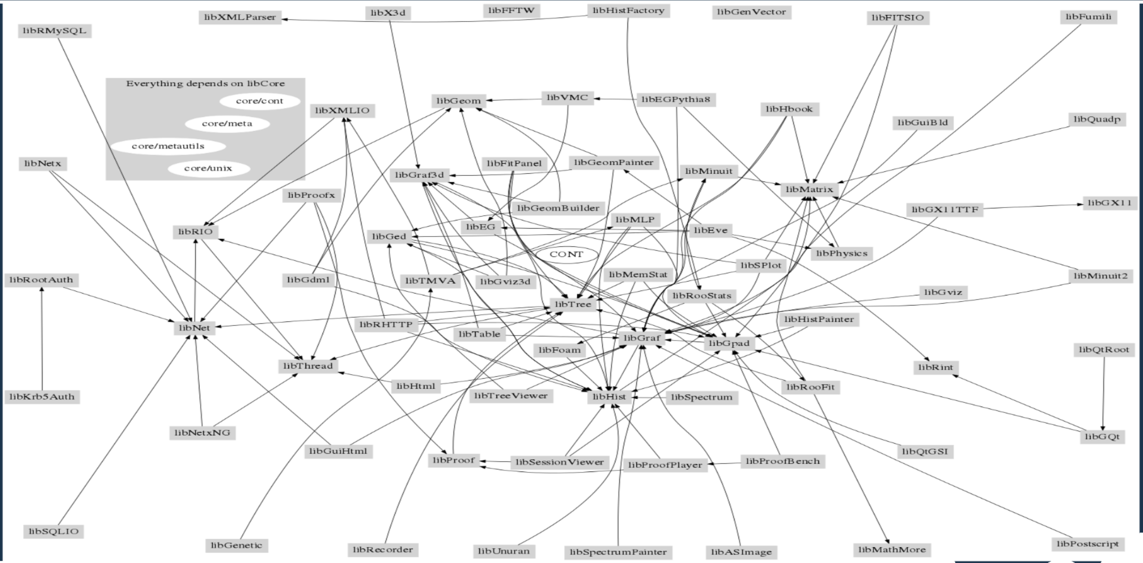




Do not do that !!!



What does this code do ?

```
float a, q, p, r, s;for(size_t _(0ul);_<m_;++_){a_[_]=0;b[_]=0
;c[_]=0;d[_]=0;e[_]=0;f[_]=0;g[_]=0;h[_]=0;i[_]=0;j[_]=0:k[_]=
0;l[_]=0;m[_]=0;n[_]=0;o[_]=0;for(size_t __(0ul);__<n;++__){a=
w[_*n+__];a_[_]+=a;q=u[__],p=v[__];r=a*q;s=a*p;b[_]+=r;c[_]+=s
;d[_]+=q*r;f[_]+=s*p;g[_]+=q*q*a*q;j[_]+=s*p*p;k[_]+=r*q*q*q;o
[_]+=p*p*a*p*p;e[_]+=r*p;h[_]+=q*a*q*p;i[_]+=p*q*p*a;l[_]+=p*q
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»       for(size_t __(0ul);__<n;++__){
»       »       a=w[_*n+__];a_[_]+=a;q=u[__],p=v[__];r=a*q;s=a*p;
»       »       b[_]+=r;c[_]+=s;d[_]+=q*r;f[_]+=s*p;
