Multiprocessor and distributed computing systems

Heterogeneous many-core processors

VIPE (Visual Integrated Development Environment)

Get ready for heterogeneous manycore future

Nowadys embedded systems are used in the broad range of domains such as avionics, space industry, automotive industry, mobile devices and home appliances and so on. Common practice for such projects is to use many core heterogeneous hardware platforms. Software development for these platforms are sophisticated task. Thus to design successful embedded solution for highly competitive markets tools for strong collaboration between various teams are needed: domain specialists, algorithm designers, embedded engineers, managers, customers and external reviewers. Industry needs a development environment with a required layer of abstraction to both developers and automated tools designed to find the optimal solution under the conditions of mutually exclusive constraints.

Computer vision

Fog computing

Aerospace industry

Other domains
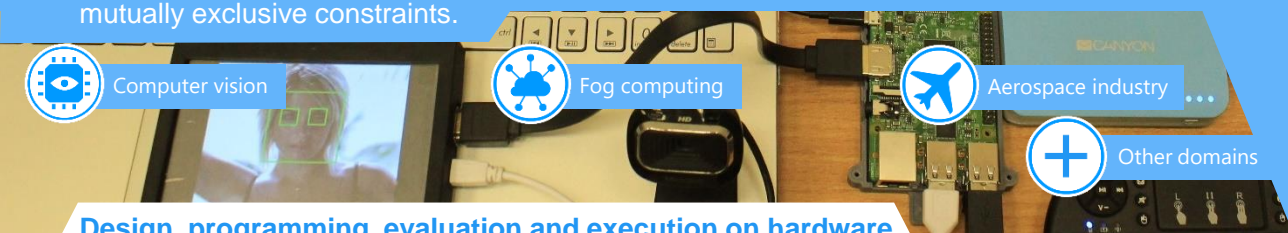
VIPE

Design, programming, evaluation and execution on hardware

VIPE is integrated development environment for designing portable software for embedded many-core systems. It uses VPL (Visual Programming Language) and a set of expandable DSLs written in this language. This approach allows to involve different specialists into development process, for example, domain experts, and helps teams to cope with large complex projects in more comprehensible and productive way. VIPE provide a full stack for software development lifecycle (SDLC), from designing program scheme to generation of final code, ready to deploy onto a target platform. During the analysis and code generation in VIPE such target platform features as manycore-ness, multiprocessing and heterogeneity are taken into account.

Supports:

OpenVX
Pthreads
OpenCV
OpenCL
MPI

Check out VIPE features
(5 minutes video)

Programming on VIPE
The prototype, running on x86

Design your product

VIPE allows to create DSL particularly for your domain.
Thus, domain experts could design program prototype and evaluate it independently from (or with a limited involvement of) coder/developer within a short time.
Environment tools (creation, evaluation and generation of code) allow to:
  o Develop program prototype quickly and show it to the potential customers
  o Develop a parallel program, that executes efficiently on a target hardware platform
  o Reduce time to market
  o Reuse developed program for other configurations of target platform, and also adopt it for other target platforms

CPU? CPU?
GPU? DSP?

ARM
MIPS
x86

Base platform
Target platform

Another platform

VIPE in PaPP project, Artemis
(20 minutes video)

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Task

Result

Support your product

Flexibility of VIPE allows to configure instrument exactly for target audience of your product. By using inner mechanisms of VIPE the level of user influence onto the embedded software development process could be regulated: either user will make decisions or VIPE IDE, for example task allocation on a platform.
VIPE could give additional incentive to promote your product on the market. The range of supported products is wide: from set of microcontroller with sensors and peripherals to smart cameras and even more complex products.

Microcontrollers

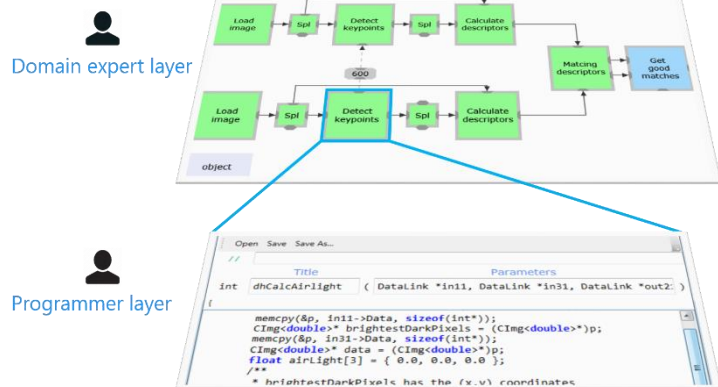· Using VIPE for recognition and tracking of people system (project on MIPS Creator Ci 20)

?

Other domains

Smart cameras
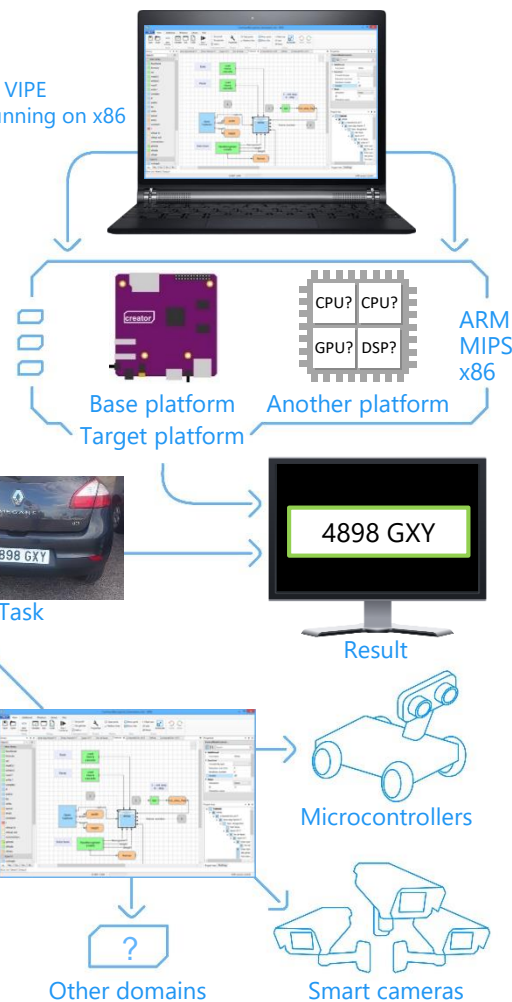
VISUAL PROGRAMMING ENVIRONMENT

