

# Embracing Innovation

## How the RISC-V Software Ecosystem Rethinks “Fragmentation” as “Differentiation”



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Chief Technologist & Founder, VRULL GmbH



**RISC-V Responsibilities**

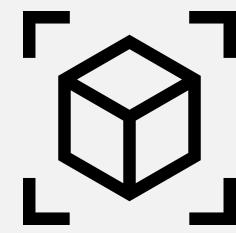
**Chair of the  
Applications & Tools Committee**

**Elected Board Representative  
for the Strategic Membership Tier**

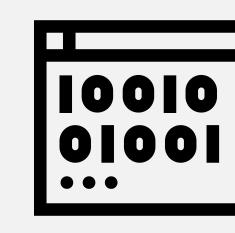
# Managing Fragmentation

Conventional wisdom

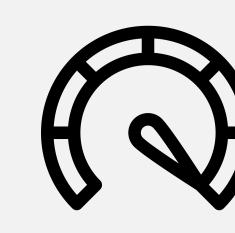
## Architecture Development and Co-Optimization



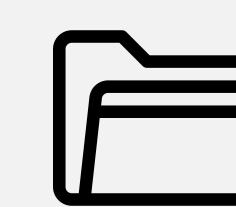
Emulators &  
Simulators



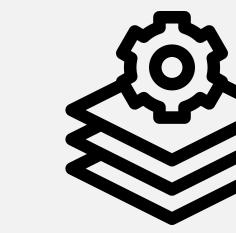
Compilers &  
Debuggers



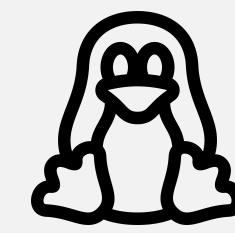
Performance Analysis  
and Modelling Tools



Performance  
Libraries



Managed  
Runtimes



Operating  
Systems

## Pre-Silicon Verification

Software Enablement for Adopters, Independent Software Vendors, and End-Users



# Modularity + Customisation = Innovation

## Modular ISA



## Vendor-defined (custom) ISA extensions

Created policies for naming of custom instructions to support **coexistence** across common open-source tools.

## Tools and simulators

Community-adopted policies for including **publicly documented** vendor-defined extensions in key open-source tools.

**RISC-V Profiles** will enhance the usability.



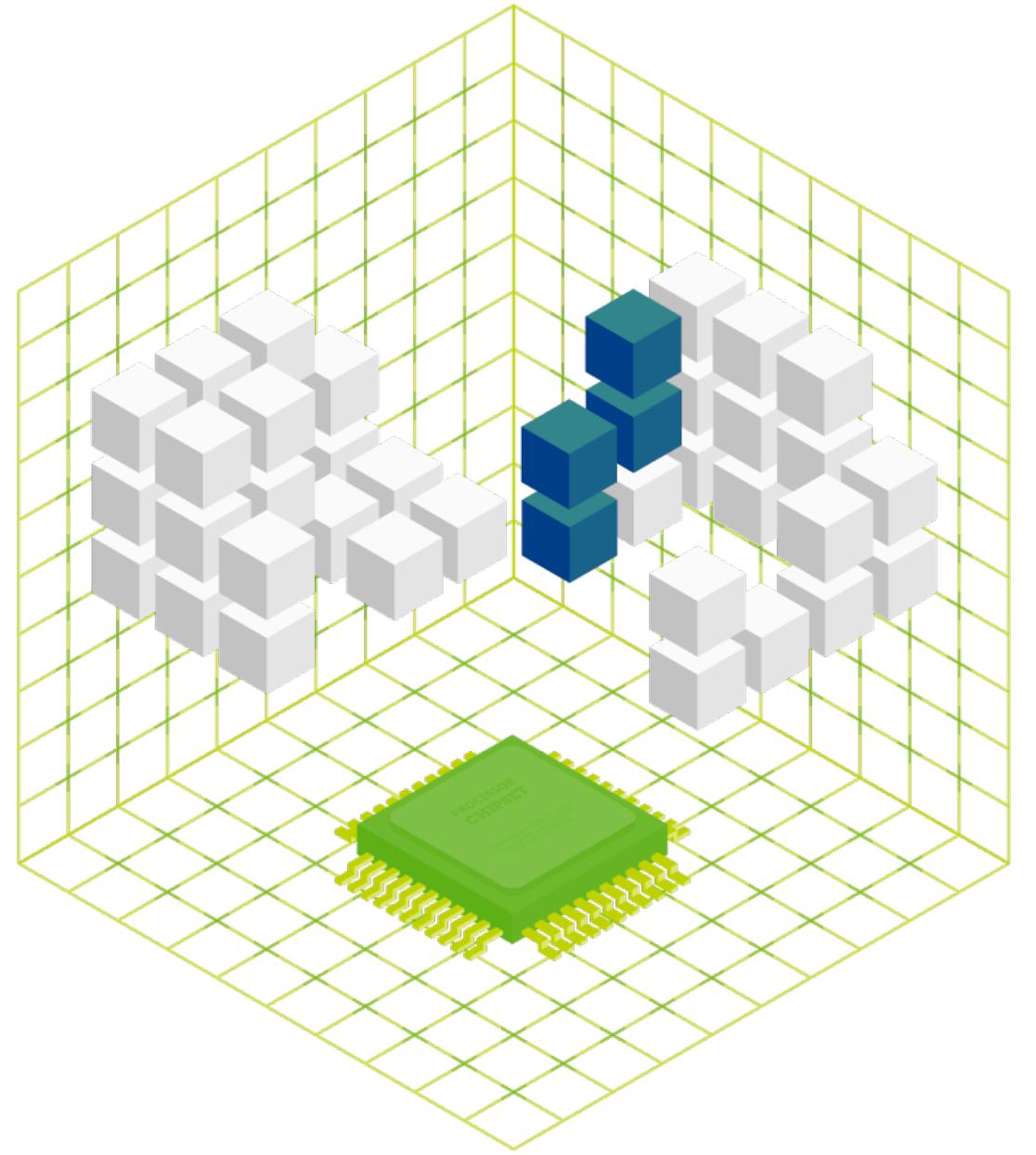
## Dynamic discovery

Multiple mechanisms to select **optimised code paths** are fully implemented in libraries and the Linux kernel

Optimised cache management, cryptography, and string functions are **just the beginning**.

