arm

Acceleration and Differentiation

for a World of a Trillion Devices

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3rd December 2019

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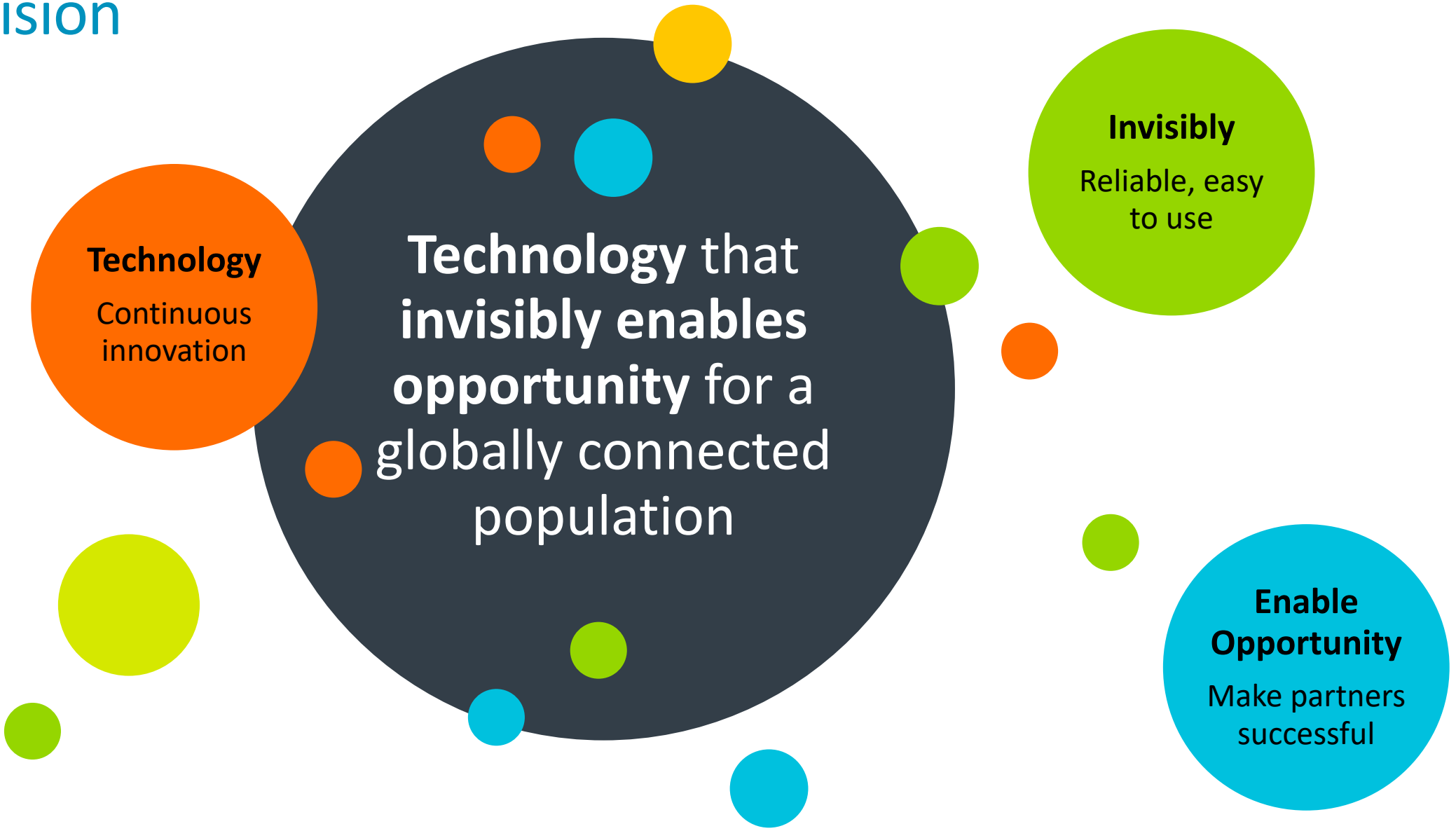
Arm's Vision



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Digital Transformation Drives Volume

