AI-Driven Verification

Leveraging AI to Achieve the Next Leap in Productivity

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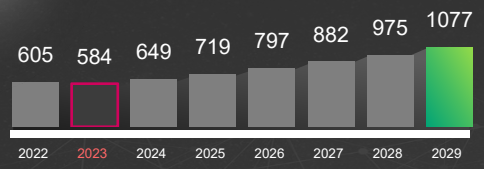
VP Product Engineering, Systems and Verification Group

cadence®

Five Generational Trends, All Anchored Around Compute

SEMICONDUCTORS

$1 Trillion

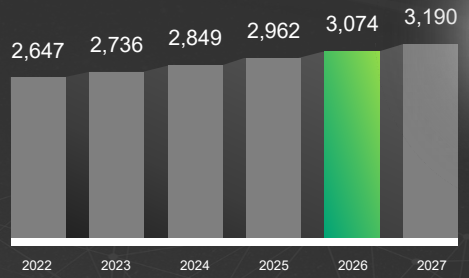


Semiconductors Growth

Source: IBS Market Forecast, September 2022

ELECTRONIC SYSTEMS

$3 Trillion



Electronic Systems Market ($B)

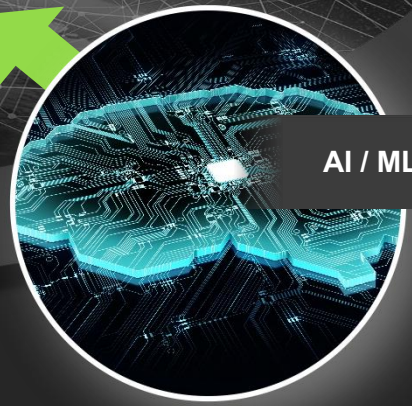
Source: Omdia, Electronic Systems Market, March 2023

5G

Industrial IoT

Hyperscale Computing

Autonomous Vehicles



AI / ML

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Productivity Challenge in Chip and System Design

Complexity Is Increasing

100X

Over the Next Decade

Source: Cadence analysis

More Annual Design Starts

4X

Over the Next Decade

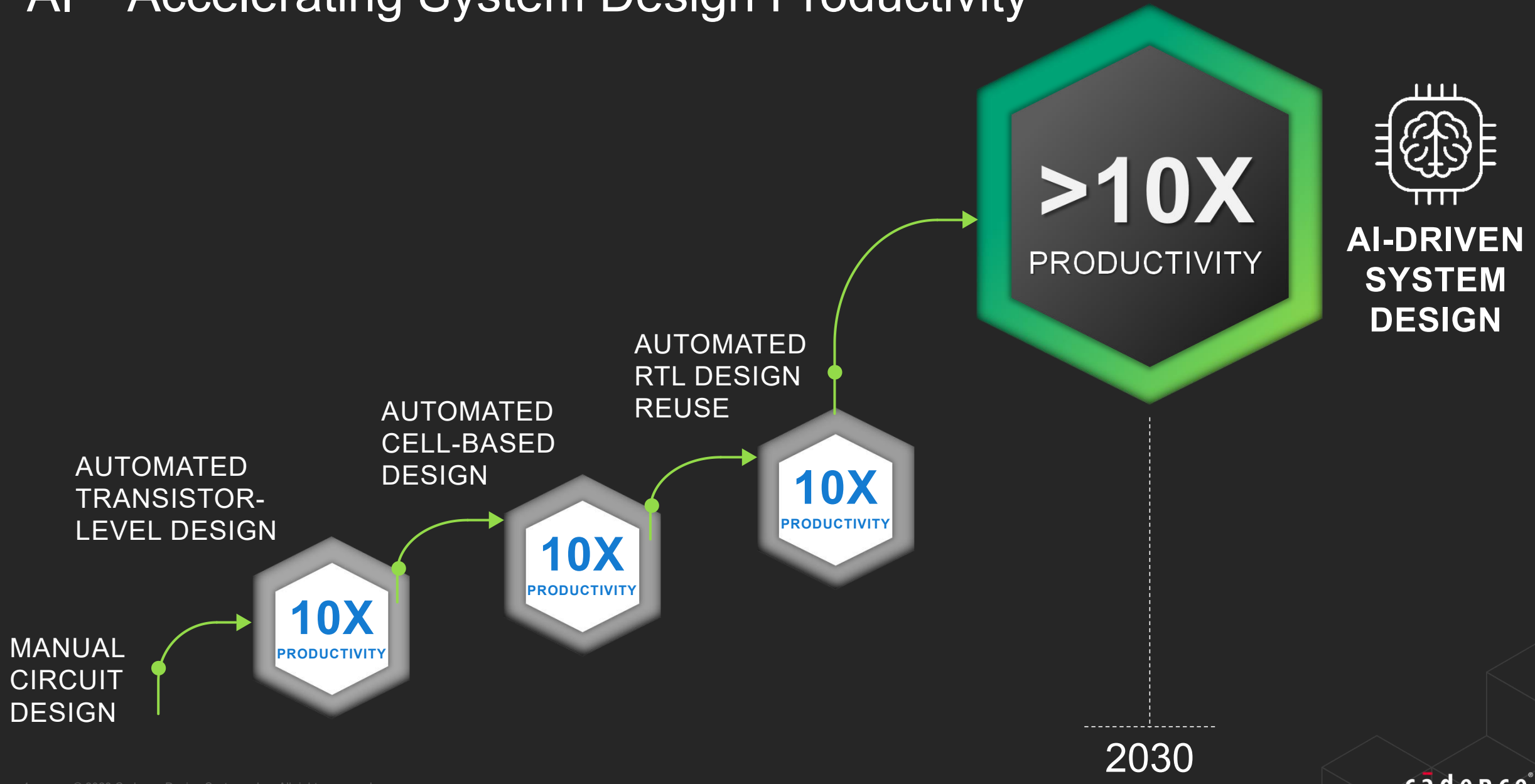
(<=10nm)