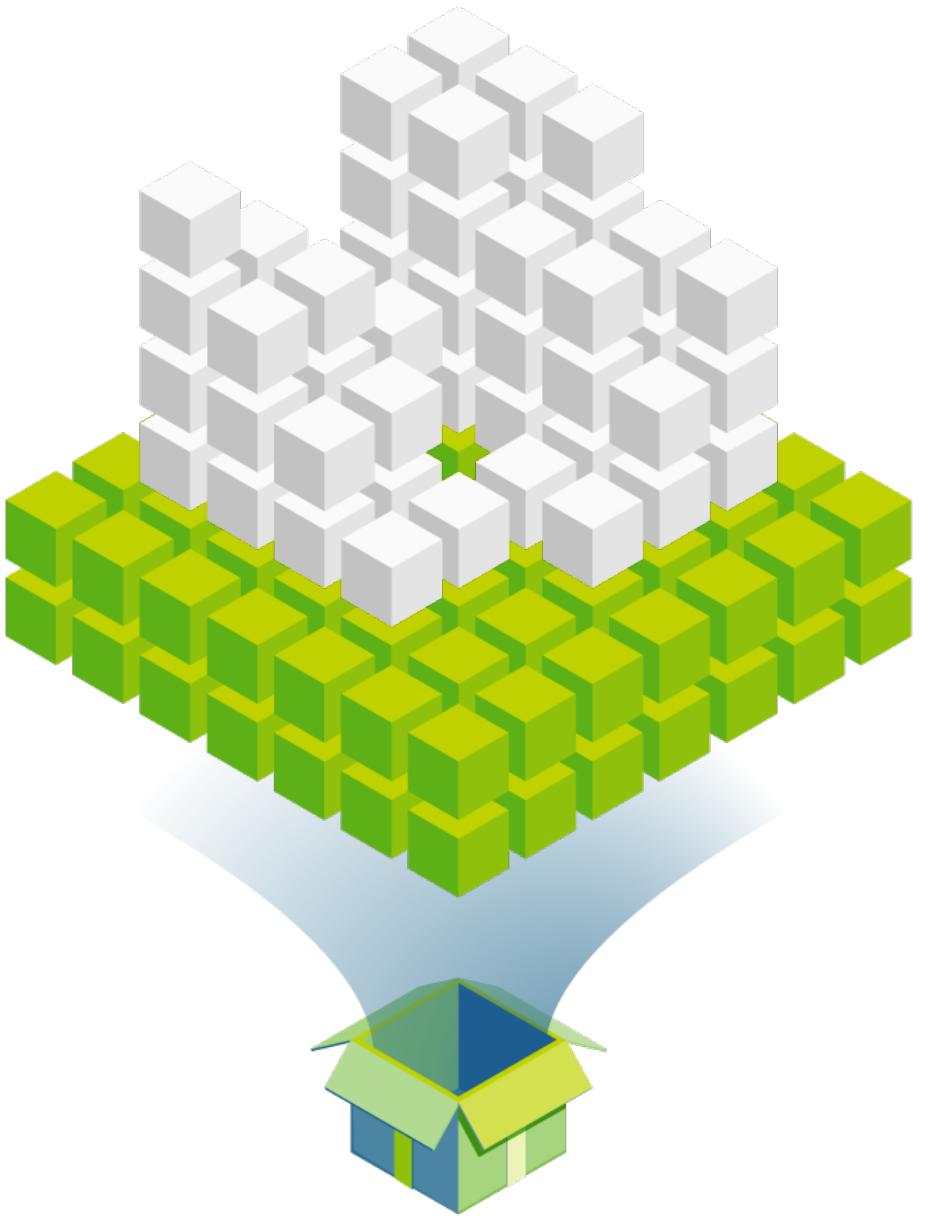


**OpenSSL**  
Cryptography and SSL/TLS Toolkit



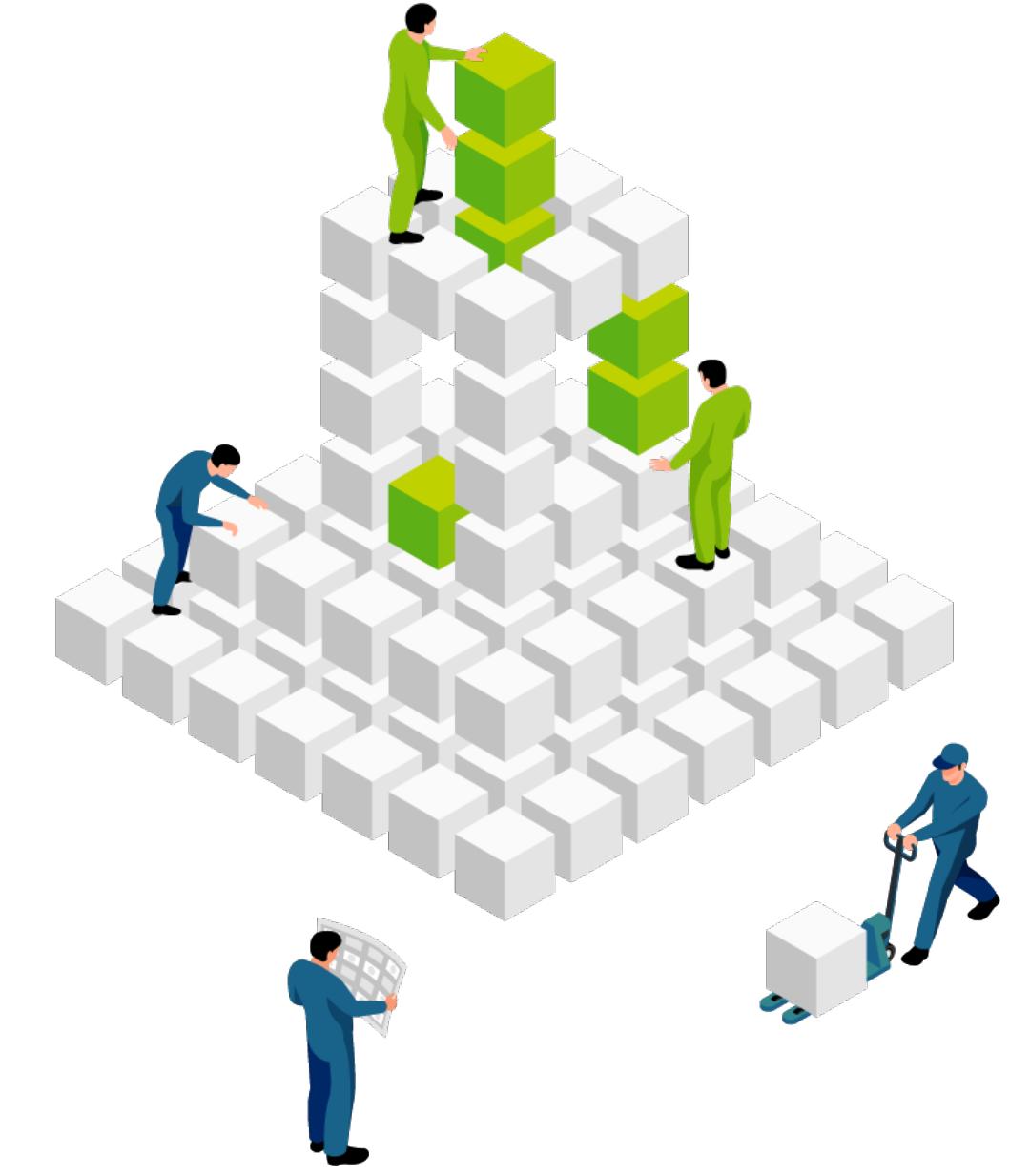
## Domain-specific extensions

Drive the definition of extensions using quantitative and software-driven methodologies to benefit **domain-specific