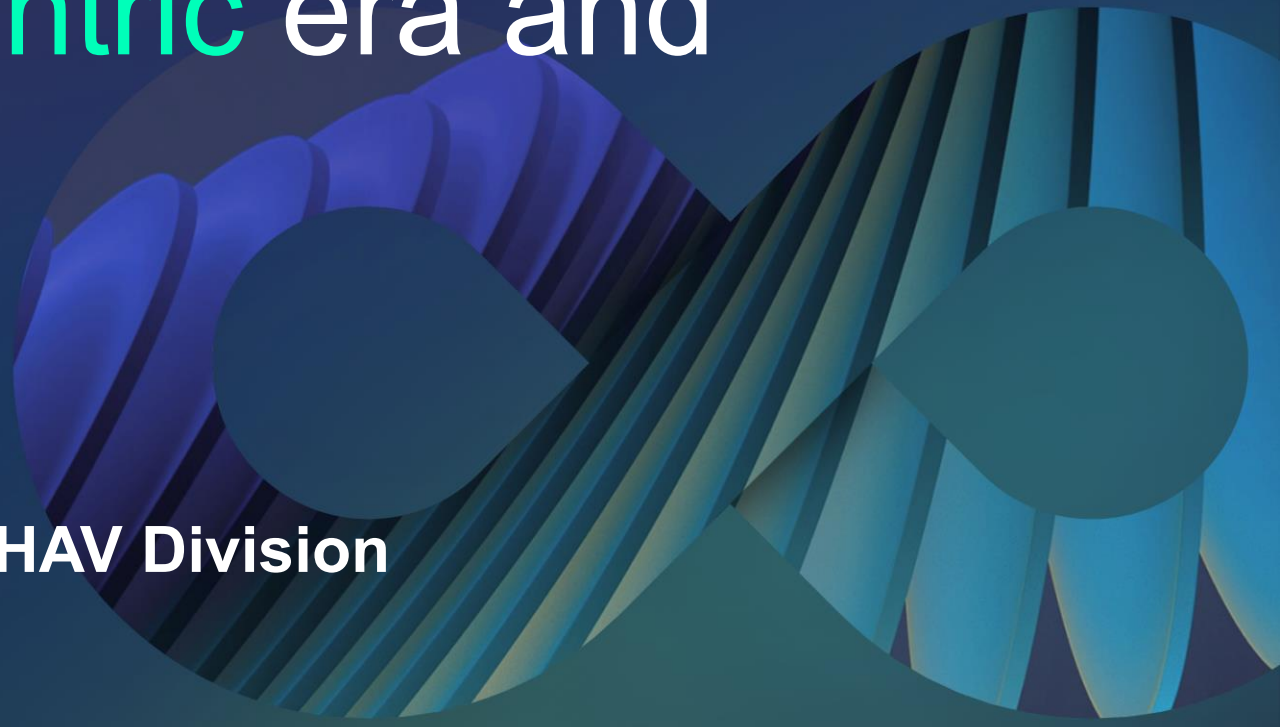
Power Dynamics: Shaping the future of the data centric era and the role of AI



Vijay Chobisa
Senior director of product marketing HAV Division
Siemens EDA
DVCON INDIA 2025

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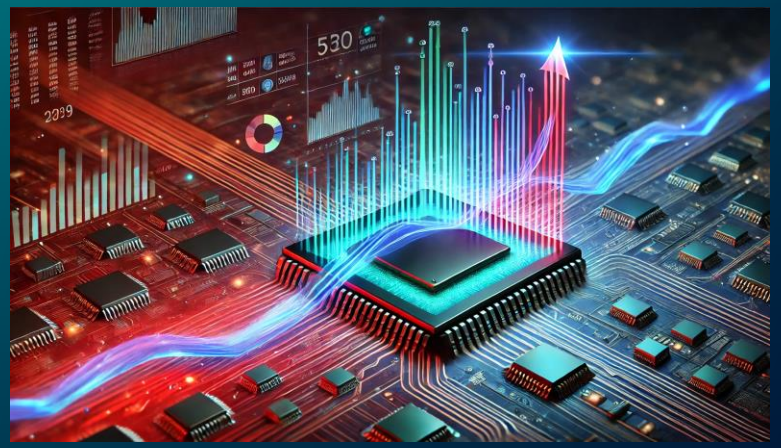
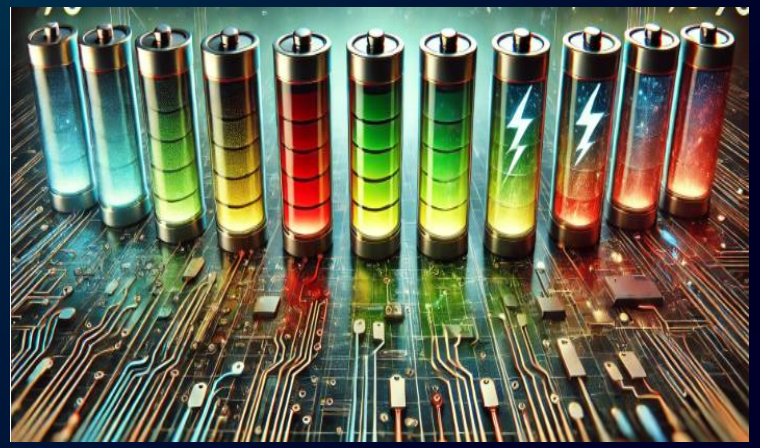
Agenda: The impact of power in a SW-defined world



Industry trend



Power challenges

Power analysis
In SW-defined world

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Semiconductor industry at-a-glance

1960 1980 2000 2020 …..

