OSCARTech　Compiler

OSCAR TECHNOLOGY CORPORATION

Copyright 2017

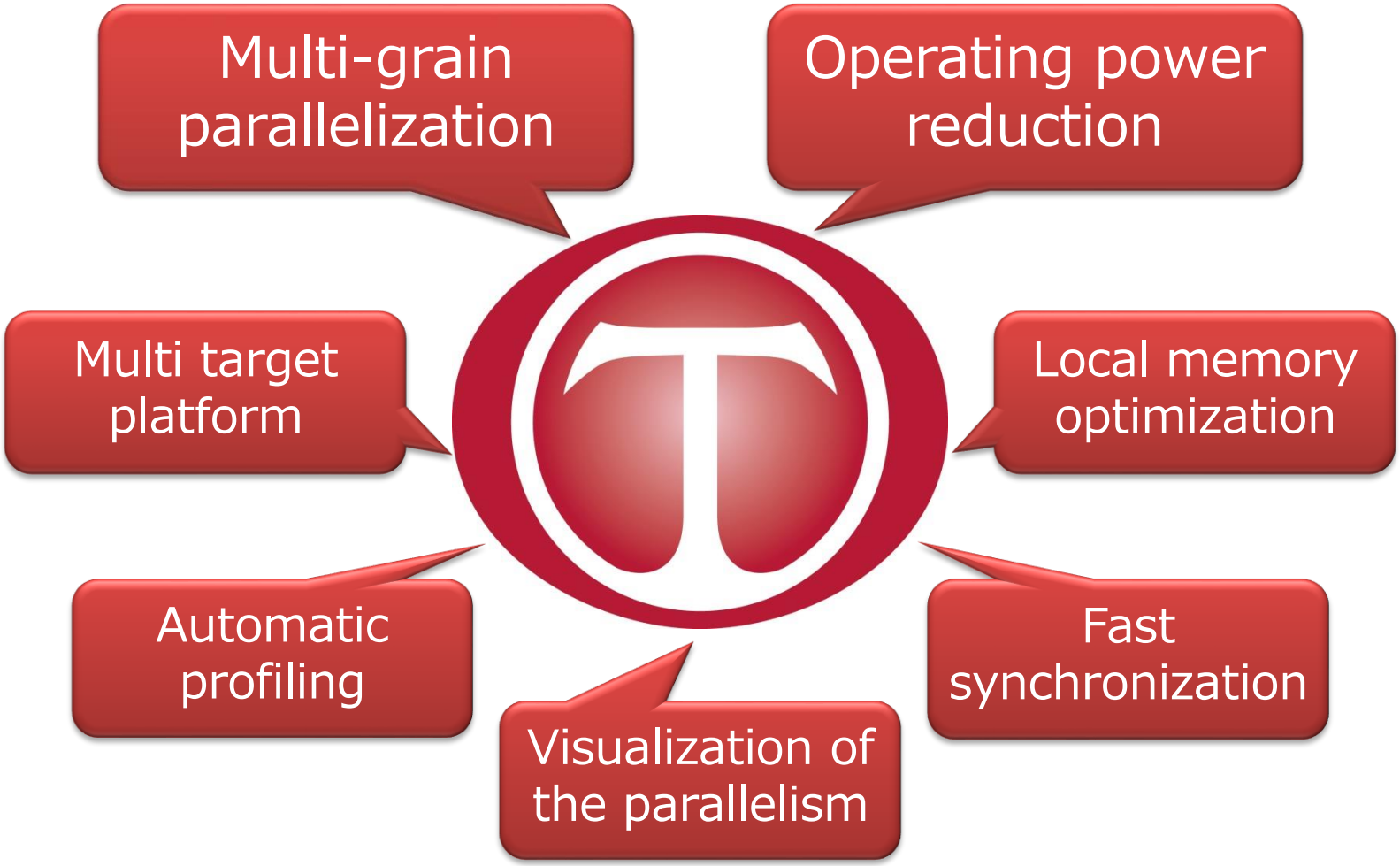
Overview: “OSCARTech® Compiler”

The OSCARTech® Compiler…

- accepts sequential programs written in C language,
- features the proprietary OSCAR multi-grain parallelization algorithms, and
- automatically generates parallel and power-saving C code.

