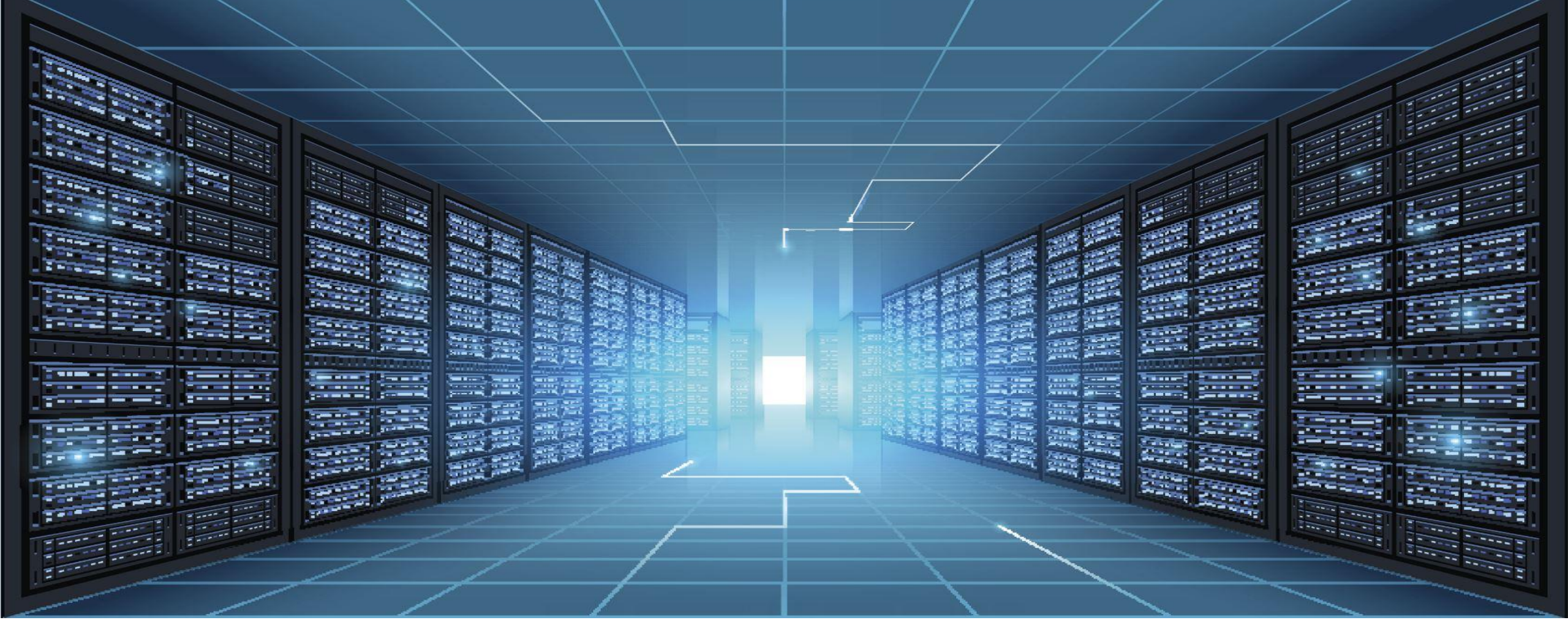


XILINX
ALL PROGRAMMABLE™

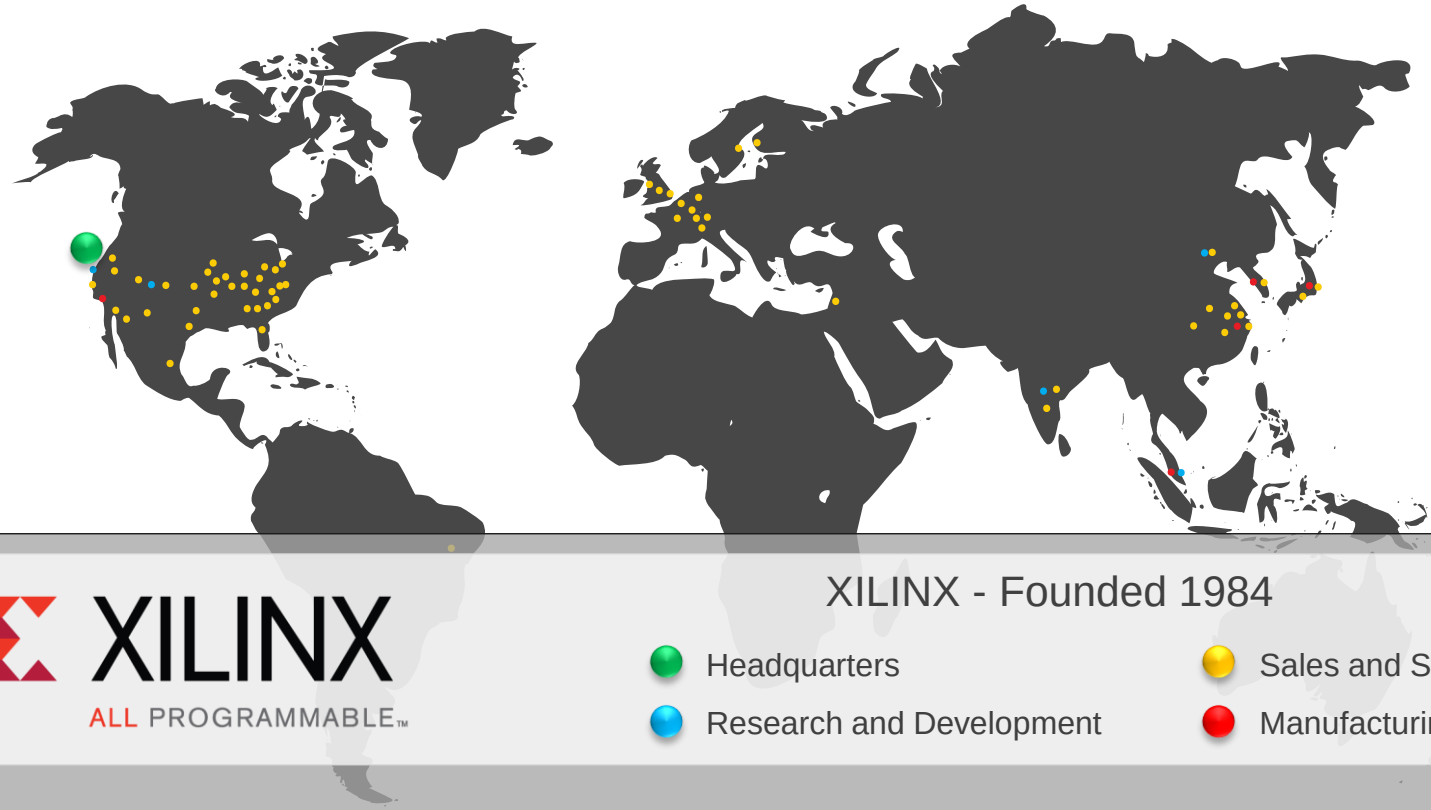
Data Center Market Overview

Napatech Capital Markets Day

April 2018

Oslo, Norway

The All Programmable Company



XILINX - Founded 1984

- Headquarters
- Research and Development
- Sales and Support
- Manufacturing

$2.35B FY17 revenue

>60% market segment share

3,500+ employees worldwide

20,000 customers worldwide

3,500+ patents

60 industry firsts

Xilinx Multi-Market Growth Drivers

Embedded Vision

Industrial IoT

5G Wireless

Cloud Computing

Edge ⟵ **Machine Learning** ⟶ *Cloud*

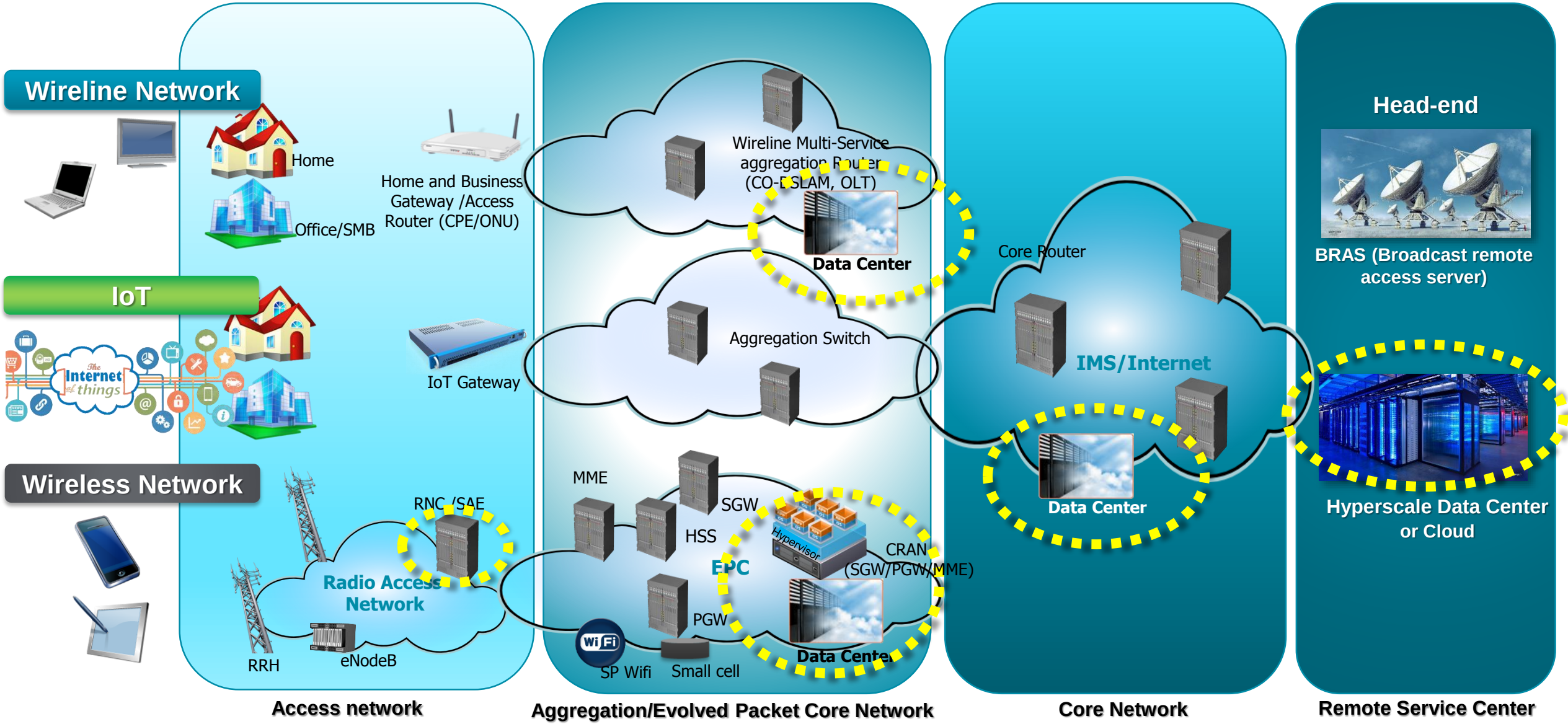
Enabling Cars and Machines to See it All