software** workloads and coexistence of **vendor-specific extensions**



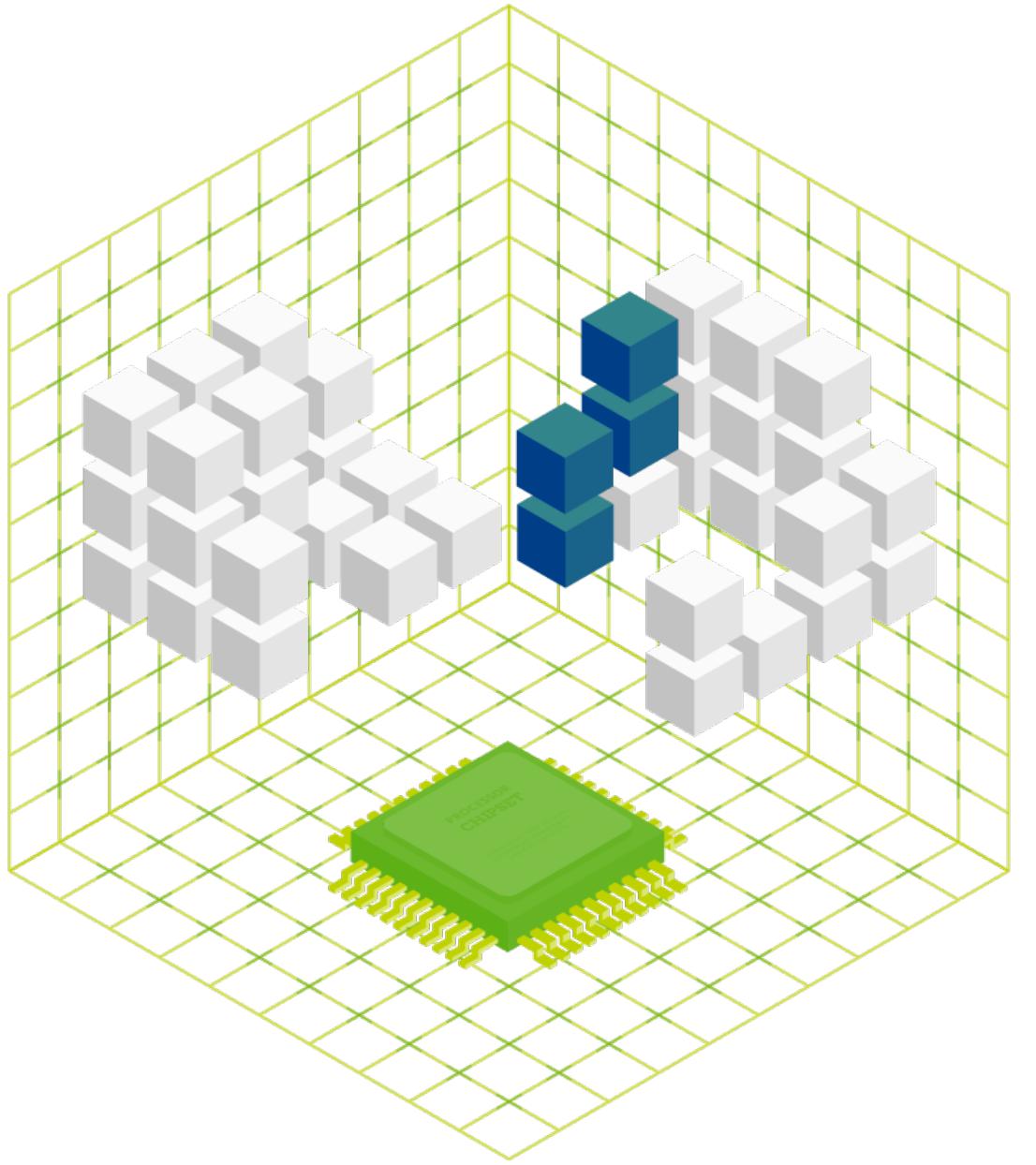
## Platform standardisation

Attract independent software vendors and **reduce platform fragmentation** for hardware/software interoperability with off-the-shelf devices and software



