User Interfaces Development in openDIEL

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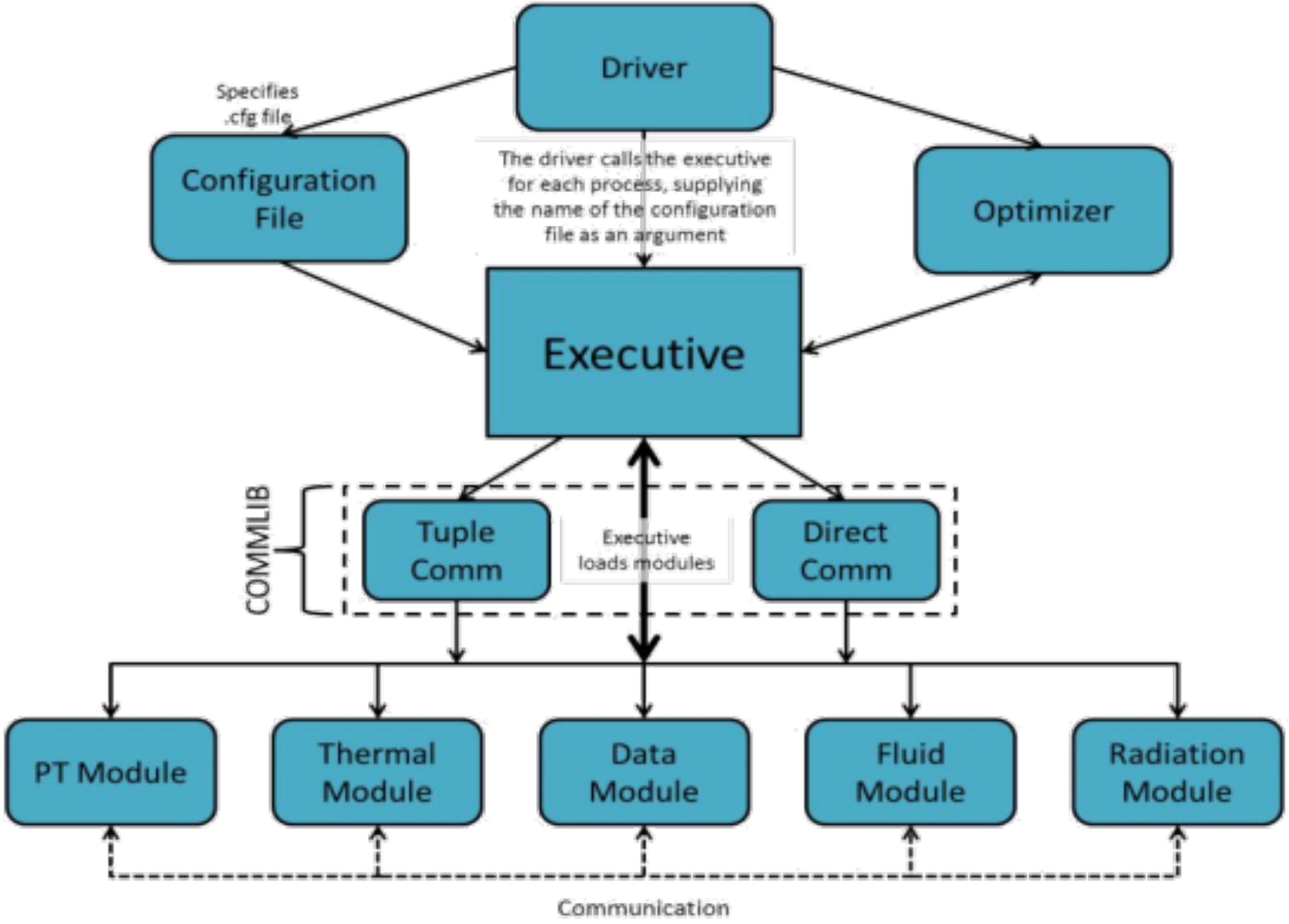
OpenDIEL – Introduction

- Open Distributive Interoperable Executive Library
- Cooperation between loosely coupled modules
- Uses MPI (Message Passing Interface)
- Outputs single executable
- Crucial in combining multiple simulation scenario !!