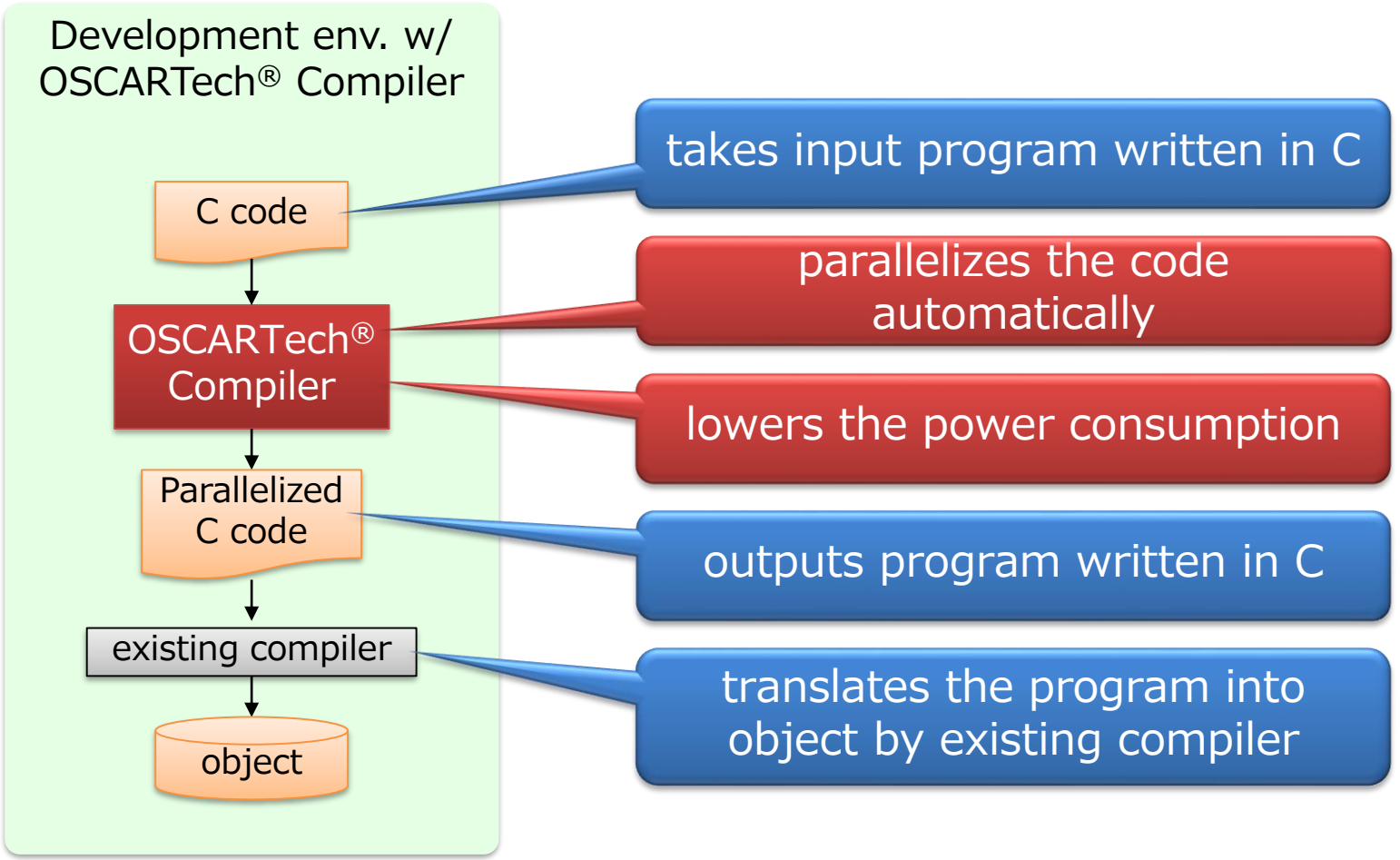
Copyright 2017

Differentiations of the OSCARTech® Compiler



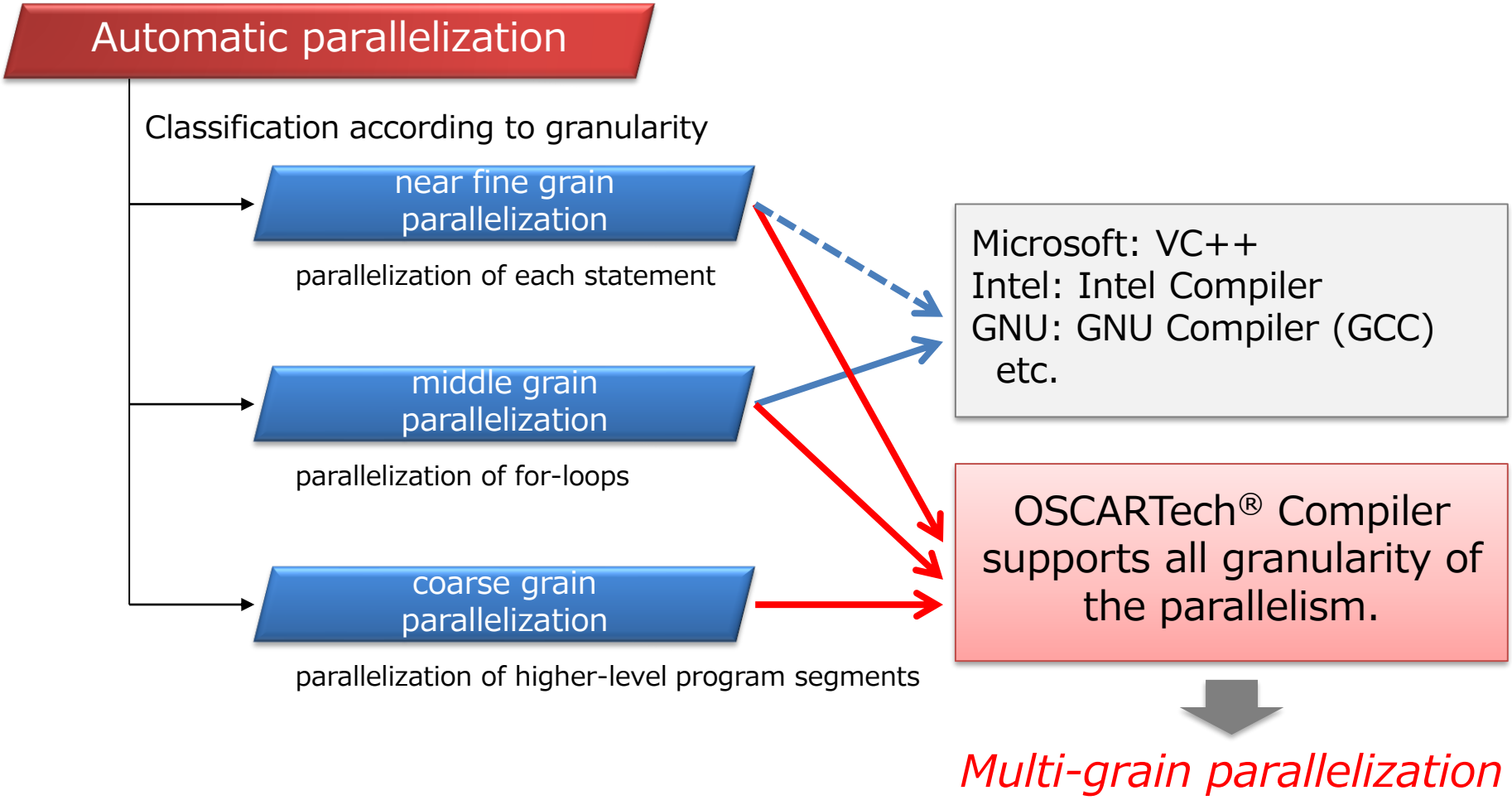