Enabling Safe and Secure Connected Machines

Connecting Any Band, Any Standard, Any Network

Accelerating Storage, Networking, and Compute

Data Centers Popping Up Everywhere



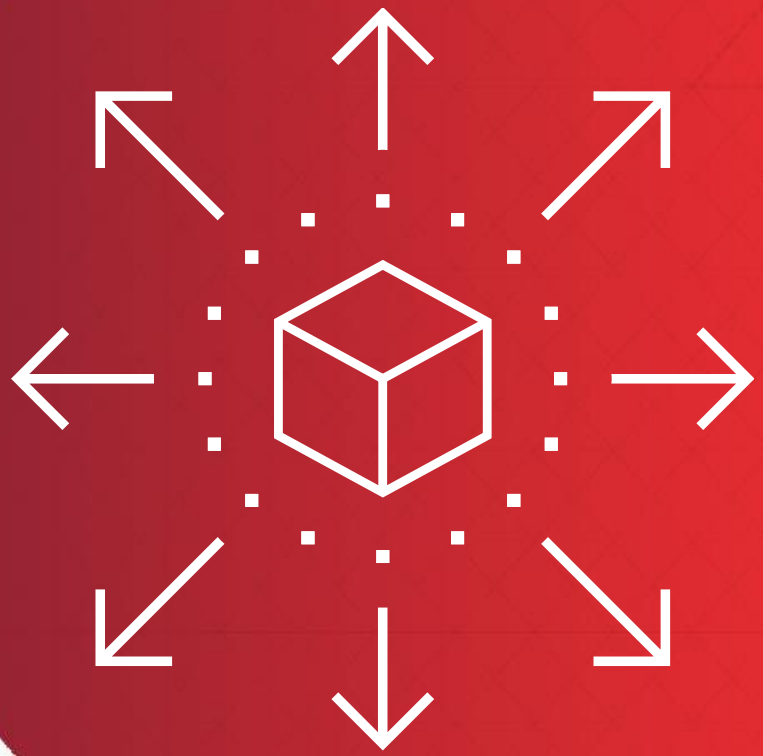
01

Explosion of Data

> 90% unstructured

> Video & image content

> Needs higher throughput & real-time computing



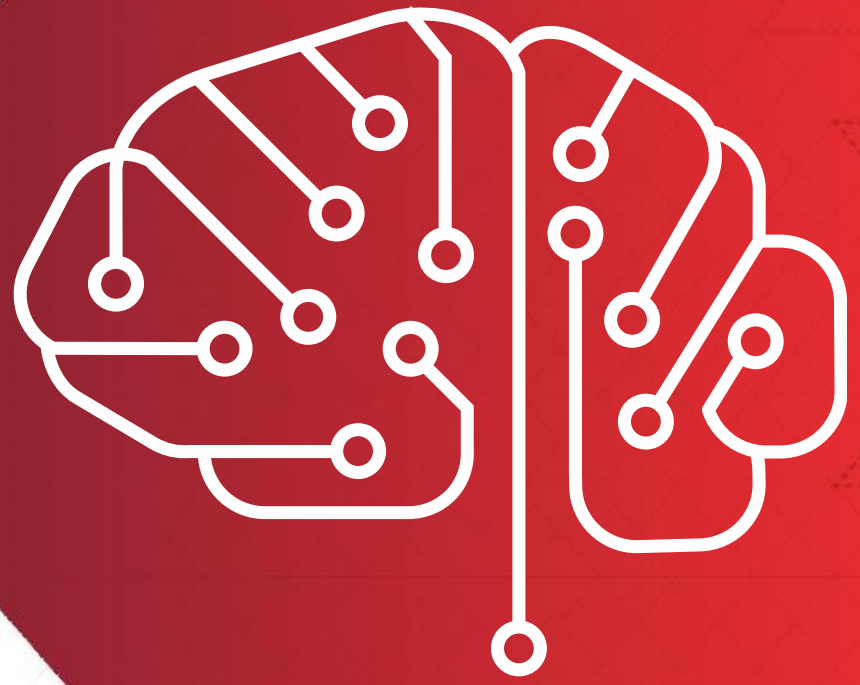
02

Dawn of AI

> Adoption across all industries

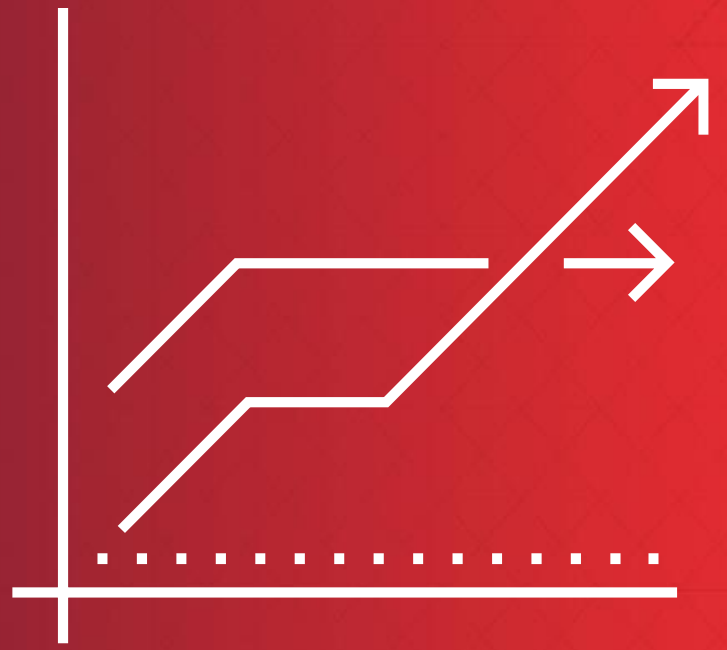
> Injecting new intelligence into apps

> From endpoints to edge to cloud



03

Computing After Moore's Law