OpenDIEL – Manual

- User has to provide:
  - Modules (Executable, C module, Fortran Module, Executable)
  - Configuration File (LibConfig)
  - Driver (C - File)

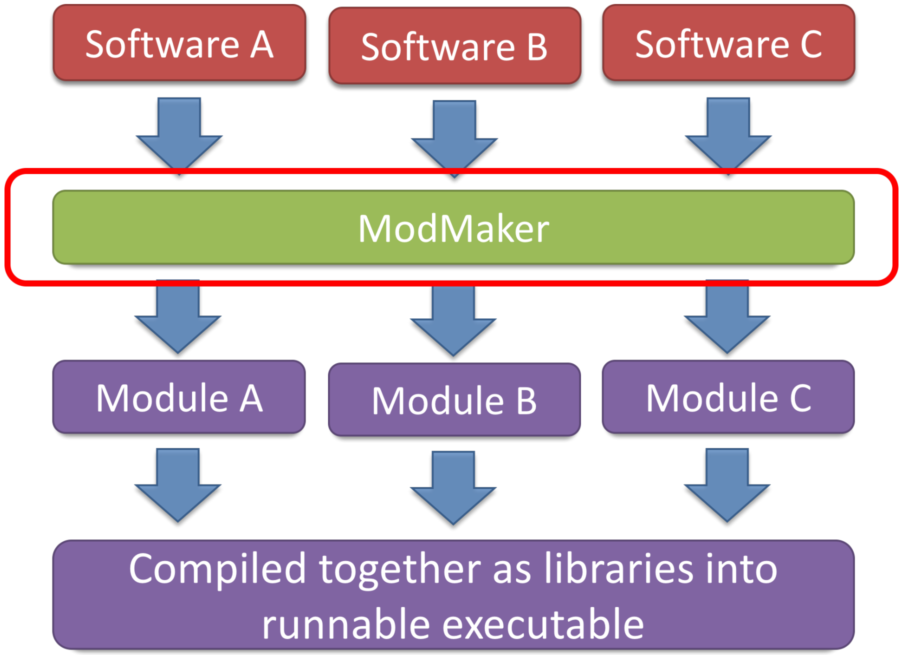

Driver
Specifies .cfg file
Configuration File
The driver calls the executive for each process, supplying the name of the configuration file as an argument
Optimizer
Executive
COMMLIB
Tuple Comm
Executive loads modules
Direct Comm
PT Module
Thermal Module
Data Module
Fluid Module
Radiation Module
Communication

OpenDIEL – Enhancements

- ModMaker
- Timer
- I/O Improvements
- Fortran Support

ModMaker – Introduction

- Transform at source code level
- No longer compiles into standalone executable
- Compiles into a library



ModMaker – Workflow

1

```
#include "mpi.h”
#include "stdio.h”
#include "test.h”
int main(int argc,char**argv)
{
	int rank;
	int size;
	int rc;

	rc |= MPI_Init (&argc, &argv);
	MPI_Comm_rank (MPI_COMM_WORLD, &rank);
	MPI_Comm_size (MPI_COMM_WORLD, &size);
	printf ("I am process %d out of all %d processes\n", rank, size);
	MPI_Barrier (MPI_COMM_WORLD);
	MPI_Finalize();

	return 0;
}
```