Domain expert layer
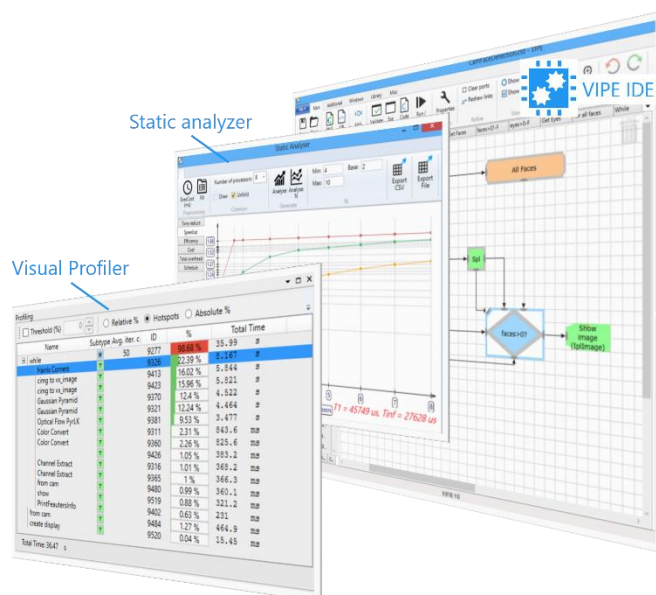
Programmer layer

- Development environment for visual parallel language VPL
- Separation of design and programming:
    - Design is for domain experts
    - Programming is for developers and coders
- Domain-driven development, visual component libraries for various domains
- Built-in tools for validation and interactive debugging
- Verification of parallel programs
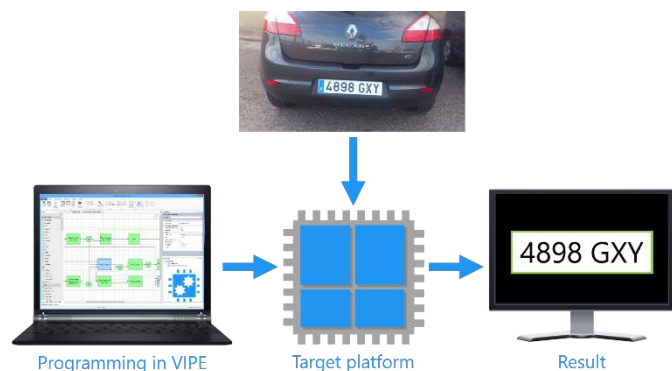
EVALUATION TOOLS

Code profiling on host computer

- Easy to grasp profiling reports to identify bottlenecks and critical paths in your programs
- Quick early estimation of program characteristics and inherent parallelism of an algorithm
- Detailed evaluation of parallel program characteristics with VPL simulator
- Analysis of parallel program's behavior on a simplified model of heterogeneous manycore platform
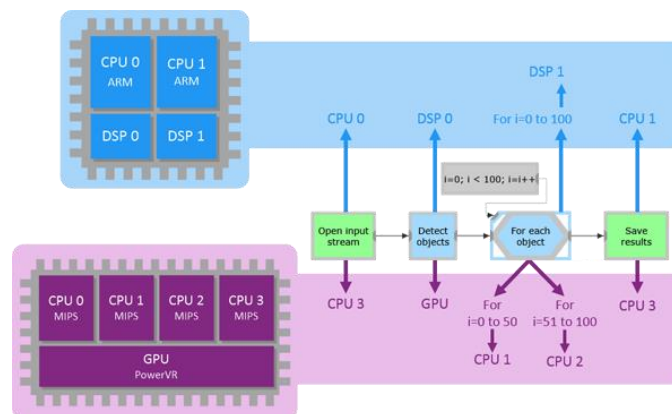- Selecting platform for a specific task

Static analyzer

VIPE IDE

Visual Profiler

CODE GENERATION TOOLS

Programming in VIPE   Target platform   Result

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- Code generation to test a program on a host computer
- Parallel code generation for various target platforms
- Applying of various optimization methods to match platform features: heterogeneity, core count, memory, internal communicational system, etc.
- Possible integration with a compiler and other external tools to build, load and run program on target platform
- Remote debugging on a target platform

HETEROGENEITY AND MANYCORE SUPPORT

Heterogeneity and manycoreness of the target platform are the features that are taken into account during code evaluation and generation. Evaluation tools allows to estimate the scalability and other parallel program characteristics for various platform configurations, variants of program components allocation and scheduling of computations. VIPE has the means to control the assignment of computations on different types of platform cores (supported by implementation of operators).
The environment generates parallel code ready to run on a target platform with a chosen configuration.

Find more on www.vipetech.ru/en

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