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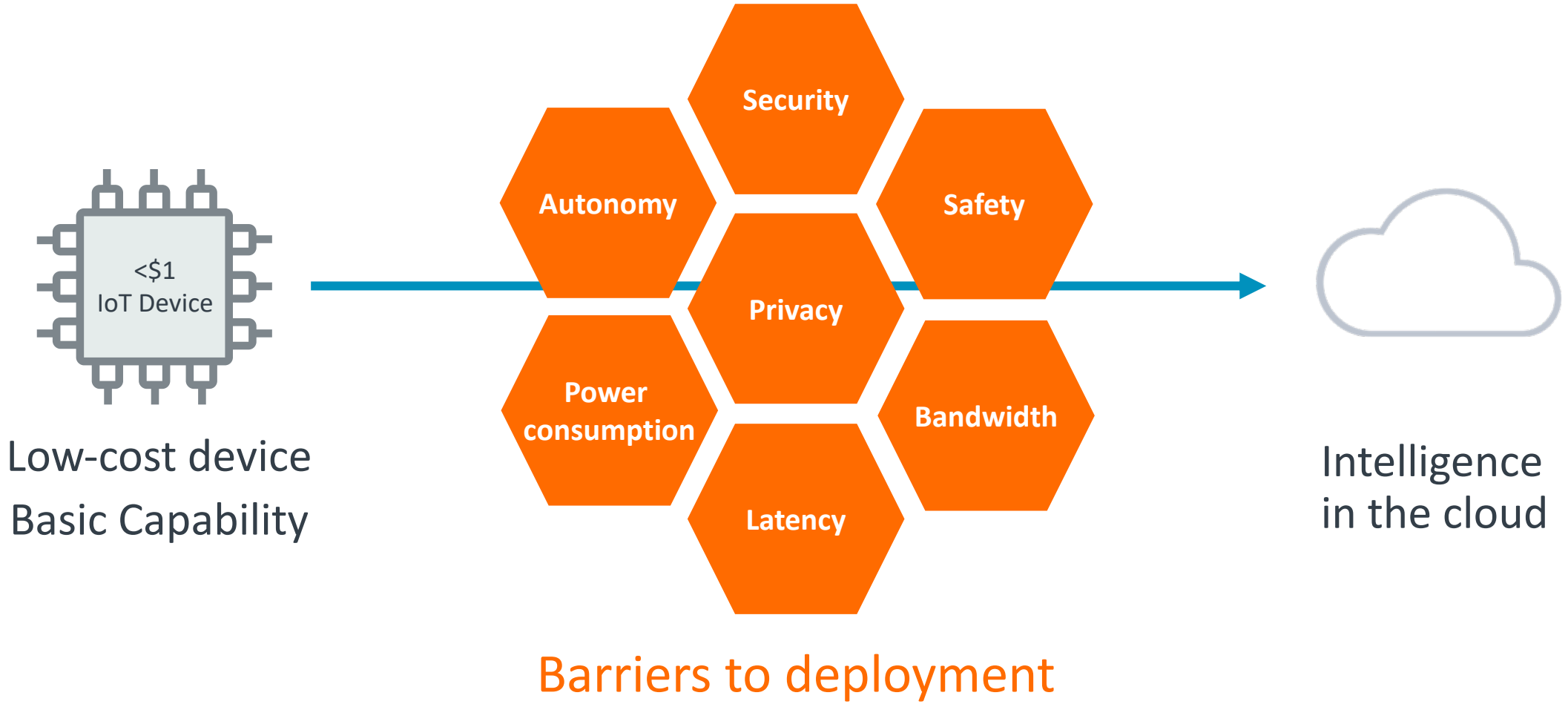
Barriers to IoT Mass Deployment

"All intelligence in the cloud" will struggle to scale



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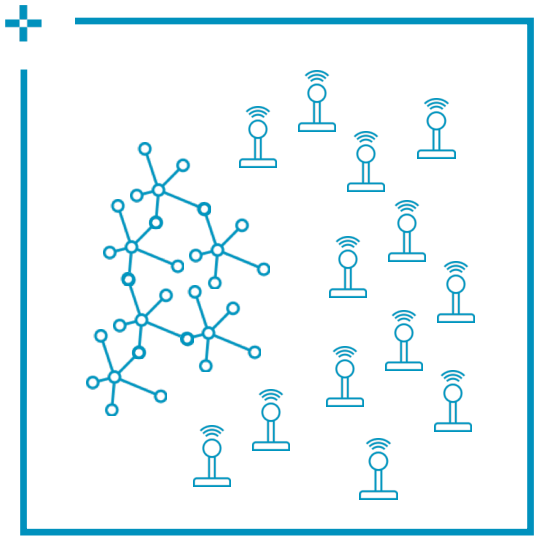
Compute Requirements in a Trillion-device World