## Building a contributor culture

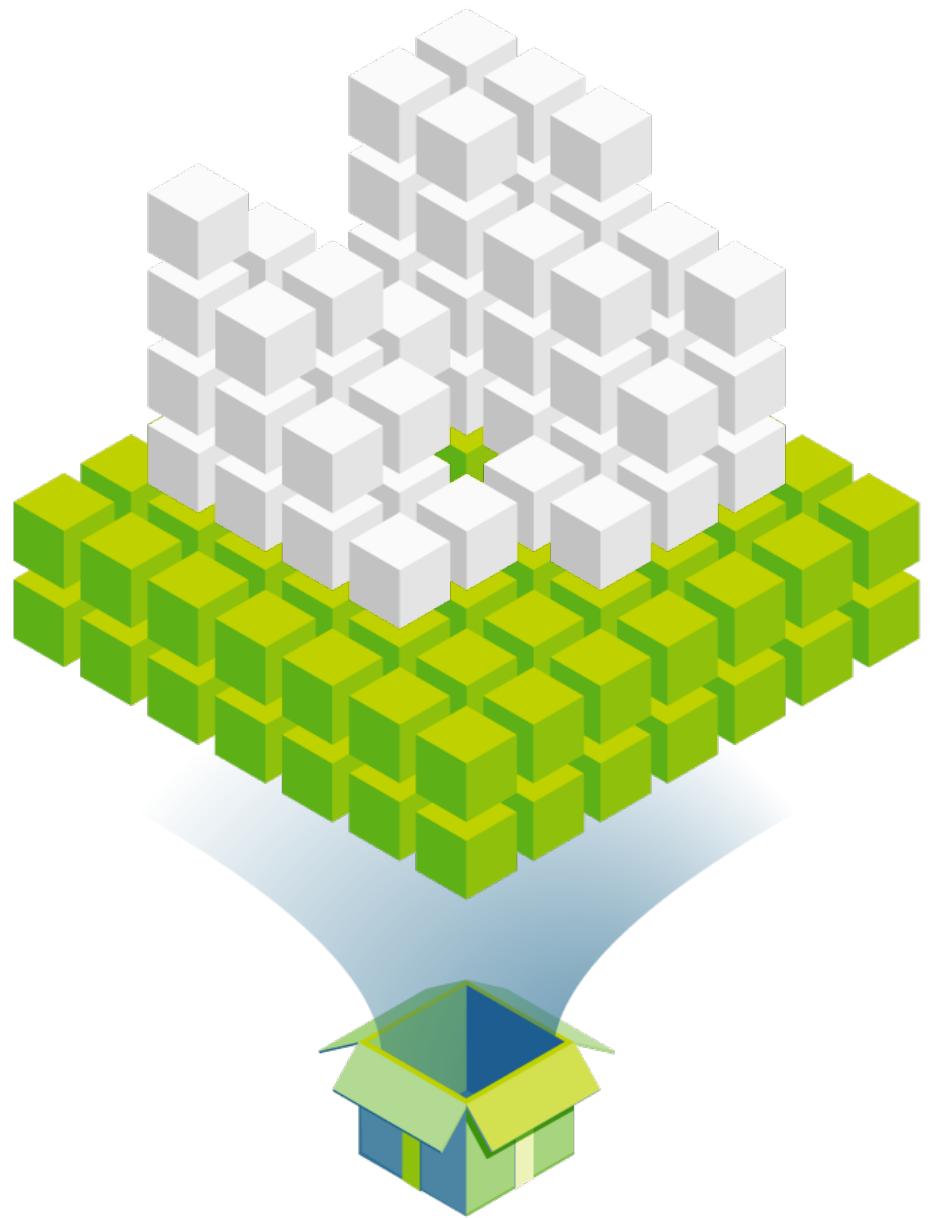
Collaborate closely with major **Open-Source Projects** to better align our standardisation and member's contributions with each upstream project's processes



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Upstream support for vendor extensions unlocks performance for novel applications

