



Vitis and Vitis AI: Application Acceleration from Cloud to Edge

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Fellow and Chief Architect SW Tools





**Heterogeneous
Compute**

**Key challenge:
Programming &
integration of accelerators**



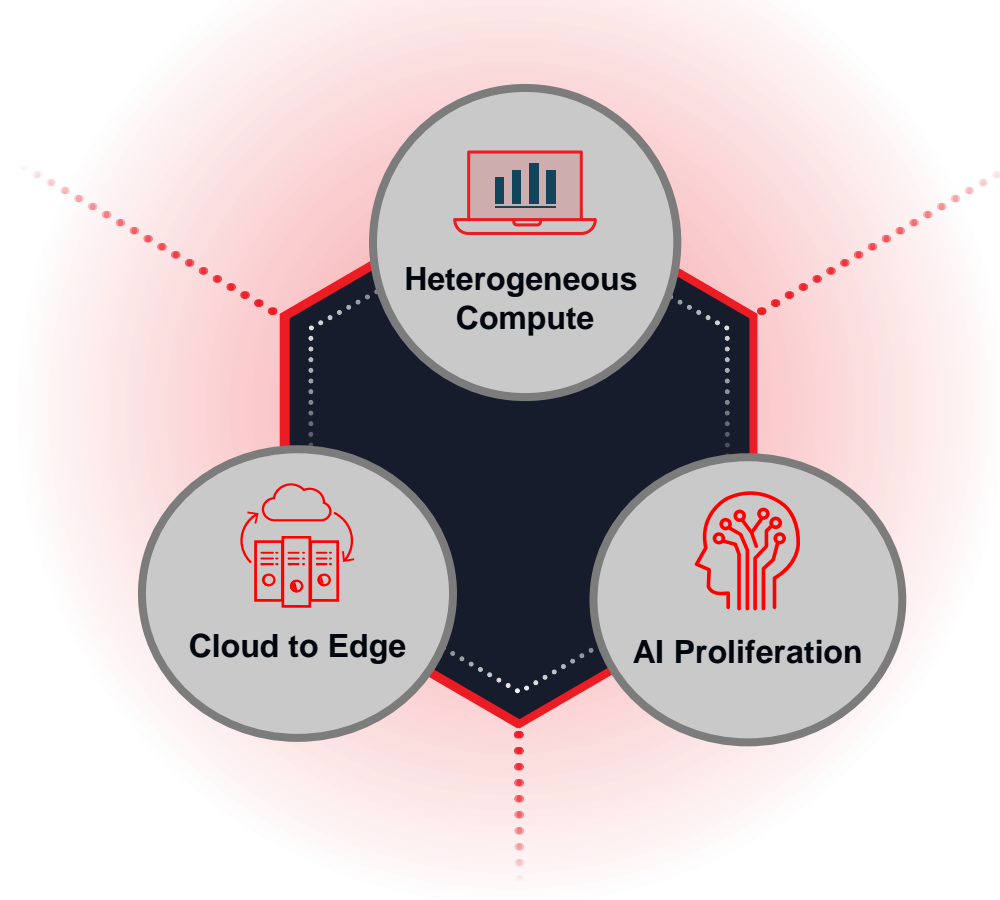
Cloud to Edge

**Key challenge:
Need for retargetability**

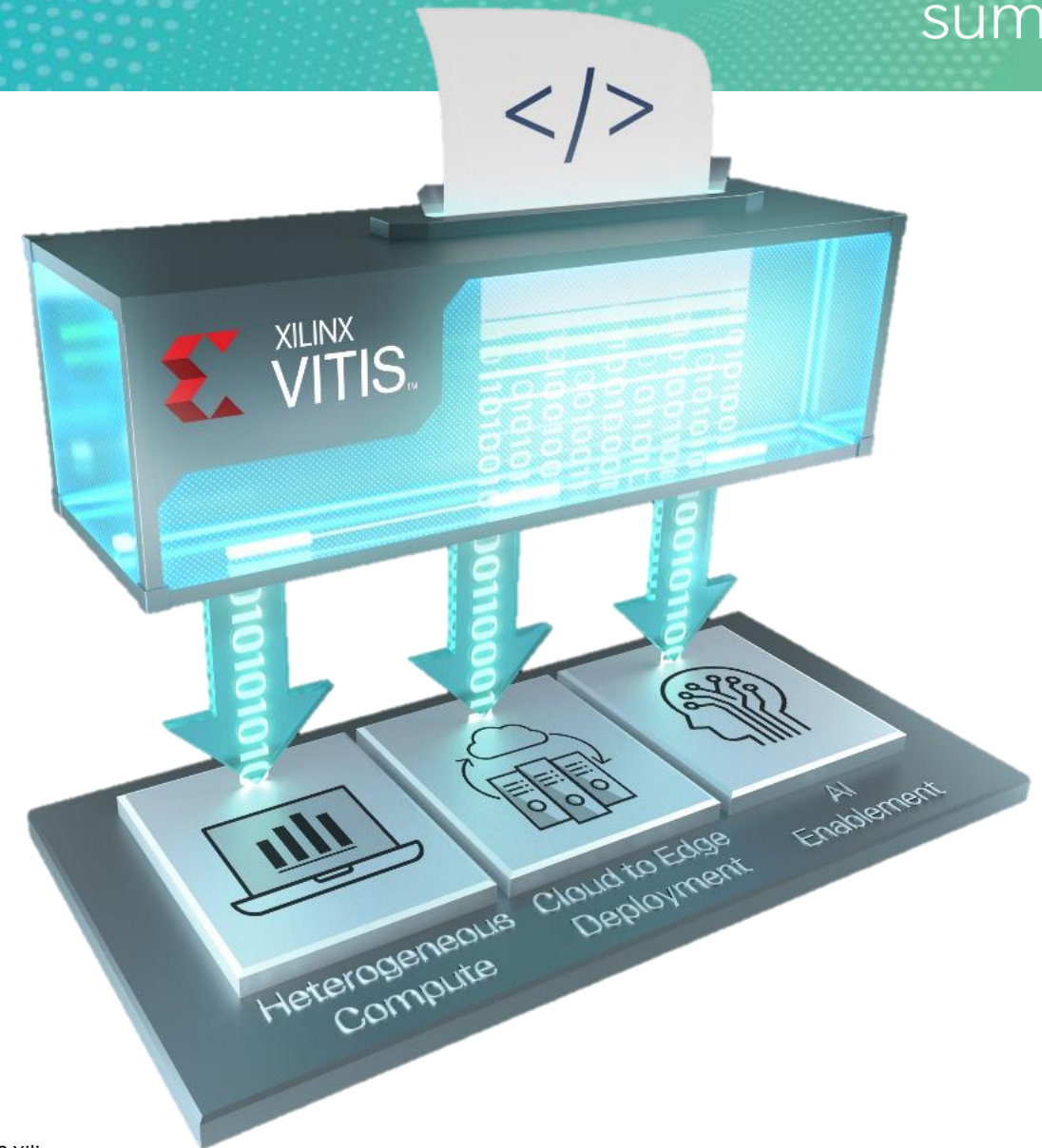


AI Proliferation

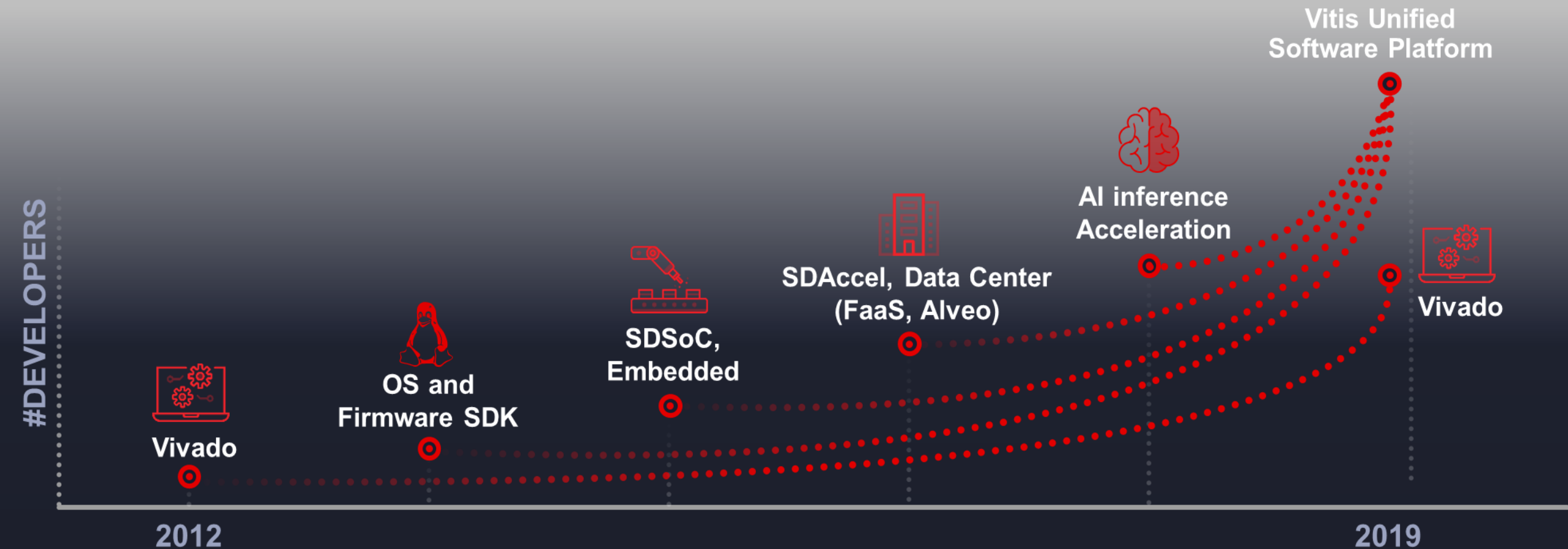
**Key challenge:
Efficient ML acceleration and
integration in the whole application**