ModMaker – Workflow

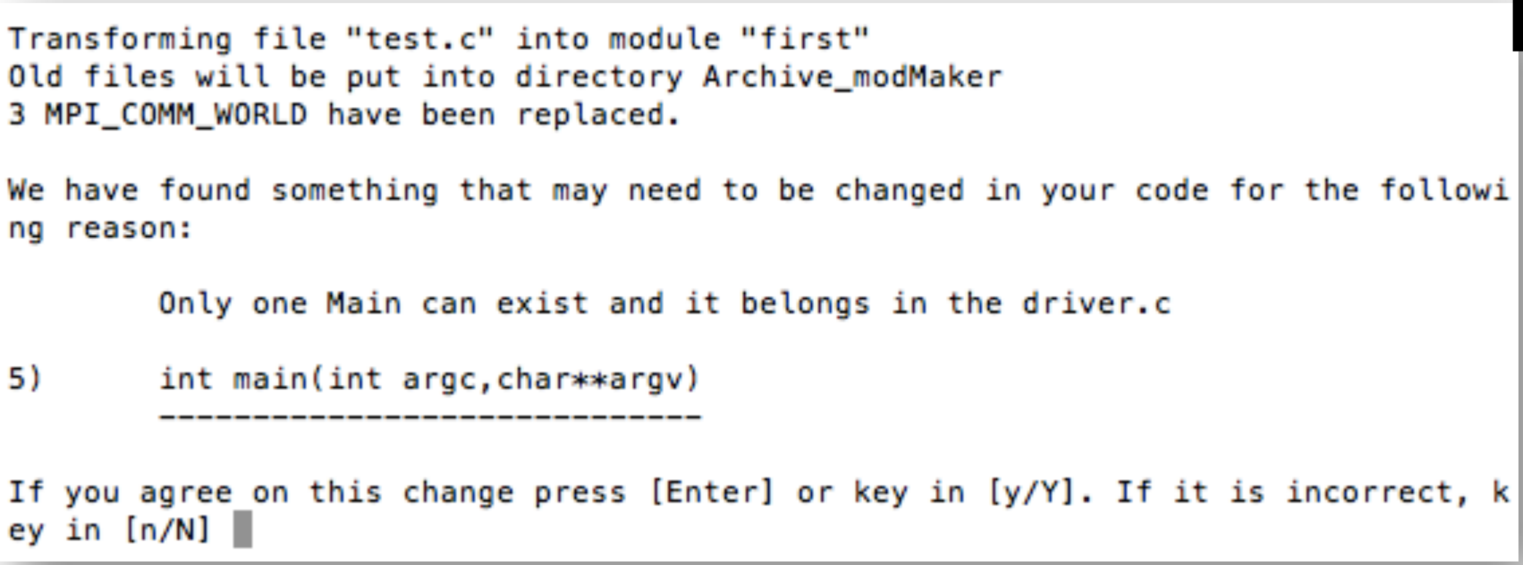
2

Identifying Feature

```
int main(int argc,char**argv)
{
        int rank;
        int size;
        int rc;

        rc |= MPI_Init (&argc, &argv);
        MPI_Comm_rank (MPI_COMM_WORLD, &rank);
        MPI_Comm_size (MPI_COMM_WORLD, &size);
        printf ("I am process %d out of all %d processes\n", rank, size);
        MPI_Barrier (MPI_COMM_WORLD);
        MPI_Finalize();

        return 0;
}
```

