Intel® Software Development Products for MeeGo*

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Dec 3rd, 2010

intel AppUp℠ developer program

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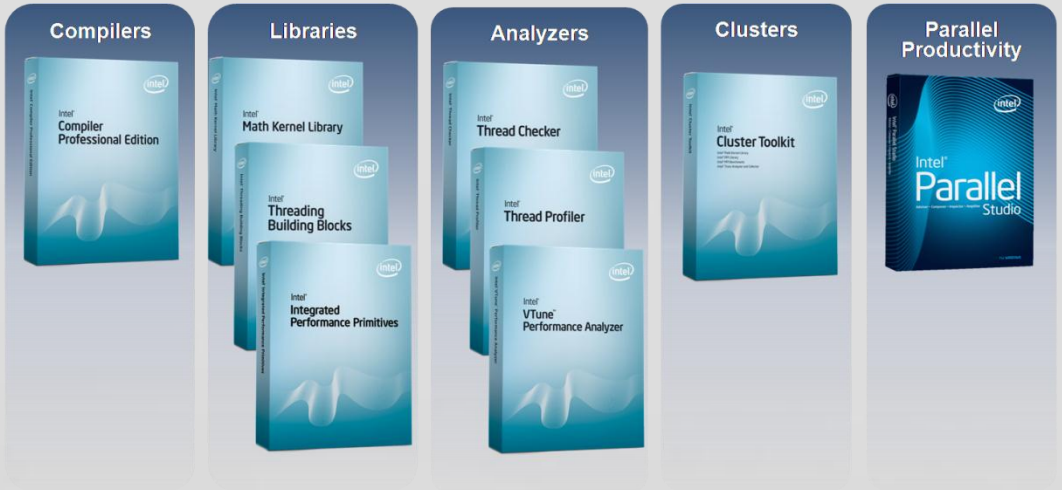
Intel® Software Development Tools Agenda

- Overview
- Optimizations
- Tools Components
- Vision

Intel – A Software Development Tools Provider

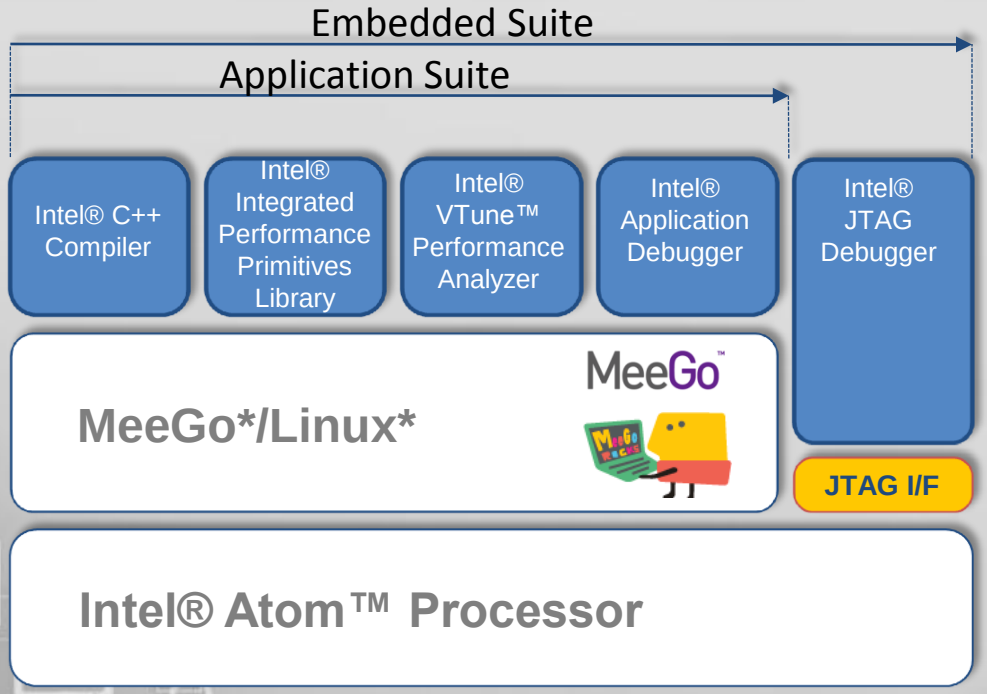
- Intel® SSG/Developer Products Division (DPD)
- Premium class tools for Intel® Architecture
- All Platforms
  - Windows*, Linux*, Mac OS*
  - MeeGo*
  - RTOS
- Focus on Performance, Parallelism, Power Consumption, Embedded SW Development