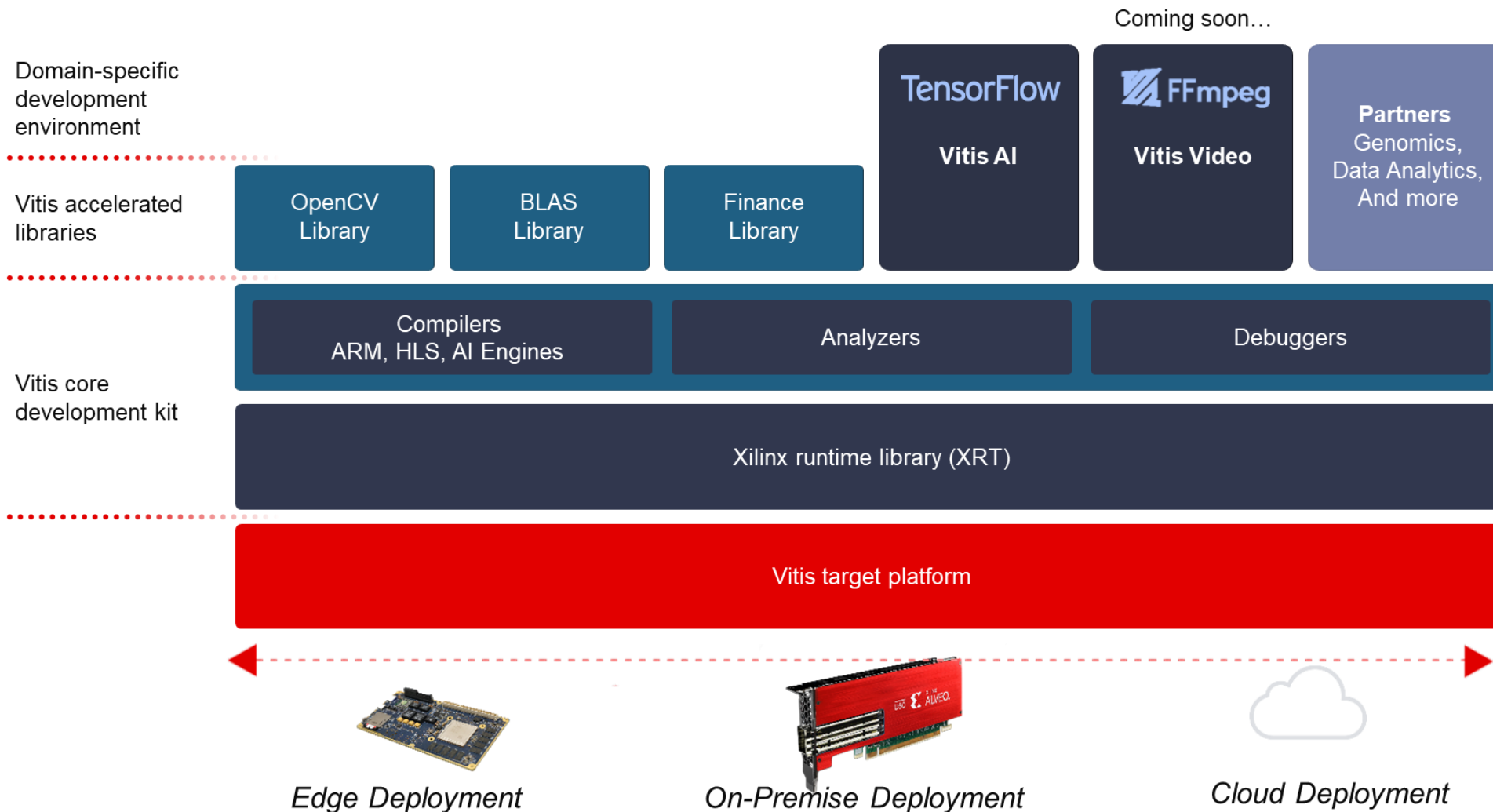
Vitis Unified Software Platform



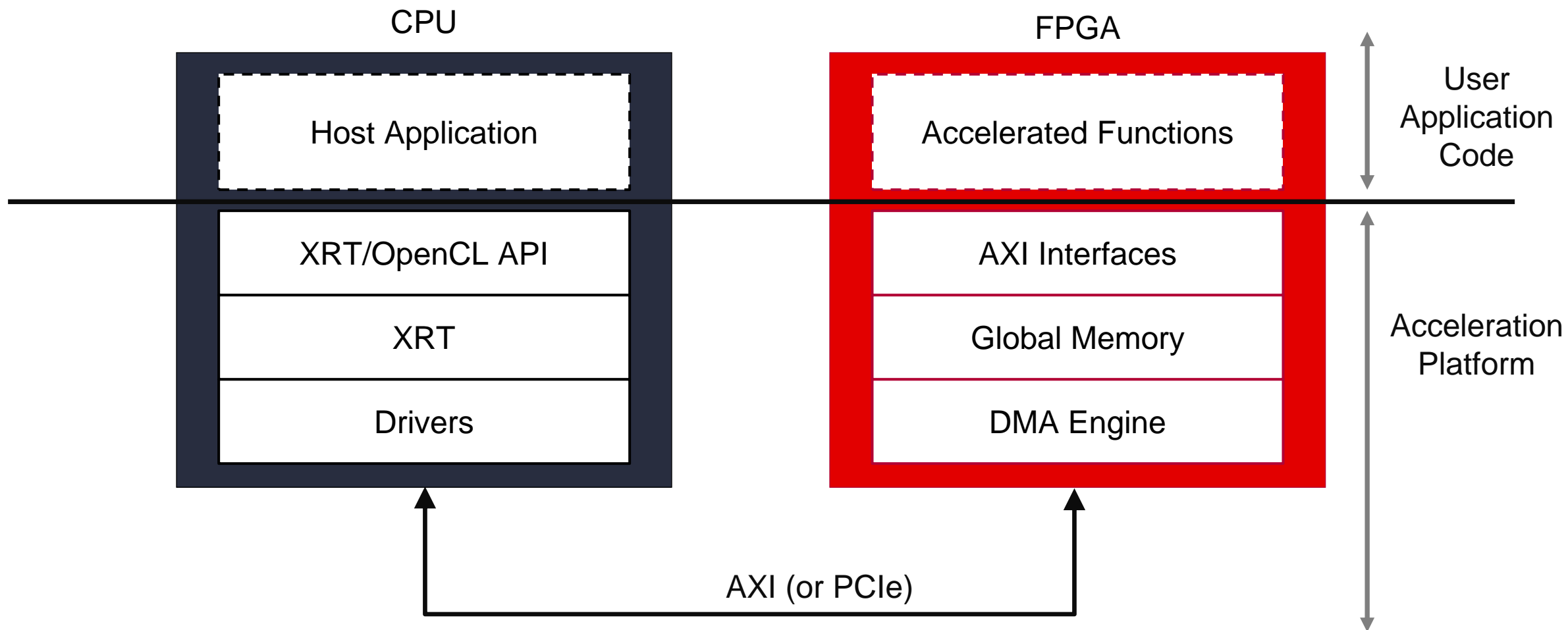
From Hardware to Software Programmable



Vitis: Unified Software Platform



Anatomy of an Accelerated Application

