



# Nordiasoft

## Increasing Performances of Applications that use OpenCL™

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# Outline

- **What is SCA?**
- **What is OpenCL™?**
- **SCA Components and OpenCL**
- **SCA Applications**

# What is the SCA?

- **Software Infrastructure to support Software Components for Embedded Systems**
- **SCA Software Components are very portable and reusable across different type of Operating Environments**
  - **Not specific to an operating system or processor**
    - Works with VxWorks, INTEGRITY, QNX, Linux, Android, and more.
    - Works on X86/64, PPC, ARM, TI DSPs, SoCs, and more.
  - **Made to exploit DSPs, FPGAs, etc.**
    - Can load, control, and communicate with business logic running on DSPs, FPGAs, Micro-controllers, etc.
- **SCA standard documents can be downloaded for free**
  - *[www.public.navy.mil/jtnc](http://www.public.navy.mil/jtnc)*

# What is the SCA?

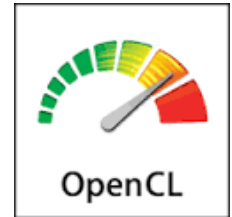
- SCA is deployed in over 400,000 military and public safety radios from around the world
  - **Manufacturers:** General Dynamics, Harris, Leonardo, Raytheon, Rockwell Collins, Rohde & Schwarz Thales, and more.





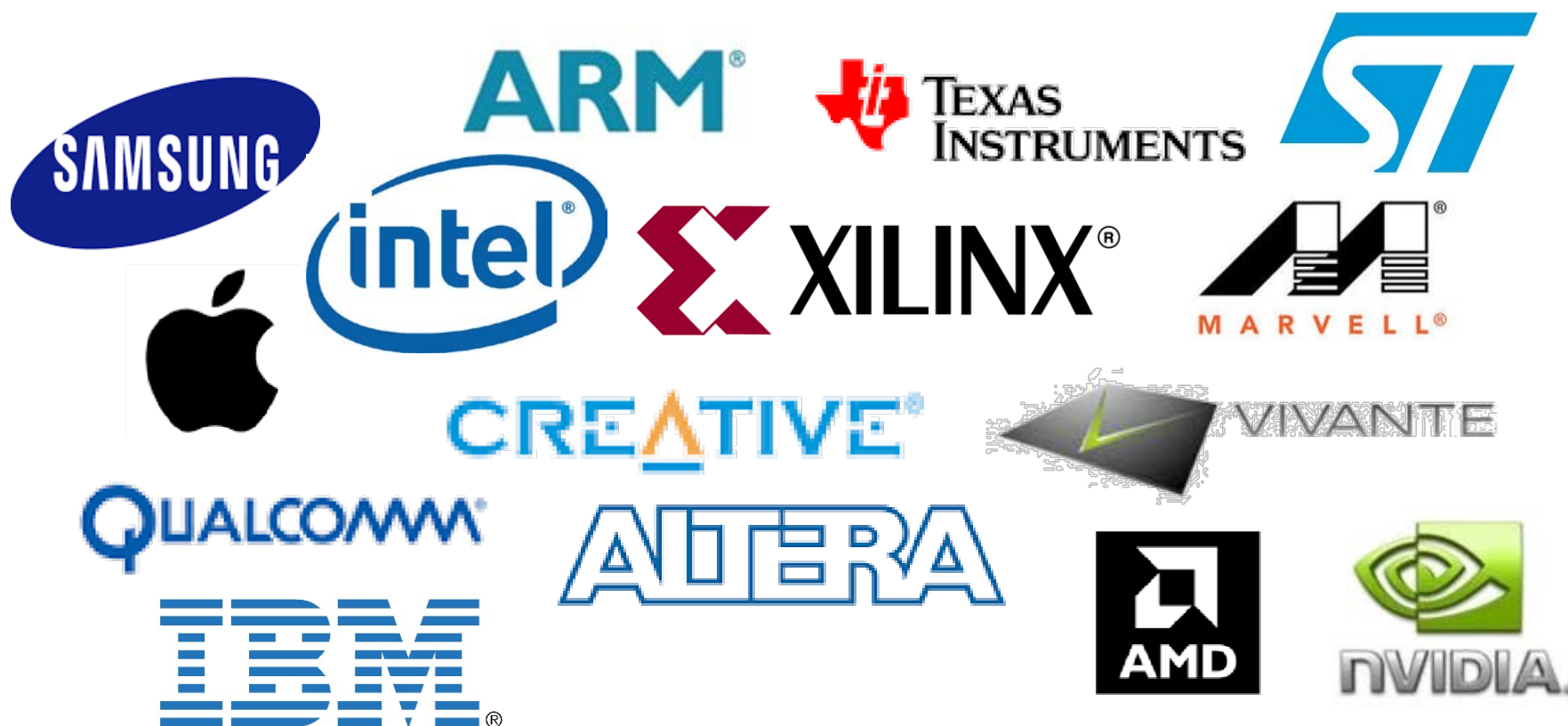
# What is the OpenCL™ ?