http://www.intel.com/software/products

Software Development Tools & MeeGo*

Market segments for Intel® Atom™ processors



Intel® Software Development Tools for better devices & better apps

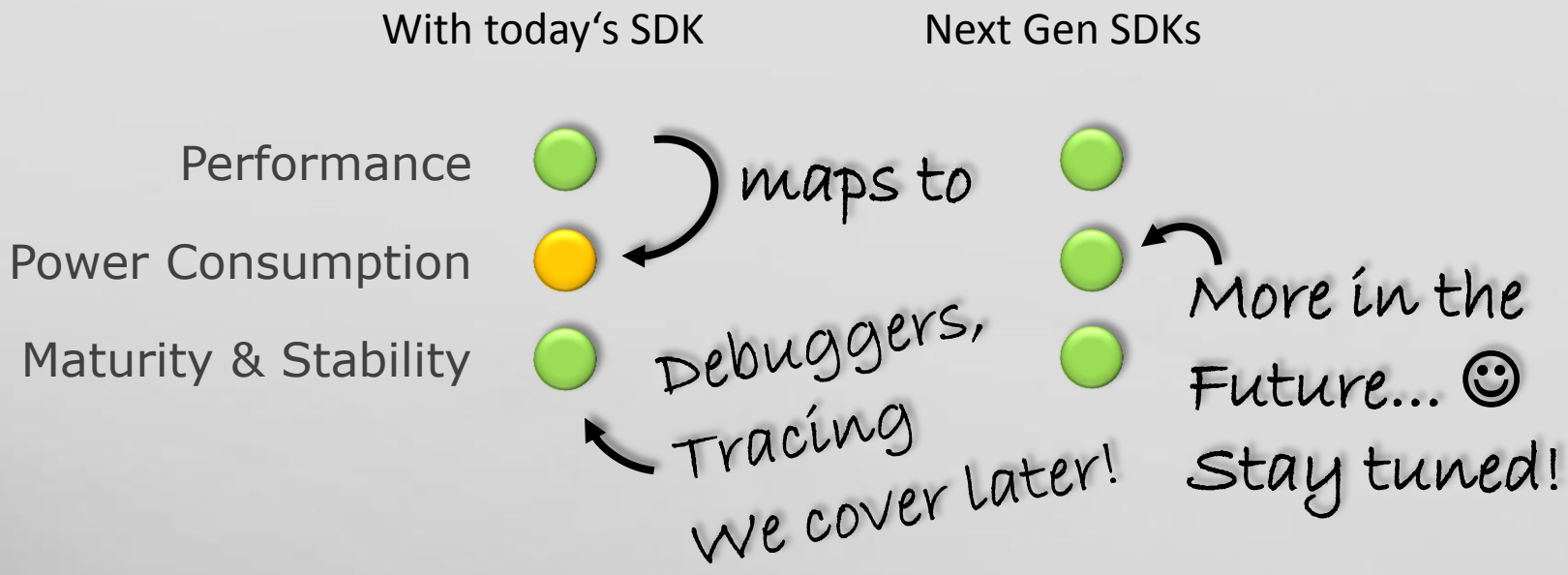
- More performance
- Less power consumption
- Robust SW
- Efficient debug sessions