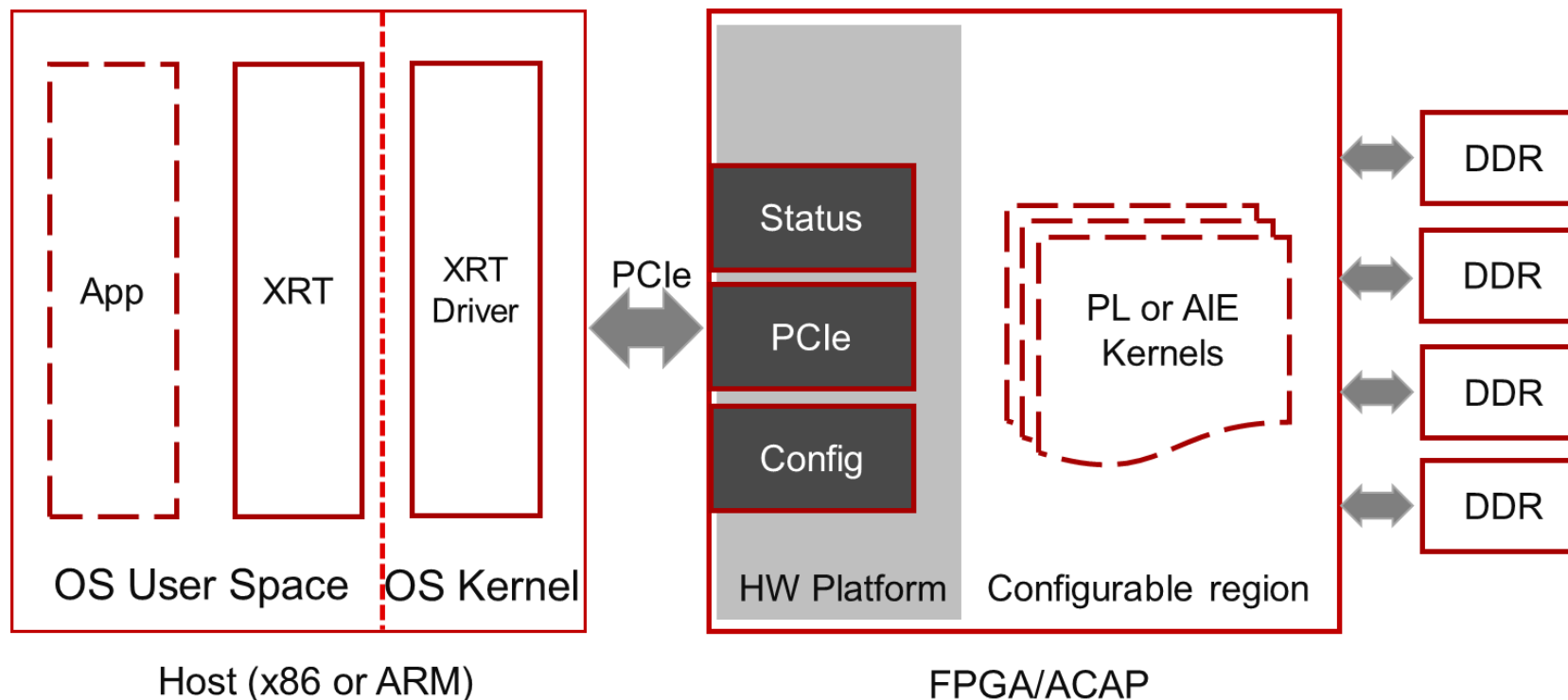


Platform-Based Development Approach

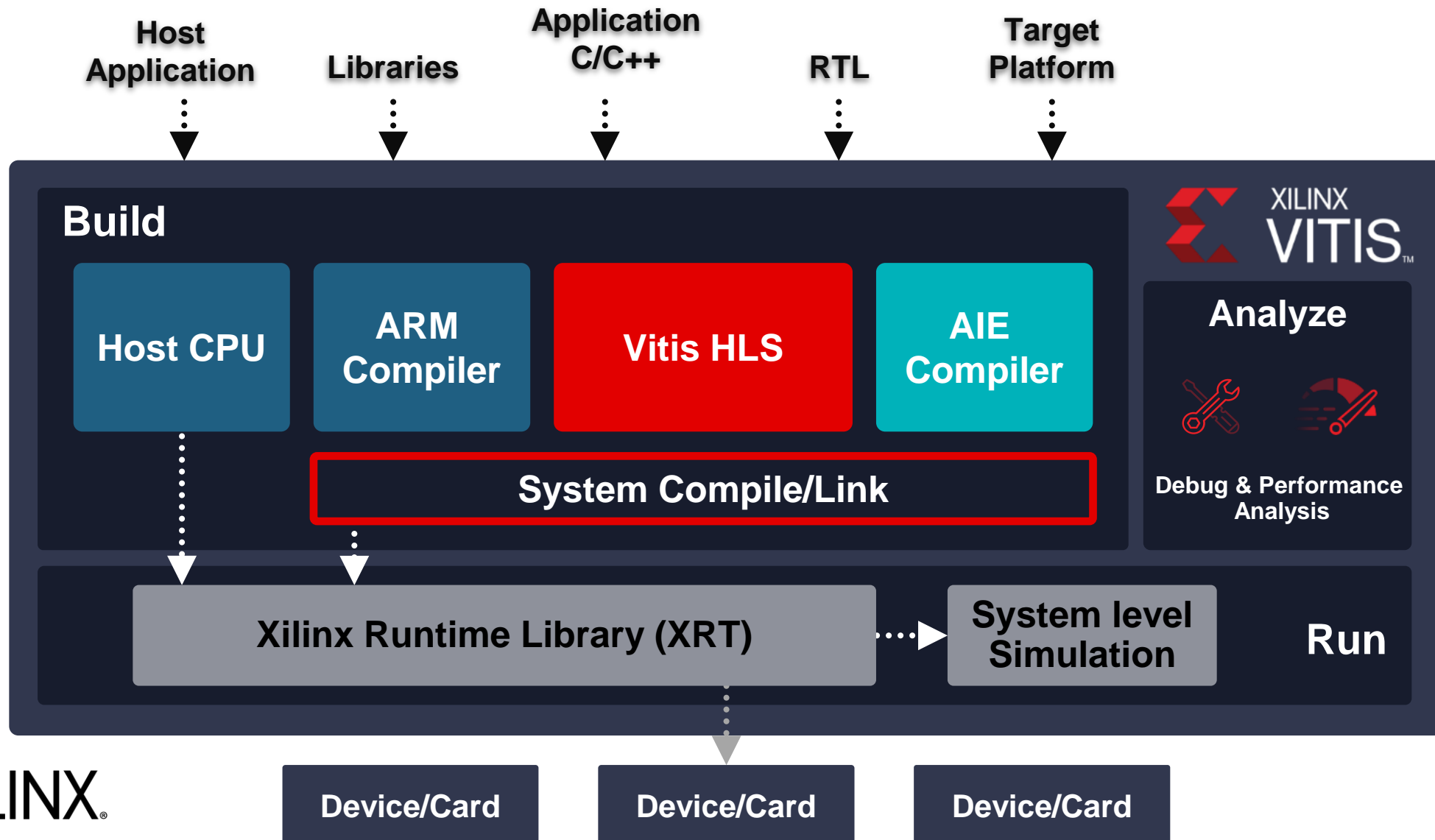
Development is performed in the context of a platform

- A pre-configured system containing I/O, status monitoring, and lifecycle management