- Language initially created to access shader engines in GPUs for general computation
- “C like” syntax, with direct support for vectorization
- Just in time compiler(s) to target various compute devices such as GPPs, GPUs, DSPs, and FPGAs
- Initially created by Apple, now fostered by Khronos
  - See [www.khronos.org/opencv/](http://www.khronos.org/opencv/)



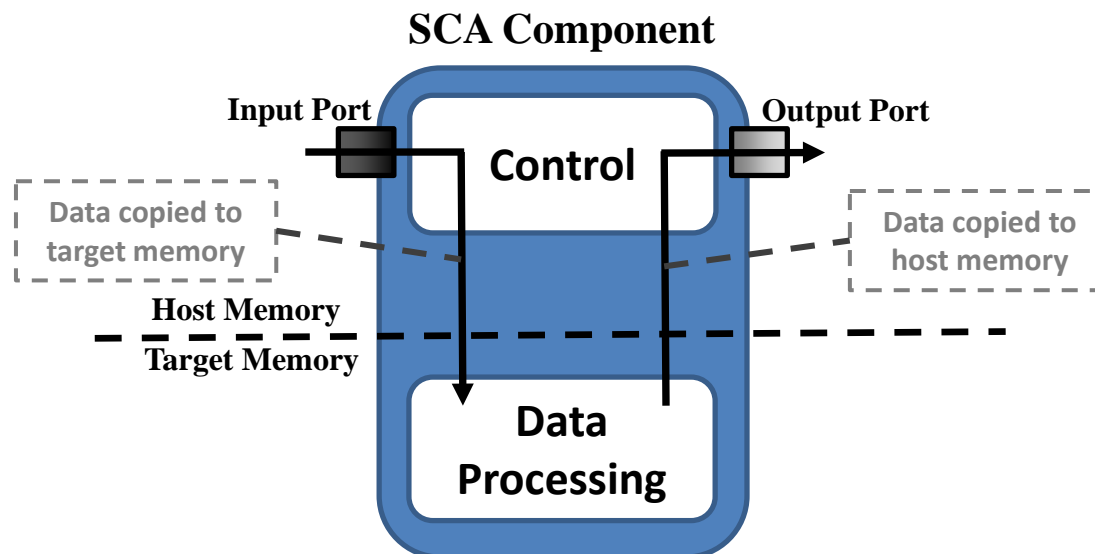
# What is the OpenCL™ ?

- OpenCL is supported by all major silicon vendor



# SCA Components and OpenCL™

- **SCA Components are made of two main parts:**
  - control and processing
- **SCA Components can target OpenCL compute devices for data processing**
  - Involves copying data between host memory and target memory