Trillions

of Devices

Millions

of Workloads

Optimal use cases for workload-specific acceleration

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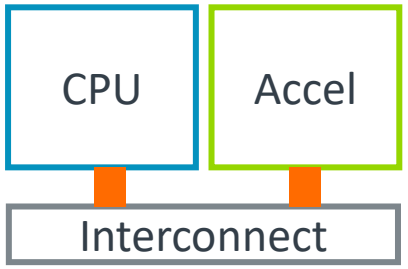
Different Types of Acceleration

Memory Mapped



- Decoupled
- Parallel

Co-processor

Custom Instructions

New for Arm

- Integrated
- Interleaved

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Acceleration Through Custom Instructions

```
mov.w    r1, #0x55555555
and.w    r1, r1, r0, lsr #1
subs     r0, r0, r1
mov.w    r1, #0x33333333
and.w    r1, r1, r0, lsr #2
bic      r0, r0, #0xCCCCCCCC
add      r0, r1
mov.w    r1, #0x01010101
add.w    r0, r0, r0, lsr #4
bic      r0, r0, #0xF0F0F0F0
muls     r0, r1, r0
lsrs     r0, r0, #24
```

Multiple general-purpose instructions

```
MyOp01   p0, R1, #0
         // pop count n R1, return r1
```

One instruction with custom logic

- Gain performance and efficiency
  - Fewer cycles, less power

- Cost of more design investment
  - Additional logic and integration

- Risk to hardware complexity and software ecosystem
  - Impact on existing design – re-verification
  - Compilers and downstream tools need to support

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The Benefits of Arm Custom Instructions

Lowest risk

Lowest cost path

to integrated custom workload acceleration

Maximizes efficiency of hardware design investment

No disruption to CPU features

Standard toolchains and SW ecosystem

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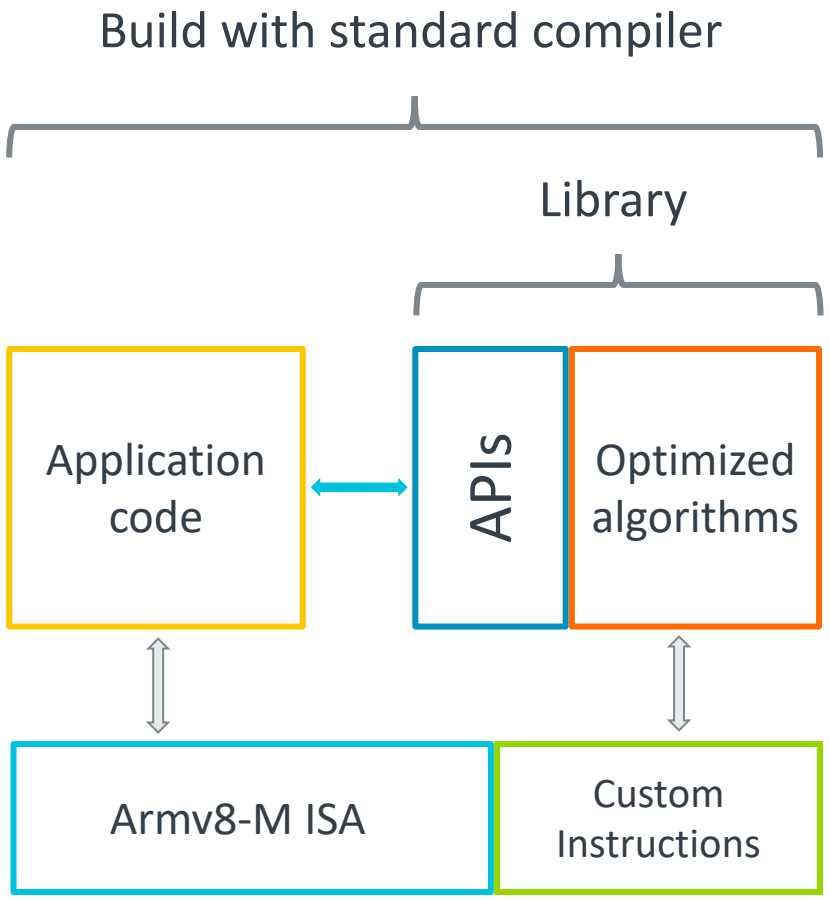
Customization without Software Fragmentation

- Custom instructions use a pre-defined instruction space in Armv8-M
- Out-of-the-box support of Arm and 3rd party compilers and debuggers
- Custom instructions enabled through libraries shipped with standard board support package



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Arm Custom Instructions

Workload-specific acceleration

- Available for Cortex-M33 CPU in 2020
  - No additional cost
- Standard for future Armv8-M processors
- Customization without software fragmentation

Supported by Arm partners

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Thank You
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Merci
谢谢
ありがとう
Gracias
Kiitos
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