Standardized interfaces allow for automated composition of user functionality

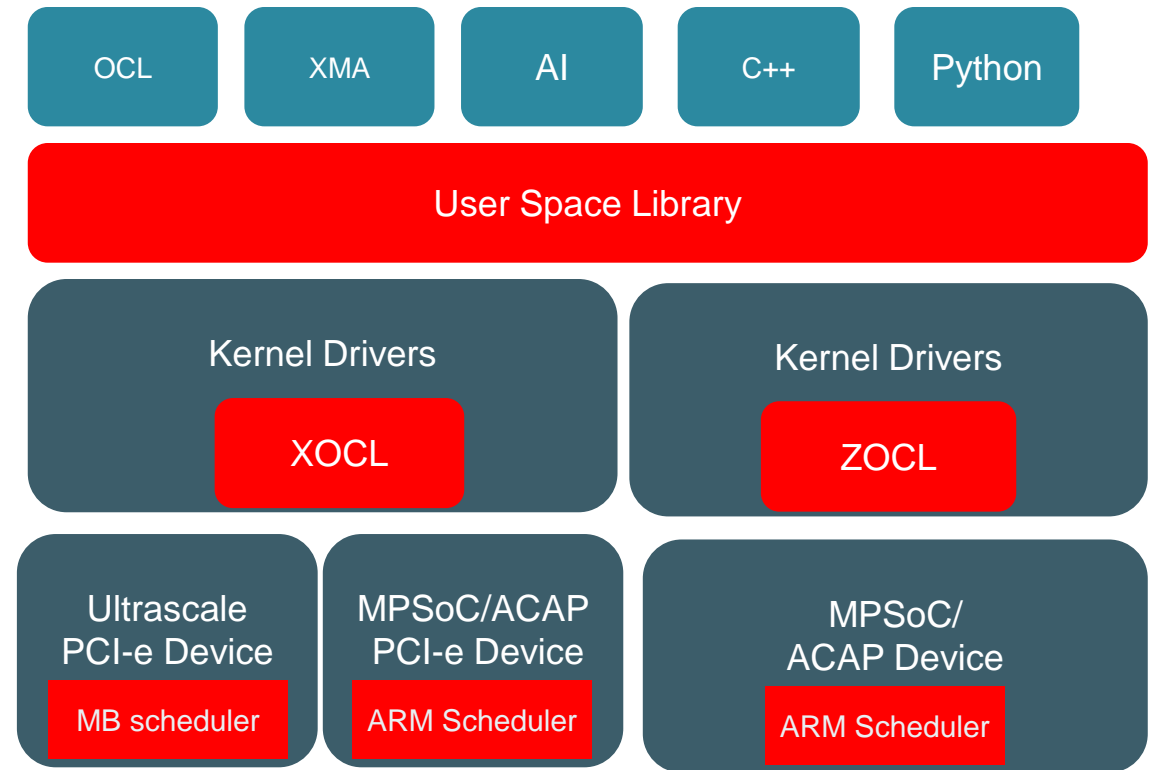


Vitis: Comprehensive Development Tool Suite



Xilinx Runtime (XRT)

- > **Platform- and OS-independent APIs for**
 - >> Device management
 - >> Memory management and data transfers
 - >> Accelerator execution management
- > **OpenCL wrappers, media frameworks, and domain-specific APIs built on top of base APIs**
- > **Open source and available on GitHub**



Open Source, Standards Based Libraries

Domain-Specific Libraries



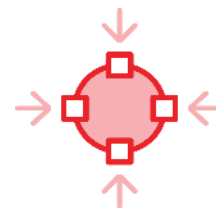
Vision & Image



Finance



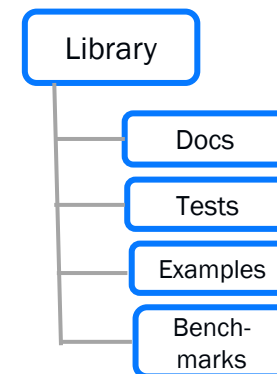
Data Analytics &
Database



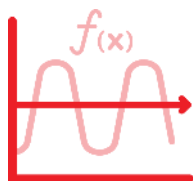
Data Compression



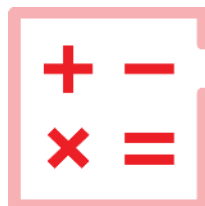
Data Security



Common Libraries



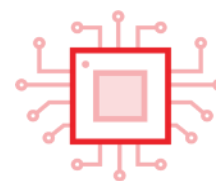
Math



Linear Algebra



Statistics



DSP



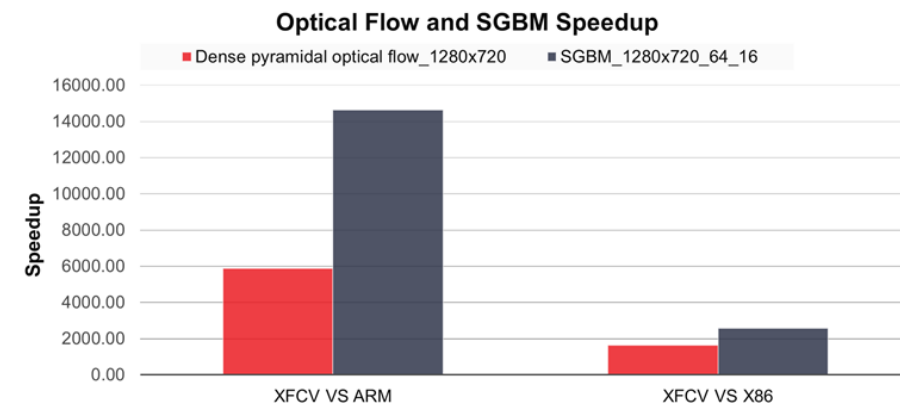
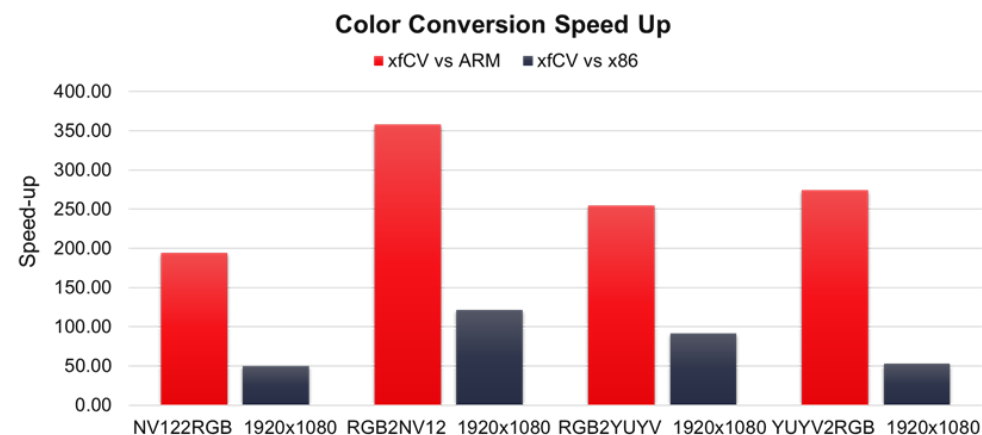
Data Management

400+ functions across multiple libraries for performance-optimized out-of-the-box acceleration