Source: IBS Global Semiconductor Industry Service Report: Design Activities and Strategic Implications, July 2022
Source: Cadence analysis

Not Enough Engineers

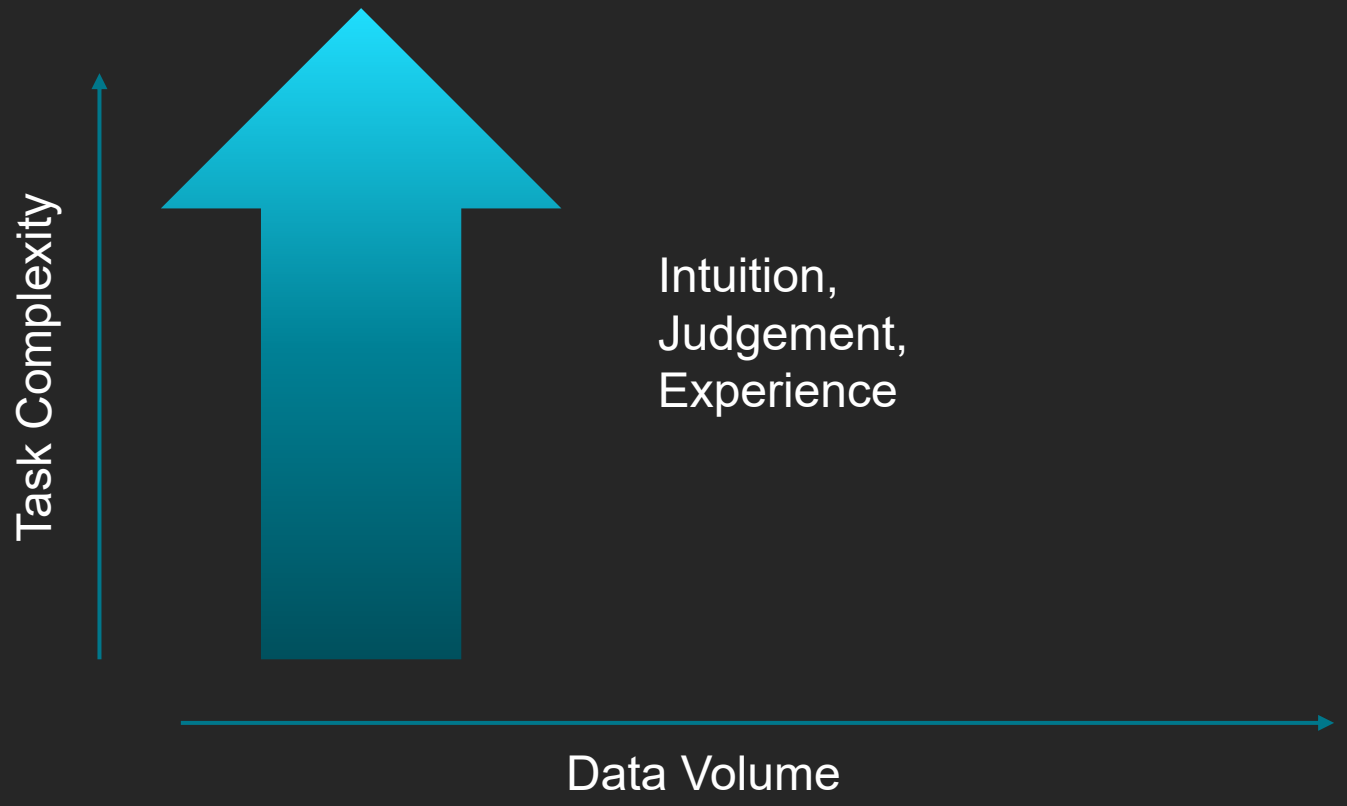
Source: https://semiengineering.com/engineering-talent-shortage-now-top-risk-factor/