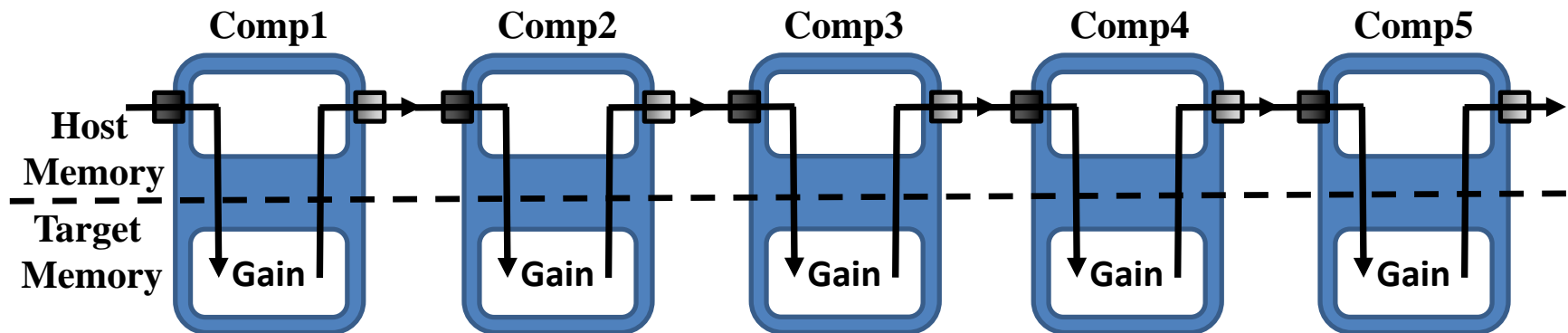
# SCA Components and OpenCL™

- **SCA Applications become much more portable**
  - OpenCL code can run on GPPs, GPUs, DSPs, and FPGAs
- **In most cases, it's faster to copy the data over the compute device, process the data, and copy the data back to the host processor than it is to simply use the host processor to perform the processing**
  - Large buffers with relatively intensive processing
  - Small buffers with intensive processing
- **See our previous paper:**
  - *S. Bernier, F. Levesque, M. Phisel, D. Hagood, "Using OPENCL to increase SCA application portability", Proceedings of SDR-WinnComm-Europe 2015, September 2015*



