Computational Software for Intelligent System Design

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Sr. Group Director, Regional System Solution, Cadence DVCon China, 26 May 2021 @Shanghai

Cadence IPO Filing in 1987

Design Automation

BUSINESS

The Company develops, markets and supports CAD software products that automate, enhance and accelerate the design and verification of integrated circuits. By reducing both product design time and design errors, these products shorten the time to market for new circuits and enable the development of increasingly complex ICs.

Cadence Customer Challenges in 2020

Design for Electronics Performance Leadership



Intelligence Performance

Learning, sensing algorithms Customized user experiences Compute optimized for application workloads

System Performance

Electromagnetic, thermal, and CFD analysis Driver, OS, and application performance RF, photonics, 3D-IC

Design Performance

Analog, digital, and mixed signal Advanced-process node enablement Billion-gate chip implementation and verification









Cadence Intelligent System Design Strategy

cadence

Design Performance Challenges for Billion-Gate Verification





Package Throughput = Engines x Logistics



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Amateurs talk about strategy... ...professionals talk about logistics.

Omar Bradley <u>General</u>, United States Army "



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Verification Throughput = Engines × Logistics





Verification Throughput = Engines × Logistics





Computational Logistics in Logic Simulation

Project Case Study	Sim jobs/day
Graphics	30k
CPU	20k
Modem	8k
CPU	25k
Graphics	15k



Example Simulation Regression CPU time vs. Queue time





Example Simulation Performance vs. Server Type



Job Runtime (hrs) / Server Cost (\$)

Computational Logistics in Full Flow Verification



Verification Computational Logistics with Cadence vManager



Regression Type -Block Nam		Total Runs	#Passed	#Failed	
(no filter)	(no filter)	(no filter)	(no filter)	(no filter	
REGRESSION	Mixed	33	20	13	
nightly	DEBUG	6	3	з	
nightly	soc	15	12	з	
nightly	DEBUG	9	4	5	
nightly	C2C	3	1	2	

² Block Name Passed %		Unique Failures	Expression Cov	ABlock Cov	
(no filter)	(no filter)	(no filter)	(no filter)	(no filter)	
Mixed	51.95	5	51.67%	72.14%	
C2C	33.33	1	36.05%	55.03%	
DEBUG	44.44	2	51.85%	72.04%	
DEBUG	50.0	1	58.77%	80.76%	
SOC	80.0	1	60%	80.76%	





Xcelium ML

Verification Computational Logistics for UVM Bench Simulation Performance



Kioxia hat effectively using the tenting mulation for a varie of our designs, and it addresses our ever-growing verification needs. With the new Xcelium ML, we've seen a 4X shotter turnaround time in our fully random regression runs to reach 99% function coverage of original, and plan to use this technology in production designs to shorten the ime to market for Kioxia's business.

Kazunari Horikawa

KIOXIA

Senior Manager, Design Technology Innovation Division, Kioxia Corporation

Xcelium ML in Action





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Xcelium ML in Action

Original Regression



Cover bins

10,000 CPU hours

Xcelium ML



Cover bins

2,000 CPU hours

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Jasper Smart Proof

Verification Computational Logistics for Formal Proof

At Cadence



Released Product



Testcase	Baseline	Smart Proof	Gain
Α	50%	59%	1.2x
В	69%	69%	1.0x
С	12%	25%	2.1x
D	44%	83%	1.9x
E	57%	94%	1.6x
F	68%	69%	1.0x
Total	53%	71%	1.3x

Palladium and Protium Dynamic Duo



Multi-engine Acceleration for Highest Verification Throughput







Simple left-to-right stream processing

Palladium Custom Processor





Fast predictable compile Flexible debug ASIC-style full Place & Route

> Protium FPGA



Highest Performance

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Cadence Excellence in Computational Software

- Numerical solvers
- Binary decision diagrams
- SAT solvers
- Quantified Boolean formula checker
- Symbolic model checkers
- SMT solvers
- Bounded model checking

- Adaptive meshing
- Matrix solvers
- Graph theory and topology
- Distributed processing
- Non-linear ordinary differential eq. solver
- Computational geometry
- Memory allocation and garbage collection

INTELLIGENT SYSTEM DESIGN

cadence[®]

Verification

Implementation

Custom Design





Multi-Physics System Analysis Technologies

Clarity[™] 3D Solver True 3D electromagnetic (EM) extraction and simulation





- Breakthrough distributed processing, cloud ready
- Up to 10X faster with unprecedented capacity
- Gold-standard accuracy

Celsius[™] Thermal Solver Complete electro-thermal co-simulation



- Steady-state and transient analysis
- Up to 10X faster with unprecedented capacity
- Thermal, fluid flow, electrical heating, and stress

Both integrated with Allegro[®] and Virtuoso[®] environments



cadence®

Computational Software for Intelligent System Design[™]

Merger of EDA, system design, AI

Pervasive intelligence throughout design

Grounded in computational software

Co-optimizing system, hardware, software

Spanning multiple system domains

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