> Heterogeneous computing with accelerators

> Breadth of apps require different architectures

> Speed of innovation outpacing silicon design cycles

Market Trend and Requirements

Varying Applications

Requirements

- Beyond Moore's Law
- Dynamic Workload Mix
- Intelligent Applications
- Power Efficiency
- Heterogeneous computing
- Computational Storage
- Storage Disaggregation
- Smart Networking
- Security

Base Components

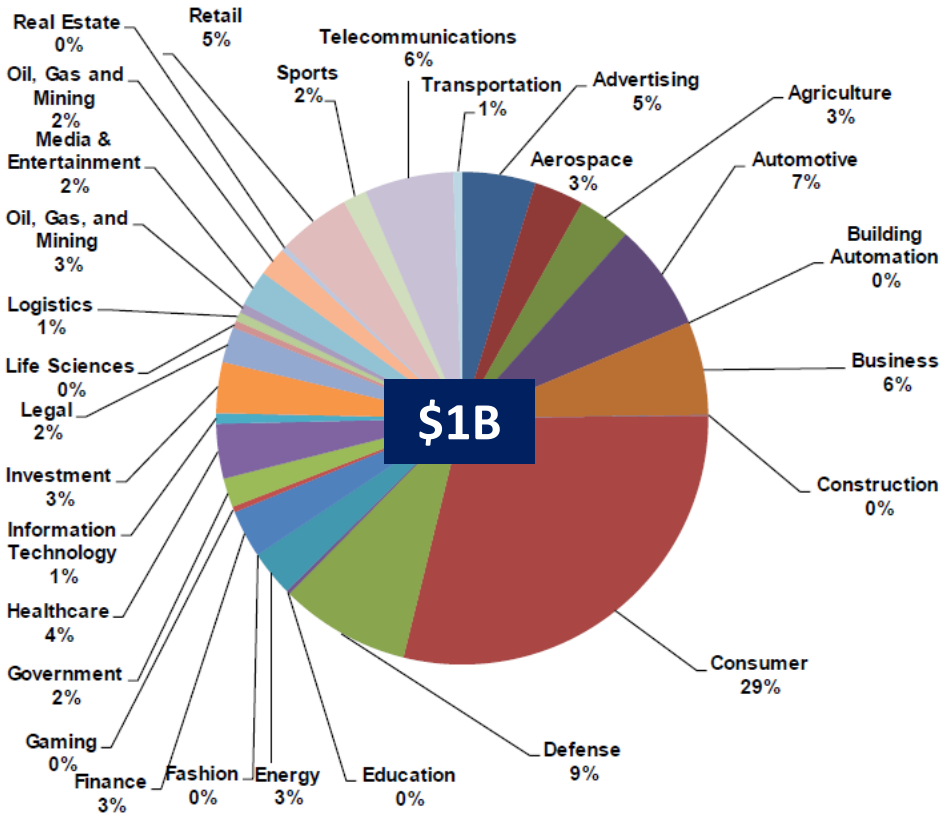
Compute

Network

Storage

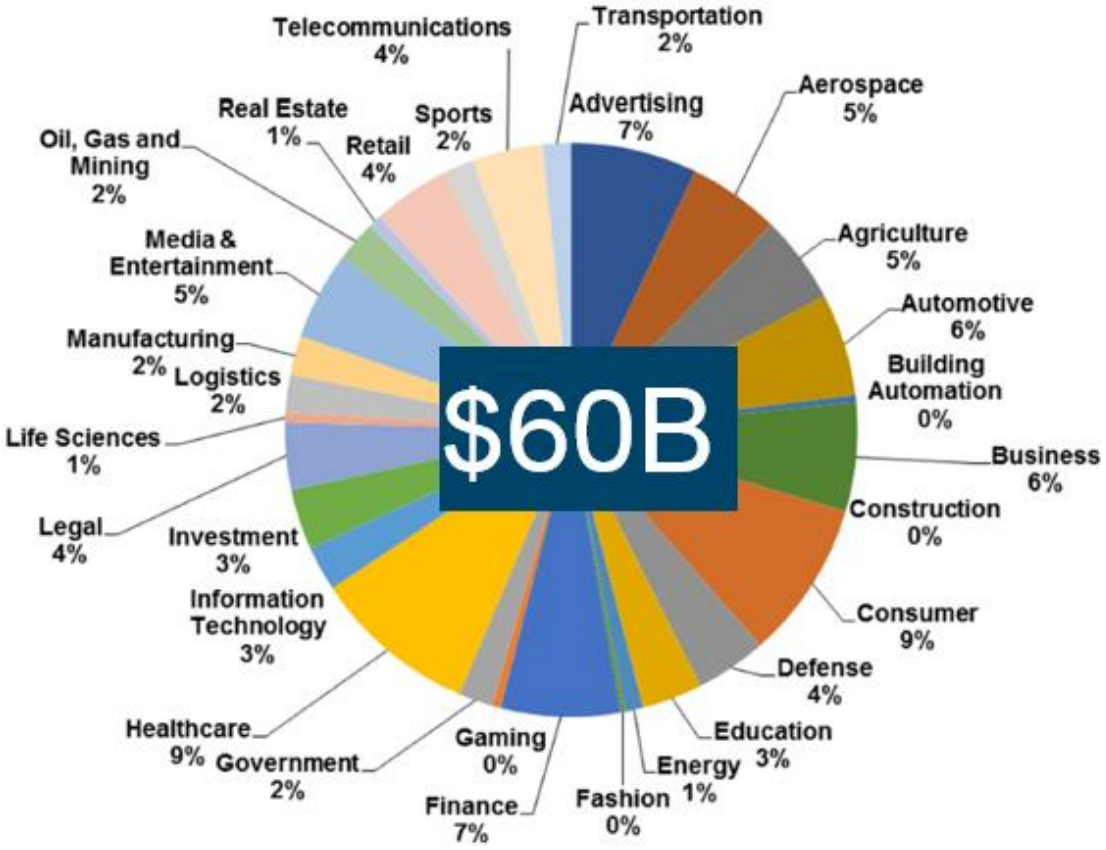
Mega Trend: AI is the new Electricity

AI Market in 2016



(Source: Tractica)