Intel® Application SW Development Tool Suite → ISVs/MeeGo* Community

Intel® Embedded SW Development Tool Suite → OEM/ODM/OSVs

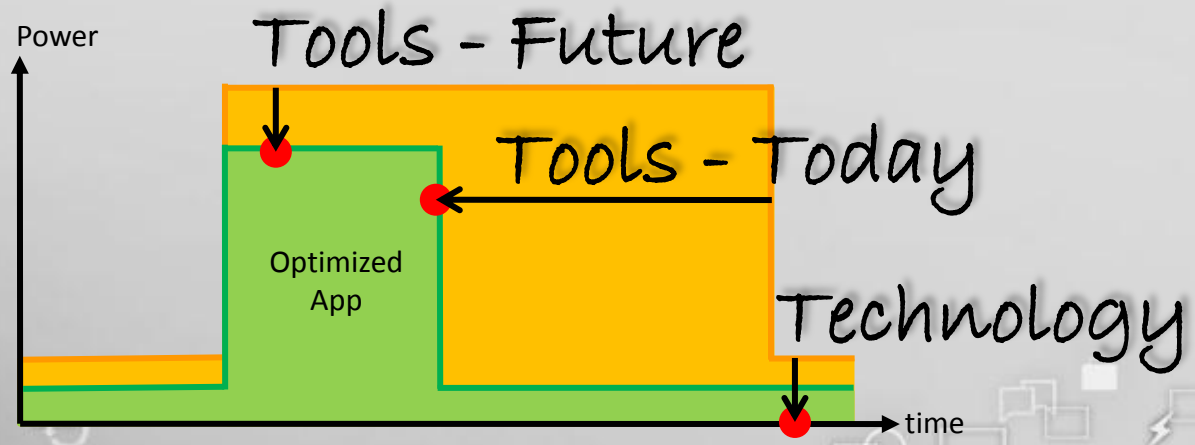
http://www.intel.com/software/products/atomtools

Optimizing Applications

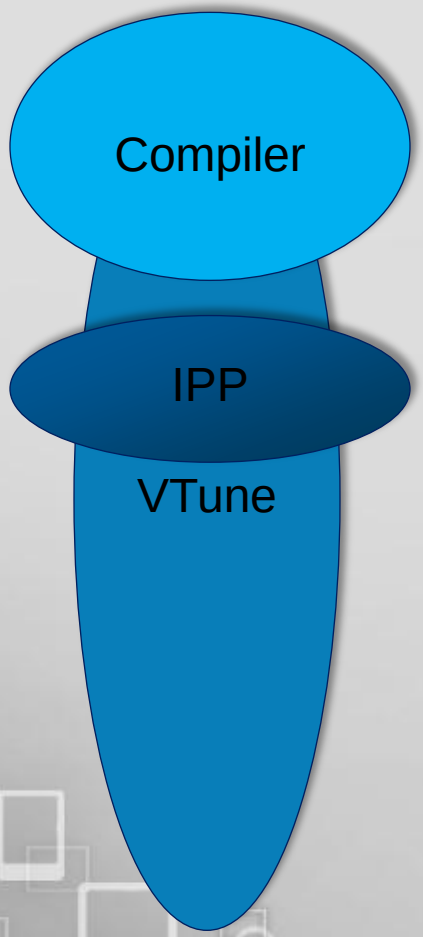


Performance vs. Power

- Performance optimized
  - Fast execution → earlier back to idle → less power consumption
- Power optimized
  - Technology driven → Silicon manufacturing process
  - Optimized OS
  - Efficient usage of SoC components during app execution



Performance Optimization Principles



Re-compile

- –xSSE3_ATOM (Atom switch / in-order scheduler)
- IPO (interprocedural optimization)
- PGO (program guided optimization)
- Threading *(works on multicore/HT only) – source modification*

Implement library functions

- Highly optimized multimedia/math library functions
- OpenMP compiled *(works on multicore/HT only)*
- Update application source code & build environment

Modify source code

- Identify C and ASM – source spot optimization opportunities
- Analyse results – update sources, rebuild, analyze again

Compiler: Intel® C++ Compiler
IPP: Intel® Integrated Performance Primitives Library
VTune: Intel® VTune™ Performance Analyzer

Intel® VTune™ Performance Analyzer

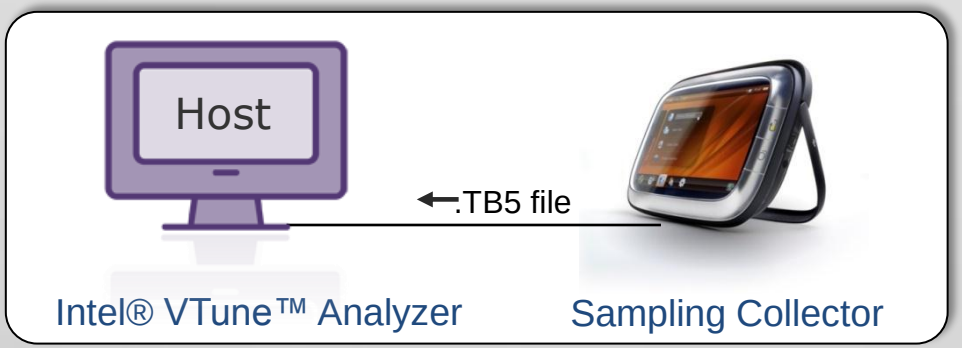
Identifies hard to find performance bottlenecks