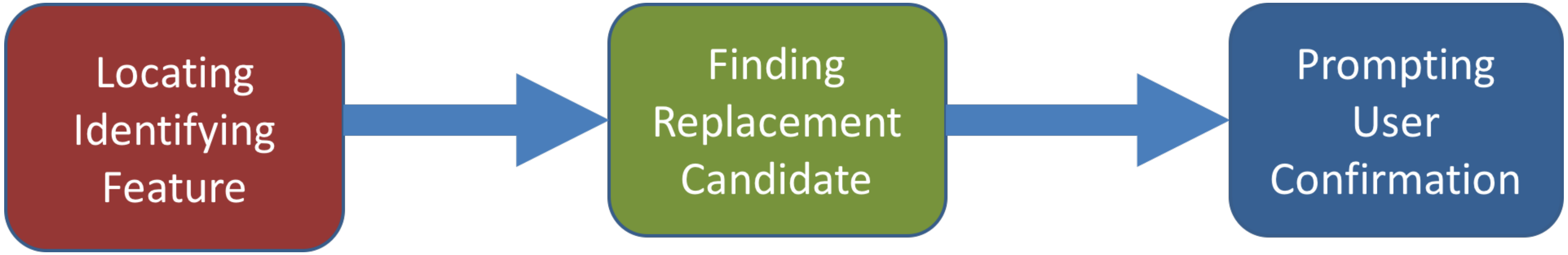
ModMaker – Workflow

3

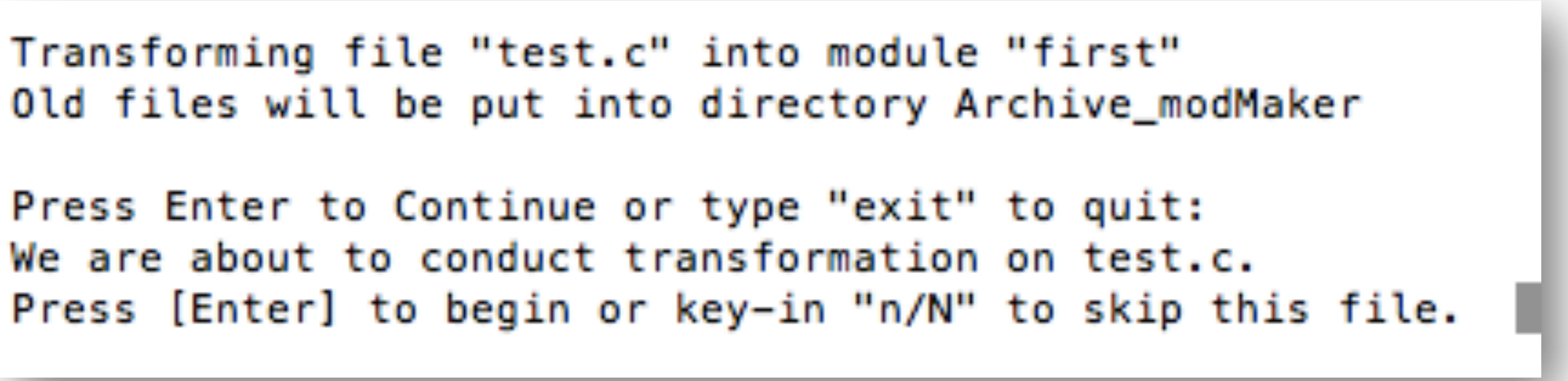


```
Transforming file "test.c" into module "first"
Old files will be put into directory Archive_modMaker
3 MPI_COMM_WORLD have been replaced.

We have found something that may need to be changed in your code for the followi
ng reason:

        Only one Main can exist and it belongs in the driver.c

5)      int main(int argc,char**argv)
        -----------------------------

If you agree on this change press [Enter] or key in [y/Y]. If it is incorrect, k
ey in [n/N]
```

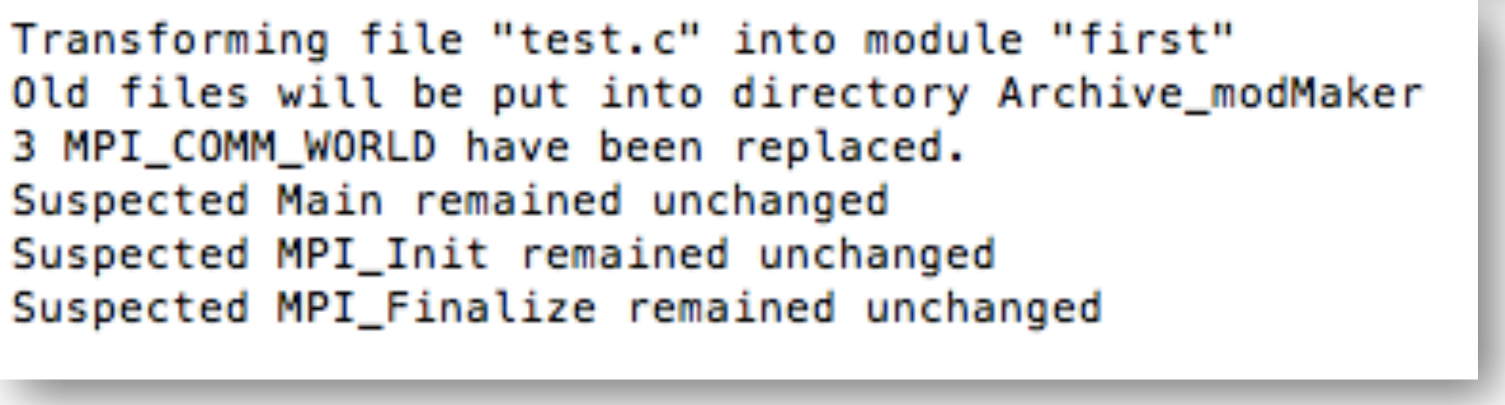
ModMaker – Workflow


Locating Identifying Feature
Finding Replacement Candidate
Prompting User Confirmation