Copyright 2017

Development Env. w/ OSCARTech® Compiler



Copyright 2017

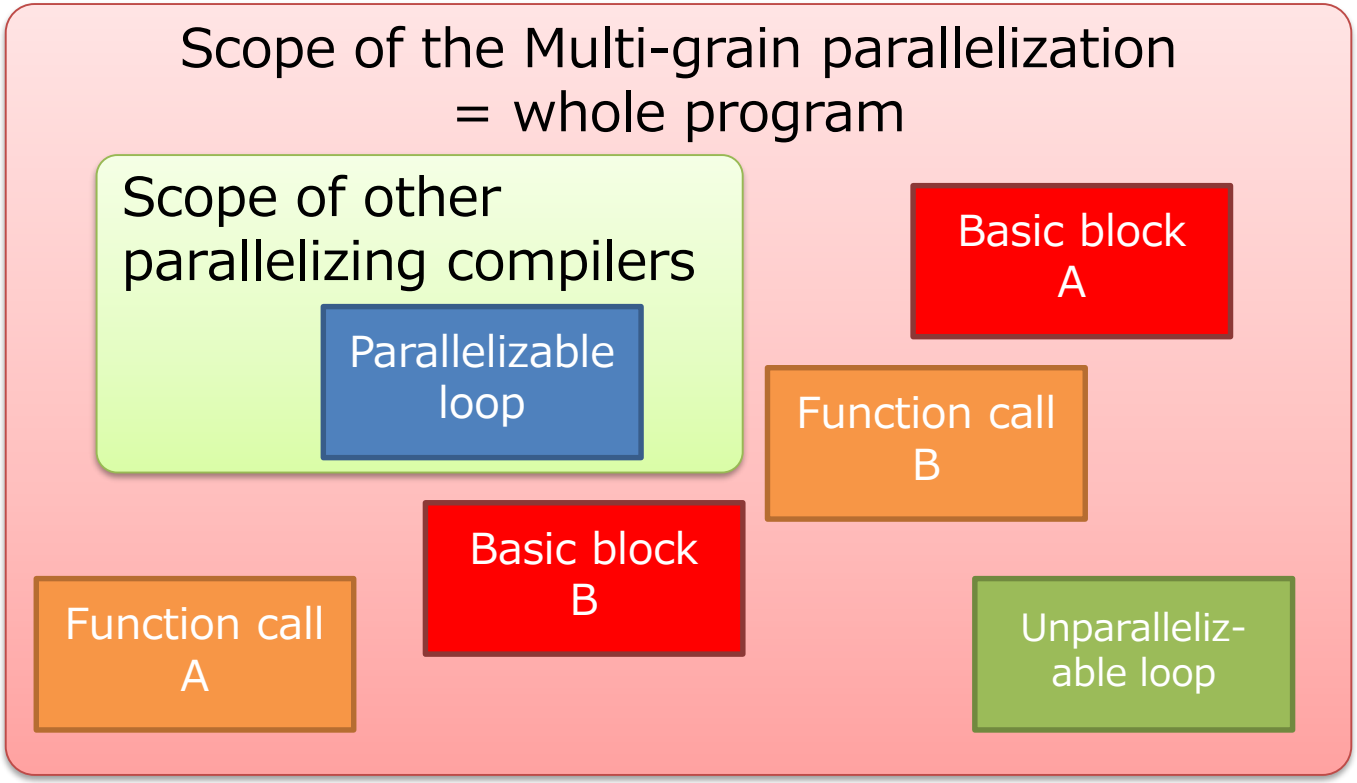
Multi-grain parallelization (1)