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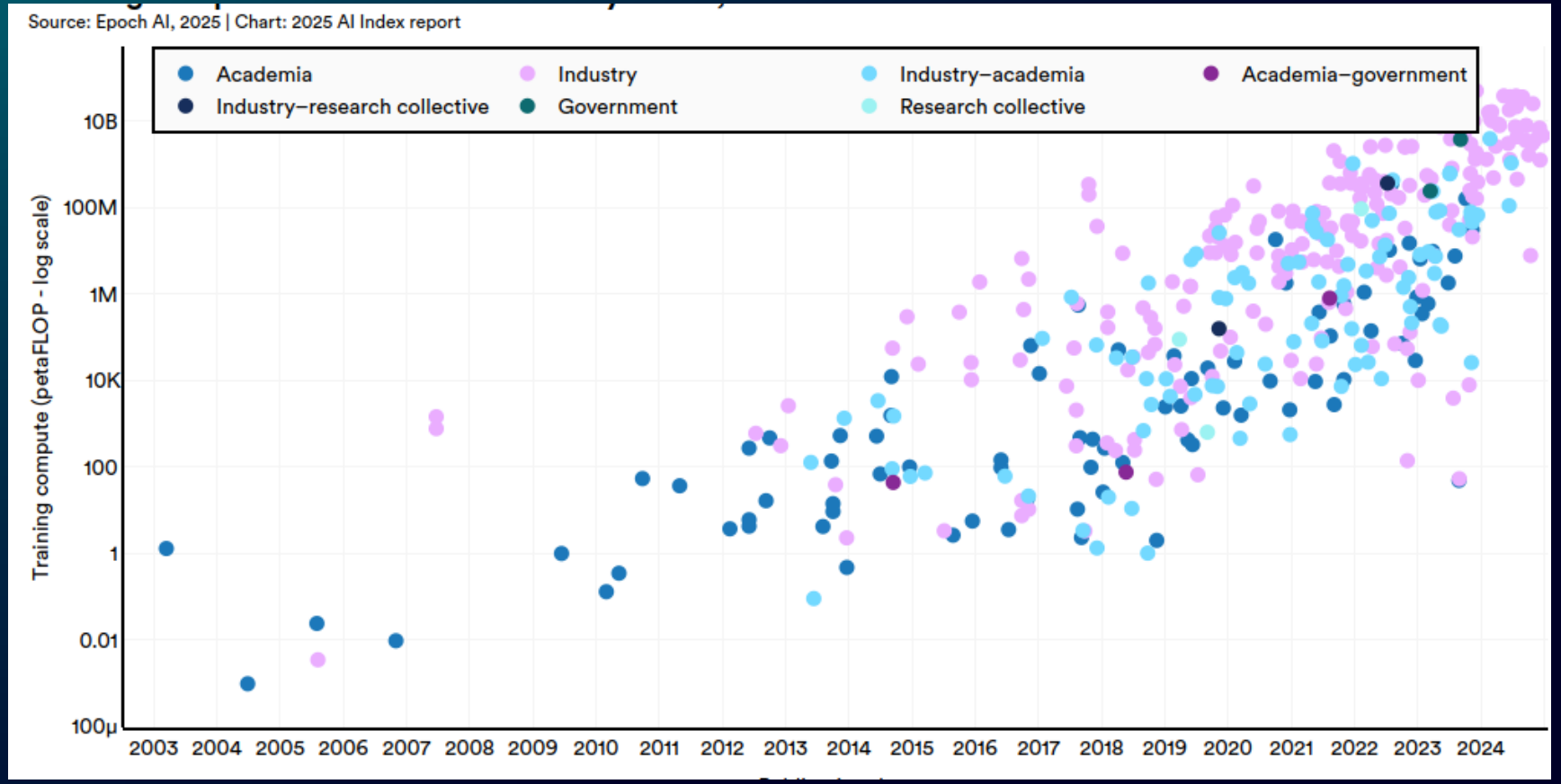
Data centric era is synonymous with AI

Massive computation

High bandwidth memories

Cutting edge communication

Maximum parallel processing (no idle phase)



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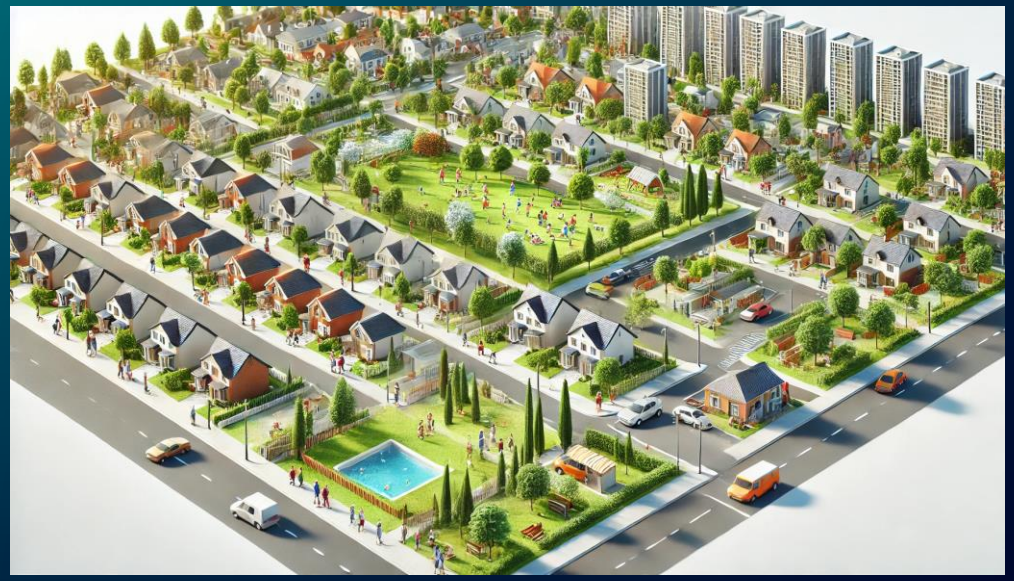
The magnitude of AI energy consumption is astounding

ChatGPT's daily power usage is nearly equal to 180,000 U.S. households



Google AI service is estimated to consume electricity as much as Ireland

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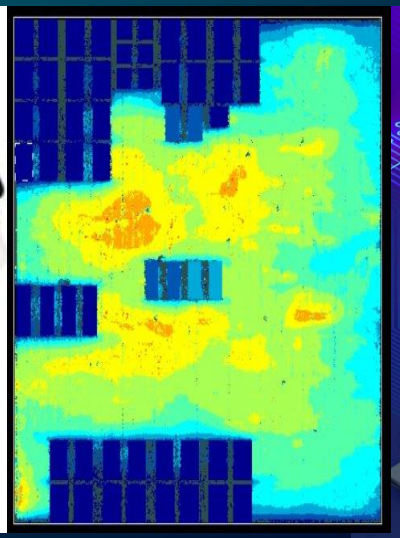
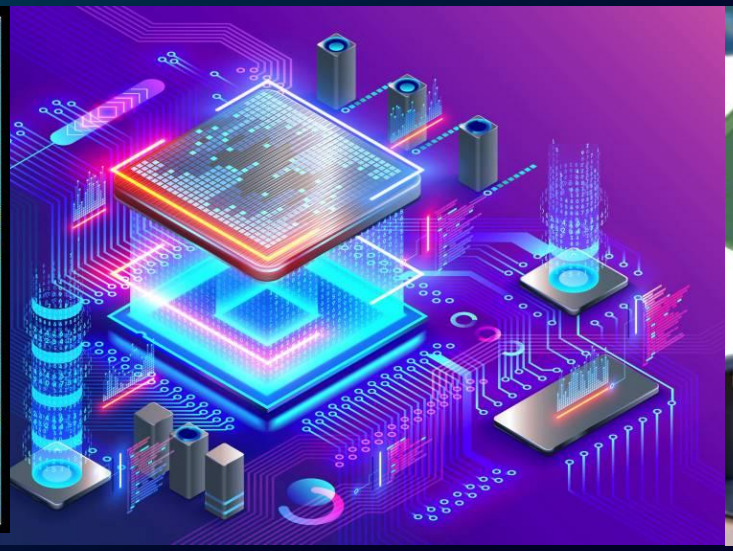
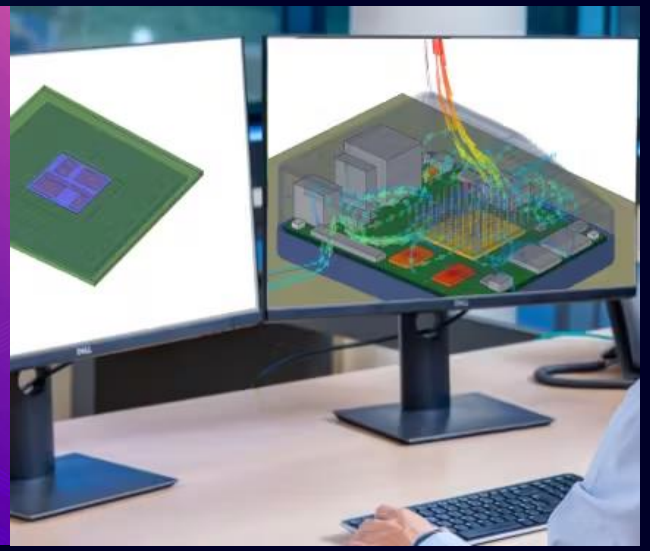
Power impacts: packaging cost and complexity