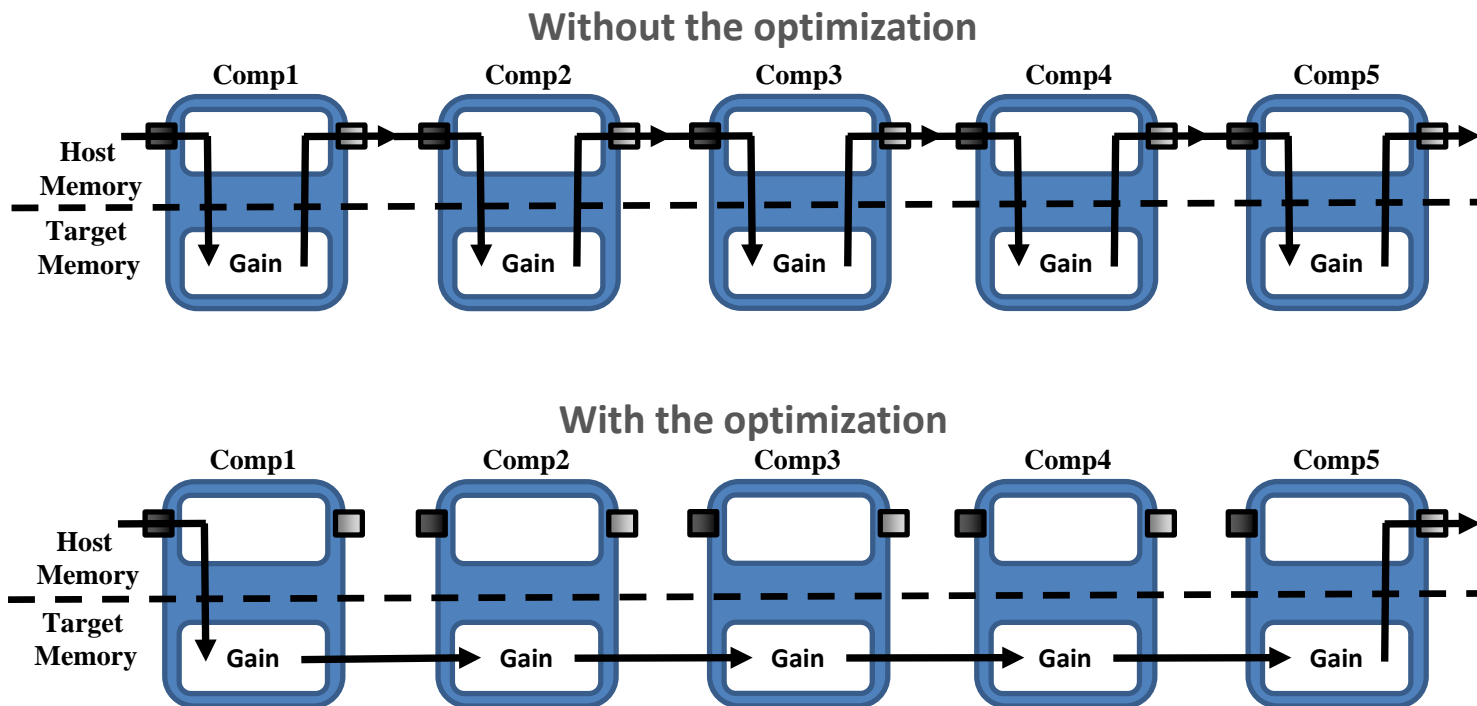
# SCA Applications and OpenCL™

- Typical SCA Application is made of several components, each of which could use OpenCL™



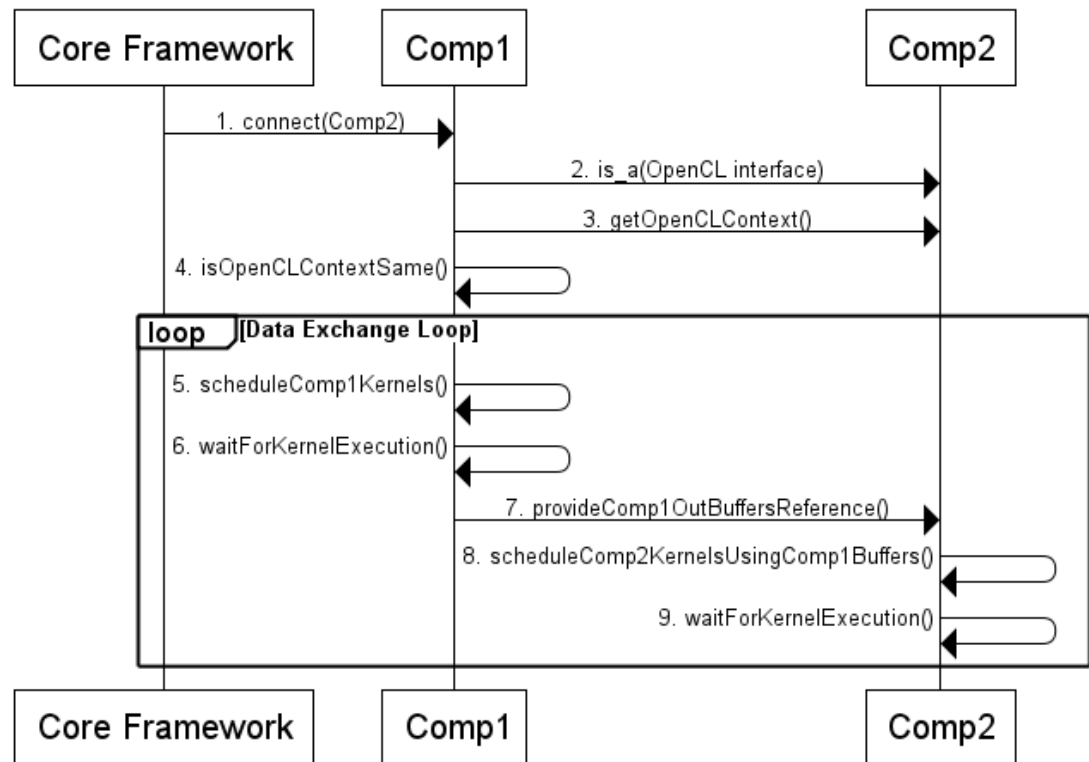
# SCA Applications and OpenCL™

- When SCA components use the same OpenCL compute device, the number of copies across the bus can be reduced



# SCA Applications and OpenCL™

- **Technic proposed in the paper allows SCA Components to be used in both use cases**
  - Components can detect when they are connected to components that are co-localized



# SCA Applications and OpenCL™

- How much time can be saved by avoiding copies when components are co-located?

KB	Samples per Buffer	Baseline (μs)	Enhanced (μs)	Baseline / Enhanced
2	512	732	435	1.68
4	1024	696	442	1.57
32	8192	851	350	2.43
64	16,384	992	444	2.23
256	65,536	2527	529	4.8
1024	262,144	10,735	3039	3.5
4096	1,048,576	32,130	7076	4.5

# Questions?

# Thanks!

- **Point of Contact Information**

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