AI – Accelerating System Design Productivity



Power of the Human

Human engineer: solve complex problems and be creative

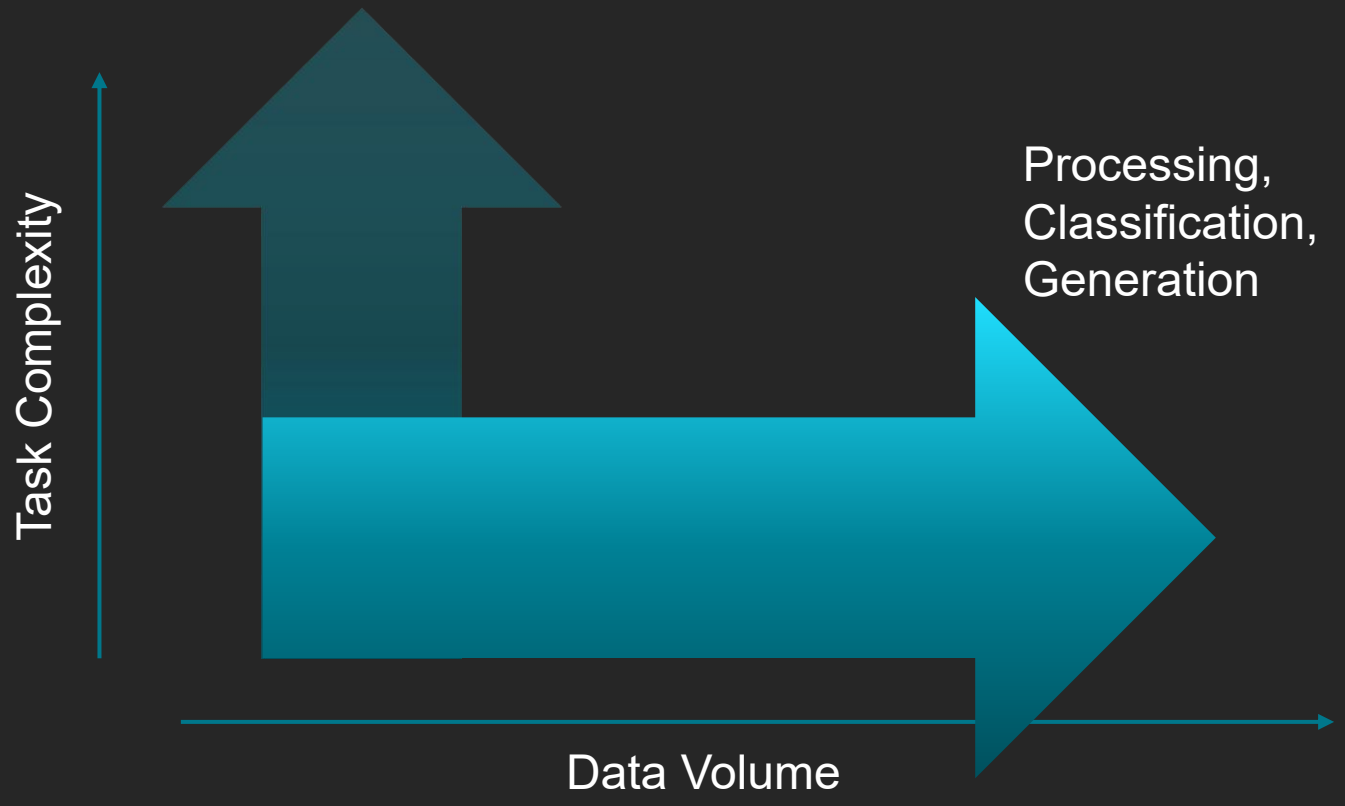


- Design algorithms
- Innovate new architectures
- Think outside the box

Power of AI Algorithms

Human limitation: serial data processing

AI strength: insights from parallel processing big data



- Chat bots
- Speech from text
- Image from text
- Recommending ads
- …

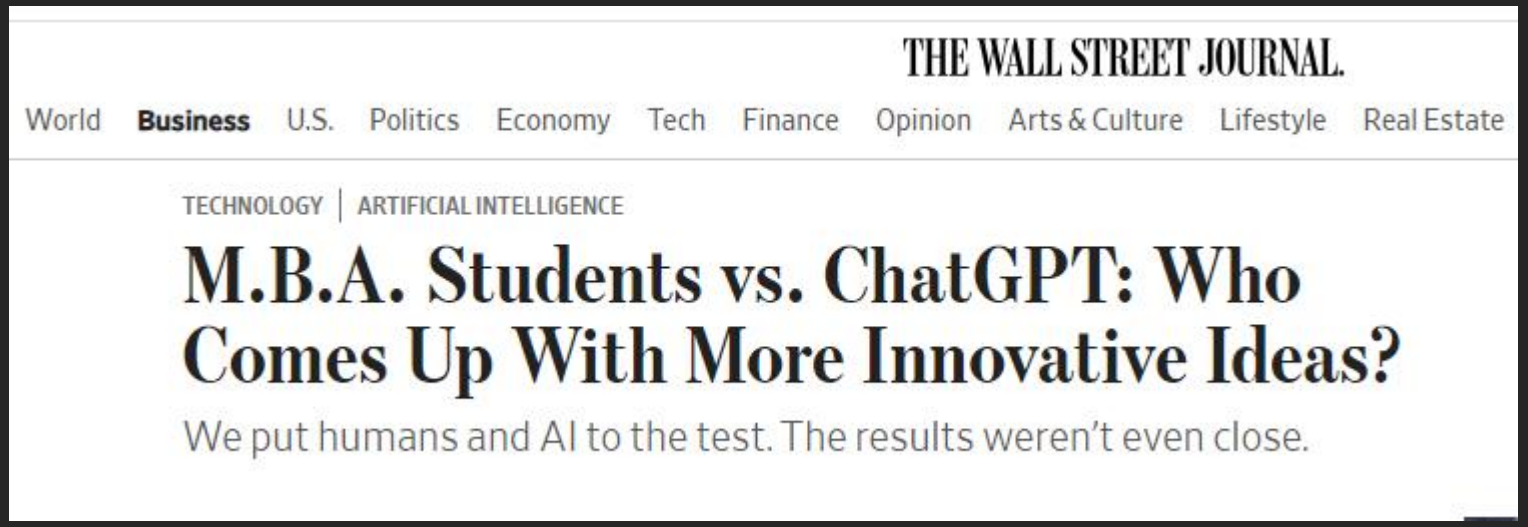
Power of AI-Driven *Solutions*

Accelerate the human in the loop

Human in the Loop AI Solutions – Pilot & Co-Pilot

"…rather than thinking about a competition between humans and machines, we should find a way in which the two work together"

Terwiesch & Ulrich – wsj.com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TECHNOLOGY | ARTIFICIAL INTELLIGENCE

M.B.A. Students vs. ChatGPT: Who Comes Up With More Innovative Ideas?