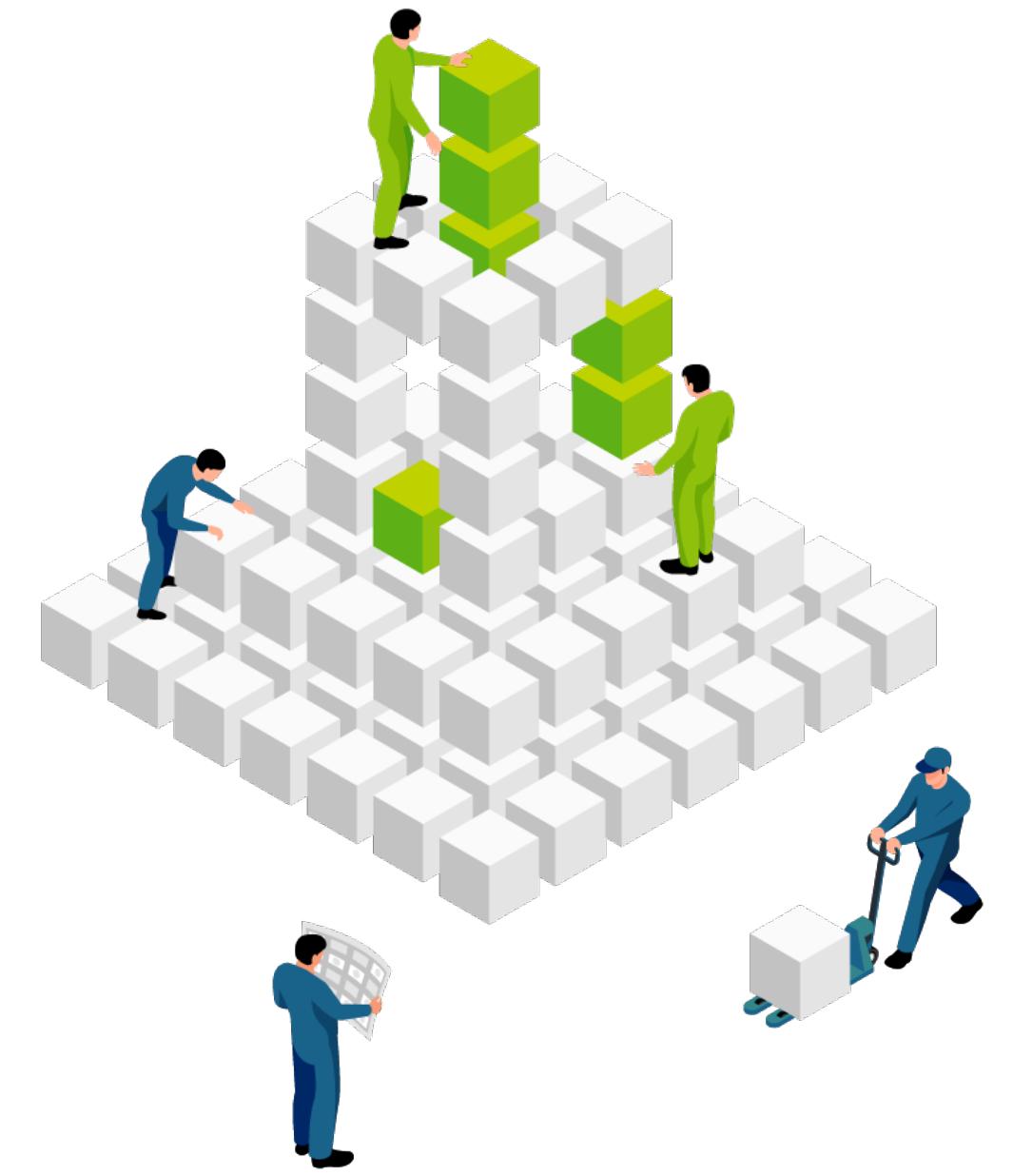
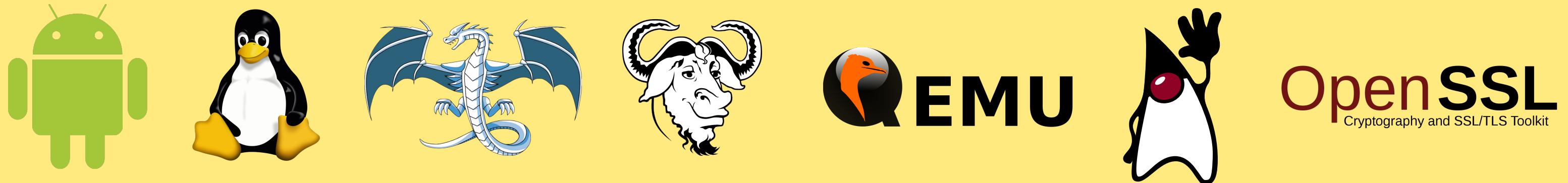


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# Profiles and Platforms are simplifying the developer journey

Member companies are  
**joined together**  
to build the best  
open-source ecosystem



### Building a contributor culture

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# “Embracing Differentiation”

A Focus on Innovation

# Modularity

RISC-V allows implementors to leave off unneeded features from their designs to “scale-to-fit”.



# Extensability

RISC-V enables implementors to add their domain-specific “secret sauce” to designs.

# Modularity

RISC-V allows implementors to leave off unneeded features from their designs to “scale-to-fit”.

*How can we leverage a common software without holding everyone back?*



# Extensability

RISC-V enables implementors to add their domain-specific “secret sauce” to designs.

*How can we innovate and roll out adoption of new features?*



# Naive solutions lead to fragmentation

- ✖ *Bad user experience*
- ✖ *Loss of developer focus*
- ✖ *Duplication of effort*

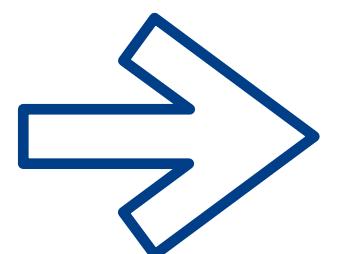
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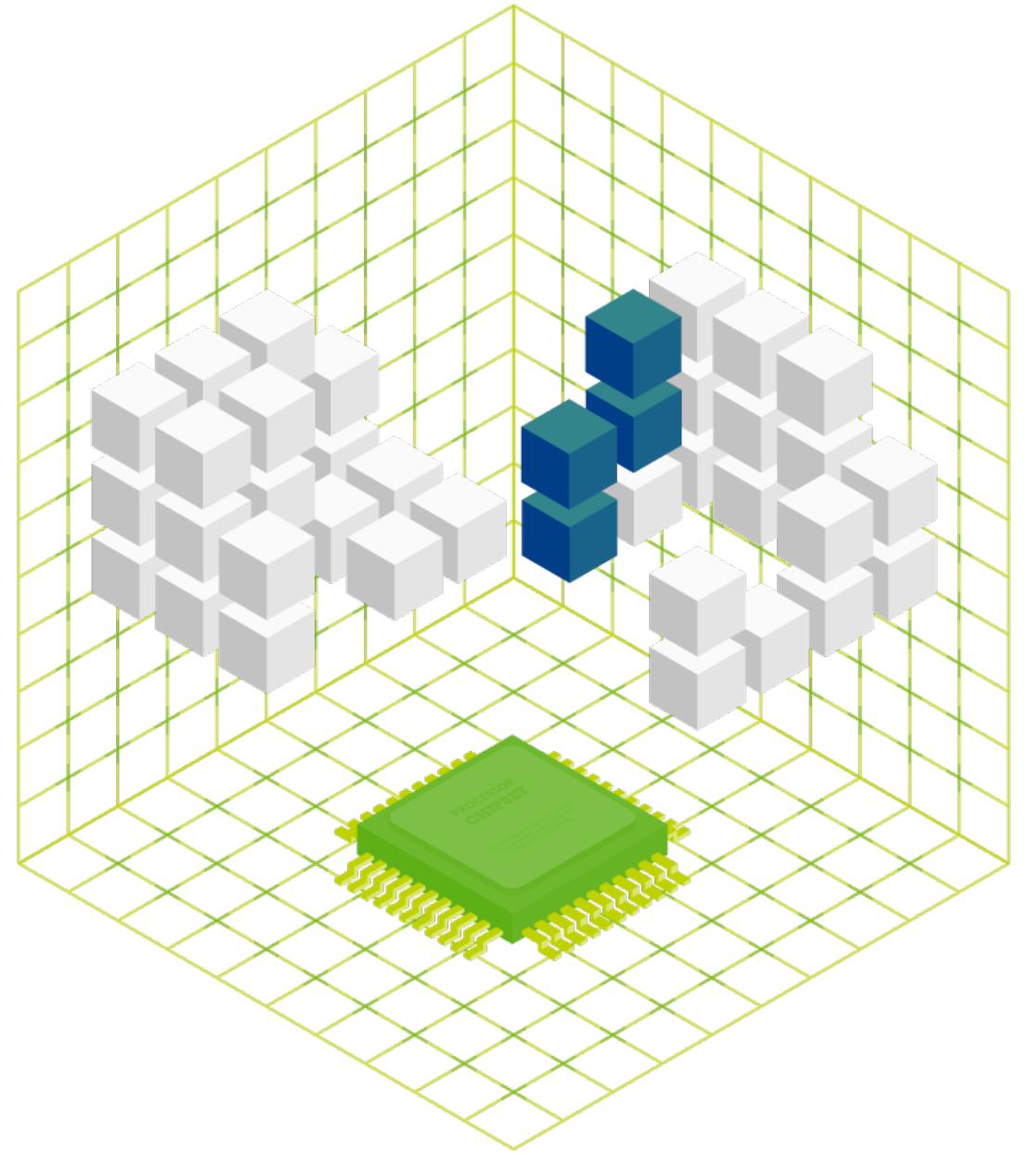
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## Unique Selling Point