DFT

thermal

package

cooling

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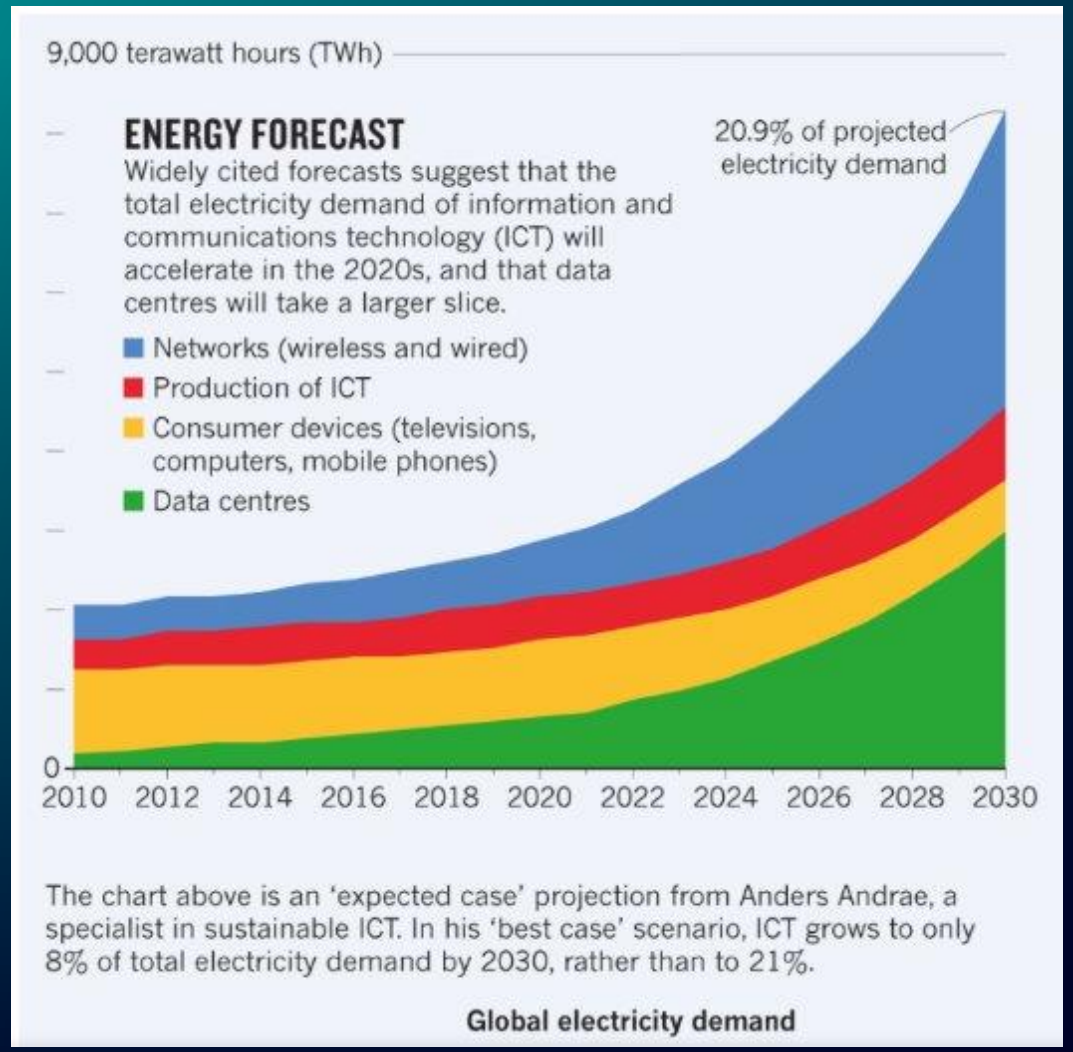
Power impacts: from micro to macro



Data Centers could consume 20% of total electricity by 2030

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Power analysis and reduction

From system to circuit

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Questions for thought

Are you running power analysis early using real end-user software?

Are you confident that you met your power numbers before silicon comes back?

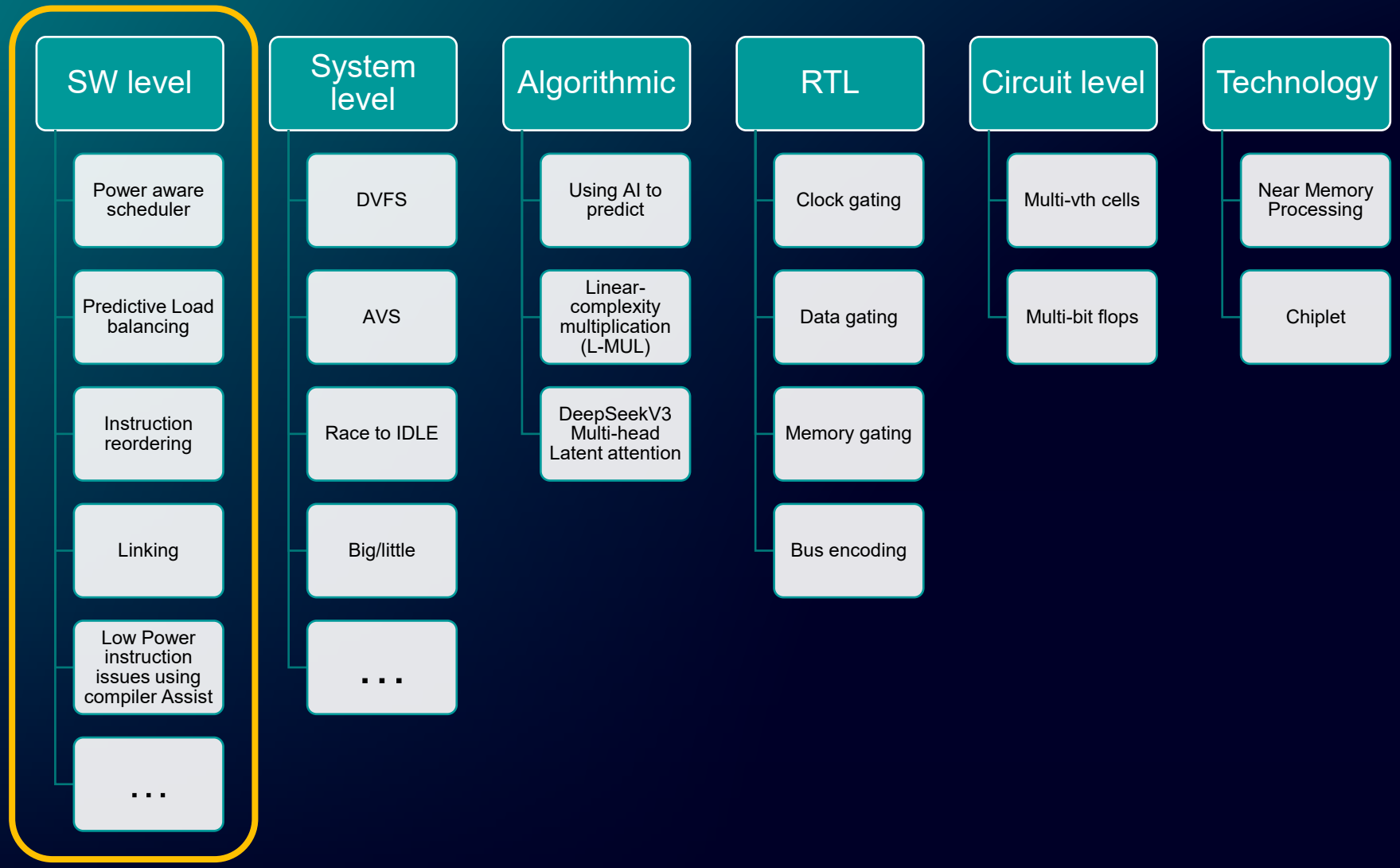
Have you ensured that all the user defined clock gating cells are saving power rather than wasting energy?