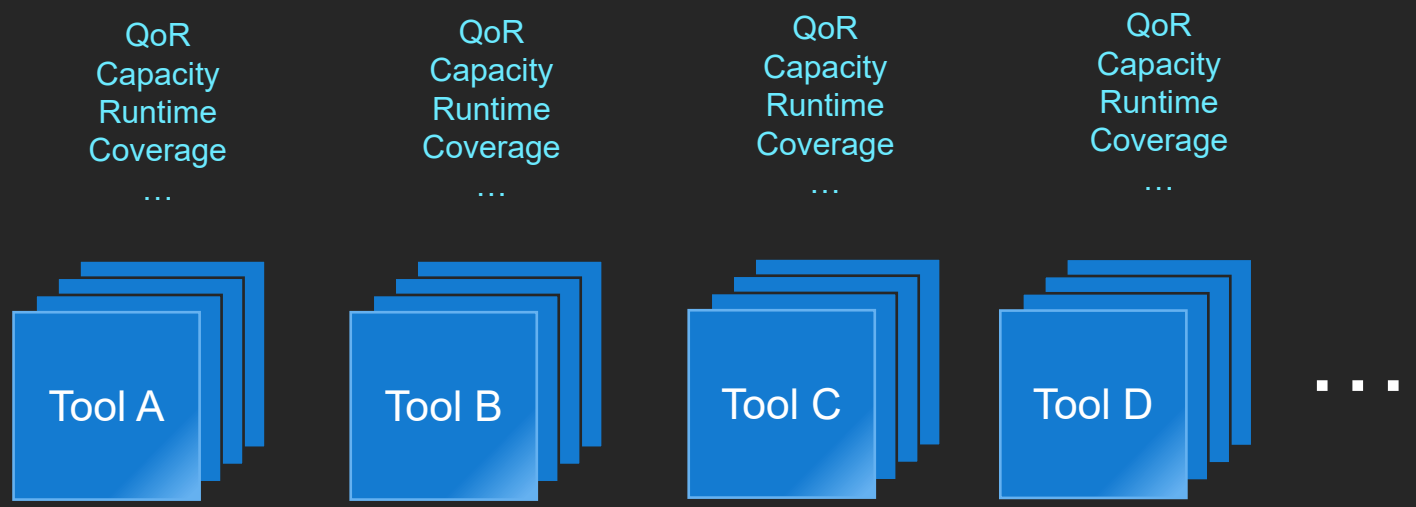
We put humans and AI to the test. The results weren't even close.

Challenge – Generate 200 "New Business" ideas : AI (ChatGPT) - ~1h;
Humans (Wharton MBA Students) – Days

Human in the loop AI – Pilot & Co-Pilot

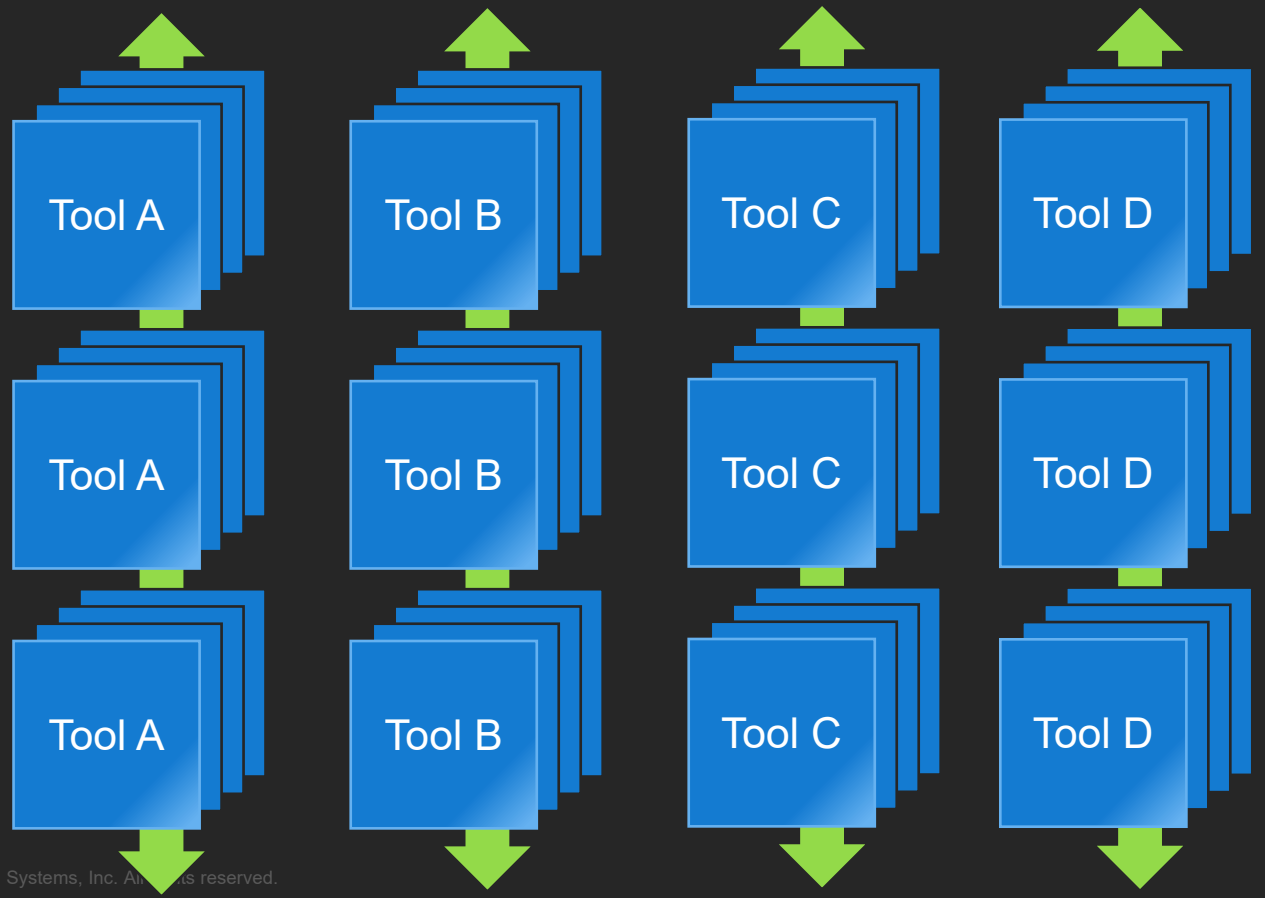
Human (Pilot) – Identify the problem.
AI (Co-pilot) – Report what is known about the problem.
Human + AI – Iterate on unique and creative solutions to the problem.