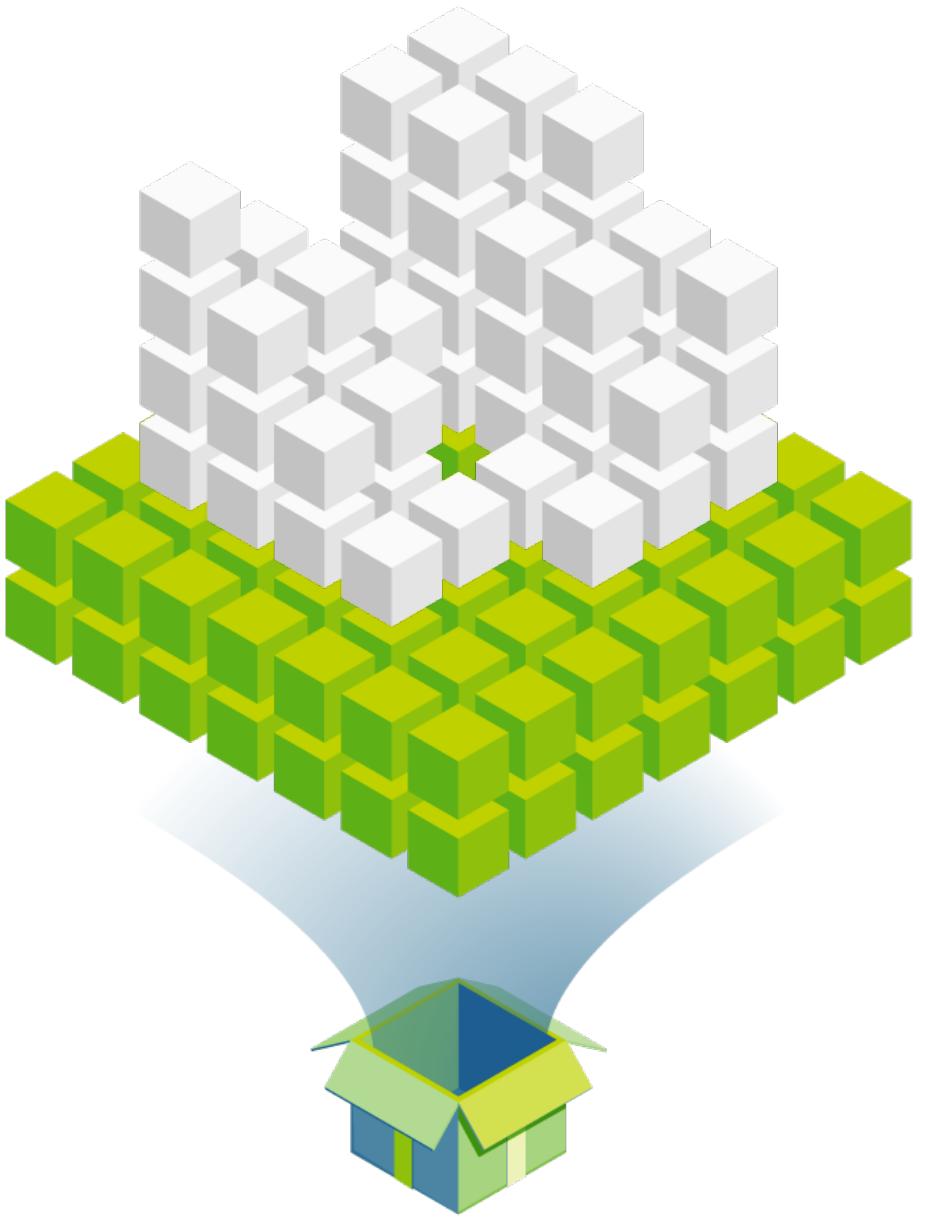
to adopt RISC-V as an ISA

We will need some ground rules to make this work...