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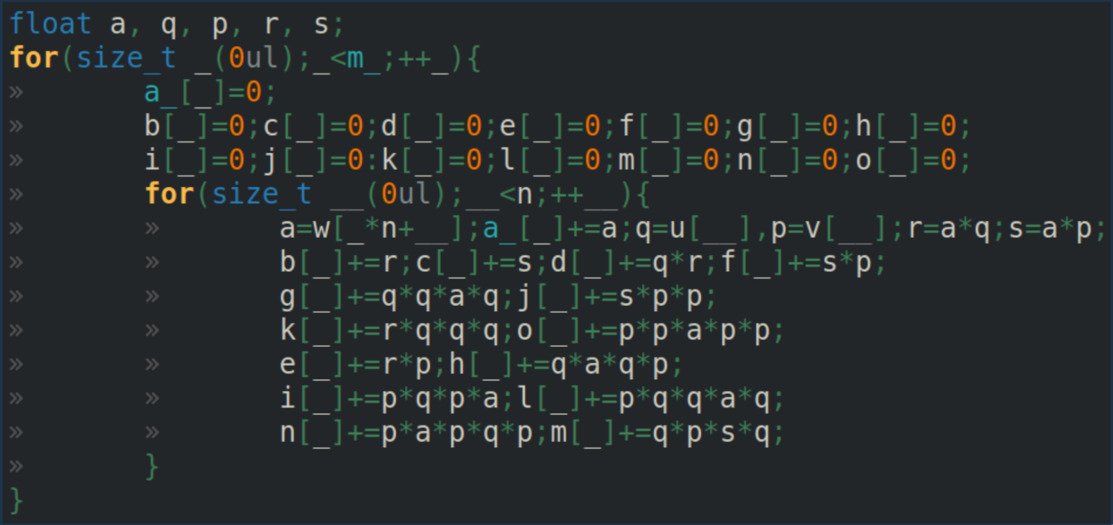

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»       »       b[_]+=r;c[_]+=s;d[_]+=q*r;f[_]+=s*p;
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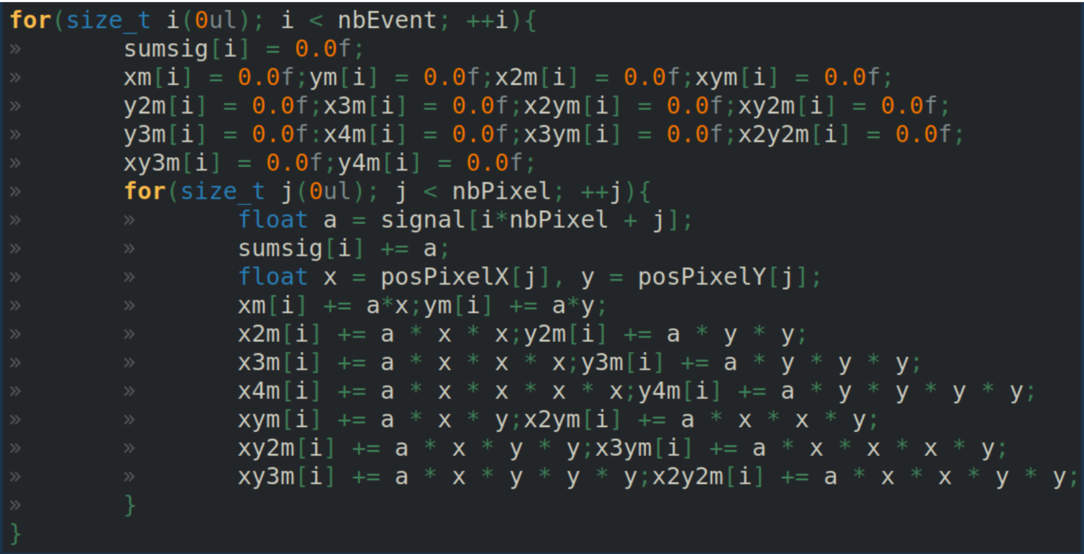
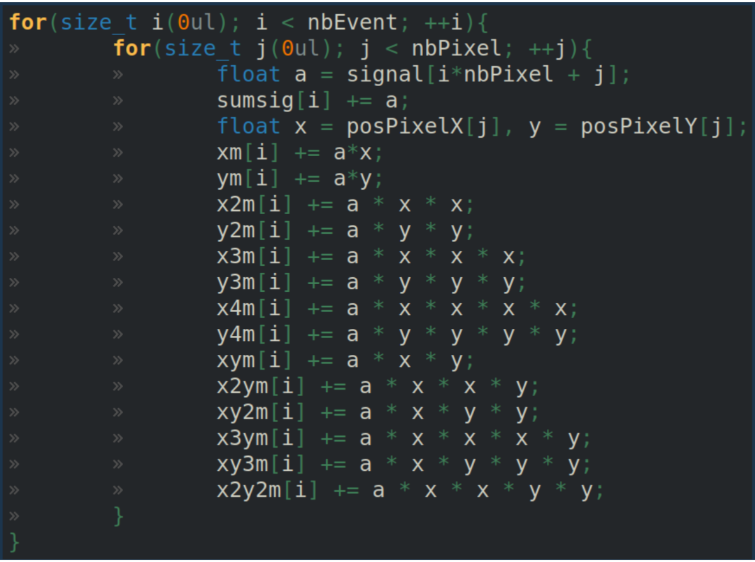


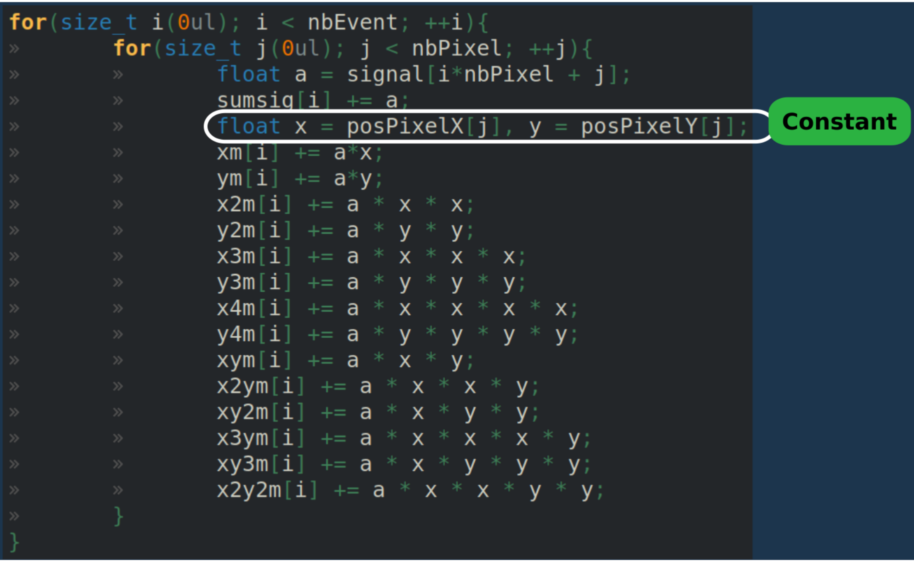
```
for(size_t i(0ul); i < nbEvent; ++i){
»       sumsig[i] = 0.0f;
»       xm[i] = 0.0f;ym[i] = 0.0f;x2m[i] = 0.0f;xym[i] = 0.0f;
»       y2m[i] = 0.0f;x3m[i] = 0.0f;x2ym[i] = 0.0f;xy2m[i] = 0.0f;
»       y3m[i] = 0.0f:x4m[i] = 0.0f;x3ym[i] = 0.0f;x2y2m[i] = 0.0f;
»       xy3m[i] = 0.0f;y4m[i] = 0.0f;
»       for(size_t j(0ul); j < nbPixel; ++j){
»       »       float a = signal[i*nbPixel + j];
»       »       sumsig[i] += a;
»       »       float x = posPixelX[j], y = posPixelY[j];
»       »       xm[i] += a*x;ym[i] += a*y;
»       »       x2m[i] += a * x * x;y2m[i] += a * y * y;
»       »       x3m[i] += a * x * x * x;y3m[i] += a * y * y * y;
»       »       x4m[i] += a * x * x * x * x;y4m[i] += a * y * y * y * y;
»       »       xym[i] += a * x * y;x2ym[i] += a * x * x * y;
»       »       xy2m[i] += a * x * y * y;x3ym[i] += a * x * x * x * y;
»       »       xy3m[i] += a * x * y * y * y;x2y2m[i] += a * x * x * y * y;
»       }
}
```

What does this code do ?