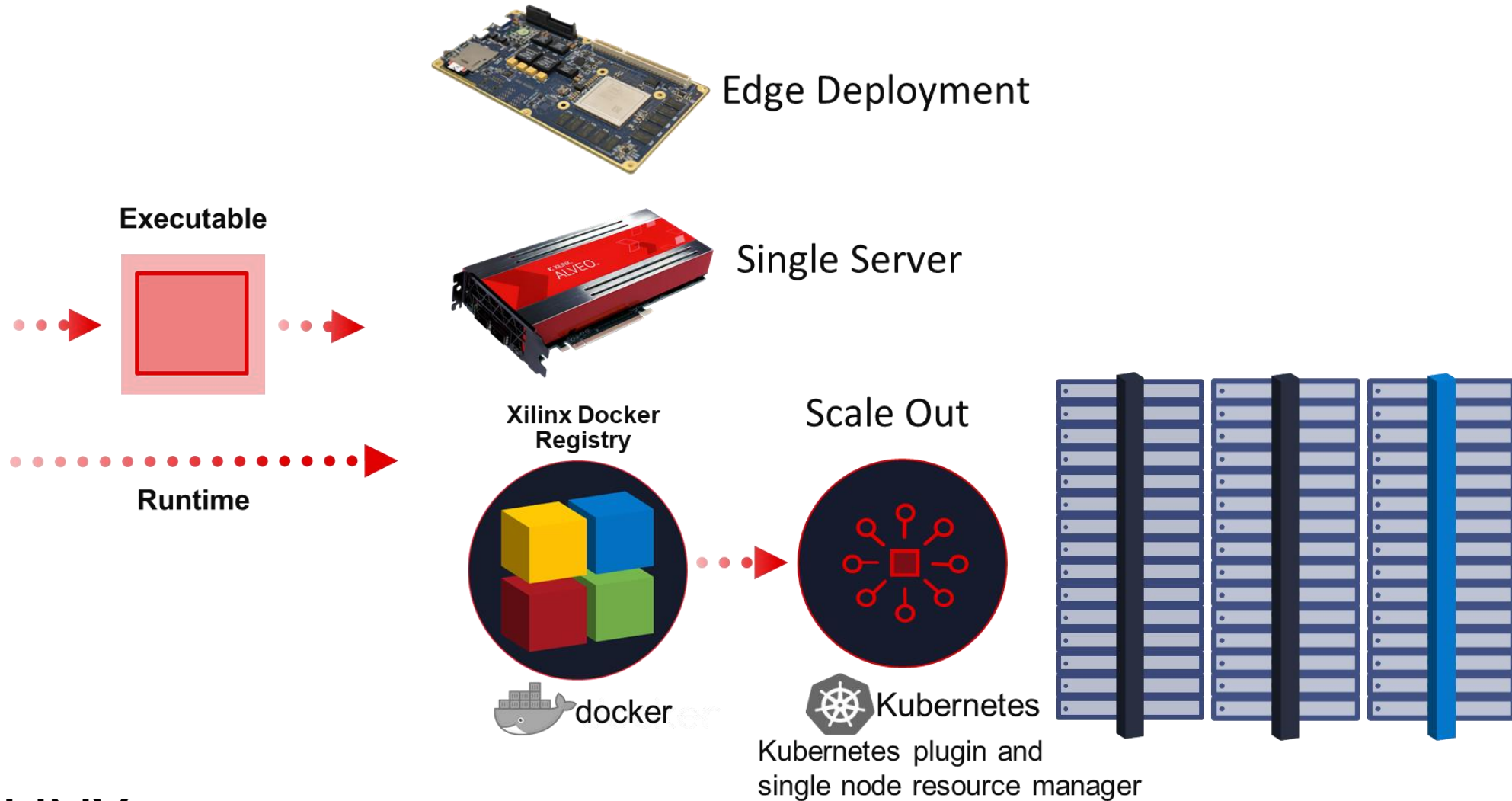
https://github.com/Xilinx/Vitis_Libraries

Vitis Vision Libraries

ISPs	• Debayer, Auto White Balance, ...
ML pre/post processing	• Resize, Letterbox, Crop, Color Conversion,...
Smoothing filters	• Bilateral, Gaussian, Median, Box,...
Edge Detection	• Canny, Gaussian of difference, Sobel,...
Thresholding	• Binary, Binary Inverse, Color, OTSU,....
Morphology	• Dilate, Erode, Houghlines, Standard Deviation,...
Geotransform	• Affine, perspective, pyrup, pyrdown, remap, translation, ...
Feature Detector, Descriptors	• Fast, Harris, Histogram of Gradients
Stereo	• Local Block Matching, Rectify, ...
Tracking	• Dense Optical Flow (LK), Extended Kalman Filter,...



Deploy: Embedded, Single Server, Scale-out



Vitis AI: Real Time AI Inference Acceleration

Frameworks



Caffe



Vitis AI Models



60+ pretrained, optimized reference models

Vitis AI Development Kit

AI Optimizer

AI Quantizer

AI Compiler

AI Profiler

Vitis drivers & runtime (XRT)