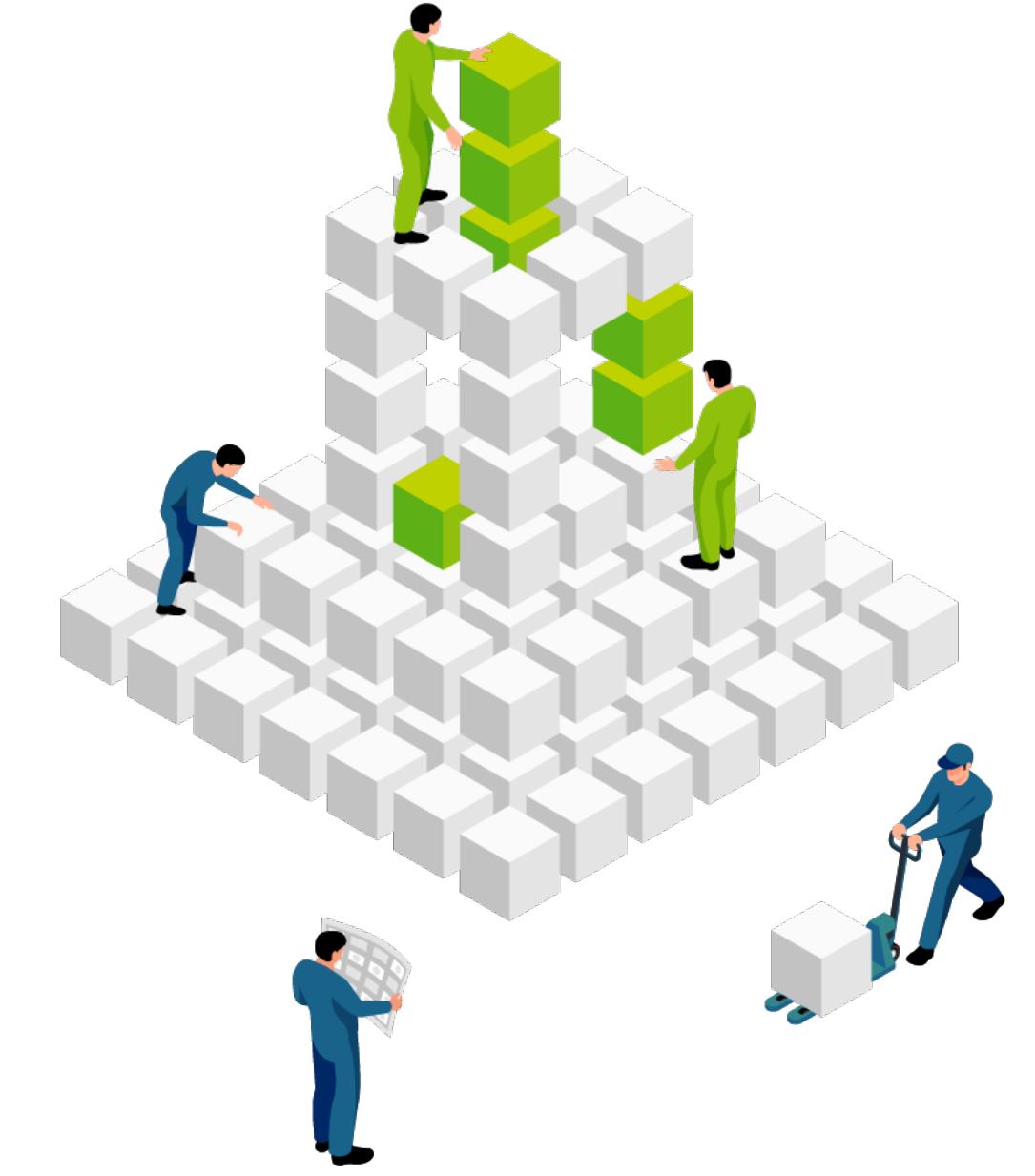
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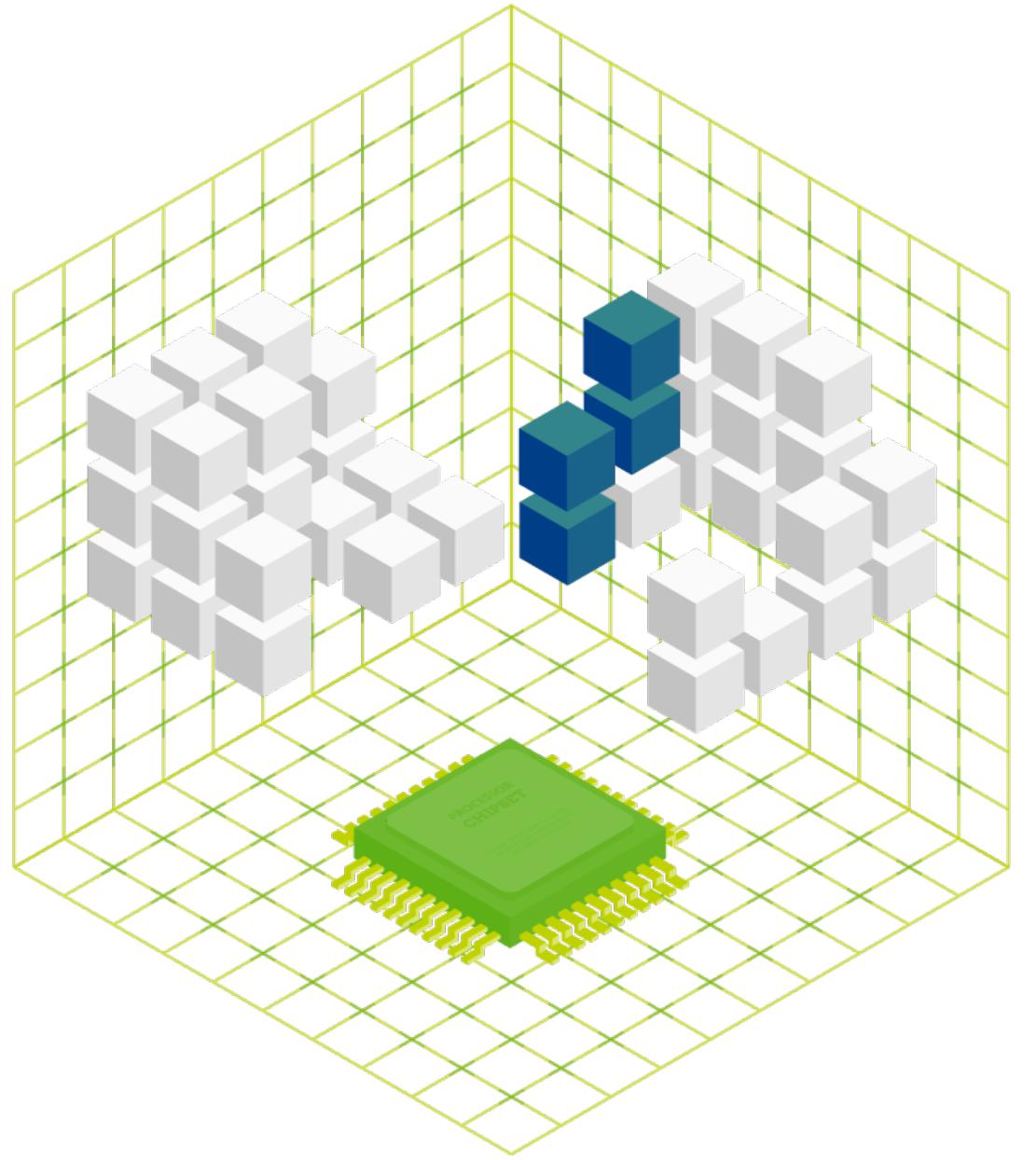
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# Upstream support for vendor extensions unlocks performance for novel applications