```
for(size_t i(0ul); i < nbEvent; ++i){
        for(size_t j(0ul); j < nbPixel; ++j){
                float a = signal[i*nbPixel + j];
                sumsig[i] += a;
                float x = posPixelX[j], y = posPixelY[j];
                xm[i] += a*x;
                ym[i] += a*y;
                x2m[i] += a * x * x;
                y2m[i] += a * y * y;
                x3m[i] += a * x * x * x;
                y3m[i] += a * y * y * y;
                x4m[i] += a * x * x * x * x;
                y4m[i] += a * y * y * y * y;
                xym[i] += a * x * y;
                x2ym[i] += a * x * x * y;
                xy2m[i] += a * x * y * y;
                x3ym[i] += a * x * x * x * y;
                xy3m[i] += a * x * y * y * y;
                x2y2m[i] += a * x * x * y * y;
        }
}
```

What does this code do ?



```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		x3m[i] += a * x * x * x;
		y3m[i] += a * y * y * y;
		x4m[i] += a * x * x * x * x;
		y4m[i] += a * y * y * y * y;
		xym[i] += a * x * y;
		x2ym[i] += a * x * x * y;
		xy2m[i] += a * x * y * y;
		x3ym[i] += a * x * x * x * y;
		xy3m[i] += a * x * y * y * y;
		x2y2m[i] += a * x * x * y * y;
	}
}
```

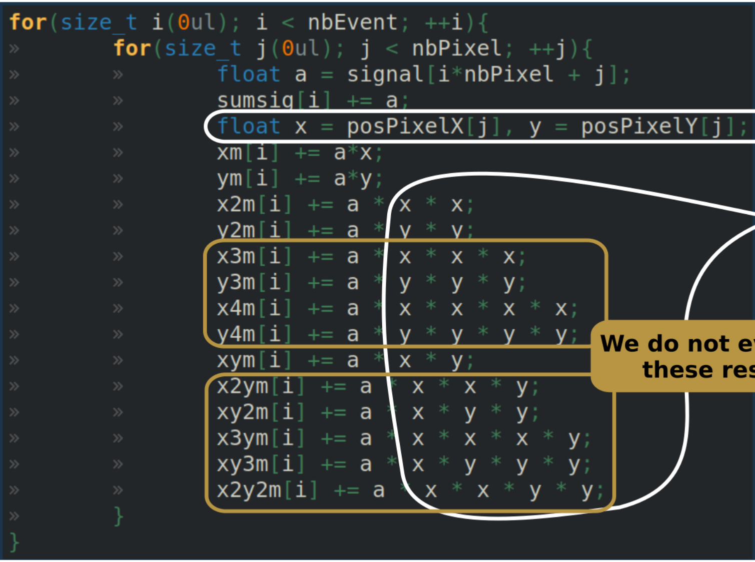
What does this code do ?

```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		x3m[i] += a * x * x * x;
		y3m[i] += a * y * y * y;
		x4m[i] += a * x * x * x * x;
		y4m[i] += a * y * y * y * y;
		xym[i] += a * x * y;
		x2ym[i] += a * x * x * y;
		xy2m[i] += a * x * y * y;
		x3ym[i] += a * x * x * x * y;
		xy3m[i] += a * x * y * y * y;
		x2y2m[i] += a * x * x * y * y;
	}
}
```

Constant

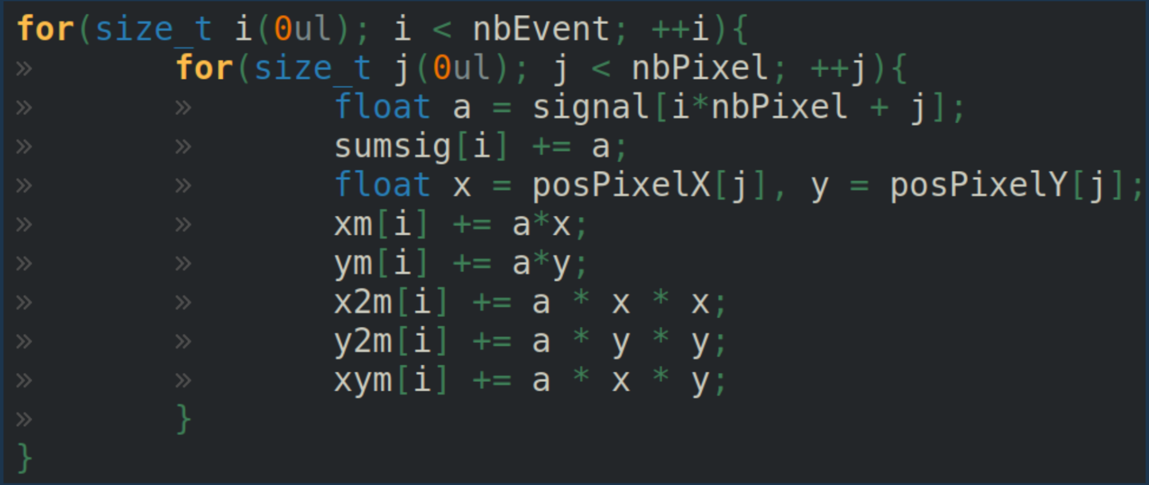
Useless computation

What does this code do ?