Features

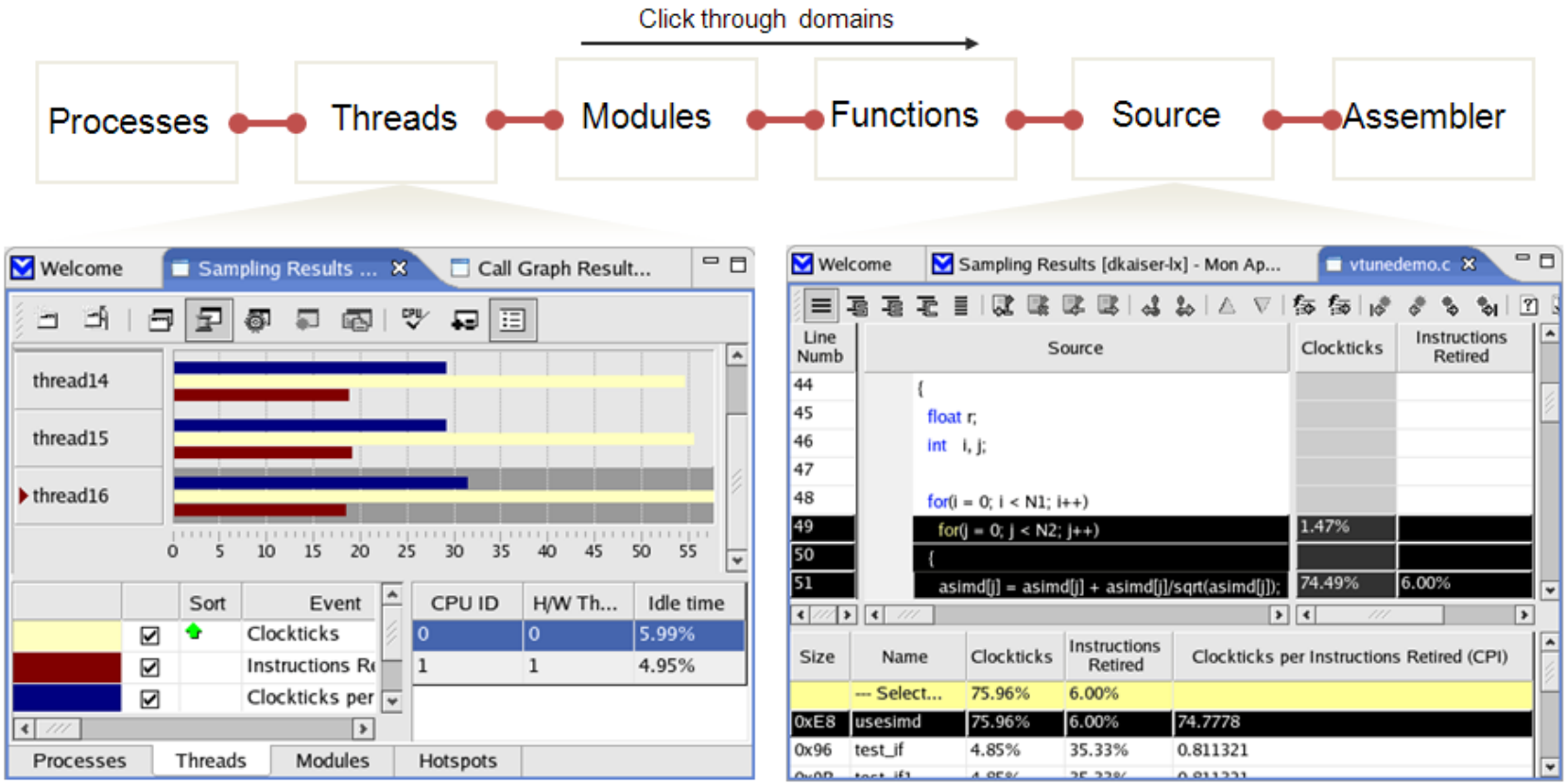
- Statistic Analysis
- Low overhead sampling
- No instrumentation required
- Monitor processor events like cache misses etc.
- View results in source or assembly

