

Elongate : Energy and power efficiency with Adaptive Voltage Scaling in commercial FPGAs

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Elongate is an adaptive voltage scaling technology based on in-situ detectors that allows reconfigurable semiconductor chips to control their own energy and power consumption at run-time. It automatically adjusts operational points to accommodate changes in the fabrication process, temperature and application load.

Introduction

Future microprocessors face an energy efficiency crisis as we move towards deeply integrated multi-core heterogeneous architectures. This is shown in the ITRS technology predictions (Fig. 1) which predicts that over the next decade, chips will increase their power requirements by almost one order of magnitude .

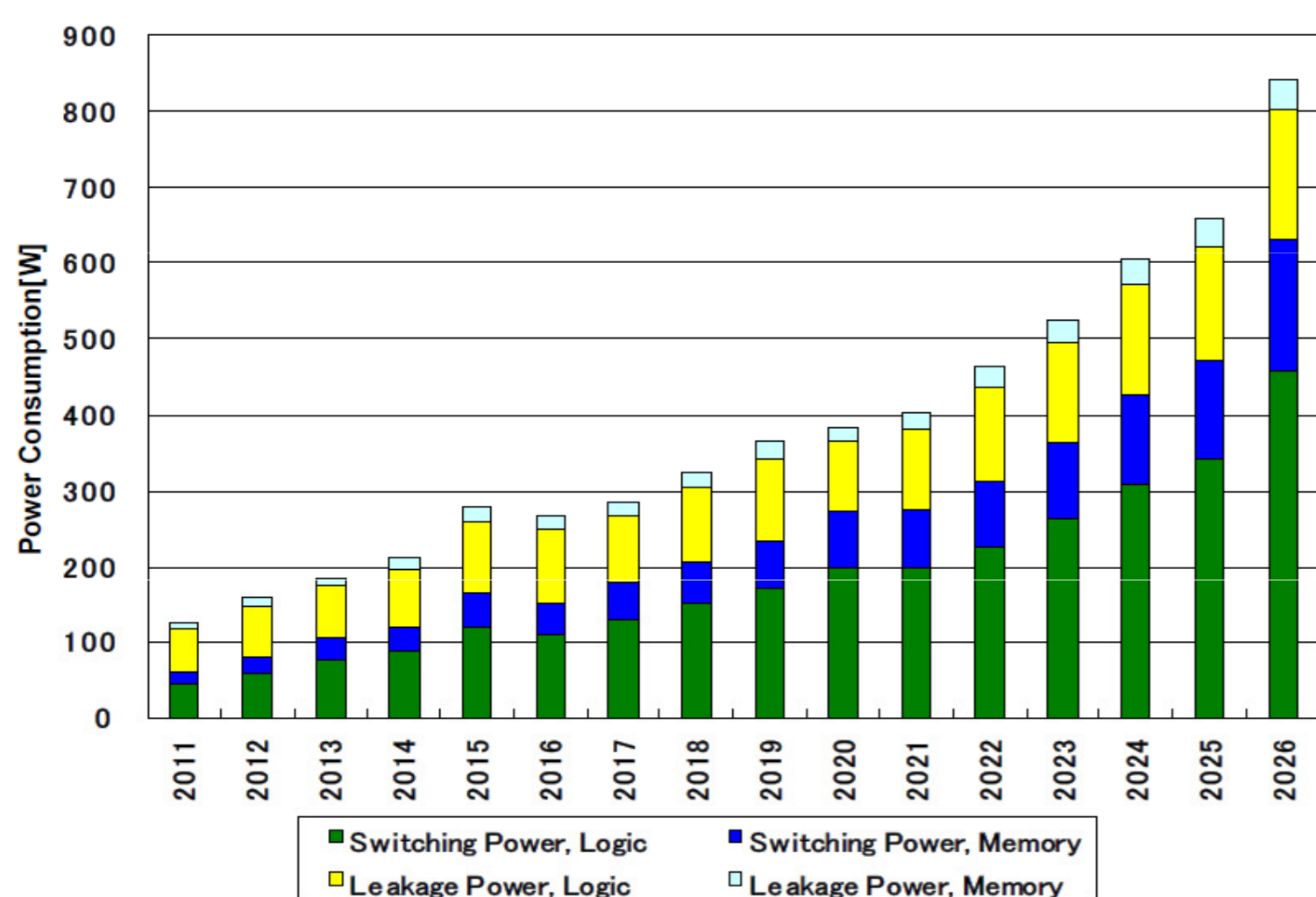


Fig 1 . ITRS power predictions.