ModMaker – User Participation

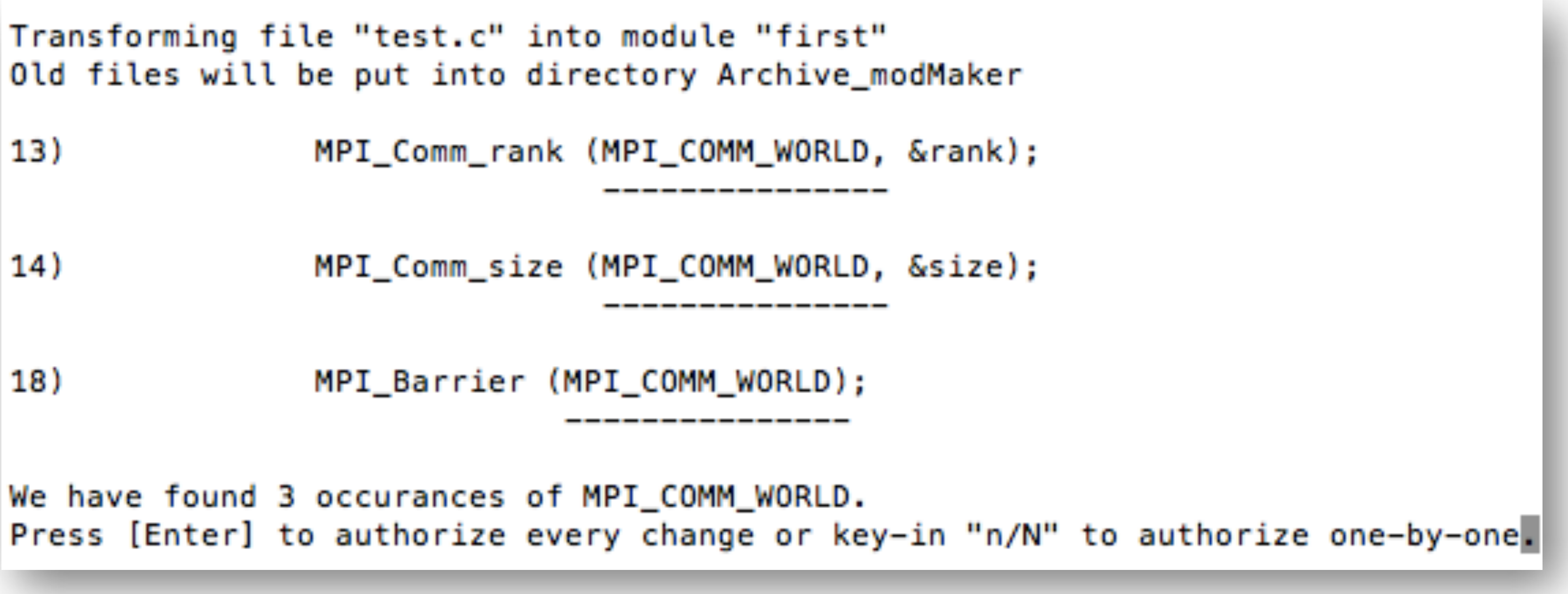


```
Transforming file "test.c" into module "first"
Old files will be put into directory Archive_modMaker

Press Enter to Continue or type "exit" to quit:
We are about to conduct transformation on test.c.
Press [Enter] to begin or key-in "n/N" to skip this file.
```



```
Transforming file "test.c" into module "first"
Old files will be put into directory Archive_modMaker
3 MPI_COMM_WORLD have been replaced.
Suspected Main remained unchanged
Suspected MPI_Init remained unchanged
Suspected MPI_Finalize remained unchanged
```

ModMaker – User Participation



```
Transforming file "test.c" into module "first"
Old files will be put into directory Archive_modMaker

13)             MPI_Comm_rank (MPI_COMM_WORLD, &rank);
                               ---------------


14)             MPI_Comm_size (MPI_COMM_WORLD, &size);
                               ---------------


18)             MPI_Barrier (MPI_COMM_WORLD);
                             ---------------


We have found 3 occurances of MPI_COMM_WORLD.
Press [Enter] to authorize every change or key-in "n/N" to authorize one-by-one.
```