Usage Model

- Two components
  - Intel® VTune™ Performance Analyzer on host
  - Sampling Collector on the target
- Collect data on target and analyze it on the host



Take Advantage of Sampling Data

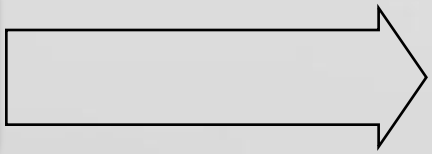


Focus your application optimization efforts where it counts – Intel® VTune™ Performance Analyzer helps to analyze applications without source and binary instrumentation

Need For In-order Scheduler Support
- avoid dependency stalls

Consider code sequence:

```
a = b * 7;
c = d * 7;
```



Representative assembly:

Processor cycles

```
1 movl b,%eax
```

Memory Load Dependency Stall — Dependency

```
2 imull $7,%eax
3 movl %eax,a
4 movl d,%edx
```

Memory Load Dependency Stall — Dependency

```
5 imull $7,%edx
6 movl %edx,c
```

- In some cases assembly code causes delays and dependency stalls which decrease the performance of application and performance critical code

Need For In-order Scheduler Support
- avoid dependency stalls

Consider code sequence:

```
a = b * 7;
c = d * 7;
```

-xSSE3_ATOM compiler switch

in-order scheduler

Representative assembly:

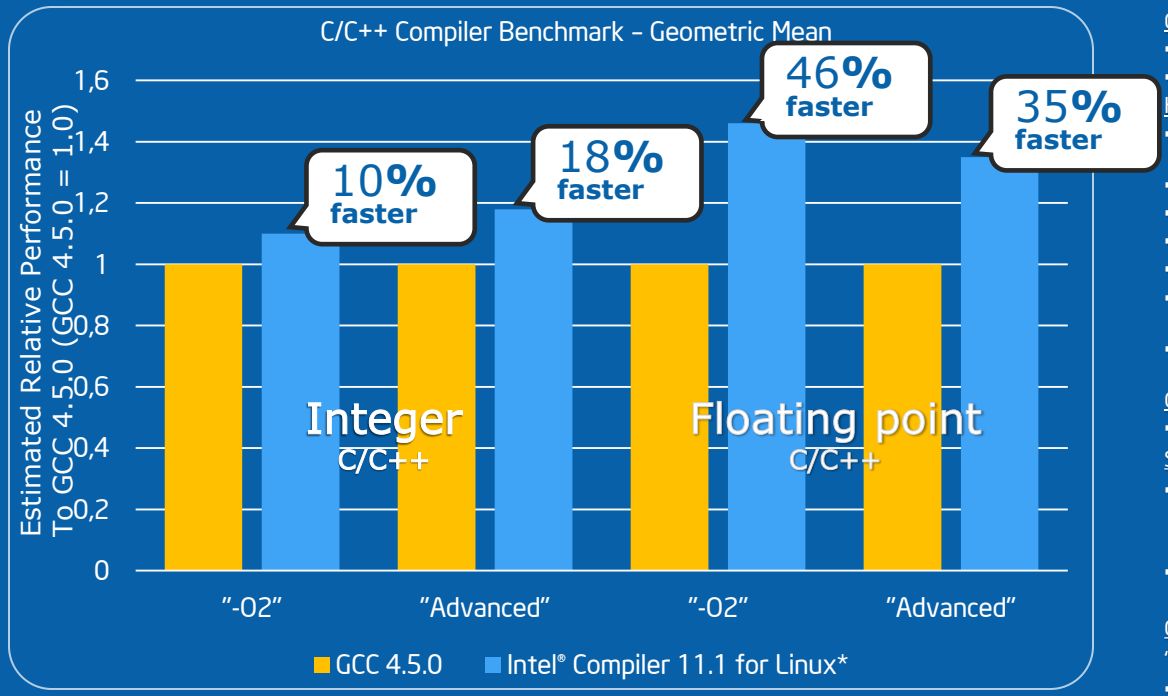
Processor >>>cycles

```
1 movl b,%eax
4 movl d,%edx
2 imull $7,%eax
5 imull $7,%edx
3 movl %eax,a
6 movl %edx,c
```

- Compiler switch –xSSE3_ATOM enables the in-order scheduler, which may improve application's performance behavior