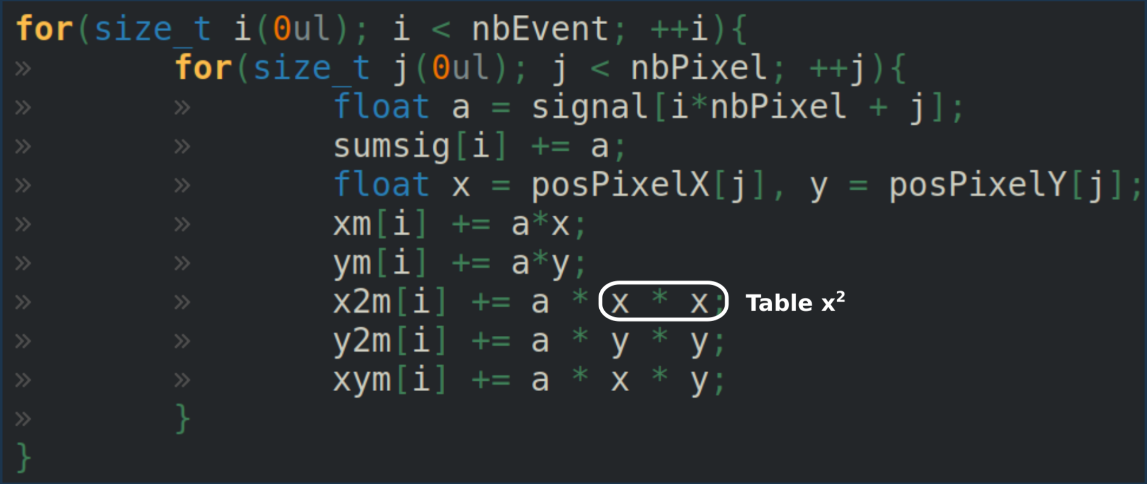
```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		x3m[i] += a * x * x * x;
		y3m[i] += a * y * y * y;
		x4m[i] += a * x * x * x * x;
		y4m[i] += a * y * y * y * y;
		xym[i] += a * x * y;
		x2ym[i] += a * x * x * y;
		xy2m[i] += a * x * y * y;
		x3ym[i] += a * x * x * x * y;
		xy3m[i] += a * x * y * y * y;
		x2y2m[i] += a * x * x * y * y;
	}
}
```

What does this code do ?