Copyright 2017

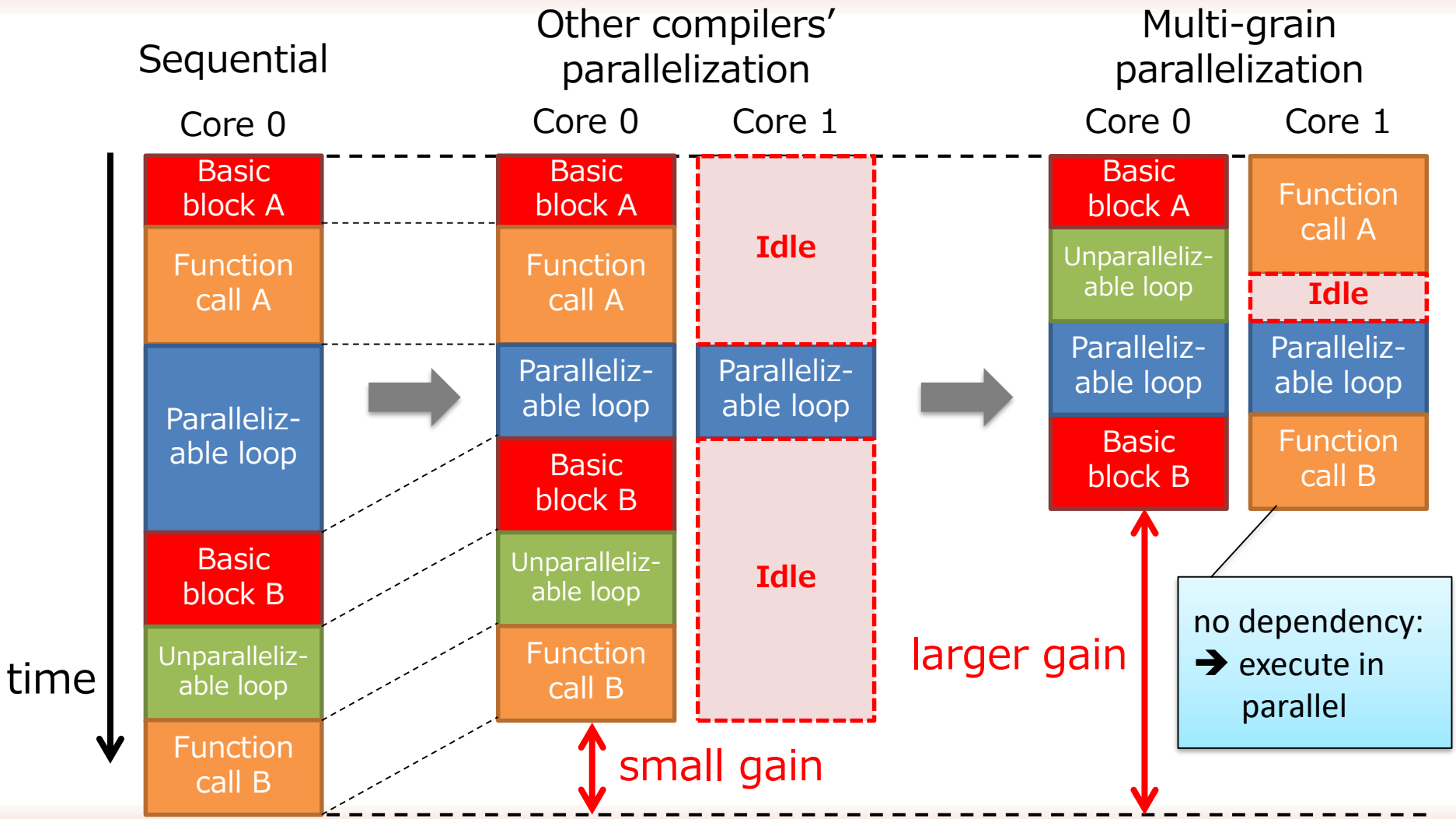
Multi-grain parallelization (2)

- Parallelization of for-loops, and at the same time
- Parallelization of higher-level program segments (macro tasks)



Copyright 2017

Multi-grain parallelization (3)