Elongate system-on-chip architecture

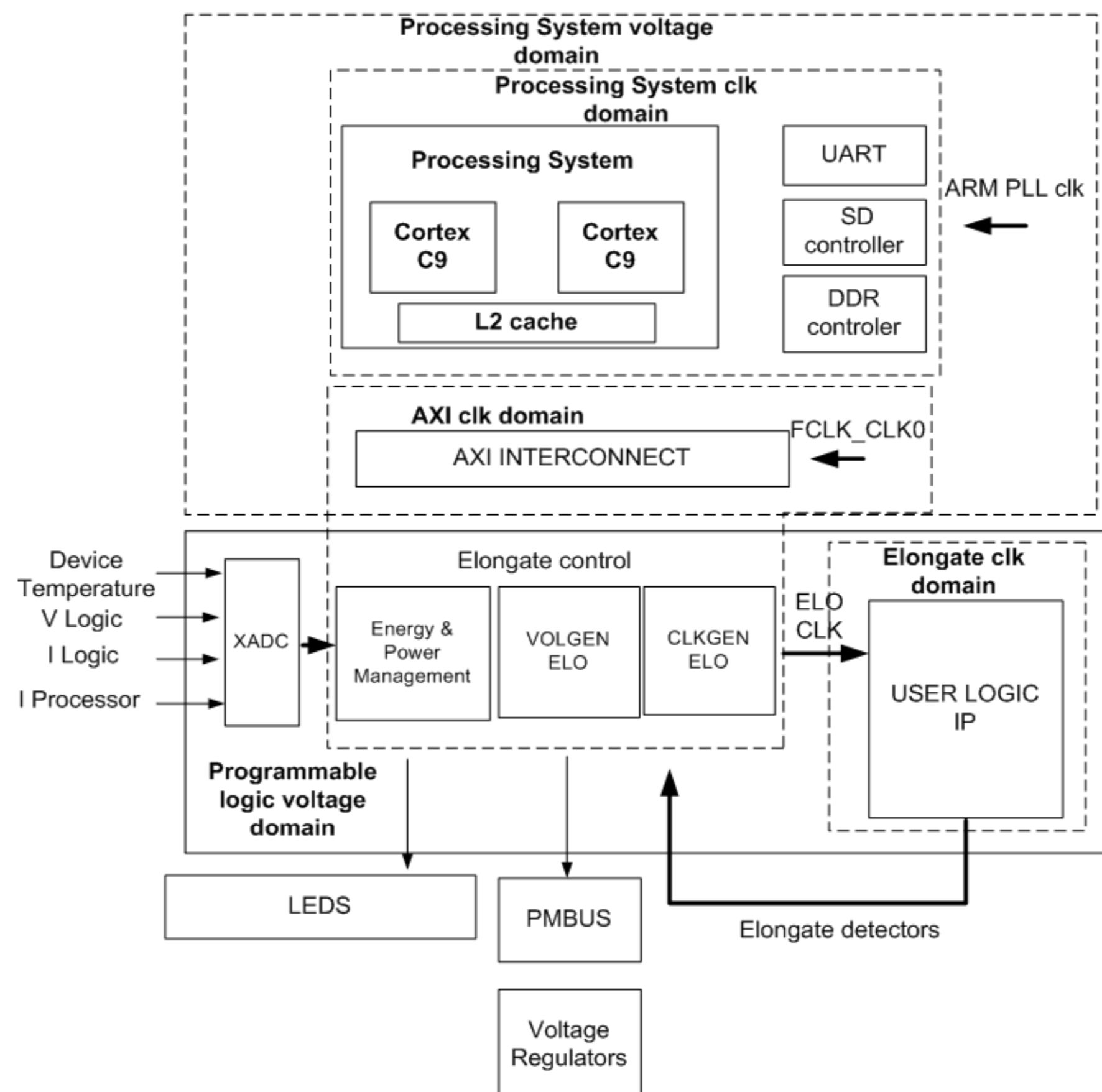


Fig 2 . ZYNQ-based Elongate system (FPGA+CPU)