Traditional EDA



User Perspective

Meet PPA Goals
Meet Coverage Goals
…



Today

Tomorrow

Next Day

⋮

Next Generation AI-Driven EDA

AI-Driven Design and Verification

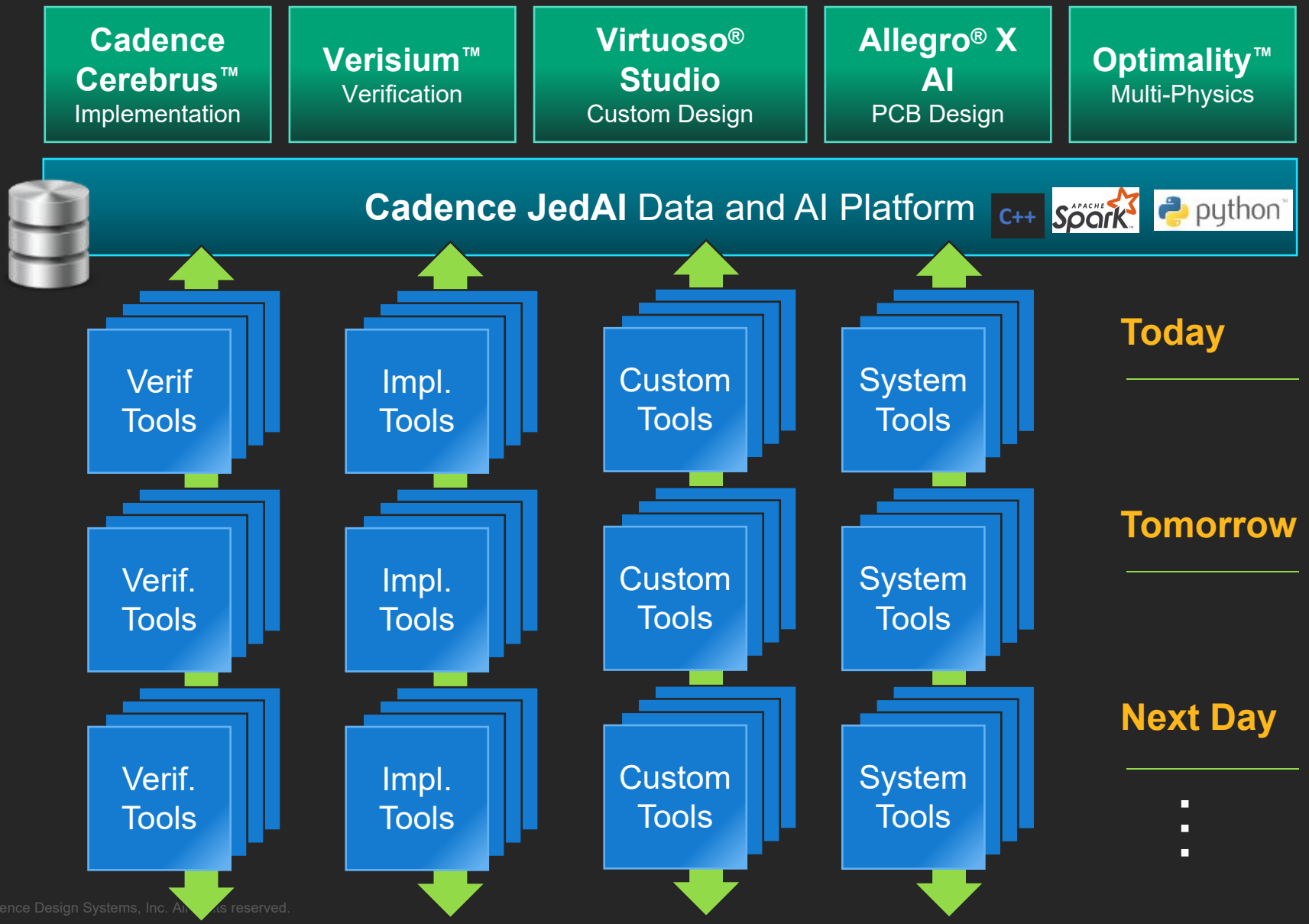
Multi-engine multi-run learning and optimization