```
for(size_t i(0ul); i < nbEvent; ++i){
        for(size_t j(0ul); j < nbPixel; ++j){
                float a = signal[i*nbPixel + j];
                sumsig[i] += a;
                float x = posPixelX[j], y = posPixelY[j];
                xm[i] += a*x;
                ym[i] += a*y;
                x2m[i] += a * x * x;
                y2m[i] += a * y * y;
                xym[i] += a * x * y;
        }
}
```

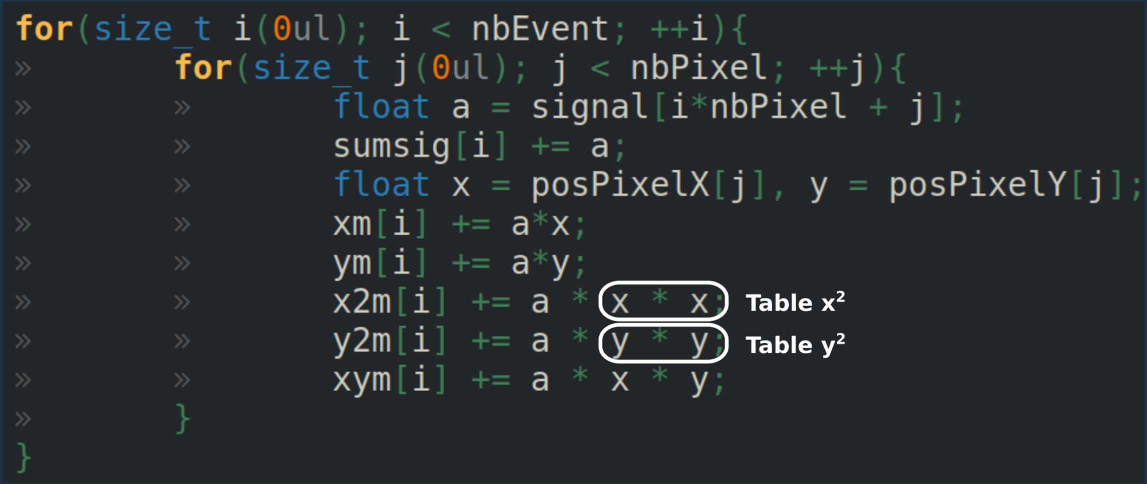
What does this code do ?



```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		xym[i] += a * x * y;
	}
}
```

Table x^2

What does this code do ?

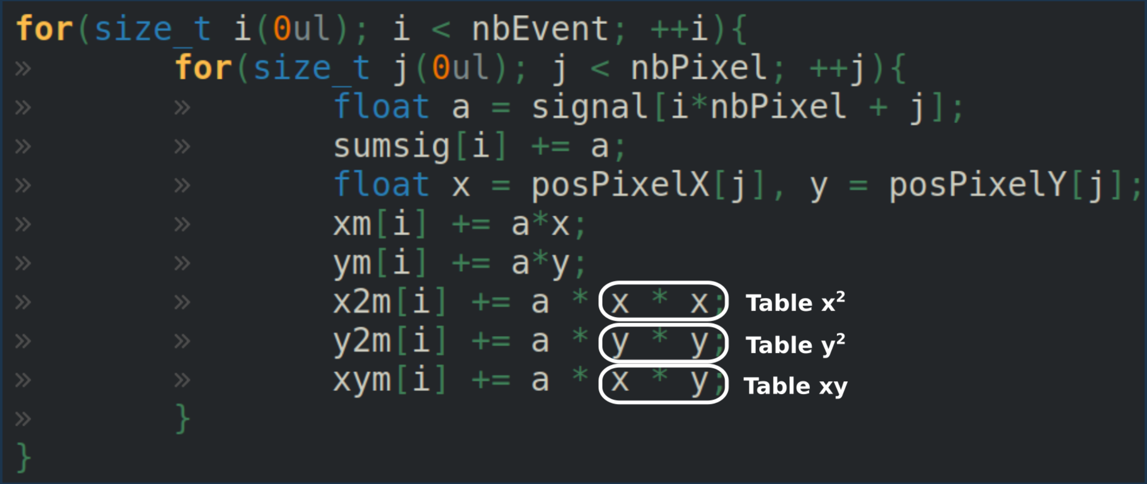


```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		xym[i] += a * x * y;
	}
}
```

Table x^2

Table y^2

What does this code do ?



```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		xym[i] += a * x * y;
	}
}
```

What does this code do ?

```
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		xym[i] += a * x * y;
	}
}
```

Table x^2

Table y^2

Table xy

These are dot products

What does this code do ?