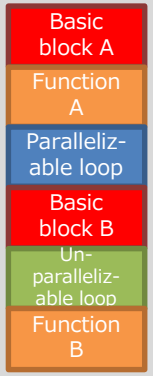
Copyright 2017

How the OSCARTech® Compiler parallelizes a program

Original C code

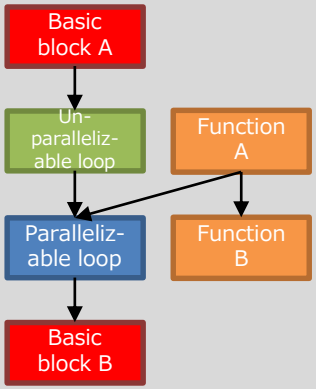
```
main()
{
  if(..){
  func0();
  } else {
  func1();
  }
}
```

① Partition the whole program



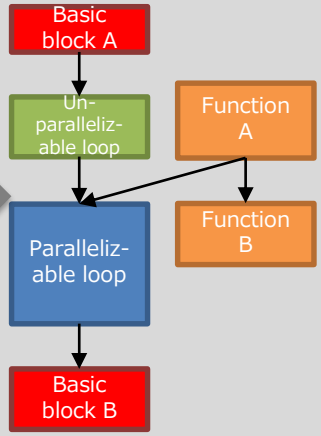
- Analyze the lexicon and the structure of the original C code.
- Recursively analyze for loop or function structures.

② Analyze dependencies



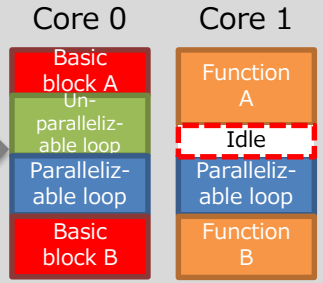
- Analyze both control and data dependencies among all parts.
- Analyze pointers and array indices.

③ Estimate execution time



- Statically estimate the execution time of each part.
- Use dynamic profiling for more precise estimation.

④ Assign parts to cores

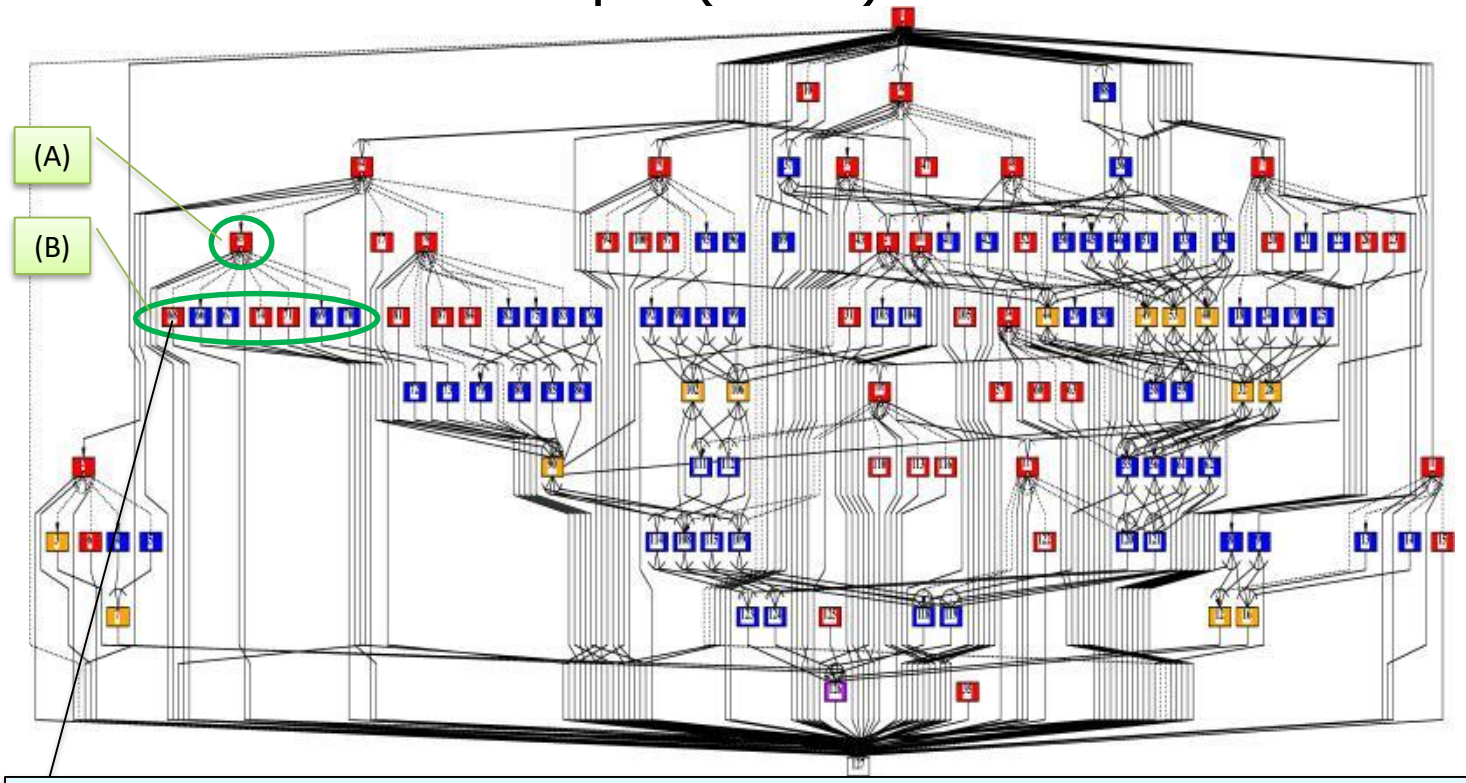


- Assign each part to the optimum core, considering the execution time, synchronization cost and data transfer cost.