AI Market in 2025



AI projected to get embedded within traditional workloads across most industries

Multi-B$ Acceleration TAM across FPGAs / GPUs / ASICs

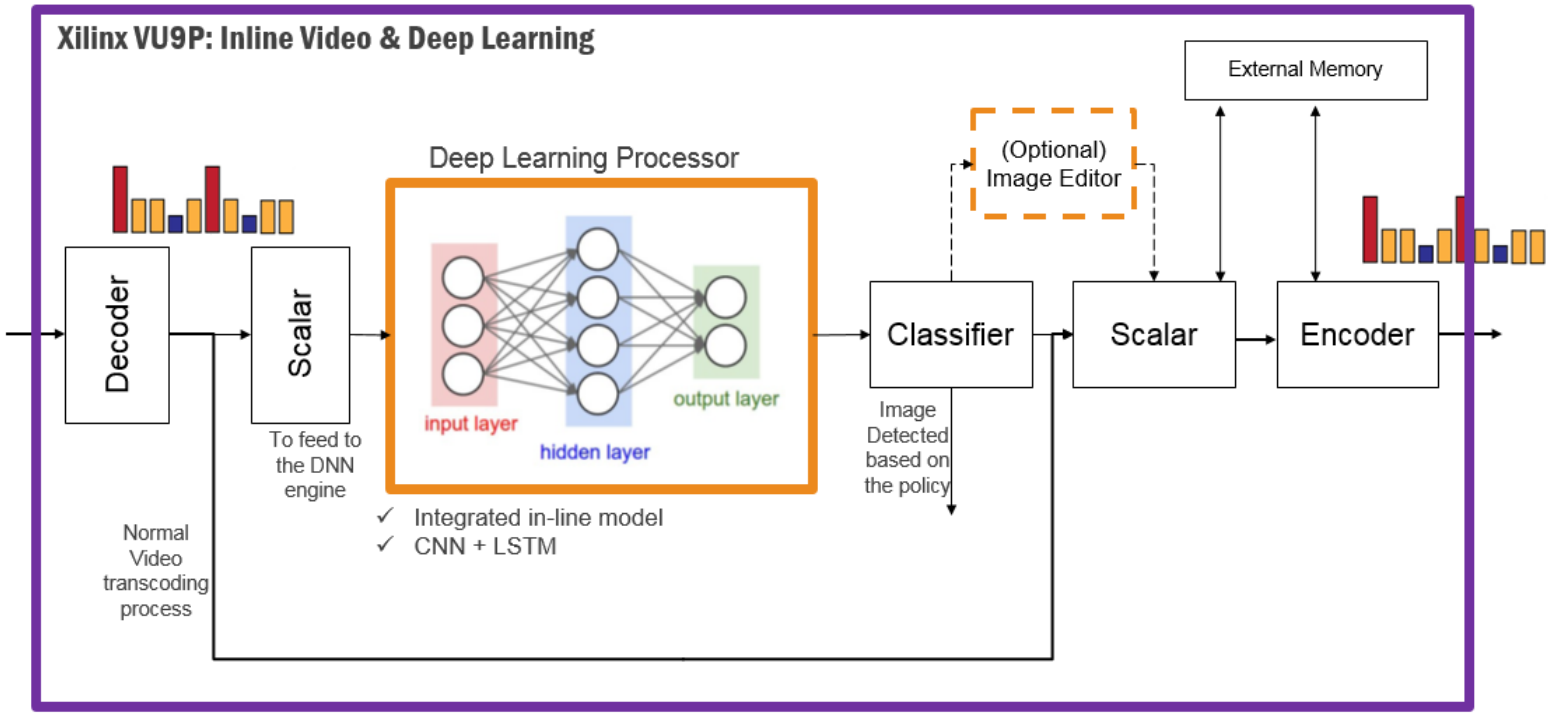
Machine Learning Use Case: Video Captioning

Input Video:

Video Tagging:
baby, boy, chair

Image (Frame) Captioning:
Two baby boys are in the chair

Video Captioning:
A baby boy is biting finger of another baby boy



Mega Trend: Reconfigurable Acceleration in Hyperscale Data Center

- **Reconfigurable acceleration is the key to scaling performance in Hyperscale Data Centers**

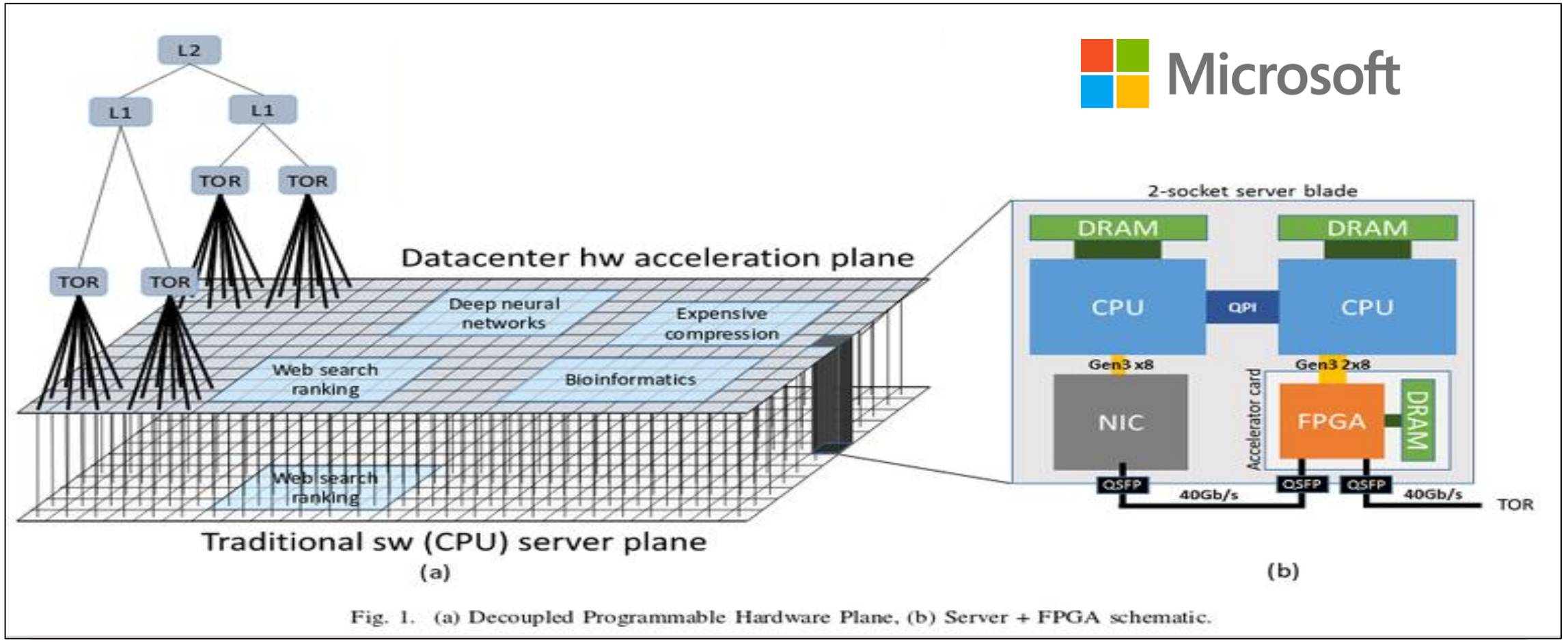
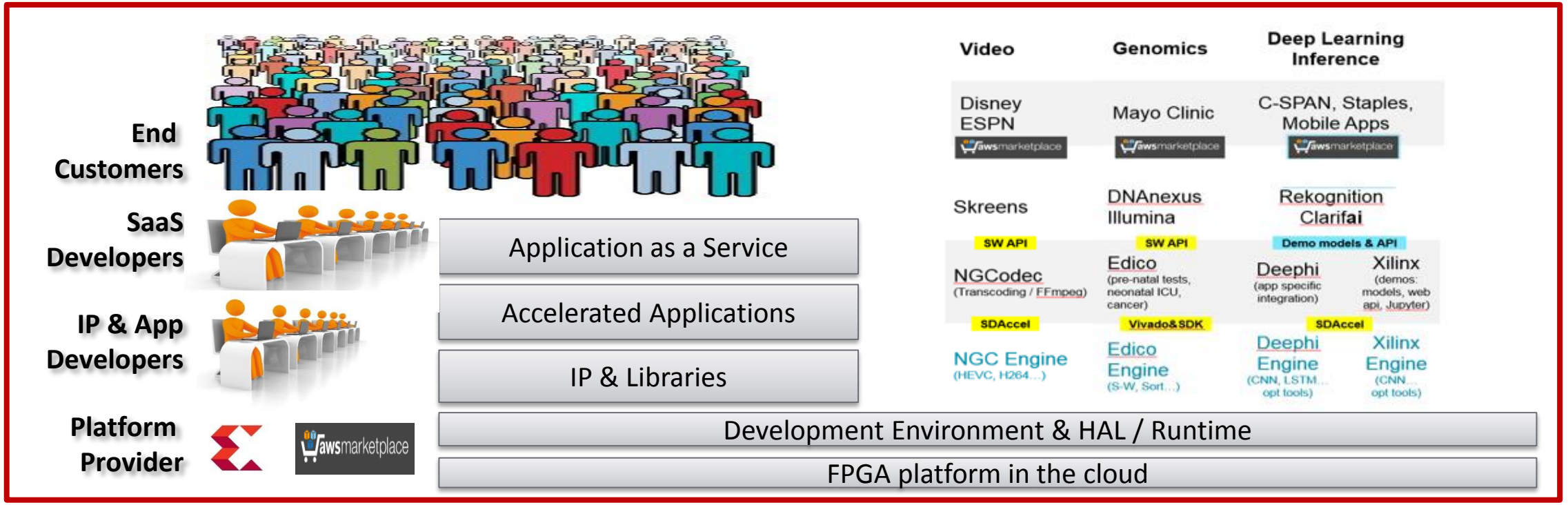


