

K H R O N O S[®]
G R O U P

SYCL[™]

Safety-Critical Exploratory Forum Call for Participation

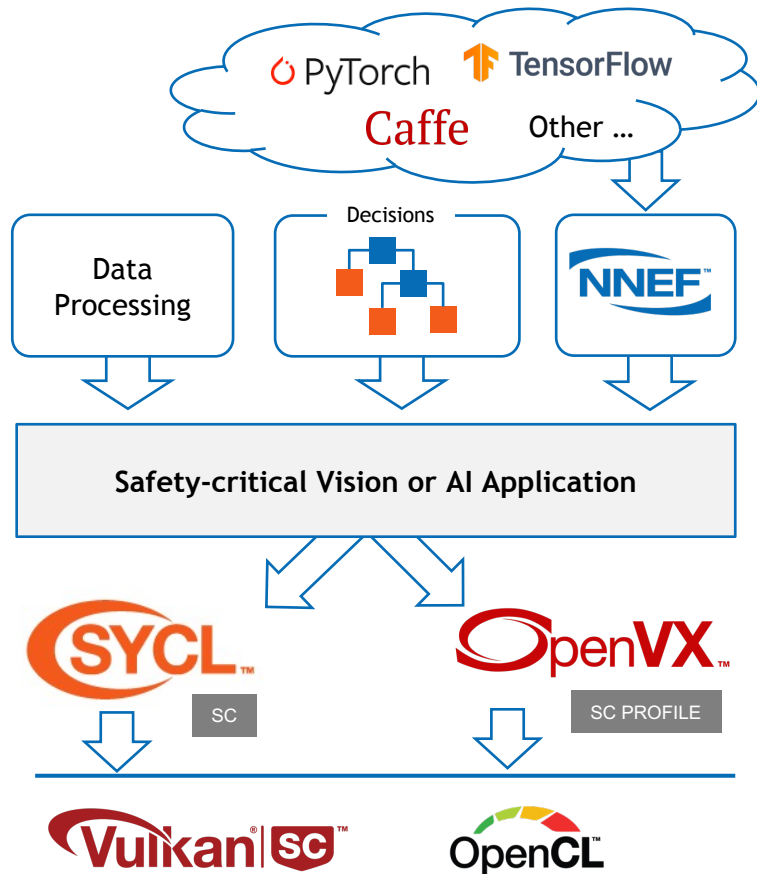
Industry Need and Opportunity

- Khronos Safety-Critical Advisory Forum (KSCAF) have expressed a need:
“Khronos expects that several additional Khronos working groups [...] will adopt the Safety-Critical guidelines when designing future APIs that will enable similar levels of certification.”
- ML Summit feedback: Request for “high-level abstractions” in a safety-critical context
- AUTOSAR/Khronos planned liaison shows automotive is looking for Khronos APIs
- Safety-Critical industries (e.g. avionics, automotive, nuclear, rail) require compliance to safety standards (e.g. ISO 26262, DIS21448/SOTIF, DO-178C, UL4600) and adherence to guidelines (e.g. by AUTOSAR, MISRA).
- Need APIs designed to support this.
- Software and hardware complexity growing, even for safety-critical systems.
 - Move from C to C++
 - Move from single- to multi-core and accelerators



No high-level API for compute that is suitable to develop safety-critical applications

SYCL SC in the Khronos SC Ecosystem



Neural network models are trained in the cloud using a variety of platforms.

Once the model is trained it is exported and converted to NNEF before being passed to a safety-critical API for inferencing.

OpenVX provides high level APIs for Vision and AI with a safety-critical profile, enabling applications to quickly deploy trained NN models.

SYCL SC provides a general parallel programming API for accelerated compute at the C++ level. A typical AI application pipeline will combine the discreet functionality exposed by OpenVX with proprietary algorithms written using SYCL SC involving data pre-processing and post-processing, as well as complex decision making.

Vulkan SC or **OpenCL** are lower, execution-level APIs that could be used to accelerate higher-level APIs like SYCL SC & OpenVX

SYCL SC Interaction With SC APIs

- The autonomy industry (automotive, avionics, medical, etc) requires AI and ML frameworks running on systems certified to industry functional certification standards
- Khronos' growing family of Safety Critical APIs are designed to streamline the system-level safety certification process
- Vulkan SC provides a safety critical execution layer for compute and graphics
- OpenVX deployment feature set provides safety critical Computer Vision and NN APIs
- Vulkan SC is aimed at the low level and OpenVX specialises in Vision / AI / ML applications. Both are not sufficient to cover all use cases.
- SYCL SC may bridge the gap between low-level APIs required to build deterministic AI and ML frameworks, and high-level programming languages like C++
- SYCL is critical to HPC and AI/ML in non-SC environments. SYCL SC could be critical to HPC and AI/ML in SC environments

Aims

- **SYCL SC will use the same definition and scope of “safety critical” as Vulkan SC**
 - Deterministic Execution (predictable execution times and results)
 - Robustness (error handling, removing ambiguity, clarifying undefined behavior)
 - Simplification (changes made to reduce certification effort and challenges)
- **Enable SYCL applications to adhere to MISRA C++ 202X as much as possible**
 - As few modifications as possible
 - Documentation of any remaining non-conformities
- **Enable safety certification of SYCL runtimes (e.g., ISO 26262)**
 - (Continue to) support SYCL SC on Vulkan SC
 - Removal of some features to reduce certification overhead
- **Enable SYCL applications to be written for enhanced functional safety**
 - Removal of some features to focus on deterministic rather than dynamic behavior
 - Addition of features for safety

Exploratory Forum Process

Proven Khronos Process to ensuring industry requirements are fully understood before starting standardization initiatives

Any company is welcome to join

No cost or IP Licensing obligations

Project NDA to cover Exploratory Group Discussions

Exploring real-world industry requirements for an *API for high-level heterogenous computing for safety-critical contexts*

KHRONOS
GROUP

SYCL SC Exploratory Forum

Online discussion forum and weekly Zoom calls, probably for a few months

No detailed design activity to protect participants IP

Explore if consensus can be built around an agreed **Scope of Work** document

Scope of Work Document

Agreed SOW document released from NDA and made public

Creation of Khronos group to create an API based on the Scope of Work

Exploratory Forum Discussion Stages

1. Level-setting

All EF members invited to present on relevant PUBLIC technologies or projects, pain points that they are experiencing, and requirements they feel are key

2. Brainstorming

Discussion on whether and how SYCL SC could fulfil the identified requirement

3. Triage and Author SOW

Attempt to generate consensus on design goals that would garner industry participation and produce a Scope of Work document

Typically, each stage can take 1-2 months

Industry Call For Participation



SYCL SC Exploratory Forum Goals

Enable industry dialog to seek consensus on:

Is there a demand?

What are the requirements?

Which are the use cases?

How should we collaborate under Khronos to define this API?

All companies, universities, consortia, industry experts, open-source participants welcome!

Influence the creation of a high-level heterogeneous computing standard to ensure it meets your needs! Open to all at no cost!

Kick-off meeting on Monday, April 4 2022

<https://www.khronos.org/syclsc>