Copyright 2017

Visualization of the parallelism

- Macro Task Graph (MTG)



: Basic block

: Loop

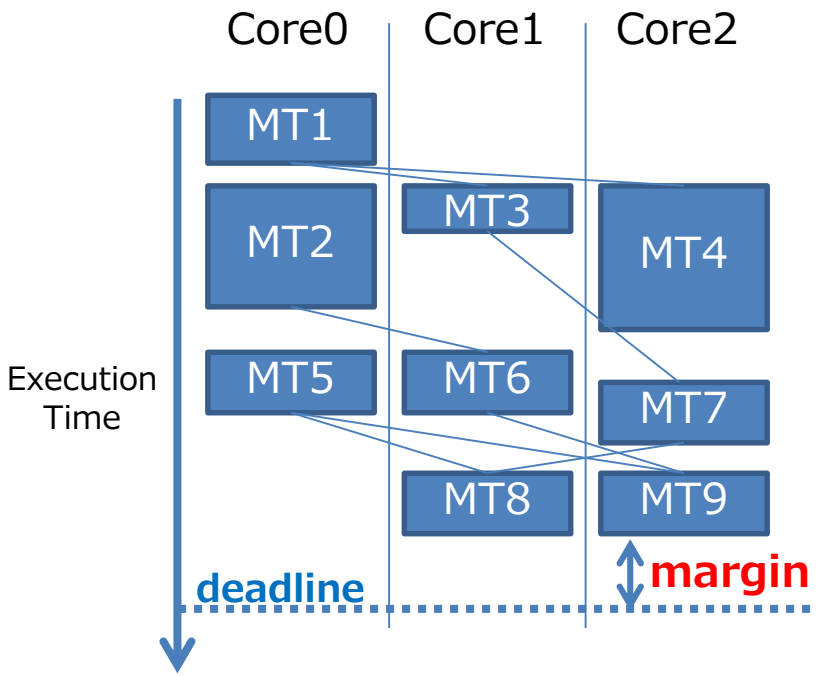
: Function call

Macro Task Graph as produced and used by the OSCARTech® Compiler: lines represent dependencies, e.g., (A) must be executed before (B)

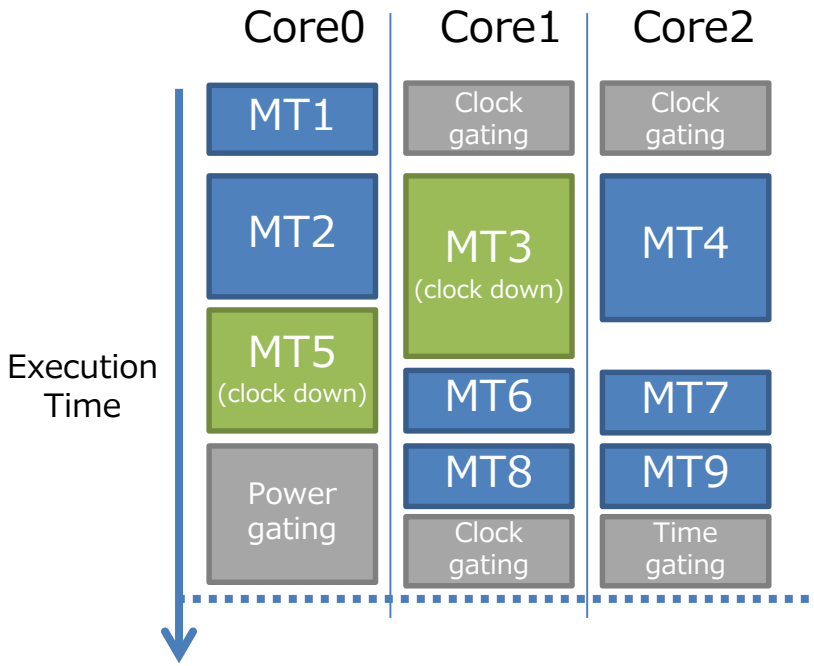
Copyright 2017

Reduce Power Consumption by Parallelization

parallelize software → gain margin on deadline → reduce clock frequency & gate power → save energy