Fig. 1. (a) Decoupled Programmable Hardware Plane, (b) Server + FPGA schematic.

Tier1 HS adopting FPGA for general purpose acceleration across multiple in-house and external workloads

Mega Trend: **FPGA-as-a-Service**

- FaaS is a new business model
- Scaling from 1000s of RTL customers → Millions of software developers → 10,000s of end-customers
- Two key success drivers:
  - **Ease of Use:** Development environment / libraries / frameworks / APIs to enable software developers & data scientists
  - **Ecosystem:** Availability of compelling applications from a multi-layered developer ecosystem



FPGA-as-a-Service Expanding Worldwide

Machine Learning Development Stack from Xilinx, Preview Edition
(0) | Version 17.11.13 | Sold by Xilinx
In this Machine Learning Development Stack, Preview Edition AMI,users easily integrate machine learning into their current applications and deploy them quickly. Users can...
Linux/Unix, CentOS 7.3 - 64-bit Amazon Machine Image (AMI)

MLE

FPGA-Accelerated Deep-Learning Inference with Binarized Neural Networks
(0) | Version 1.2 | Sold by Missing Link Electronics, Inc.
Starting from **$5.00** to **$5.00/hr** for software + AWS usage fees
Image classification of the Cifar10 dataset using the CNV neural network. Based on Xilinx public proof-of-concept implementation of a reduced-precision, Binarized Neural Network...
Linux/Unix, Ubuntu 16.04 - 64-bit Amazon Machine Image (AMI)

FPGA Developer AMI
(0) | Version 1.3.0_a | Sold by Amazon Web Services
The FPGA (field programmable gate array) AMI is a supported and maintained CentOS Linux image provided by Amazon Web Services. The AMI is pre-built with FPGA development...
Linux/Unix, CentOS 7.3 - 64-bit Amazon Machine Image (AMI)

ZEBRA on 1 FPGA (image classification)
(0) | Version 2017.04.1 | Sold by Mipsology
Zebra offers users FPGA-based class-leading acceleration for neural network inference. The user-defined neural network works on Zebra just as it would on GPU or CPU. Zebra...
Linux/Unix, CentOS 7.3 - 64-bit Amazon Machine Image (AMI)

Free Trial

Zebra Deep-Learning engine for Caffe (1 FPGA)
(0) | Version V2017.08.1 | Sold by Mipsology SAS
Starting from **$0.10** to **$0.10/hr** for software + AWS usage fees
Zebra accelerates neural network inference using FPGA. User-defined neural networks are computed by Zebra just as they would be by a GPU or a CPU. Zebra is fully integrated...
Linux/Unix, Ubuntu 14.04 - 64-bit Amazon Machine Image (AMI)

Visual System Integrator for FPGA and Embedded Development
(0) | Version 2017.1_1.0 | Sold by System View
Starting from **$0.50/hr** or from **$2,500.00/yr** (43% savings) for software + AWS usage fees
Visual System Integrator is the one-of-a-kind tool for embedded development which, for the first time, makes it possible to develop a full functioning system. Visual System...
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Merlin Compiler AMI
(0) | Version 1.0.1a | Sold by Falcon Computing Solutions, Inc.
14 Day Free Trial Available - The Merlin Compiler AMI is provided by Falcon Computing Solutions, Inc. The AMI is pre-built with Merlin Compiler that provides push-button C/C++...
Linux/Unix, CentOS CentOS 7.3 - 64-bit Amazon Machine Image (AMI)

NGCodec HEVC Encoder C02
(0) | Version 4.02 | Sold by NGCodec
Using an F1 instance, offload HEVC encoding to an FPGA. This version of the NGCodec Encoder features low latency, I&P frame encoding at up to 1080p60 resolution/frame rate.
Linux/Unix, Amazon Linux 3.1 - 64-bit Amazon Machine Image (AMI)

Hyperion F1 10G RegEx File Scan
(0) | Version 5.5.2 | Sold by TITAN IC SYSTEMS LTD
Starting from **$1.50** to **$1.50/hr** for software + AWS usage fees
The Hyperion F1 10G RegEx File Scan instance provides a preloaded IP image of th... eXpression Processor (RXP) on the FPGA and a pre-installed SDK allowing the...

Bitfusion Flex Manager
(0) | Version 2017.00 | Sold by BitFusion
Bitfusion Flex includes everything you need to manage your AI infrastructure as well as develop, train and deploy deep learning applications efficiently across CPUs, GPUs...