C/C++ Compiler Benchmark

Intel® C++ Compiler 11.1 for Linux* VS. GCC 4.5.0 based on SPEC* CPU2000 estimated results – July 30th, 2010



For more information on the compiler's optimization approach, please refer to the page labeled with "Optimization Notice" in the backup

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Estimated by measurement on internal systems based on the following configuration assumptions:

- Source: Intel estimates as of July 30th, 2010
- Basis of comparison: Intel estimates of Intel and GCC compilers as of July 30th, 2010

Compilers:

- Intel® C++ Compiler 11.1 for Linux* (ICC)
- GCC 4.5.0

Hardware:

- Intel® Desk Top Board D945GCLF2 with Intel® Atom™ processor 330 1x1.60GHz, 2GB, 512 KB, 533MHz system bus
- Form factor: Mini-ITX / micro-ATX compatible
- Chipset: Intel® 945GC and ICH7
- Audio: Realtek ALC662 audio codec (5.1 channel HD audio)
- Video: Intel® Graphics Media Accelerator 950 & S-video output support
- I/O Control: SMSC LPC47M997 based Legacy I/O controller for serial, parallel, and PS/2 ports
- LAN control: 10/100/1000 Mbits/sec LAN subsystem using the Realtek LAN adapter device

Operating System:

- Red Hat* Enterprise Linux Server release 5 (Tikanga)

SPECint* base2000 and SPECfp* base2000 from SPEC CPU2000 V1.3

- SPEC and SPECint, SPECfp are trademarks of the Standard Performance Evaluation Corporation. For more information see www.spec.org
- SPEC has retired SPEC CPU2000 and is no longer publishing results on its website

Compiler switches used for estimates:

"-O2"

- ICC: -O2
- GCC: -O2

"Advanced"

- ICC: -O3 -ipo -no-prec-div -xSSE3_Atom -prof_gen -prof_use
- GCC: -O3 -ffast-math -funroll-all-loops -m32 -mtune=atom -msse2 –fprofile-generate –fprofile-use

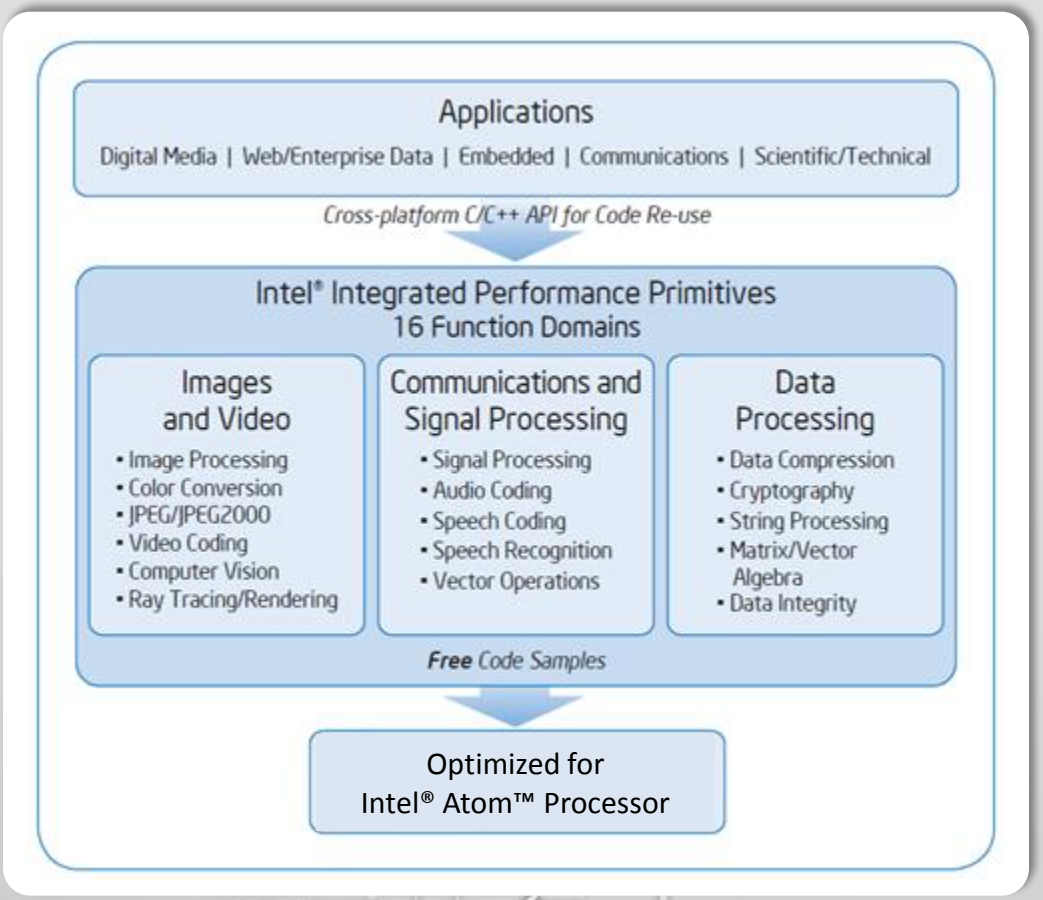
Note:

- Floating point geometric means are based on the C/C++ workloads from the SPEC CPU2000 floating point suite (177.mesa, 179.art, 183.equake, 188.ammp)

Use Intel® C++ Compiler for higher performance on Intel® Atom™ processors

Intel® Integrated Performance Primitives (Intel® IPP) Library

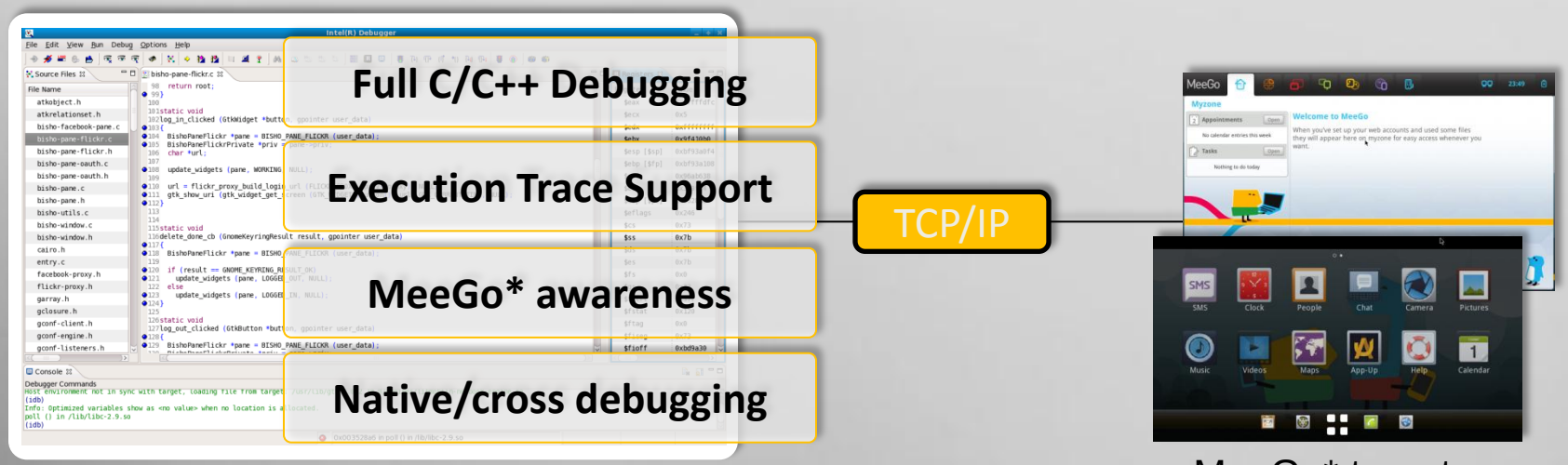
- **Highly optimized multimedia functions**
  - **Images & video**
  - **Communication & signal processing**
  - **Data processing**
- **Fully utilizing**
  - **Intel® MMX™ technology**
  - **SSE2, SSE3**
  - **Multi-core / Intel® Hyper-Threading technology**
- **Rapid application development**
- **Cross-platform compatibility & code re-use**
- **Outstanding performance**