System monitoring

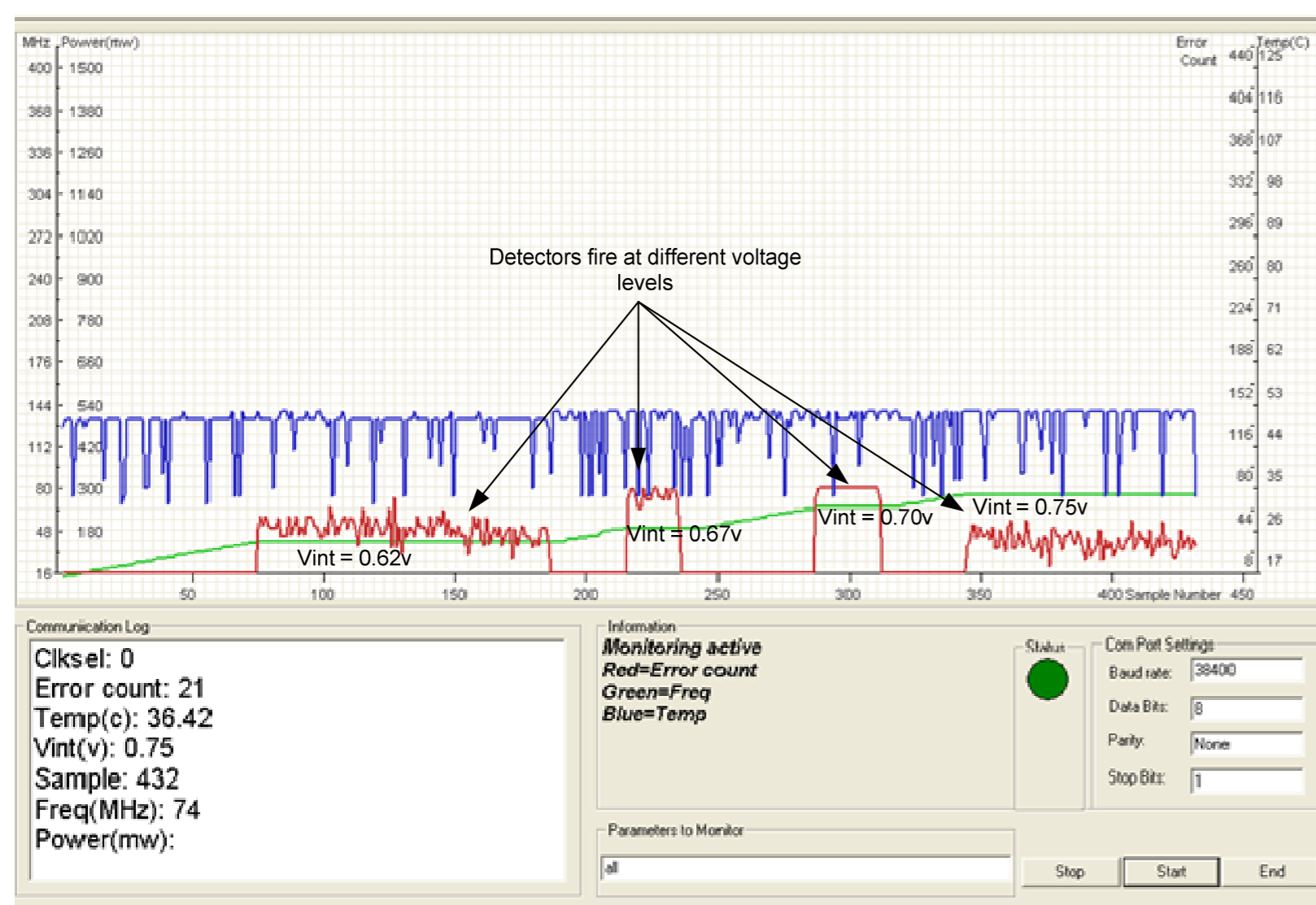


Fig 4 . Run-time system monitoring