Macro tasks (MT) scheduled for **fastest** execution at **fixed** frequency



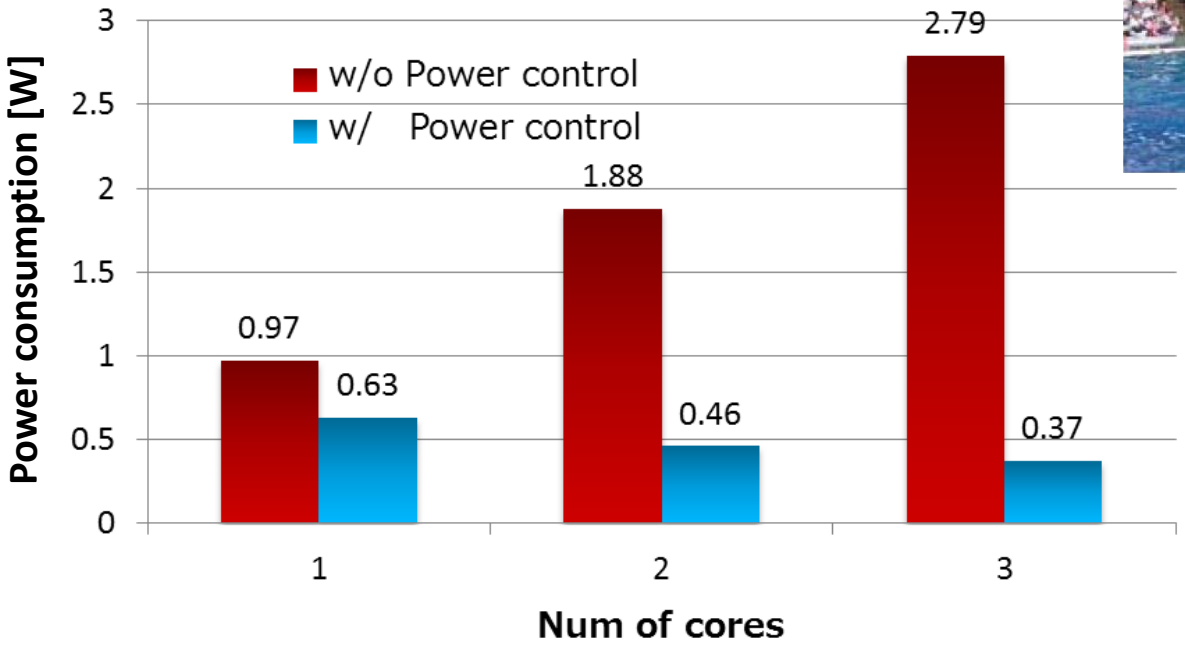
Power-aware scheduling using power gating and dynamic frequency/voltage scaling

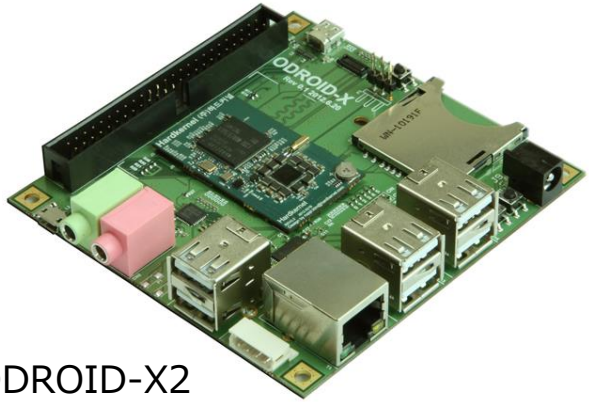
OSCAR TECHNOLOGY CORPORATION

Copyright 2017

Outcome of the OSCARTech® Compiler power reduction

- Power consumption of the MPEG2 decoder on ARM Cortex-A9 Quad-core device



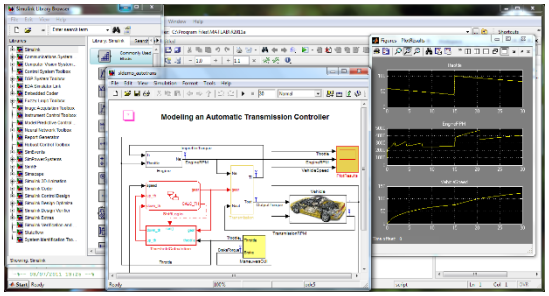


ODROID-X2
ARM Cortex-A9 Quad-core

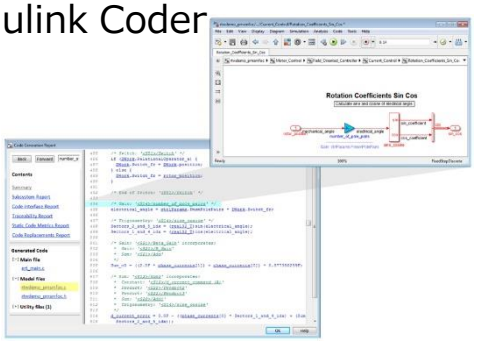
Copyright 2017

OSCARTech® Compiler for Model-Based Design/Development

MATLAB/Simulink



Embedded Coder
Simulink Coder



OSCARTech® Compiler can parallelize the output of Simulink.