If you exceed your thermal budget, how do you deal with consequences?

Are power and dynamic IR drop during DFT impacting your time to market?

Are you power numbers in the lab , exceed 30% or more your estimation?

Dynamic power reduction



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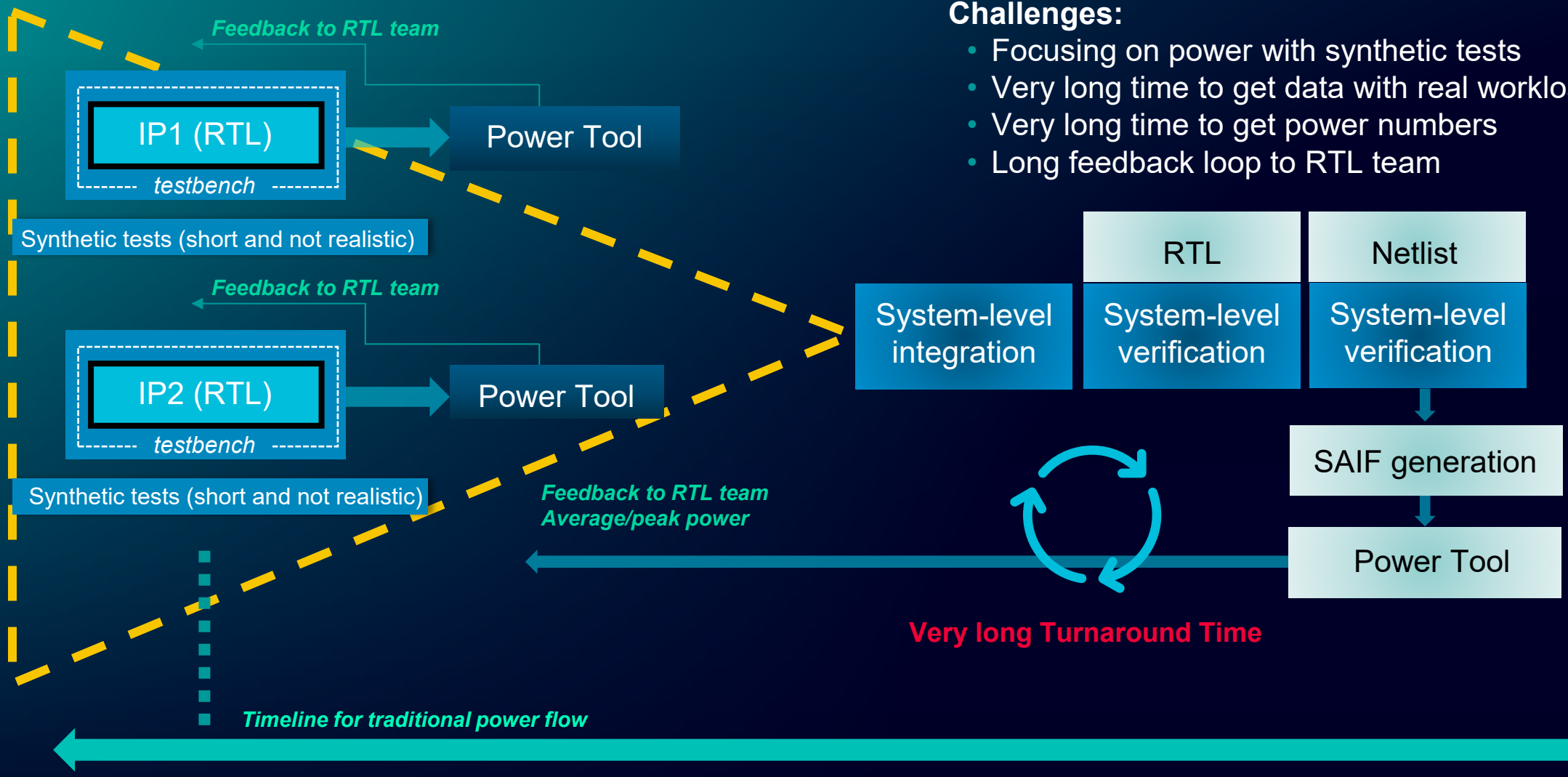
Traditional power flow



Challenges:

- Focusing on power with synthetic tests
- Very long time to get data with real workloads
- Very long time to get power numbers
- Long feedback loop to RTL team