Energy reduction

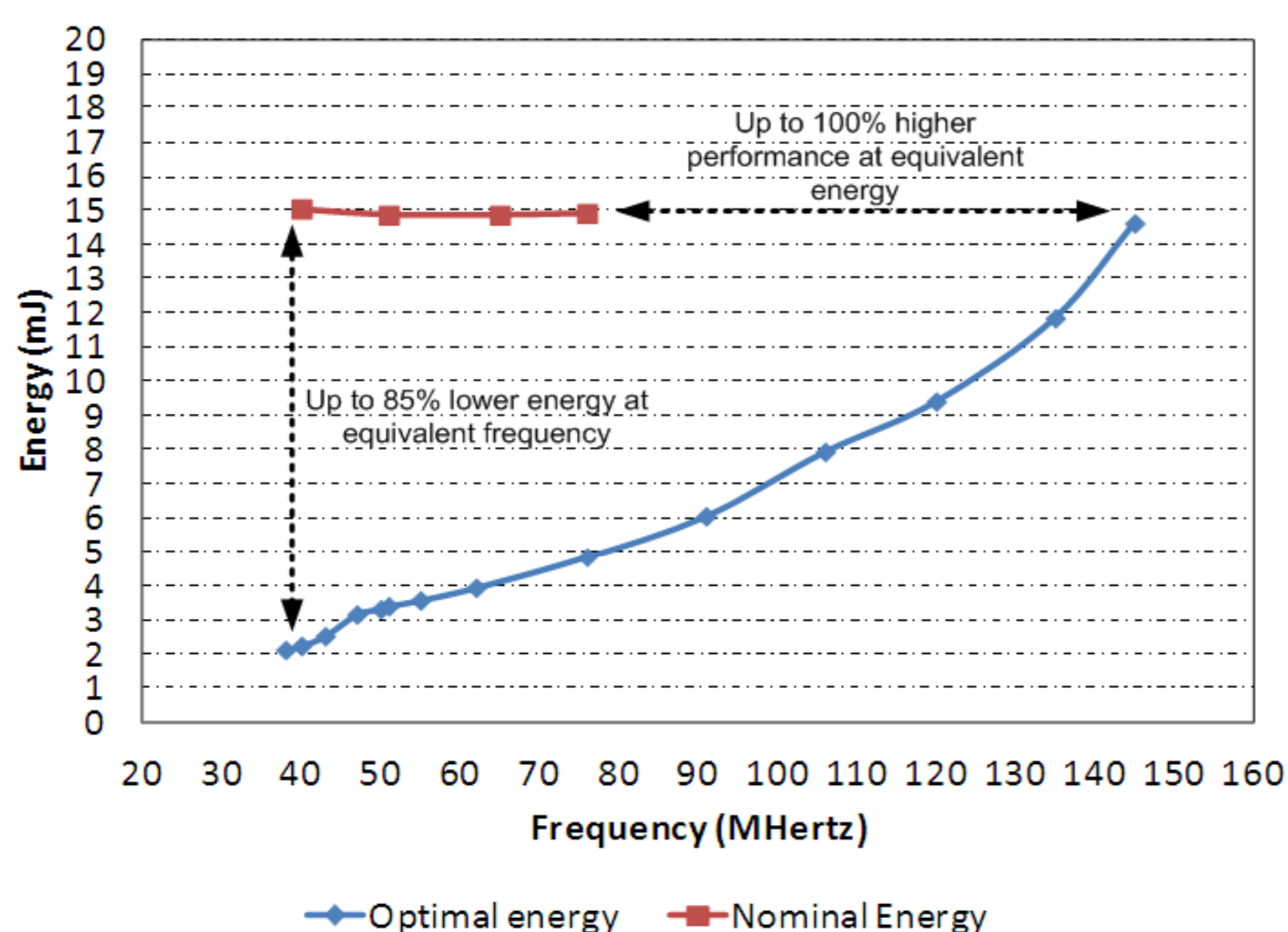


Fig 5 . Energy and performance scaling.

