OPEN SOURCE IP IN THE DESIGN OF SYSTEMS
Industries are driving data analytics use cases

**Computing paradigm shifts**

**Legacy computing**
- Large algorithmic code
- Small data sets

**Today**
- Very large data sets
- Small program code replicated
- Statistical methods
  - Analytics
  - Inference
  - Deviation
  - Predictive analysis

**Big Data**
- Compounding
- Competitive Advantage
- Artificial Intelligence

- More Data
- Insights

Finances, Banking, Healthcare, Fraud detection, Science, Manufacturing, Retail, Advertising, E-commerce, Education, Automotive

- Image & video processing
- Natural language
- Fraud detection
- Patient diagnosis
- Anomaly detection
- Inventory optimization
- Demand forecasting
- Recommendation system
- Intrusion detection


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Scalable System Design integrating various processors – targeting specific use cases

Around Smart Interconnect, SoC architecture integrates:

- CPU
- Graphics
- Graphics engines for ML
- Neural Network for AI
- Network Processing Unit
- DSP
- Memory

The CPU will always play a critical role in the system architecture

Flexibility, transparency in the CPU ISA are fundamental requirements
- Flexible and Open architecture (custom instructions, data paths, accelerators)
- Custom extensions
- Transparent security model
Automotive is a very good example of this new trend

Additional functions drive greater workloads and unique requirements on the architecture of the system

Scaling Performance and Redundancy to meet Use-cases and Required Failure Rates

<table>
<thead>
<tr>
<th></th>
<th>Single Core</th>
<th>Multi-Core</th>
<th>Cluster of Multi-Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>&gt;1 TOPS</td>
<td>&gt;10 TOPS</td>
<td>100 TOPS</td>
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</tbody>
</table>

Source: National Highway Traffic Safety
MOVING FROM PROPRIETARY TO OPEN ISA ARCHITECTURES

Proprietary

1990s

CPU Hardware Architectures

RISC-V Open Architecture

Arm IP Architecture adopted widely

Multiple companies adopting one architecture (i.e. PowerPC, X86)

Wide range of proprietary CPU Hardware architectures

Open Source - Linux

Multiple Open Source OS options – Linux, Zephyr, FreeRTOS...

Proprietary OS’s – Windows, MacOS

Software Operating Systems

Open source

Today

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• RISC-V foundation based in Switzerland – non-profit - neutral vs geopolitical challenges
• Driven by contributions of members – no control by one entity – enables independence
• Growing ecosystem
• Open ISA
• Scalable architecture
• Custom extensions for unique use cases and operations
• Transparent security model
• Traction with academic world
• Traction across markets
• Emerging traction in high end market, including Automotive
• Technology of choice for secure enclaves
• Linux software ecosystem
• Tools chain (GCC, LLVM)

Opportunity to create unique products
Embedded Intelligence with Open-Source ISA

**Consumer/Media/AR/VR**
- Image enhancement
- Viewer analytics
- Environment awareness
- Gesture Control
- Voice UI
- User interaction

**Automotive**
- Emergency braking
- Lane departure warning
- Collision warning
- Driver monitoring
- Navigation & safety
- Traffic sign recognition

**IoT**
- Security
- Smart Buildings
- Footfall analytics

**Mobile**
- Facial identification
- Application monitoring
- Speech recognition
- Picture annotations
- Advanced camera filters
- Smart Assistance

**Industrial**
- Defect detection
- Object detection
- Context awareness

**Smart Surveillance**
- People tracking
- Abnormal behaviour alerts
- Queue Monitoring
- Event detection
- Engagement recognition
- Vehicle detection

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Why an open-source ISA for Imagination?

- An open standard that reduces reliance on one supplier
  - Driven by a wide range of contributors from many different disciplines
  - Already widely adopted, and gathering pace

- Range of performance points from one architecture, from sensors to high end servers
  - Modular and extendable to match end use case requirements

- Open International Board
  - Leadership roles in Technical and Marketing aspects to drive forward the community

- Enabling ecosystems across a wide range of segments
  - Working together brings innovation to market quicker
  - Android support for RISC-V committed by Google

RISC-V ISA | Flexible | Leadership | Ecosystem
Flexibility for the customers of Imagination

Mid tier to high end solutions

Markets = Modems, Automotive, Heterogeneous computing

5G Modem Controller
Real time
Deterministic
MPU
32-bit

Safety Island
ASIL-D
High End Real time
MPU
Deterministic
32-bit

Automotive Gateway
ASIL-B
High end 64 bits
Multi core
MMU + 64b
Integration with EPP

Software ecosystem: Toolchain (GCC, LLVM, Debug), FreeRTOS, full Linux with bootloader + kernel + file system

Automotive certification ISO 26262

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What does an open-source ISA deliver to developers and their customers?

- Customization for the use cases of our customers
- Optimization for specific performances
- Flexibility of the architecture
- Ability to certify products all the way to the IP
- Breadth of possible solutions
- Multiple performance points
- Optimized for use cases
- Clear and open governance
- Neutrality

Build uniquely differentiated solutions with an open-source ISA.
THANK YOU