Performance improvement up to 10-20x

DSA

CNN DPU

LSTM DPU

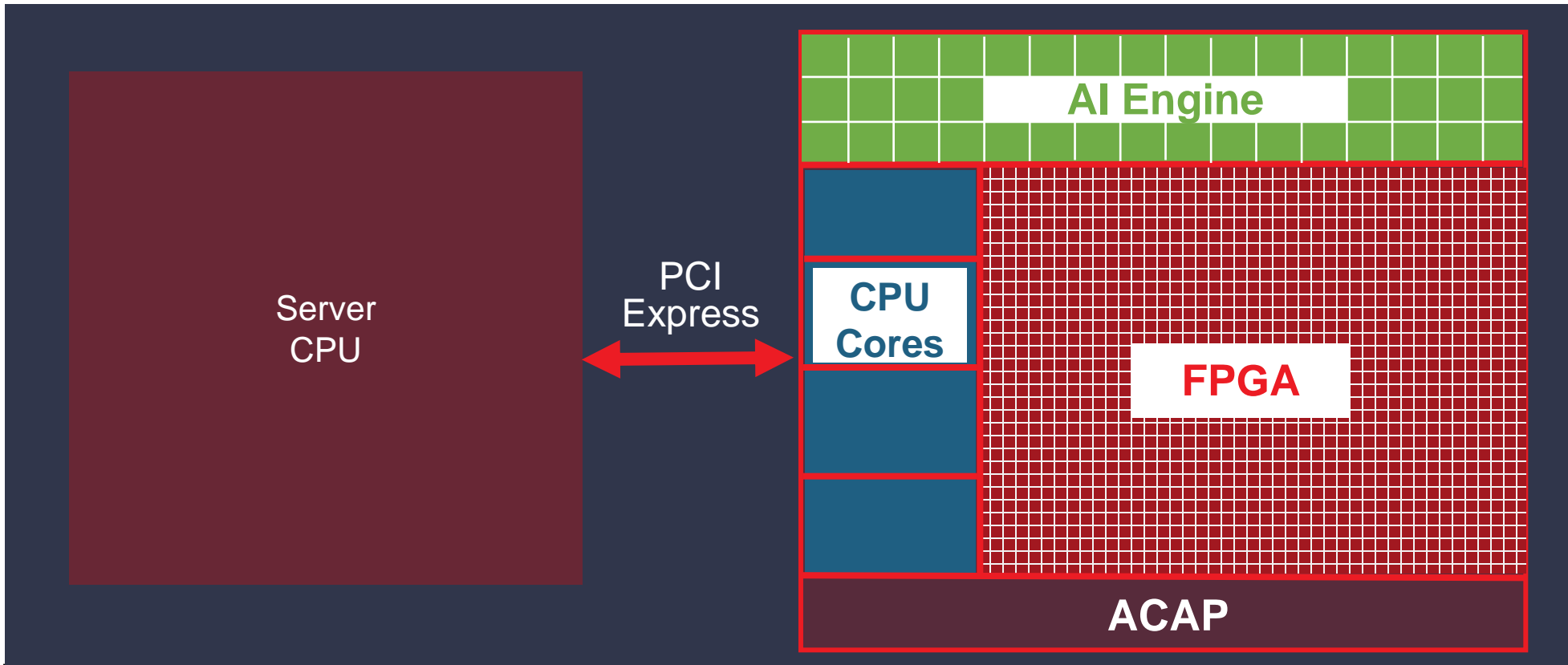
MLP DPU

Tensor based ISA for true software programmability

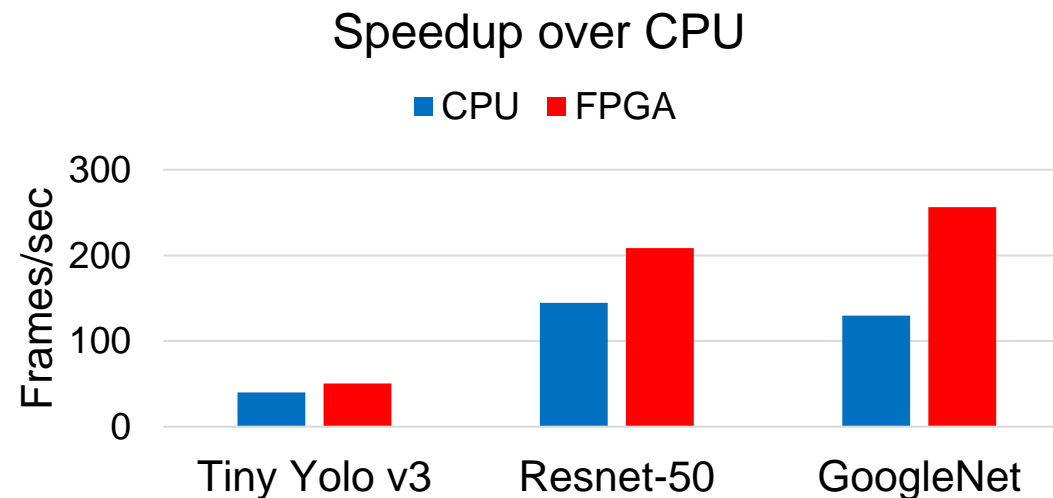
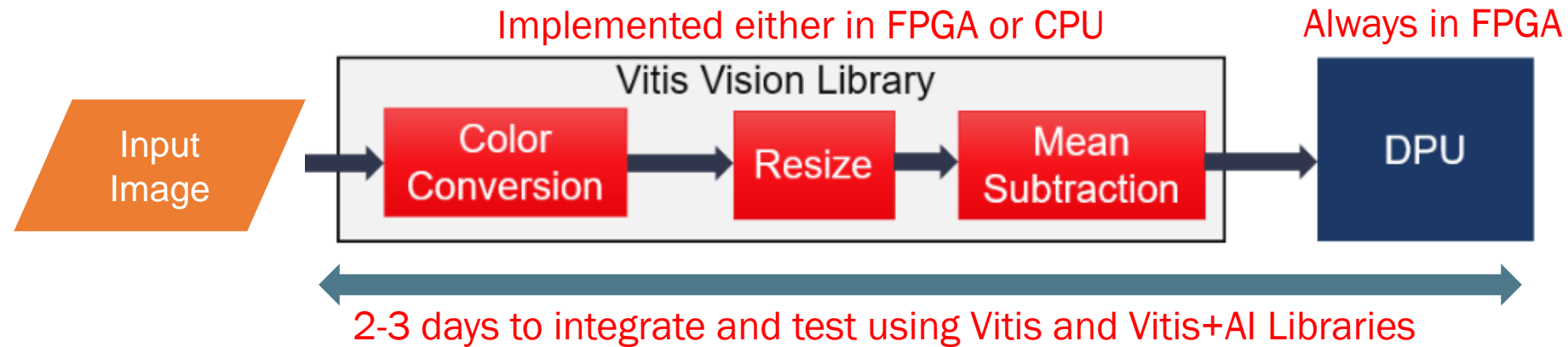
DSA – Domain Specific Architecture