Elongate tools

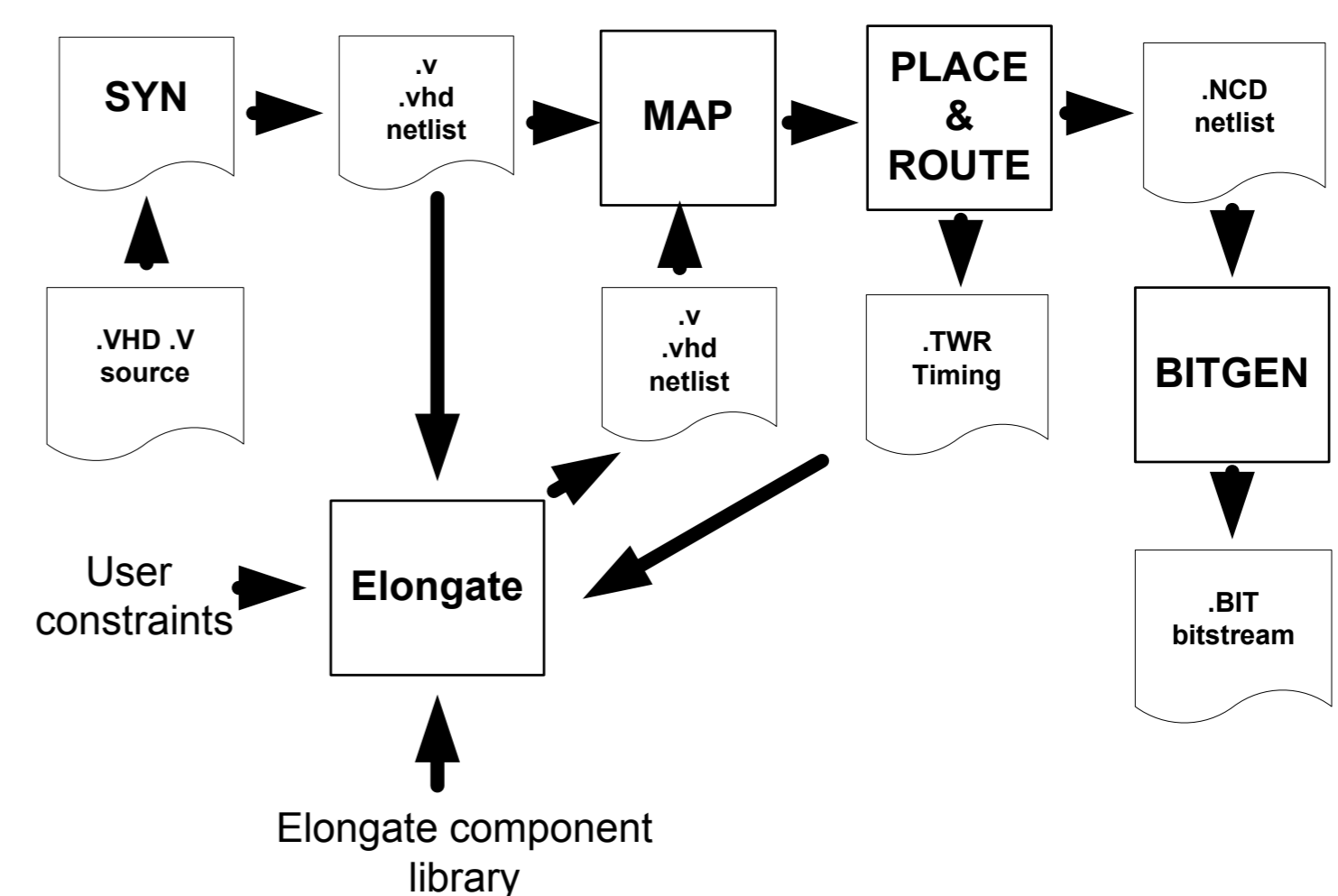


Fig 3 . Elongate toolset embeds power adaptive controller IP and soft-macro detectors in a user design.

Conclusions

- Works with standard Xilinx FPGA devices in state-of-the-art 28 nm fabrication processes (e.g Zynq) and also older 65 nm processes (e.g. Virtex-5).
- Different operational models under investigation:
 - **Performance driven** => system delivers maximum level of performance at nominal energy.
 - **Energy driven** => System delivers best possible performance at minimum energy.
 - **Balanced** => System delivers requested performance level at minimum energy.
- Patent pending technology.