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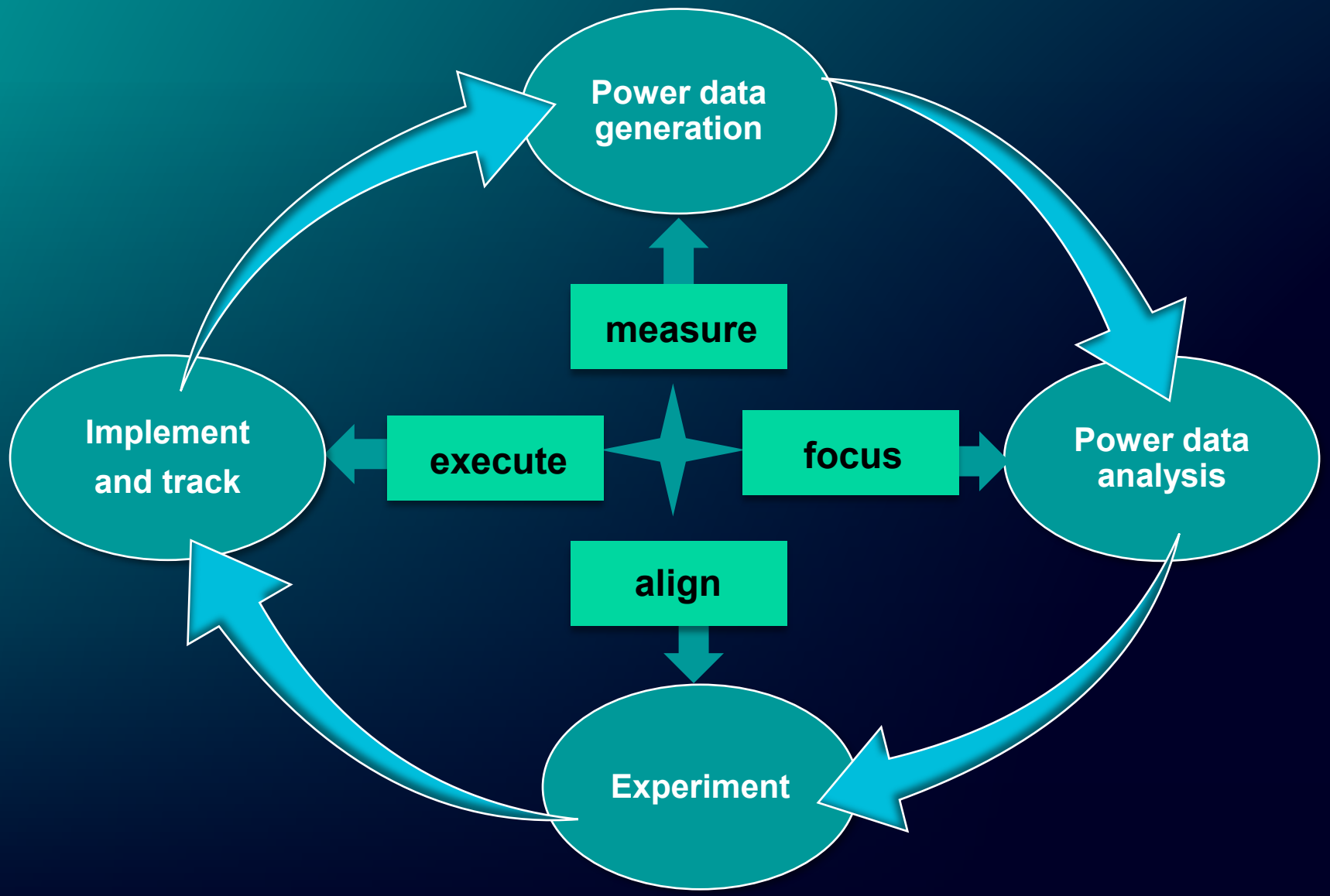
Shift left vision of power analysis



- Early in the design cycle
- Power data generate with real workloads
- Generating actionable power metrics
- Achieving high accuracy

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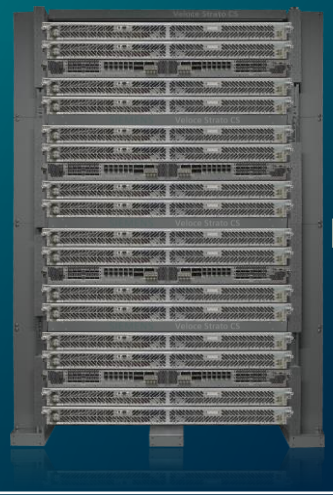
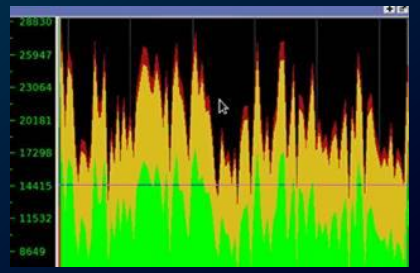
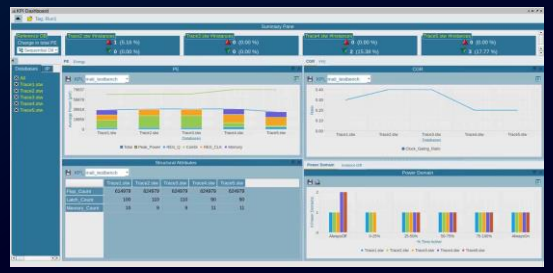
Compelling solution for design teams

- Design
- Liberty
- UPF
- Workload



Power trend analysis





Time-base CGE

Time-based FFE

- ✓ Capturing power profile for entire workload
- ✓ Capturing key power indicators at cluster or SoC level
- ✓ Accurately finding peaks

Generating power profile for Billions of cycles

Making key decisions based on real data

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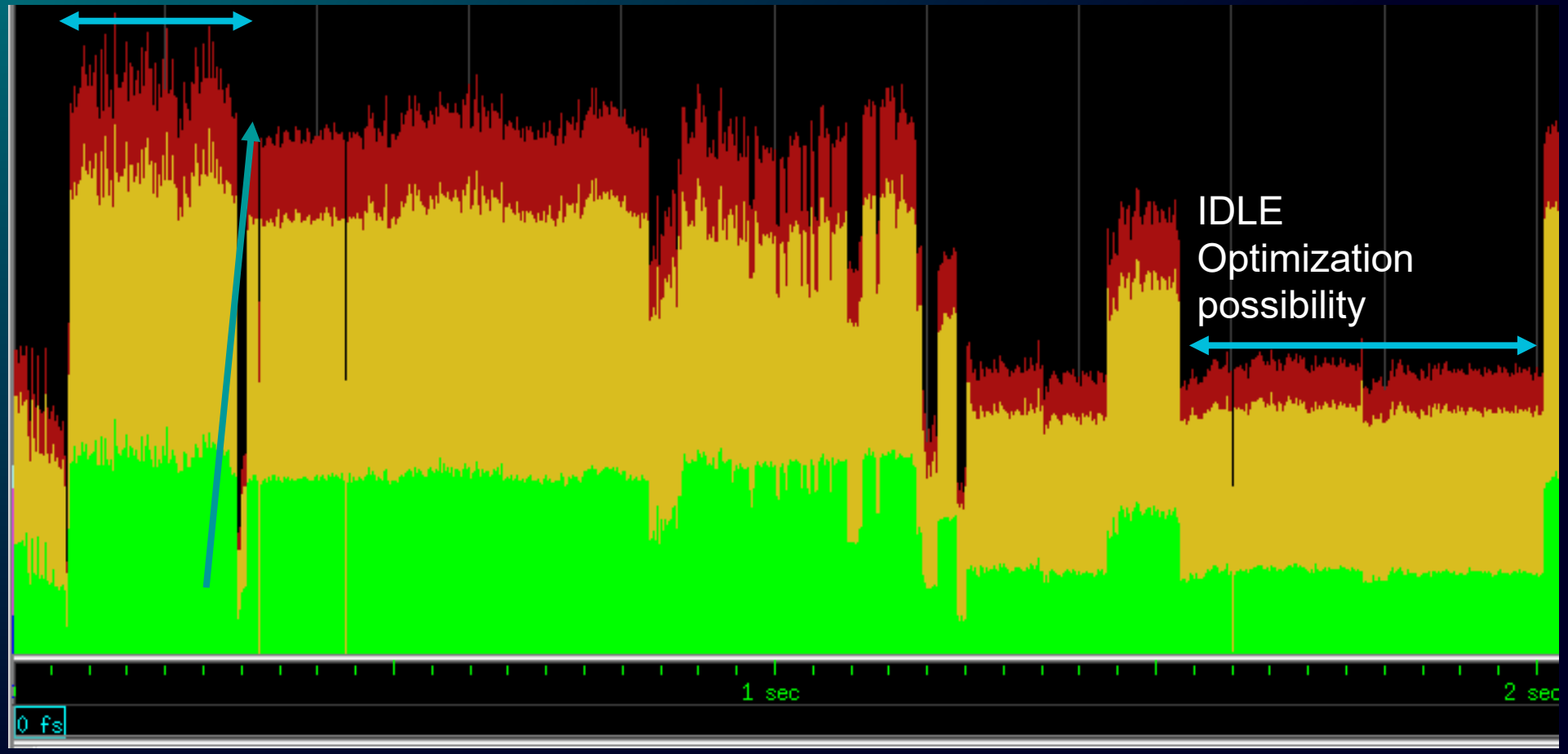
Power profile/heat map for realistic benchmarks allows focusing on right area

Hot zone
optimization possibility

Is this benchmark interesting for power analysis?



