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
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.

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

- Any company is welcome to join
- No cost or IP Licensing obligations
- Project NDA to cover Exploratory Group Discussions

**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

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

- Scope of Work Document
- Agreed SOW document released from NDA and made public

Any company is welcome to join. There are no cost or IP Licensing obligations. A project NDA will cover Exploratory Group Discussions. The purpose is to explore real-world industry requirements for an API for high-level heterogenous computing for safety-critical contexts. The process includes an online discussion forum and weekly Zoom calls for a few months. No detailed design activity is conducted to protect participants' IP. The goal is to build consensus around an agreed *Scope of Work* document. The Khronos group will then create an API based on the Scope of Work. The Scope of Work Document will be released from NDA and made public.
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