InTime
(0) | Version 2.3.0 | Sold by Plunify
InTime is an automated optimization software for FPGA design by Plunify. It optimizes timing and design performance using machine learning to find the best combination of...
Linux/Unix, CentOS 6.9 - 64-bit Amazon Machine Image (AMI)

Toolkit Powered by RYFT Heterogeneous Computing
(0) | Version v1.1.0 | Sold by Ryft
Starting from **$1.00** to **$1.00/hr** for software + AWS usage fees
Ryft's Toolkit is a pre-configured, ready to run image for instantly integrating smarter, more sophisticated FPGA-accelerated search & analysis capabilities into existing...
Linux/Unix, Ubuntu 16.05 - 64-bit Amazon Machine Image (AMI)

Elasticsearch Powered By RYFT Heterogeneous Computing
(0) | Version v1.1.0 | Sold by Ryft
Starting from **$2.00** to **$2.00/hr** for software + AWS usage fees
Ryft's ELK is a pre-configured, ready to run image for deploying the powerful open source, distributed real-time search and analytics engine, Elasticsearch, on Amazon's...
Linux/Unix, Ubuntu 16.04 - 64-bit Amazon Machine Image (AMI)

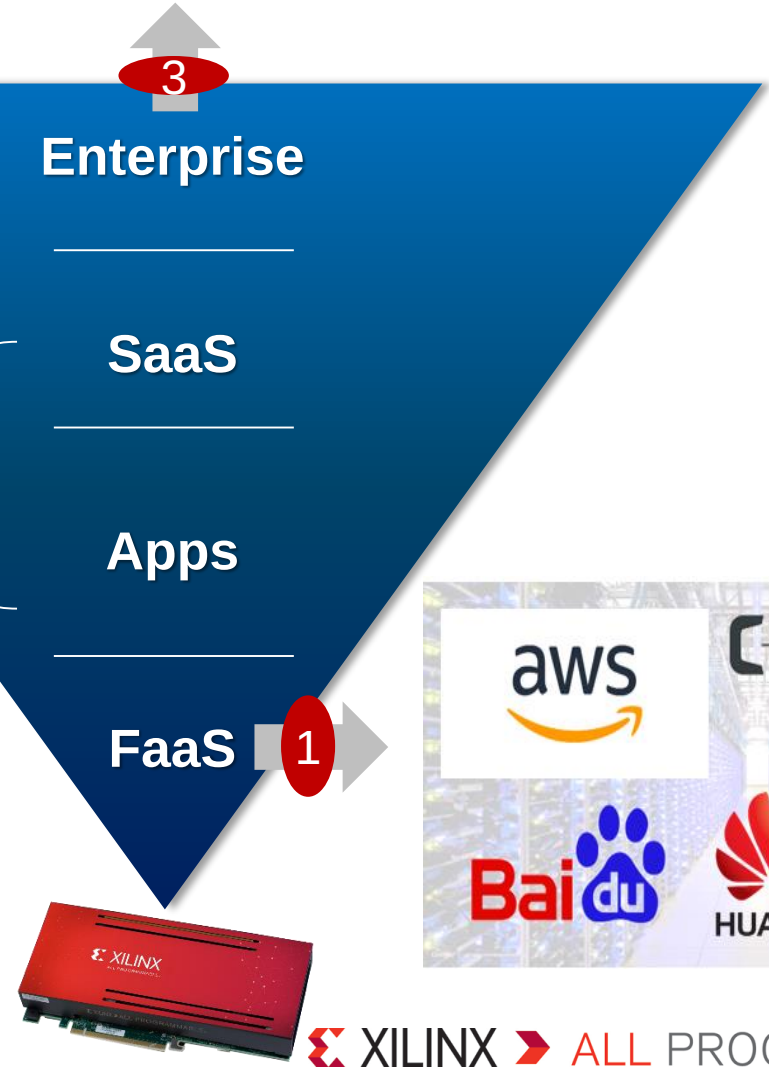
FireSim Demo v1.0
(0) | Version 1.0 | Sold by Berkeley Architecture Research
FireSim is an FPGA-accelerated hardware simulation tool that cycle-accurately simulates RISC-V RocketChip-based clusters, with peripherals like disks and network interface...
Linux/Unix, CentOS 7.3 - 64-bit Amazon Machine Image (AMI)

DRAGEN Genome Pipeline (Germline)
(0) | Version 2.4.3-36496 | Sold by Edico Genome
Starting from **$18.00** to **$48.00/hr** for software + AWS usage fees
The DRAGEN Genome Pipeline** enables ultra-rapid analysis of Next Generation Sequencing (NGS) data, reducing the time required for analyzing a whole genome at 30x coverage...
Linux/Unix, CentOS 7.2 - 64-bit Amazon Machine Image (AMI)

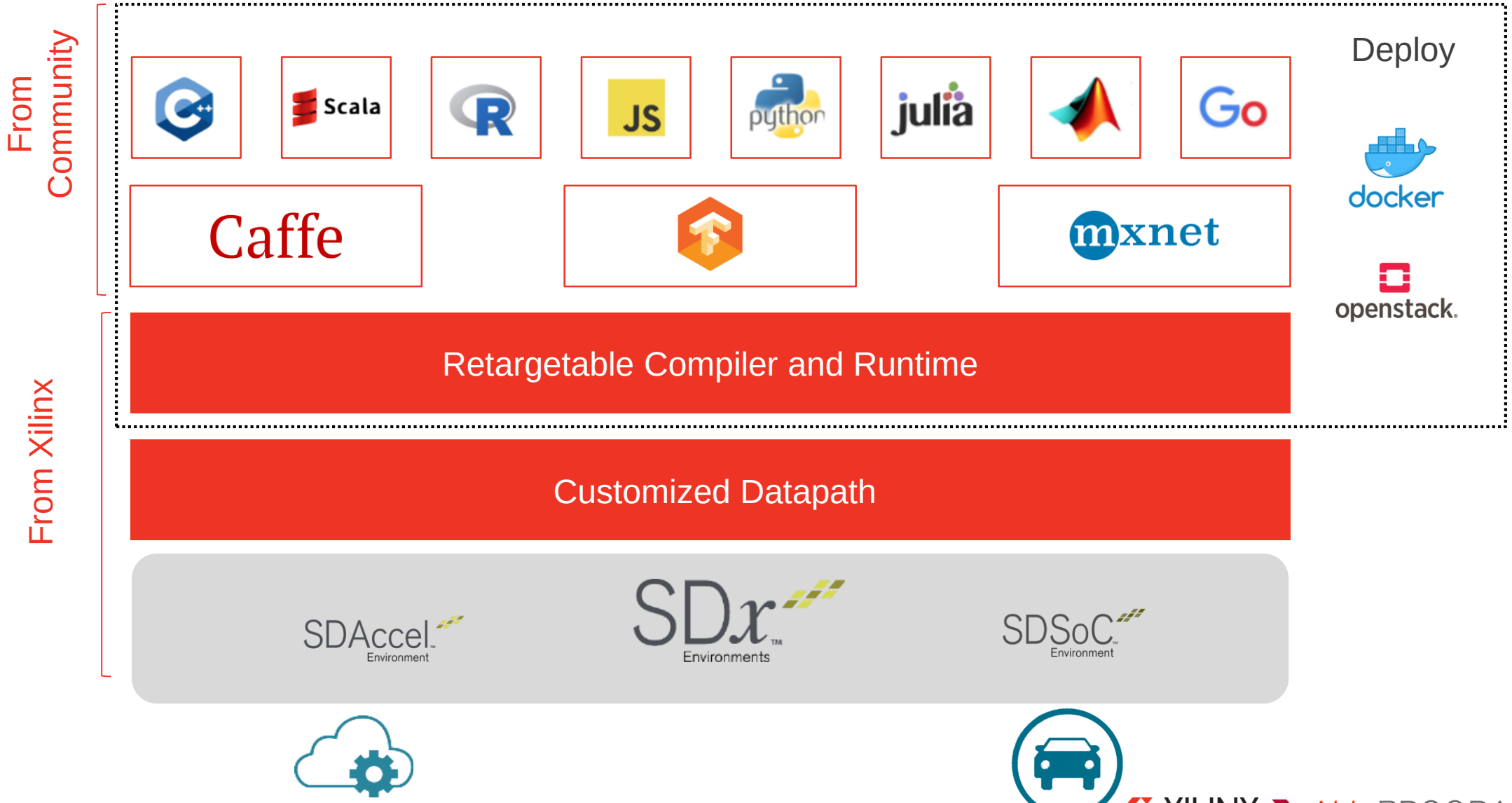
Free Trial

DRAGEN Exome Pipeline (Germline)
(0) | Version 2.4.3-36496 | Sold by Edico Genome
Starting from **$48.00** to **$48.00/hr** for software + AWS usage fees
The DRAGEN Exome Pipeline enables ultra-rapid analysis of Next Generation Sequencing (NGS) data, reducing the time required for analyzing a whole exome at 200x coverage from...
Linux/Unix, CentOS 7.2 - 64-bit Amazon Machine Image (AMI)