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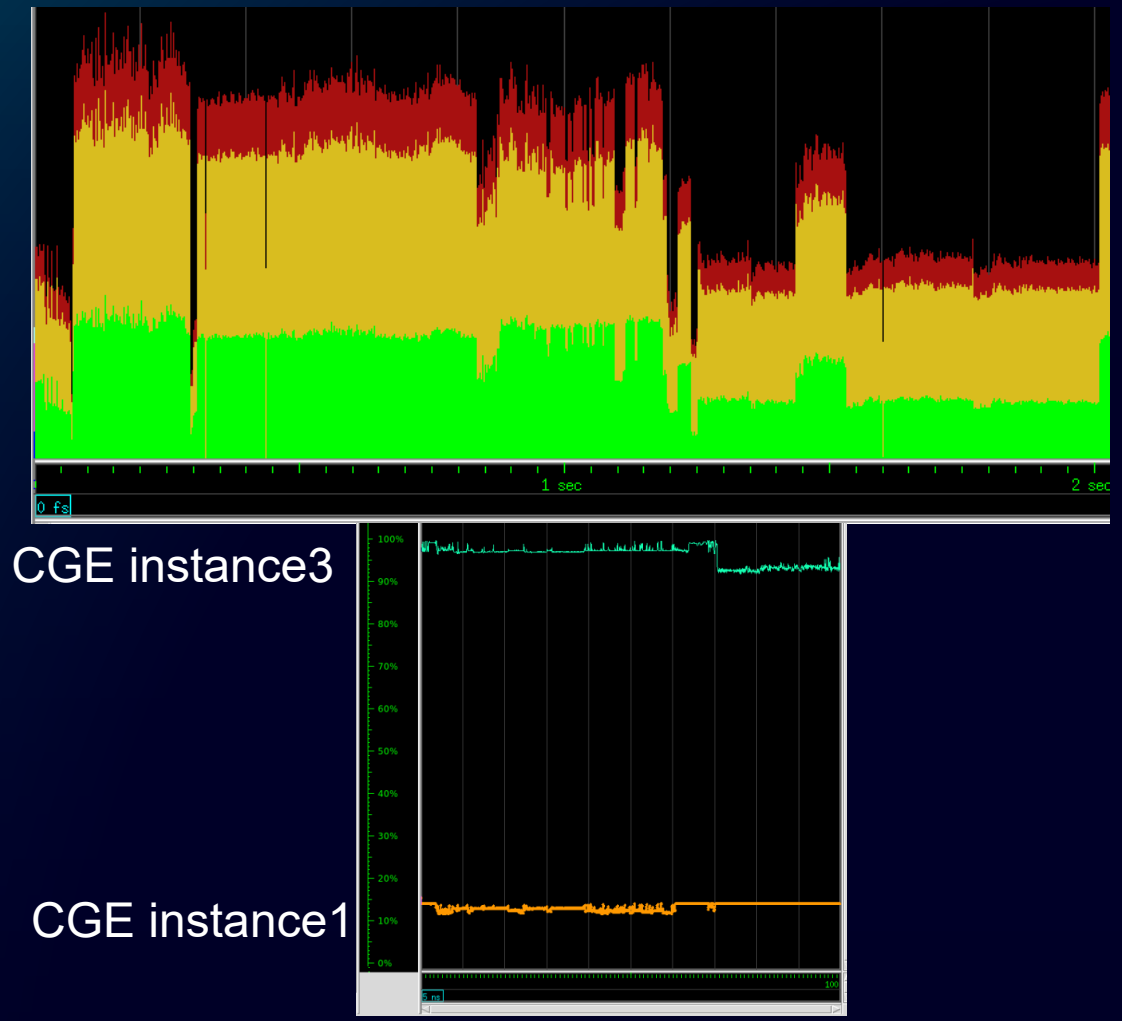
Cycle accurate power profile, CGE and FFE for entire duration of workload

- Power profile for each instance
- Power profile enables peaks and possible dynamic di/dt detection
- Time-based CGE/FFE at SoC level and within 1% accuracy from power tools
- Time-based CGE/FFE based on global/local clocks



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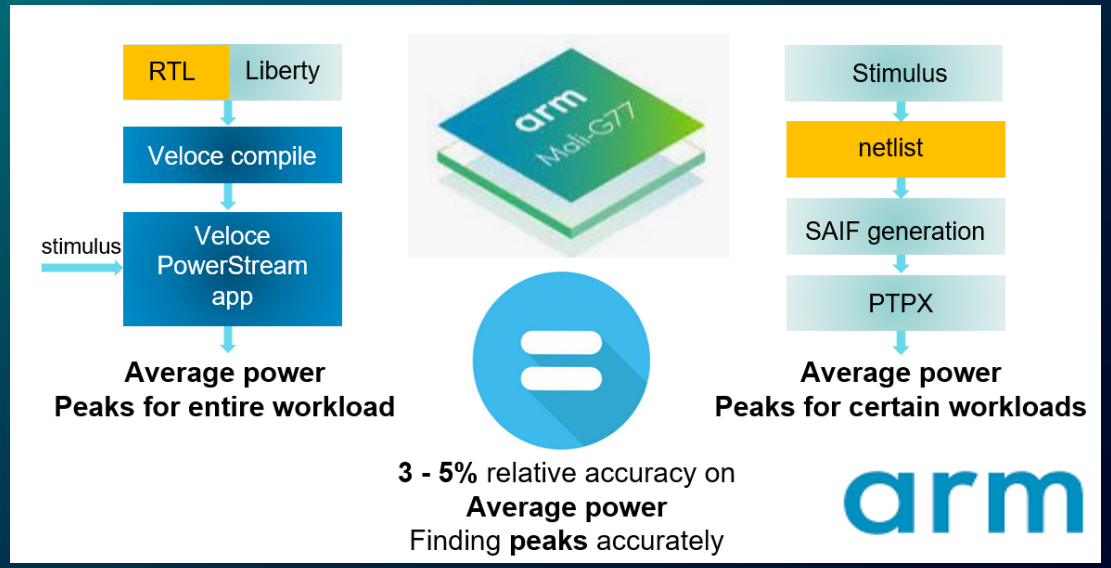
Accuracy is always a requirement



Alibaba.com

Veloce power app is a key instrument for below use cases:

- Finding peaks
- IR drop analysis → Leveraging power data for packaging guidance
- De-peaking

Emulation based power analysis address some of the challenges

- Faster TAT for activity generation & analysis
- Faster & accurate power calculation
  between emulator & power analysis t