DPU – DNN Processing Unit

AI Embedded in Apps, Rarely the Whole App

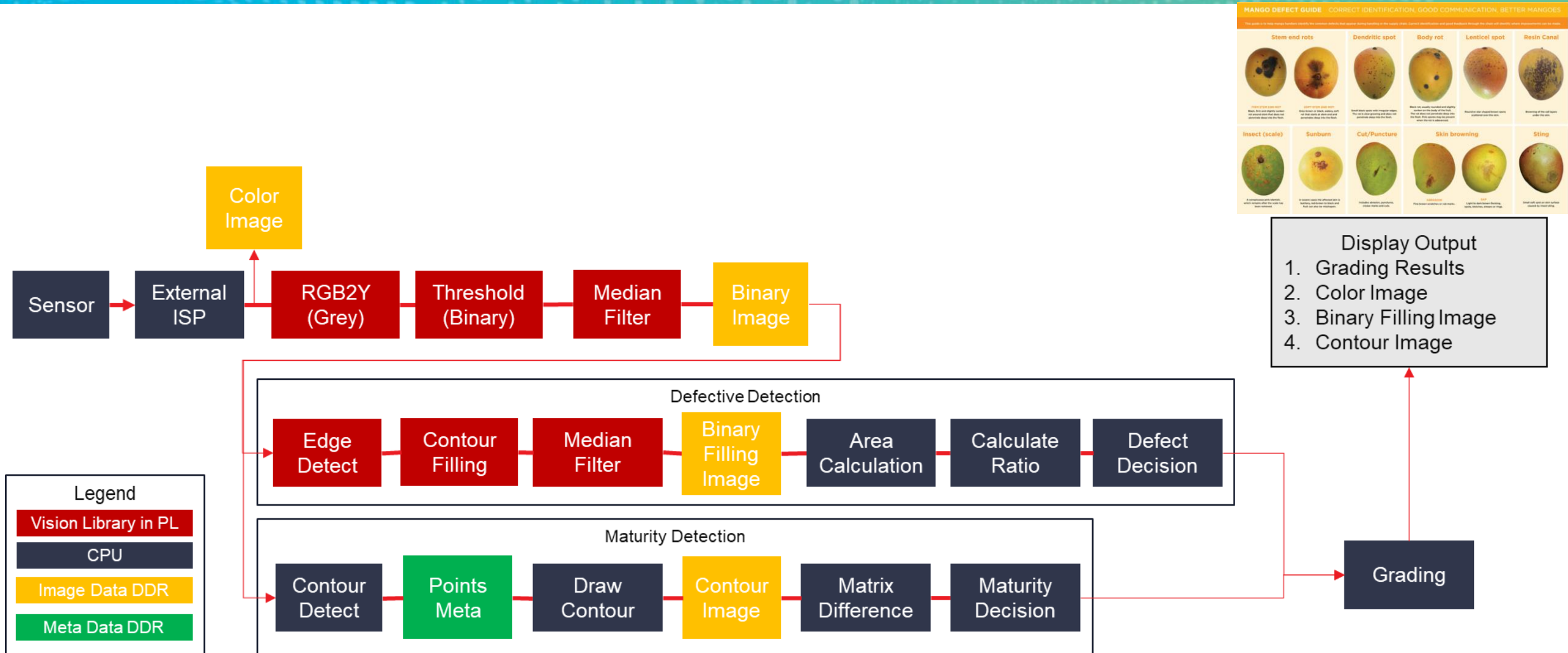


Example: Whole Application Acceleration



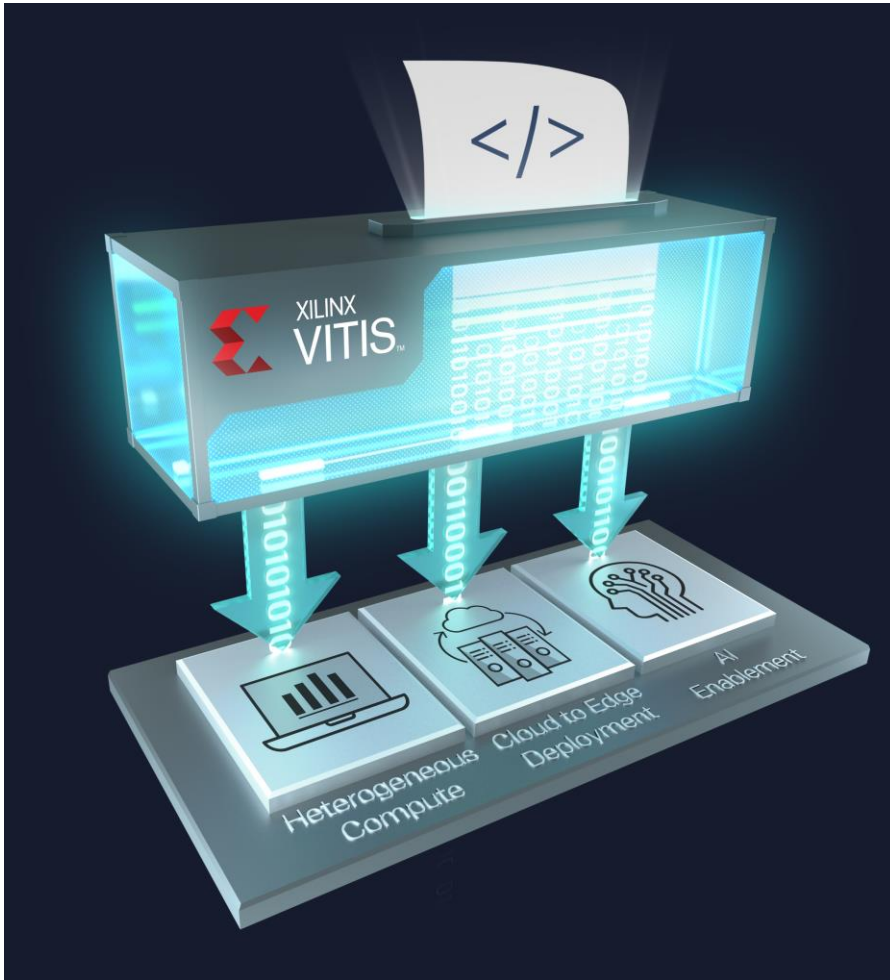
Example: Defect Detection

Low Latency: End-to-end < 250ms



Putting it All Together





▶ Unified Software Platform

- ▶ Cloud to edge, software and AI
- ▶ Comprehensive tools, runtime, libraries and models

▶ Standards, Open Source

- ▶ Participating in open source
- ▶ Use of standard environments & APIs

Additional Resources

Please visit the following sites for more information

Vitis Unified SW Platform

- <https://www.xilinx.com/products/design-tools/vitis.html>

Vitis Libraries

- <https://www.xilinx.com/products/design-tools/vitis/vitis-libraries.html>
- https://github.com/Xilinx/Vitis_Libraries/

Vitis AI

- <https://www.xilinx.com/products/design-tools/vitis/vitis-ai.html>

Visit the Avnet-Xilinx booth to see the following demonstrations in action:

- Face Detection, Pedestrian Detection, Pose Estimation, Machine Learning and more
- Hardware families include the Zynq Ultrascale+ and Versal AI Core
- Demonstration platforms include our SmartCamera+, Ultra96, and UltraZed
- Xilinx and Avnet staff will be available to answer any questions

2020 Embedded Vision Summit

- Vitis and Vitis AI: Application Acceleration from Cloud to Edge
- September 17, 2020, 11:00-11:30AM PDT