Free Trial



Seamless Deployment of Software Stack



Compute Acceleration

Machine Learning **40x***

Video & Image Processing **10x***

Data Analytics **90x***

Genomics **100x***

Compute Acceleration

XILINX

Genomics Use Case: Personalized Medicine

Whole genome diagnosis to treat critically ill newborns

Analysis reduced from 1 day to 20 minutes

Patient-specific genomics dynamically optimized

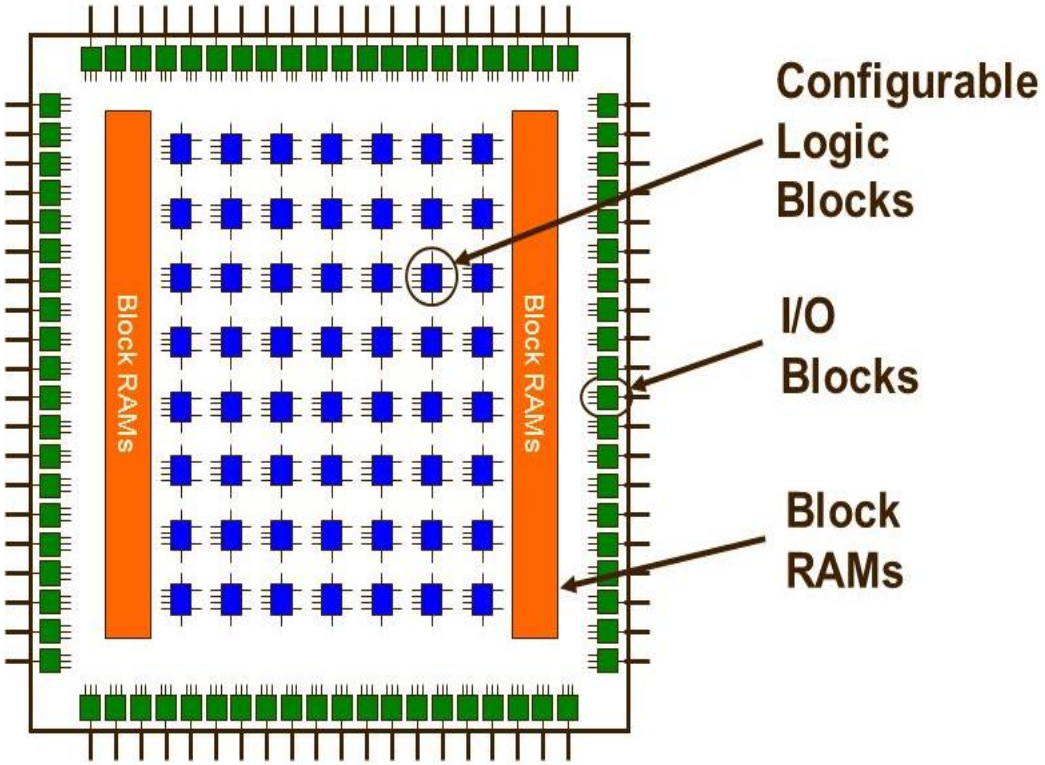
GUINNESS WORLD RECORDS™ RECORD HOLDER

Rady Children's Hospital San Diego

edico genome

XILINX®

What is an FPGA ?



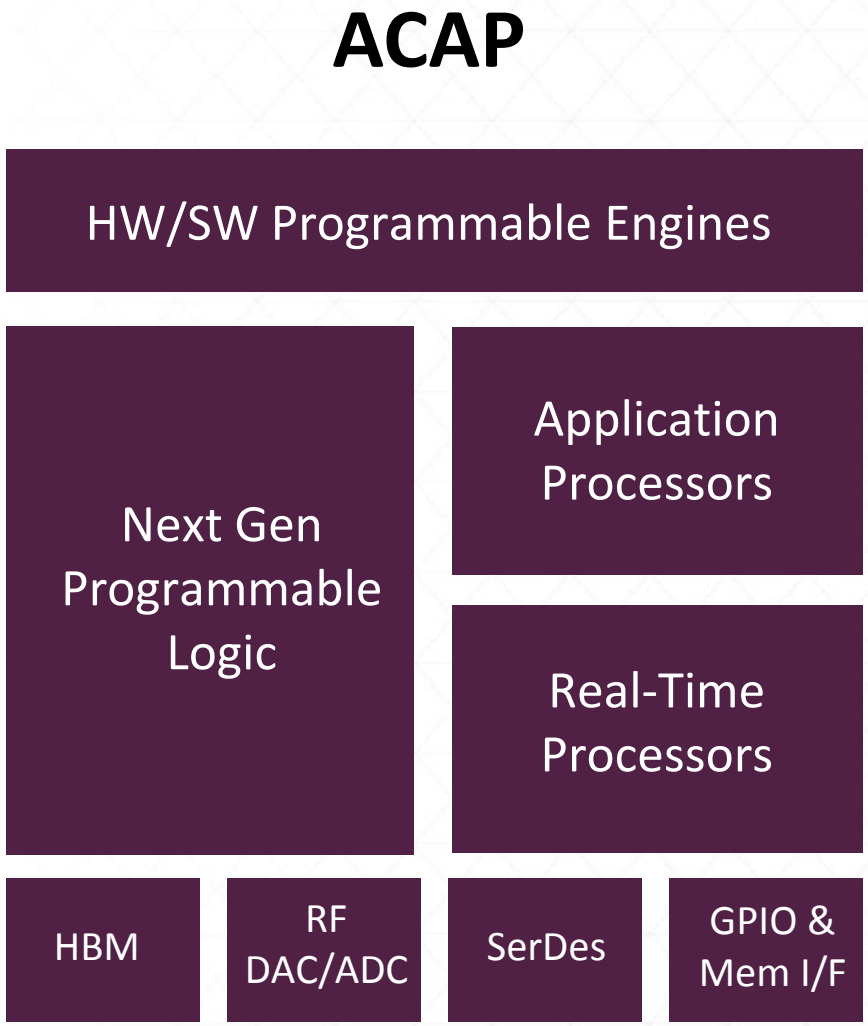
- Field Programmable Gate Arrays (FPGAs) are semiconductor devices that are based around a **matrix of configurable logic blocks** (CLBs) connected via **programmable interconnects**.
- FPGAs can be **reprogrammed to desired application** or functionality requirements **after manufacturing**.
- This feature distinguishes FPGAs from Application Specific Integrated Circuits (ASICs), which are custom manufactured **and fixed** for use cases.