Qualcomm

Companies with accuracy requirements for early RTL power analysis

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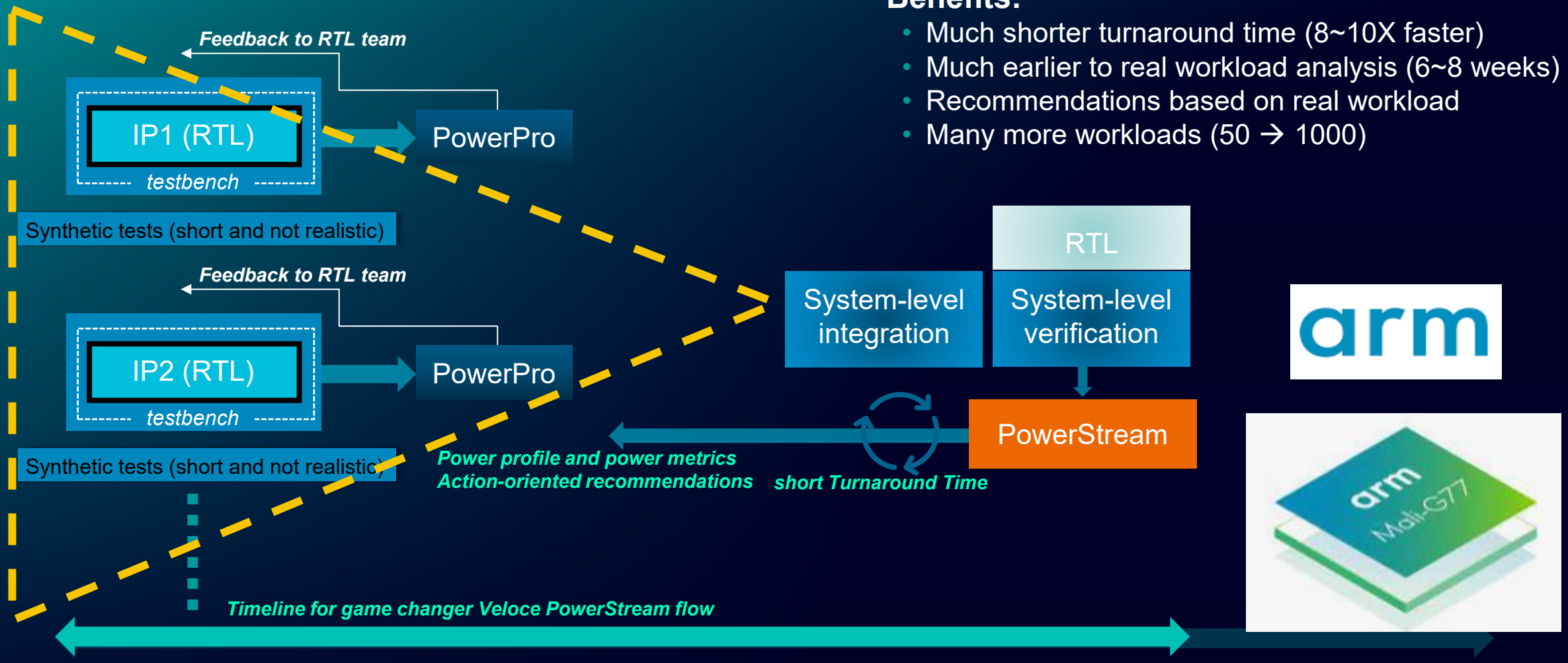
Veloce PowerStream is a game changer: SPEED disproportionately matters

Benefits:

- Much shorter turnaround time (8~10X faster)
- Much earlier to real workload analysis (6~8 weeks)
- Recommendations based on real workload
- Many more workloads (50 → 1000)



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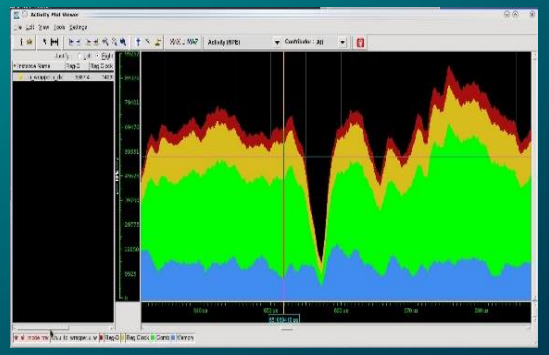
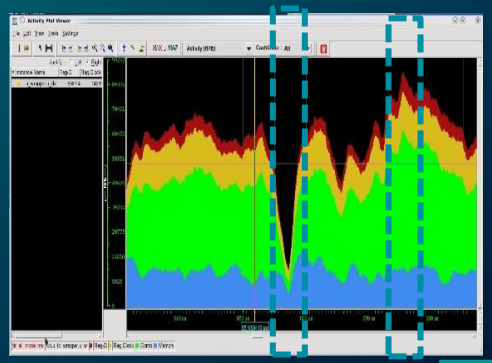
Power journey: billions of cycles to detailed power data on interesting areas





Power profile billions of cycles

Checkpoint periodically

Identify areas of interest

Streaming API

OR

File-based SAIF/FSDB

Replay from closest interval

Power tools

Power estimator

Power optimizer

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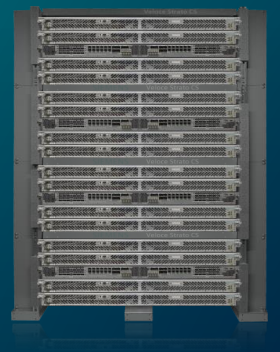
Veloce PowerPro differentiated solution

Delivers high performance for virtually unlimited capacity through design partitioning

Traditional file-based flow

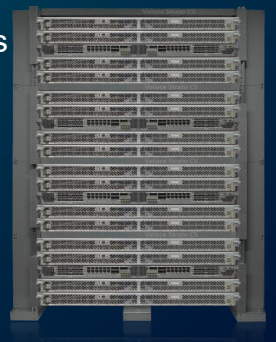


Veloce Power App → Generate file SAIF/FSDB → Power tools → Average power peak power

vs

Streaming API based flow with Power Tools

Faster | Smaller disk space | Entire workload



Veloce Power App → Dynamic API Read → PowerArtist PrimePower → Average power peak power

vs

Streaming API based flow with PowerPro

Faster | Virtually unlimited capacity | Entire workload

Veloce Power App → Dynamic API Read → Design Partitioning → PowerPro → Average power peak power