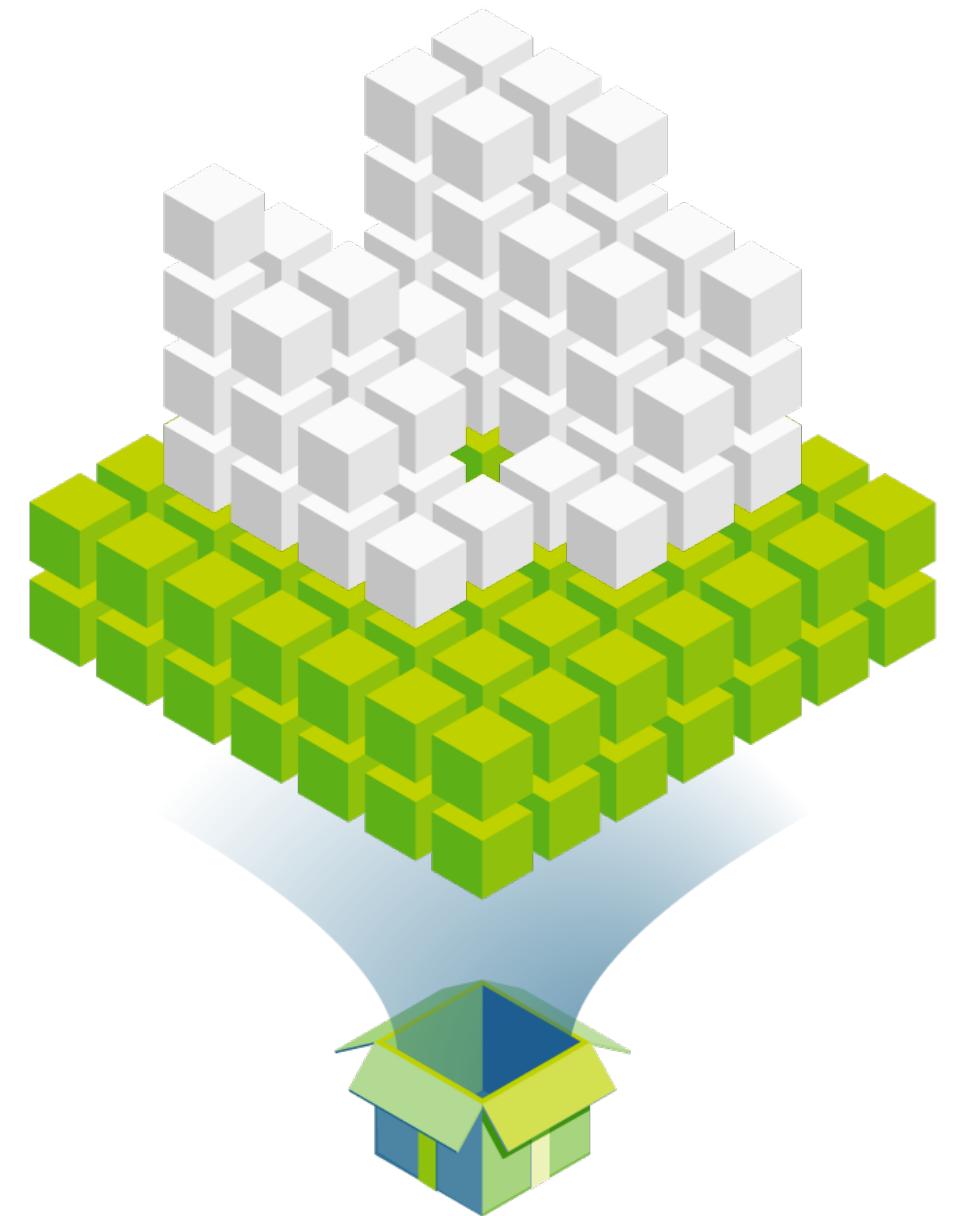
*Provide public documentation*



*Submit for standardisation*



*Upstream support early and commit resources to maintenance*



## Platform standardisation

Attract independent software vendors and **reduce platform fragmentation** for hardware/software interoperability with off-the-shelf devices and software

# Profiles and Platforms are simplifying the developer journey



*Don't let a platform hold you back!*



*Discover your features dynamically*



*Platforms matter only where COTS hardware meets COTS software*

# Member companies are joined together to build the best open-source ecosystem



*Don't differentiate without reason*



*Promote your extensions  
and build consensus*



Collaborate closely with major  
**Open-Source Projects** to better align our  
standardisation and member's contributions  
with each upstream project's processes

# Thank you!



<https://lists.riscv.org/g/software>



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