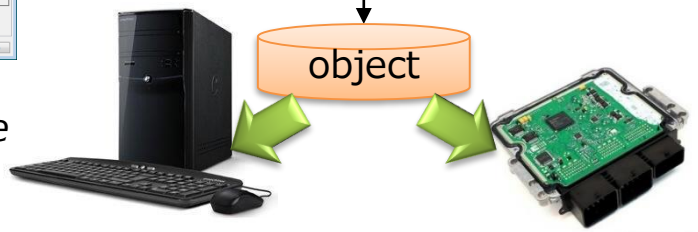
C code

OSCARTech® Compiler

Parallelized C code

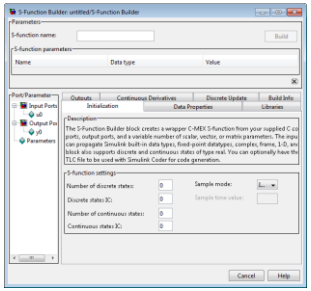
existing compiler

object



The parallelized code can be executed on PC/servers or on ECUs.

manual or S-Function Builder



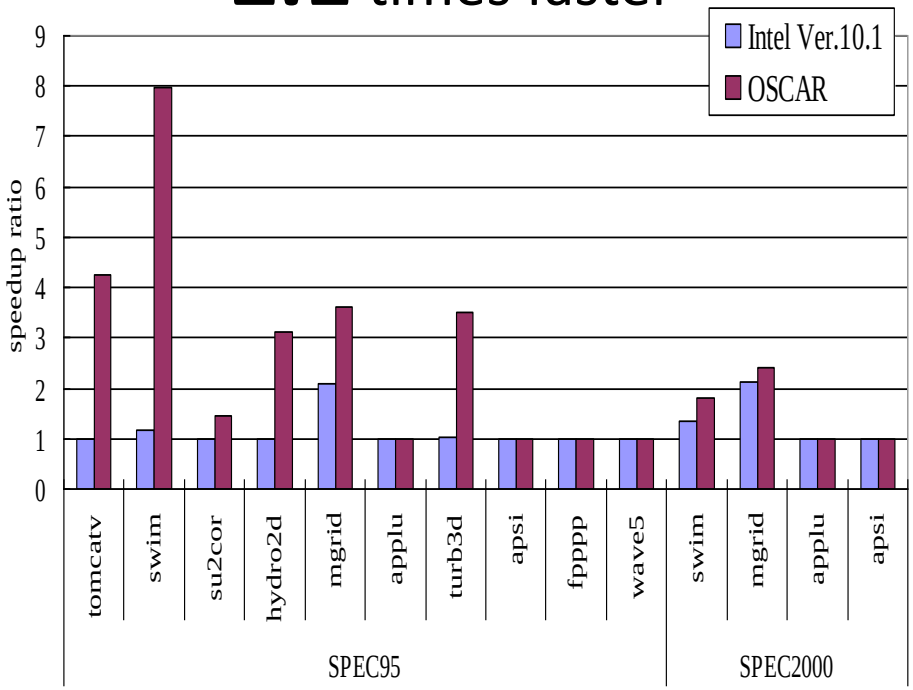
The parallelized code can be restored to Simulink as an S-Function block.

Copyright 2017

Benchmark of the OSCARTech® Compiler parallelization

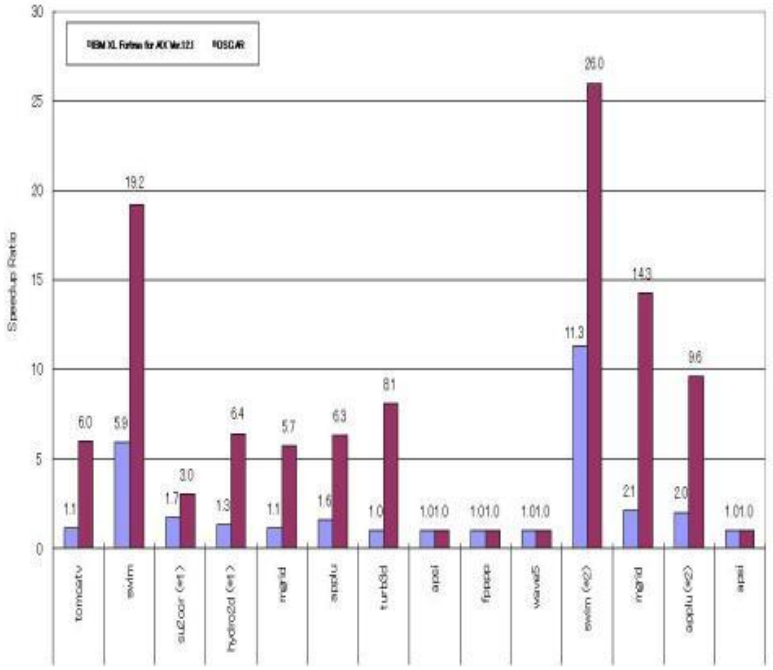
vs. Intel Compiler on Intel's quad core Xeon processor

2.1 times faster



vs. IBM Compiler on IBM's 32-core SMP server (IBM Power 595, Power6 processor)

3.3 times faster



Copyright 2017

Our Business:
OSCARTech® **Compiler Licensing**

Oscar Technology Corporation can license OSCARTech® Compiler to customers.

OSCARTech® Compiler:
generates parallel and power-controlled C code
➔ higher execution speed
➔ lower power consumption

Copyright 2017