```cpp
for(size_t i(0ul); i < nbEvent; ++i){
	for(size_t j(0ul); j < nbPixel; ++j){
		float a = signal[i*nbPixel + j];
		sumsig[i] += a;
		float x = posPixelX[j], y = posPixelY[j];
		xm[i] += a*x;
		ym[i] += a*y;
		x2m[i] += a * x * x;
		y2m[i] += a * y * y;
		xym[i] += a * x * y;
	}
}
```

Table x^2

Table y^2

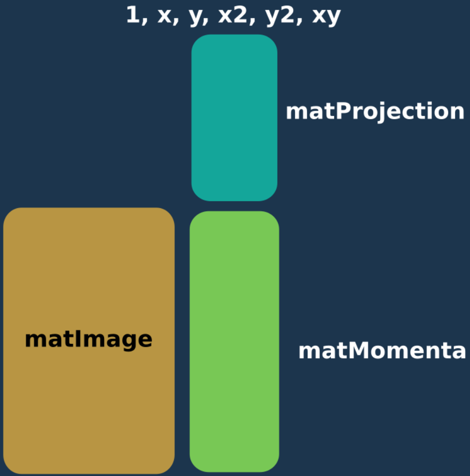
Table xy

These are dot products

This is a Matrix Multiplication

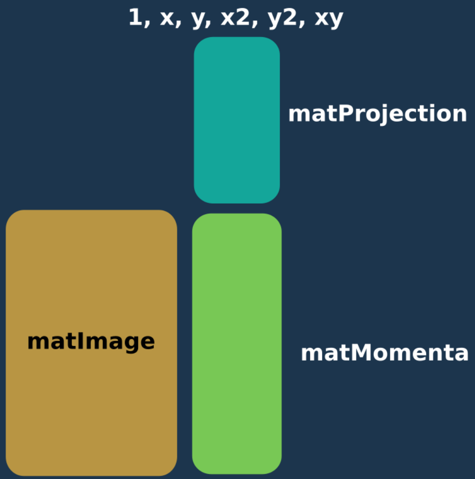
What does this code do ?

```
sgemm(matMomenta, matImage, matProjection);
```



What does this code do ?

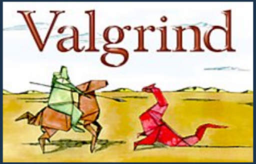
```
sgemm(matMomenta, matImage, matProjection);
```



Profiling Tools

Profiling Tools

- **Valgrind** :
  - Dynamic binary **Profiler**
  - **Memory** binary Checker



Profiling Tools

- **Valgrind** :
    - Dynamic binary **Profiler**
    - **Memory** binary Checker

- **Maqao** :
    - **Static** binary profiler
    - **Dynamic** binary profiler

Profiling Tools

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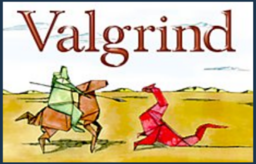
    - Dynamic binary **Profiler**
    - **Memory** binary Checker

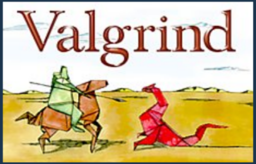


- **Maqao** :
    - **Static** binary profiler
    - **Dynamic** binary profiler

- **Auto profiling** library :
    - Only **selected functions**
    - But has to be **part of the software**

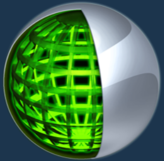
Profiling Tools

- **Valgrind** :
    - Dynamic binary **Profiler**
    - **Memory** binary Checker



- **Maqao** :
    - **Static** binary profiler
    - **Dynamic** binary profiler

- **Auto profiling** library :
    - Only **selected functions**
    - But has to be **part of the software**



Conclusion

Conclusion

git

Conclusion

Gitlab

Conclusion

Gitlab

Project builder

Unit tests

Conclusion

Gitlab

Project builder **Unit tests**

readme.md :
- Showcase
- Depedencies
- Installation / Compitation
- Use cases

Development Documentation :
- Doxygen
- Sphynx

Conclusion

Gitlab

Project builder **Unit tests**

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Profiling

NSight

Conclusion

git

Gitlab

Project builder **Unit tests**

CMake
Cross-platform Make

readme.md :
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- Sphynx

doxygen

Implement **small functions**

Profiling

Valgrind

MAQAO

NSight