



# System Level Tools for Power and Thermal

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Power saving can reach 40-70% if handled at the Electronic System Level

# Explore

# Develop

# Validate

- Early power-thermal exploration, dimensioning and "landing zone"
  - What-if investigation: power consumption, floor planning, assembly/package options
    - Power profiles inputs: from spreadsheets, traces, characterized data from existing design
- Implementation phase
  - Supports Power planning with feedback from thermal behavior
  - Non-regression tests
  - Converge/refine Power/Thermal behavior during implementation
    - Power profiles inputs: power traces from emulators, RTL/Gate level power analysis tools
- Validation phase
  - Replaces thermal probes (often missing or not exact placement) for debug and analysis

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Power profiles inputs: measurements, power probing

# Where is your area of concern ?



Early power-thermal-performance trade-off exploration and architecture specification

Use Case power budget tracking



Power-thermal aware software development and validation



Thermal exploration and validation



## What is the Impact of using the wrong thermal scenario?

Most Thermal Studies Use Simplistic Scenarios due to length of Transient Simulations in CFD tools



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# Validation Support

- How can I validate the power and thermal behavior on packaged devices?
  - Limited number of thermal sensors
  - Limited number of observable power ports
- Use power-thermal model!



Power traces from Validation boards





# **Solution Overview**



### CFD Import Thermal Model Capture Tool

3D geometry, floorplans, materials, heat exchange surfaces

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# Compact Thermal Model Generation



Simulation Set-up Environment

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### **Result Dashboard**



## **ESL** Power Thermal Simulation

- Enables compact thermal models generation that are a few 100 nodes multi-source models:
  - Suitable for transient simulations and dynamic thermal management modeling
- Using Thermal Models for exploring floorplans and dynamic use cases:
  - Power Architects can perform what-if analysis and take into account thermal issues at a very early stage.
  - Shorter loop cycles between thermal Experts and System Architect/Engineering teams.
- Calculate the power/temperature coupling:
  - Power profiles obtained at an assumed constant temperature can be corrected for more accurate power estimations.



# Power/Thermal aware software development:

## Example of thermal management policies Cosimulated with a Virtual Platform



# MPSoC use case: LOCOMOTIV

- LOCOMOTIV architecture
  - -Multi-Core with shared memory
  - -Thermal sensors
  - -Power management
    - •Local: adapts to process/ageing/temperature
    - •Global: DVFS control per core
  - -Hardware Assisted Runtime Software (HARS)
- Pedestrian Detection Application
  - -Variable execution time
  - -Parallel execution





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# **Power & Thermal Aware Virtual Platform**



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# **Thermal Management Policy Comparaison**





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## Validation with real software



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