New Device Category for Adaptive Workload-Specific Acceleration

> HW/SW programmable engines

> IP subsystems and a network-on-chip

> Highly integrated programmable I/O

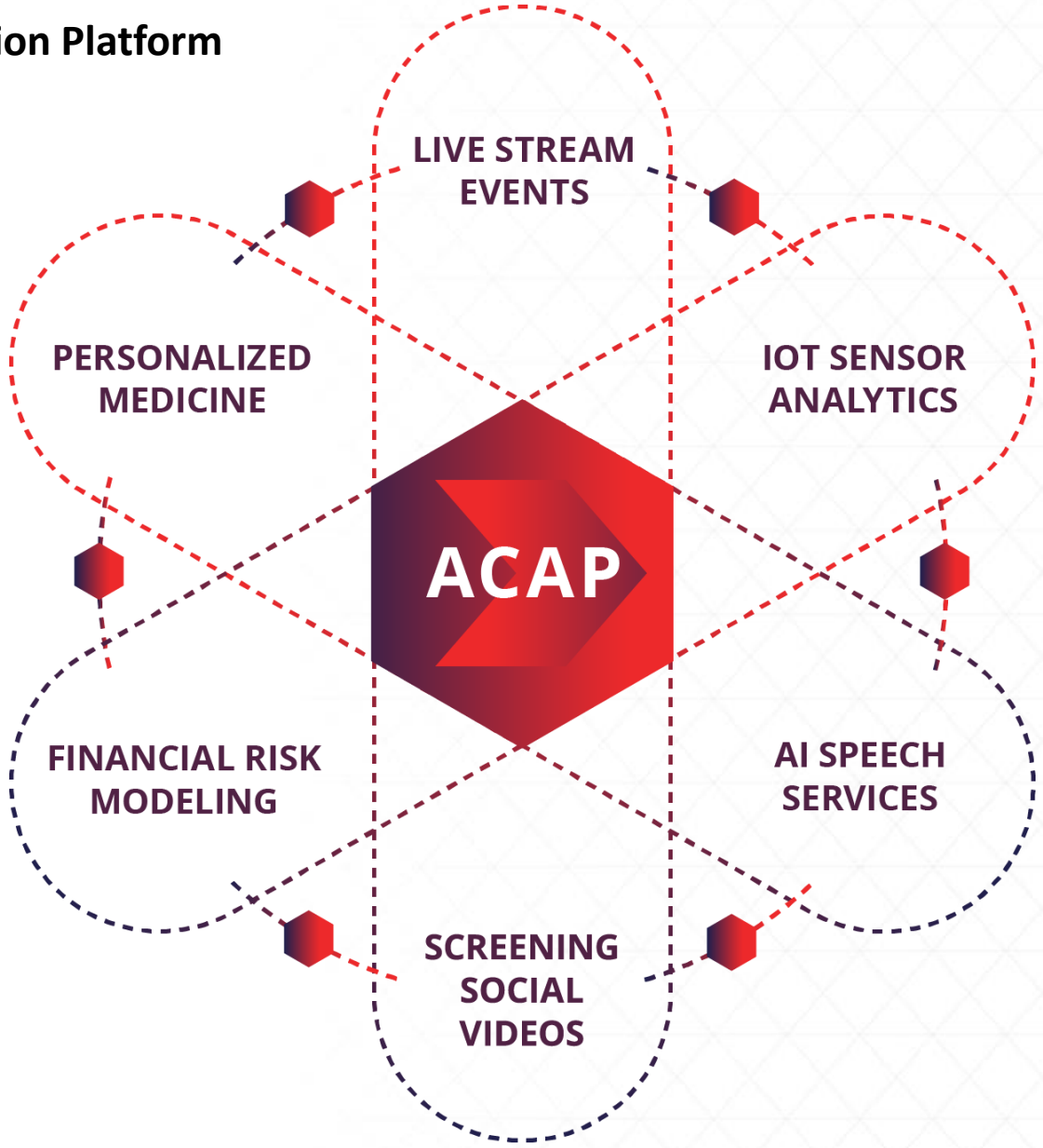


Benefits of an Adaptive Compute Acceleration Platform

Dynamically Adaptable to Workloads

Exponential Increase in Acceleration

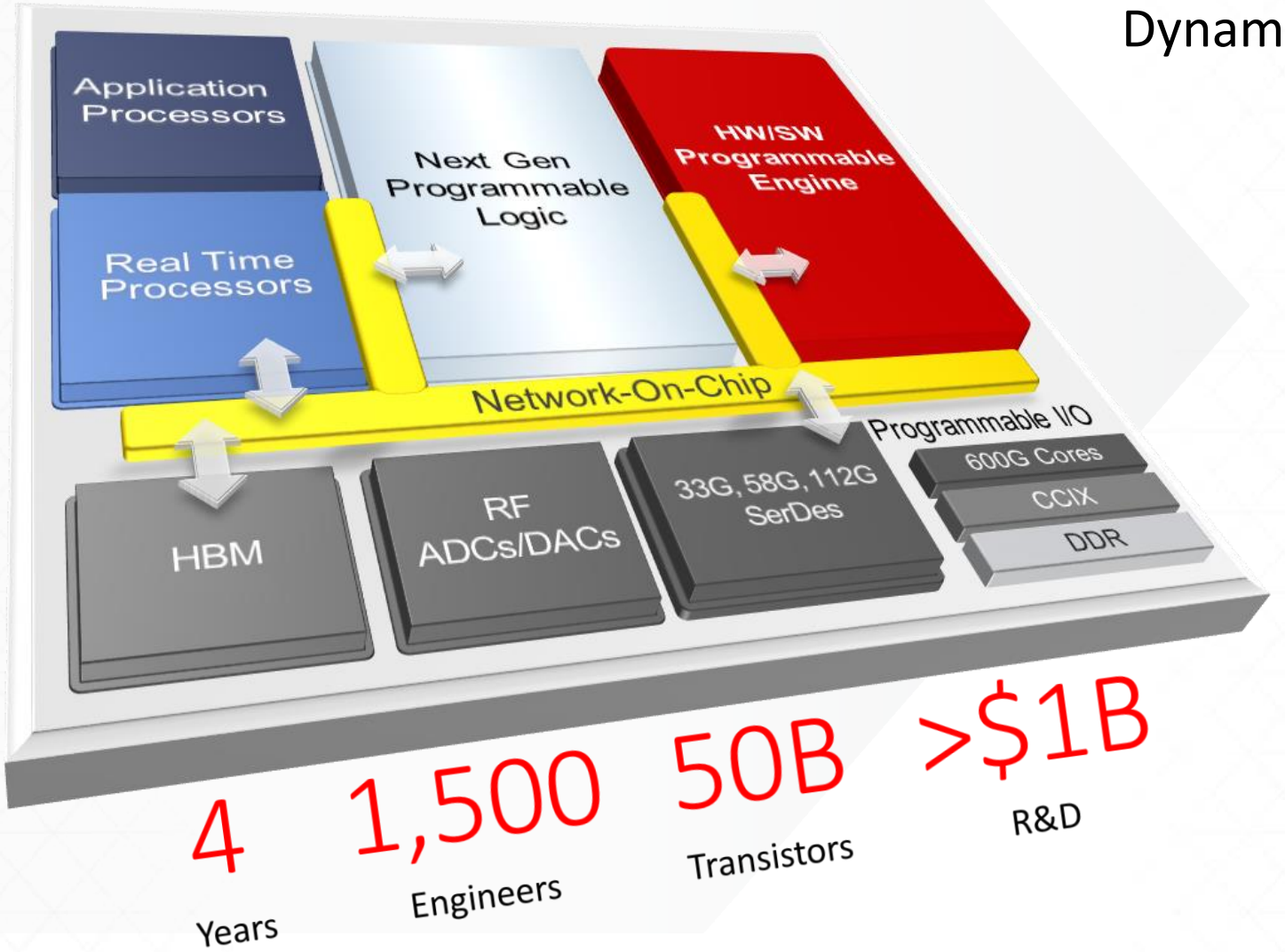
Software Programmable



Custom acceleration for any workload – in milliseconds

XILINX®

Project "Everest" The First 7nm ACAP Product Family



Revolutionary Adaptability
Dynamic Optimization for Workloads

Software & Hardware Users
Rapid Innovation & Deployment

20x
AI Compute Capability

4x
5G Communications Bandwidth

XILINX

Our Journey Towards “FPGA in Every Server” is just getting started…..