Best PPA
Highest coverage
Fastest time-to-market

Big Data Platform

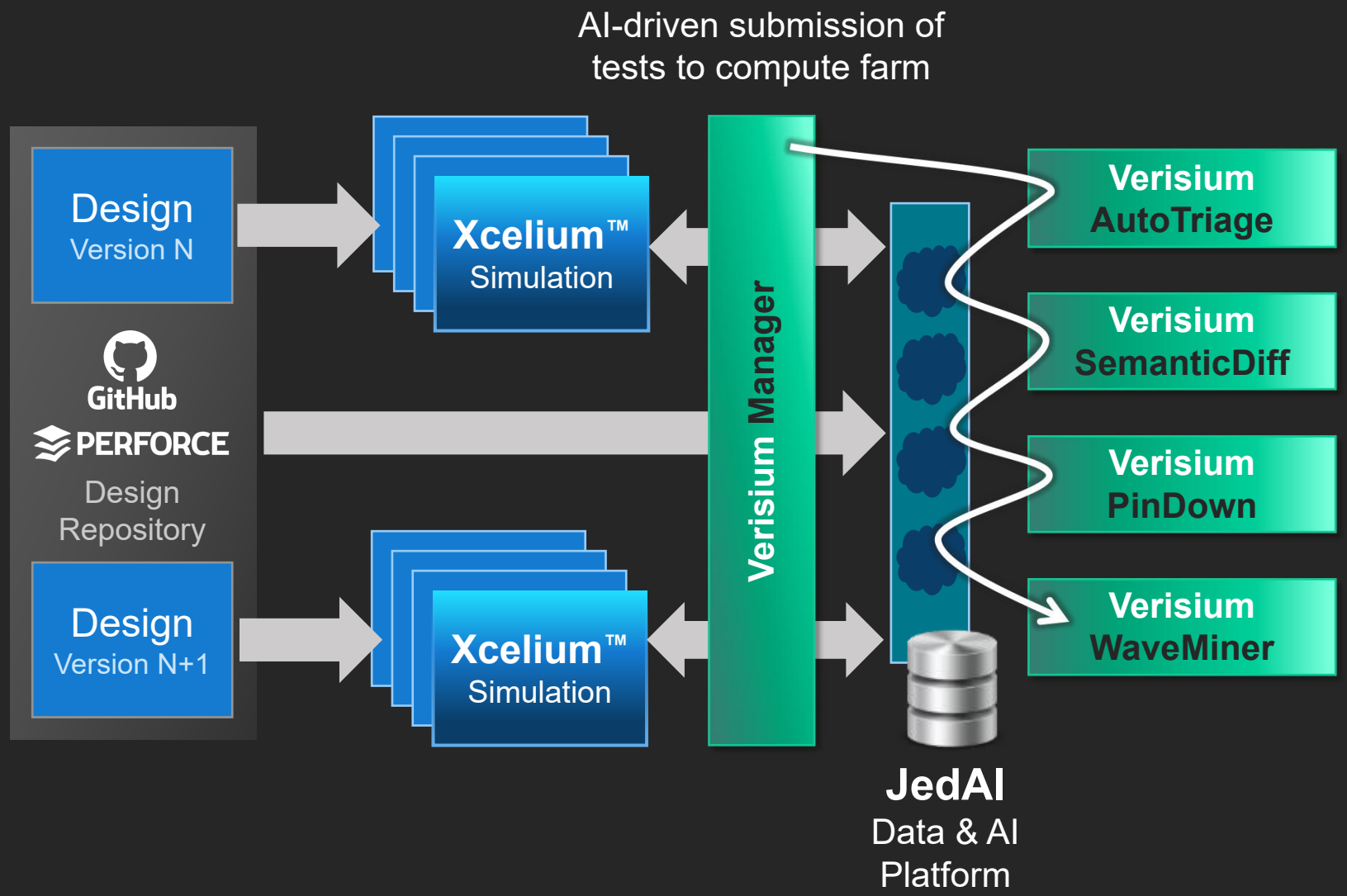
Verif Tools	Impl. Tools	Custom Tools	System Tools	Today
Verif. Tools	Impl. Tools	Custom Tools	System Tools	Tomorrow
Verif. Tools	Impl. Tools	Custom Tools	System Tools	Next Day
				⋮

Cadence AI-Driven Transformation



Next-Generation AI-Driven Verification Workflow

Cadence Verisium™



Automatically groups tests failing due to the same underlying bug

Automatically rank the risk of code changes between design versions N and N+1

Automatically predict and validate the source commits most likely to cause bugs

Analyzes waveforms and automatically identifies the root cause of bugs (signals + time)

AI Driven Workflow: 3x – 60x Productivity Gain

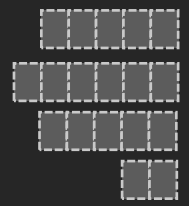
Verisium™ Results

30X **Faster Waveform Analysis** Memory Controller IP	**3.3X** **Reduction Failure Triage Time** Block and System-Level Regressions	**6X** **Total Debug Effort Improvement** Automotive SoC
60X **Less Effort for Design Change Analysis** >1B Gate Mobile SoC	**10X** **Productivity End to End SoC Debug** Mobile SoC	**4X** **Faster Identification of Buggy Source** Interface IP
4X **Better TaT for Bug Fixes** CPU Core IP	**20X** **Faster Verification of Changed RTL** RISC-V CPU	**8X** **Regression CPU Time Reduction** Image Sensor IC