ModMaker – Pattern Matching

- Two options were considered
  - Matching by character
  - Matching by string

- Matching by string is used
  - Simplicity
  - Similar performance

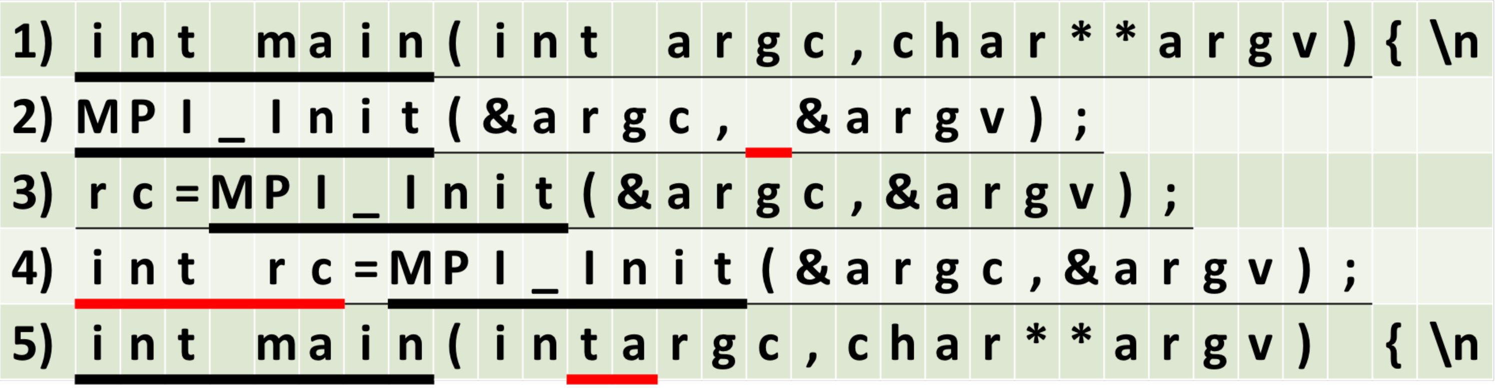
$$O(n, s) = ns$$

n = string size, s = document size (measured in character)

Text	/	*	T	h	i	s		i	s
Pattern 1	i	n	t		m	a	i	n	
Pattern 2	M	P	I	_	I	n	i	t	
No match x 2	/	*	T	h	i	s		i	
No match x 2		*	T	h	i	s		i	s

Text	/	*	T	h	i	s		i	s
Pattern 1	i	n	t		m	a	i	n	
No match	/	*	T	h	i	s		i	
No match		*	T	h	i	s		i	s
Pattern 2	M	P	I	_	I	n	i	t	
No match	/	*	T	h	i	s		i	
No match		*	T	h	i	s		i	s

ModMaker – Syntactic Freedom

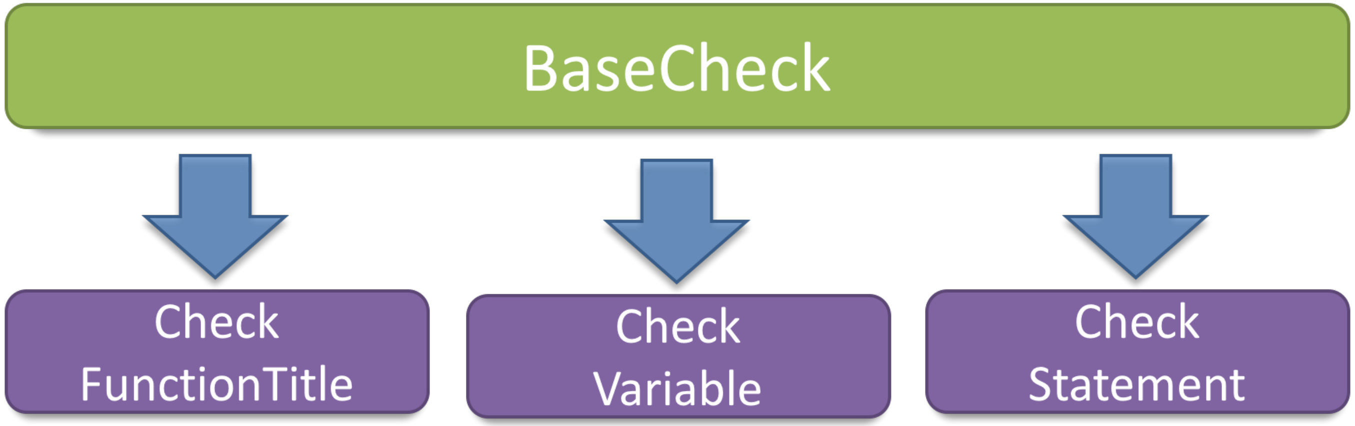


```
1) int main(int argc,char**argv){\n
2) MPI_Init(&argc, &argv);
3) rc=MPI_Init(&argc,&argv);
4) int rc=MPI_Init(&argc,&argv);
5) int main(intargc,char**argv) {\n
```

- Locating
- Spaces
- Variable Declaration

ModMaker – Modularization

- Function Title
- Statement
- Variable



- BaseCheck (line, tokenList, prevSep, nextSep, msgBundle, replacement, returnValue)

Future Work

- Timer
- Multipler I/O
- ModMaker – Fortran Support