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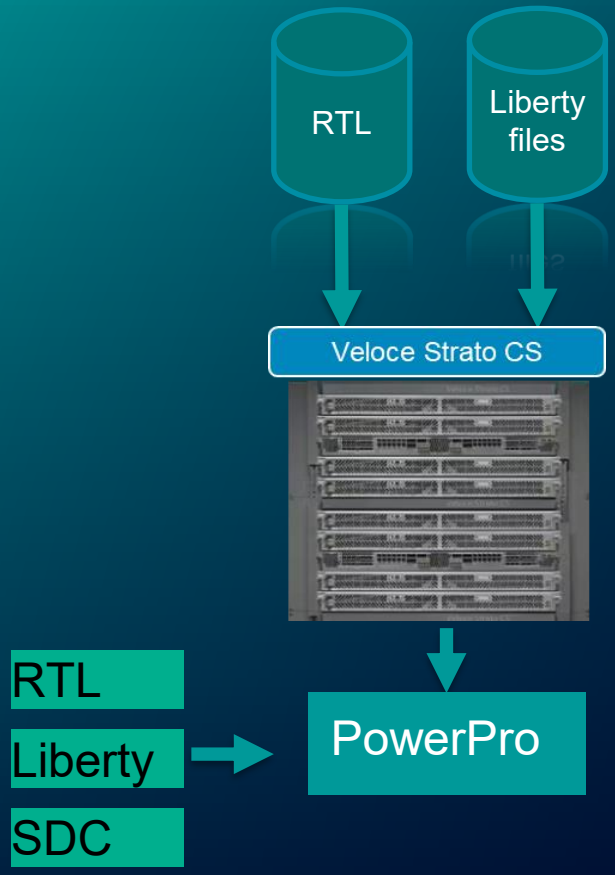
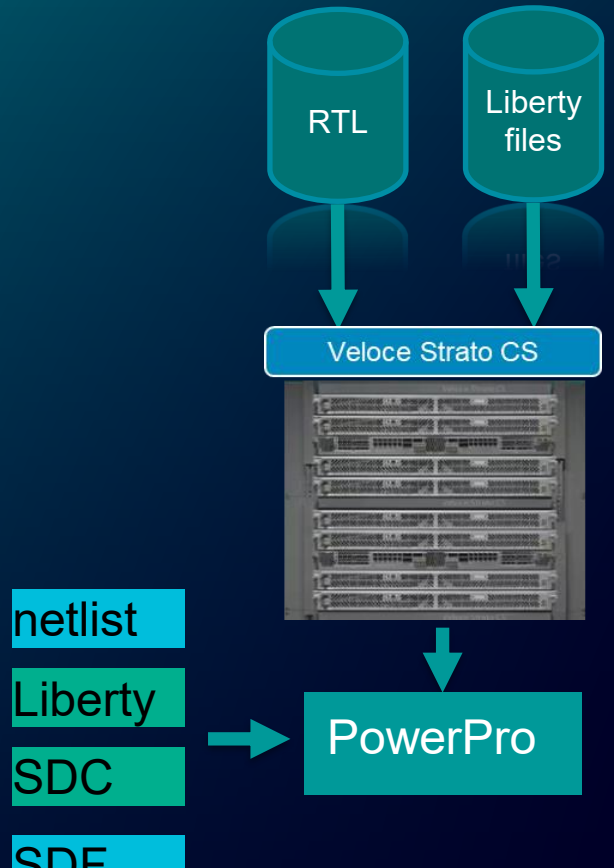
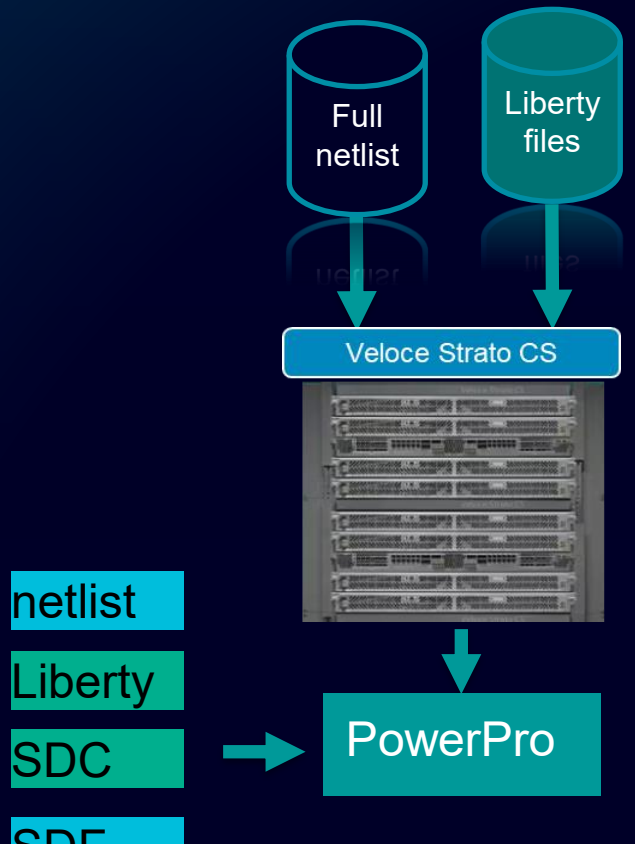
Veloce Power App + PowerPro provides versatility for different phases of the design cycle







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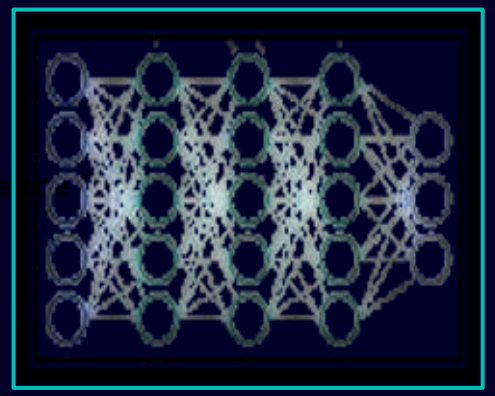
Veloce is using AI to solve AI power challenges

RTL
Liberty
SDC
SPEF



Cycle accurate power

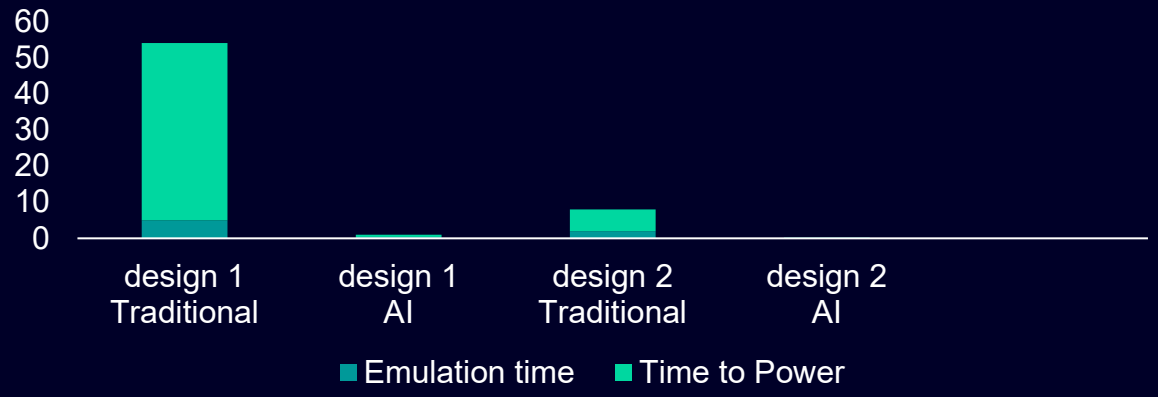
Internal power

Switching power

Clock power

CGE/FFE/CGCE

Emulation Time and Time to power comparison with traditional flow



Emulation time reduction ~10x

Time to power reduction ~ 100X

Accuracy more than 95%

Training is needed once per RTL release

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MUST: Early power analysis with real workloads!

Power analysis needs to be performed as early as possible with real workload

Highly configurable platforms will provide missing pieces to enable real workload analysis in early design cycle

Running 100s of benchmarks early in the design cycle is possible and essential!

Power impacts: What you can do…

Data centers could consume 20% of total electricity by 2030 ….

….or we can reduce that with effective power management

Thank you

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