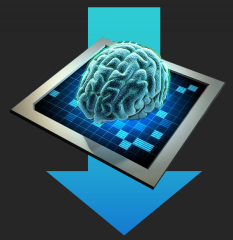
AI-Driven Simulation Performance

Cadence Xcelium™ ML

Randomized Test Suite **Run N**

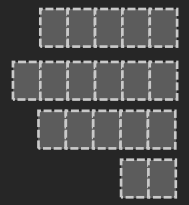


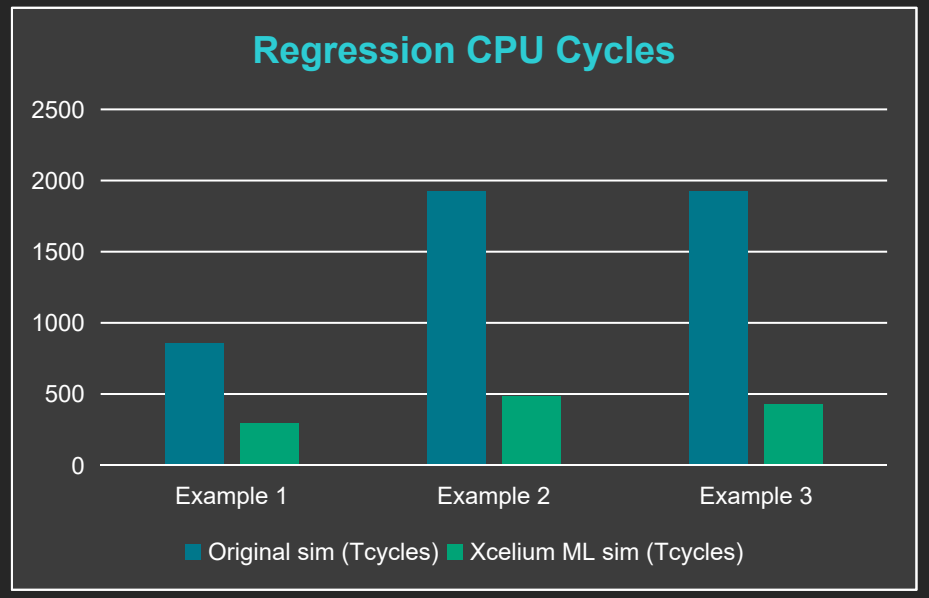
*Up to **5X** faster*
Same coverage

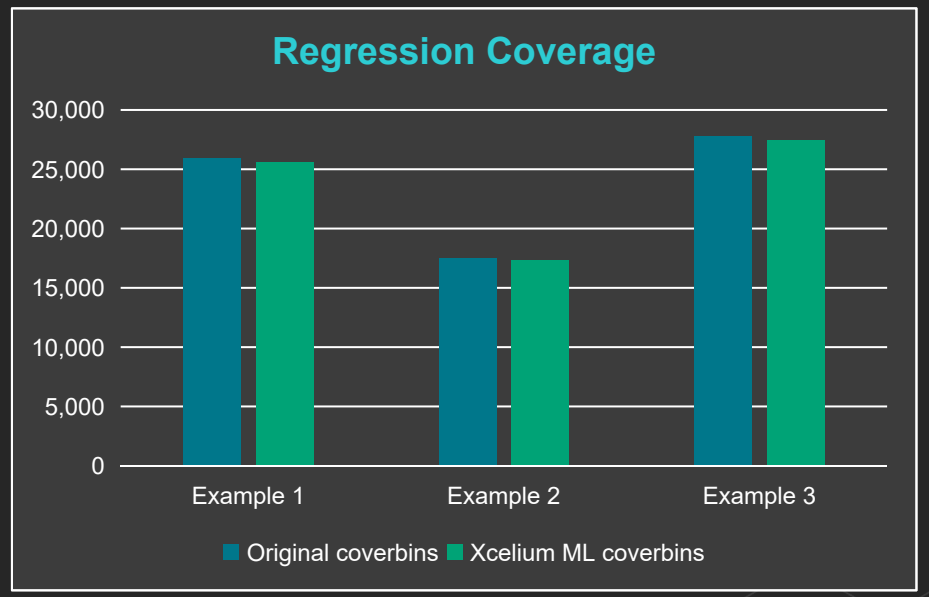


Machine Learning

Randomized Test Suite **Run N+1**

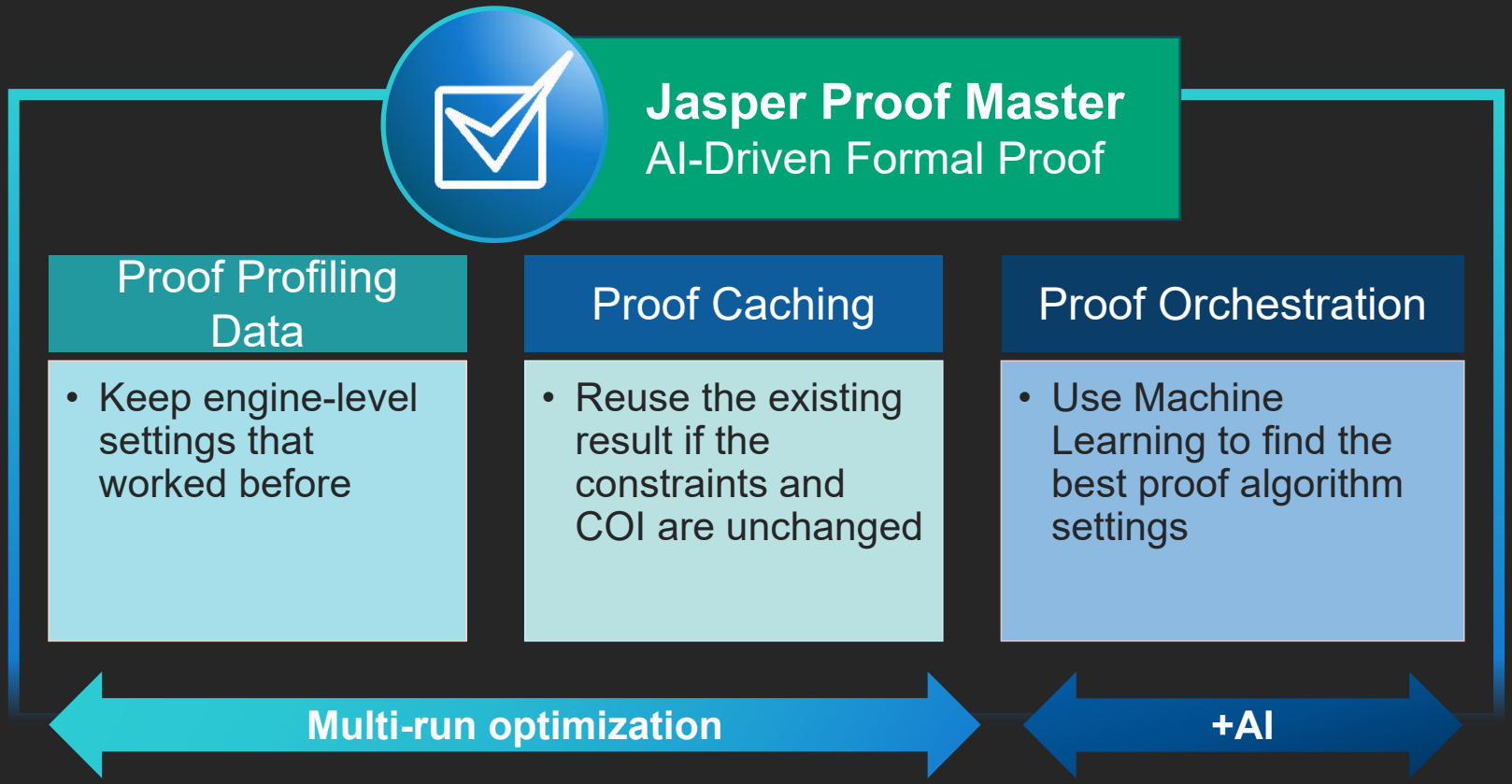






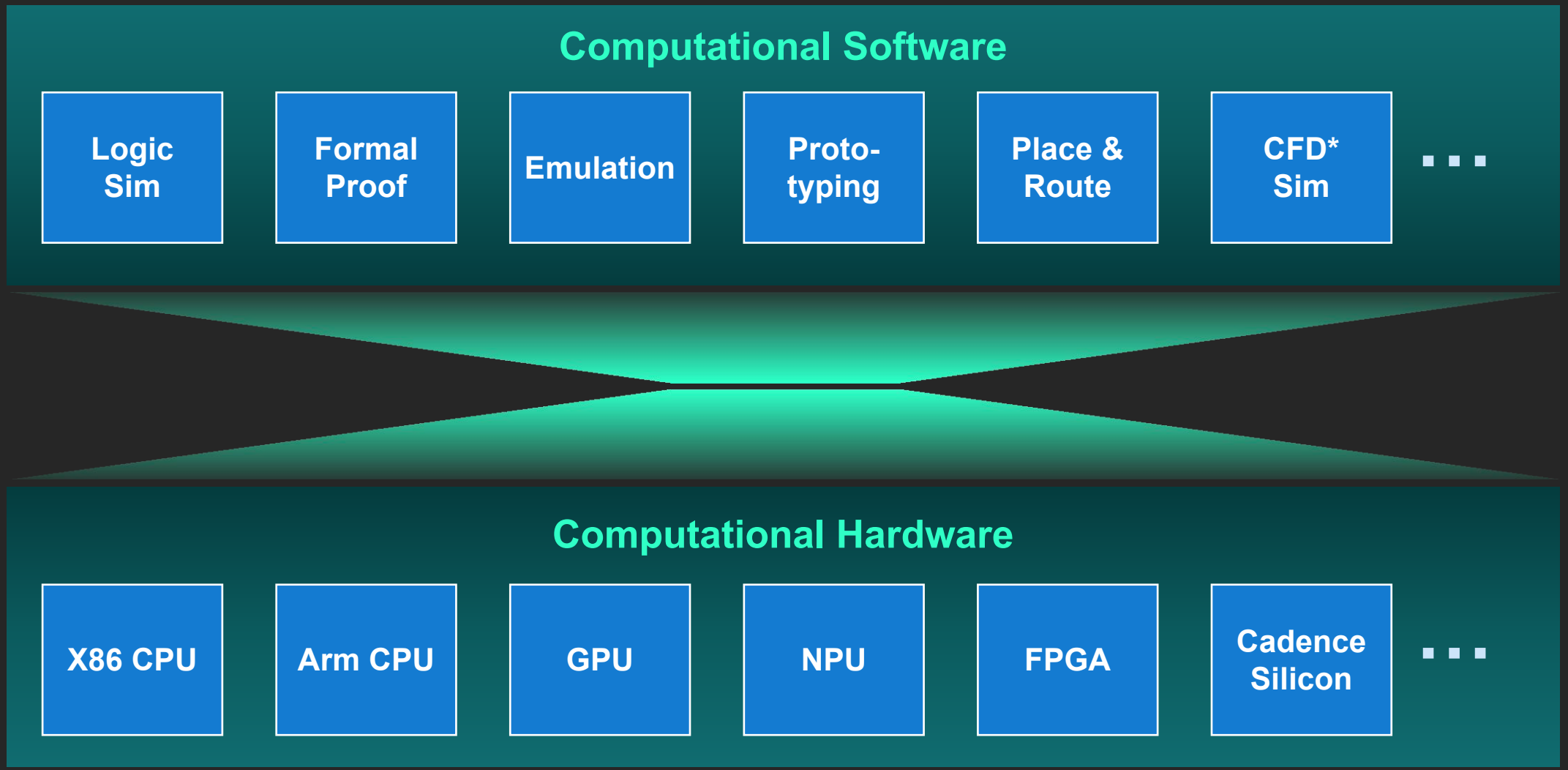
AI-Driven Formal Proof

Cadence Jasper™ Proof Master



Testcase	Baseline	Smart Proof	Gain
A	50%	59%	1.2X
B	69%	69%	1.0X
C	12%	25%	2.1X
D	44%	83%	1.9X
E	57%	94%	1.6X
F	68%	69%	1.0X
Total	53%	71%	**1.3X**

Domain-Specific Compute in EDA



* Computational fluid dynamics

Domain-Specific Compute for EDA on the Cloud

Cadence Cloud Service

Pop-up ready-to-go full flow for design and verification

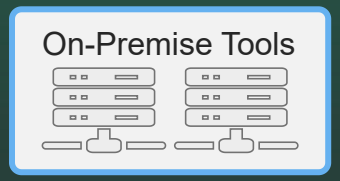
Foundry and IP partner security certified

powered by aws · Azure · IBM Cloud

IP and Foundry Partners: tsmc VDE · GlobalFoundries · SAMSUNG SAFE™-Cloud

Cadence Cloud Passport

Cadence tool licensing enabled on the cloud



Cloud Passport

powered by aws · Azure · Google Cloud Platform · IBM Cloud

Cadence OnCloud

New SaaS-based cloud native solutions

Multiphysics Analysis

CFD Simulation

Allegro PCB Design

Palladium Protium

Next-Generation AI-Driven Verification Full Flow

Cadence Verification Solution