Application Debugging on MeeGo*

intel AppUp℠ developer program

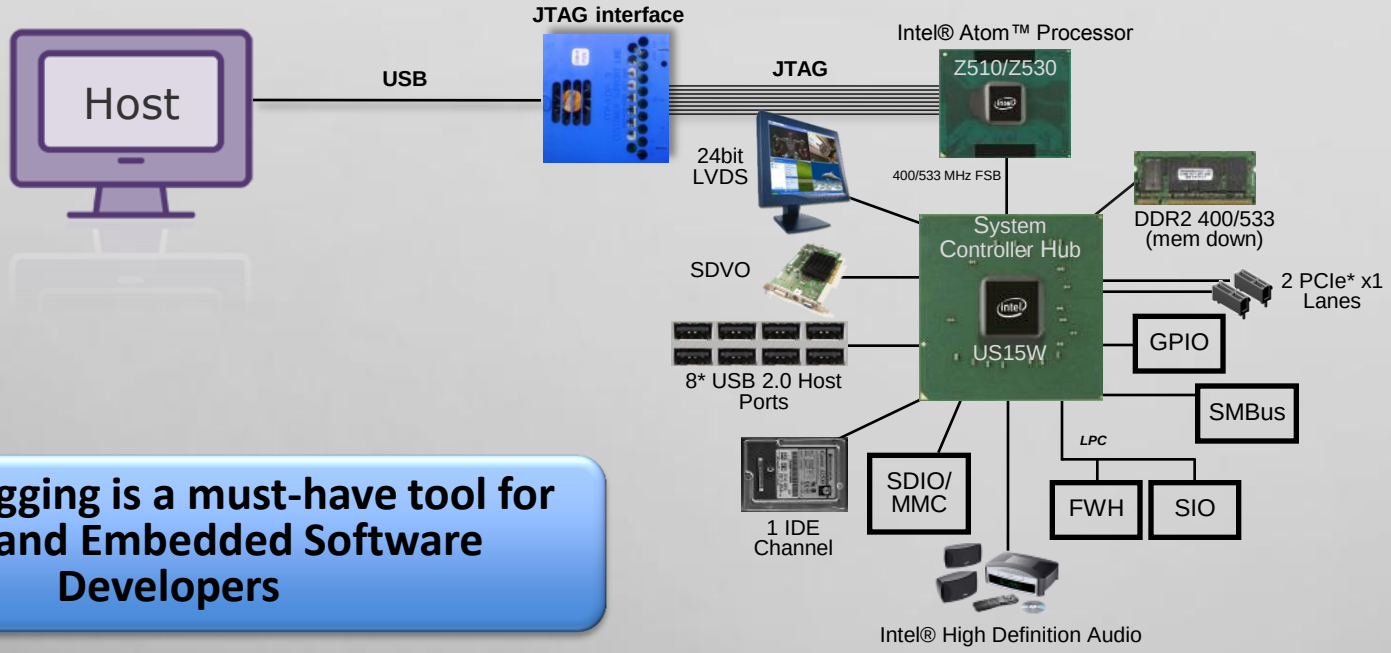
- Intel® Debugger offers full Eclipse* GUI debug approach
- Small or custom form factor usually makes native debug undesirable
- Solution: Cross-debug using TCP/IP for application debug
  - on QEMU virtual machine
  - on Intel® Atom™ processor based target hardware device
  - Into MeeGo Image Creator change root system



Intel® JTAG Debugger

intel AppUp℠ developer program

- Cross-debug using JTAG for system, MeeGo* OS and device driver debug
  - on Intel Atom processor based target hardware device
- System Software Development starts with bare metal programming
- JTAG connector on the target hardware required – to access
  - CPU registers
  - SoC components / peripheral registers
- Support for Macraigor* "usb2demon*", visit: www.macraigor.com/intel



JTAG Debugging is a must-have tool for OEMs, and Embedded Software Developers

Vision

- Complete Solution
- Qt Creator integration
- Power Analysis
- and more...

Tools Summary

- Intel® Software Development **Tools for OEMs, OSVs,** (“Embedded Suite“) and **ISVs** (“Application Suite“) **cover the entire cycle of SW development**
- Intel® Tools for Intel® Atom™ processors **target and integrate with MeeGo* environment**
- Intel Tools provide a **complete spectrum of performance optimization** methodologies (compiler switches, Intel® Integrated Performance Primitives (Intel ® IPP) multimedia libs, performance bottleneck analysis with Intel® VTune™ Performance Analyzer)
- Even **tighter integration with MeeGo** and QT Creator* in the making
- Power Analysis Tool targets power hogs and identifies **power optimization opportunities**

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Optimization Notice

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