ESL Adoption

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Main ESL drivers

- Increasing SW content
  - SW can't wait for HW delivery
  - Same SW needs to be tailored for multiple HW platforms
- Need to Reduce Overall Product Development Time
  - Early validation and verification
    - less iterations in design, maybe avoid an ASIC round
  - Parallel SW and HW development
- Growing Importance of Reusable Platform Concept
  - Scaling a desired functionality to varying product categories
  - Customizing a generic platform for an individual element in a product family

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Current challenges in design areas

- SW
  - Late availability of platform model
    - Wait for RTL
  - Emulation approach expensive and complex
    - SW based solution would allow larger use base

HW IP

- Late feedback from SW for HW development
- Allow better re-use of C-based test benches
- HLL (C/C++) -> RTL synthesis

Architecture development

- Architecture exploration more dream than reality
  - limited possibility to use simulation techniques in early design phases
- Difficult to analyse effect of multiple parallel operations with static analysis

Platform management

- Information does not move in electronic form through design flow
  - Paper based specifications

Verification

- Limited possibilities to connect requirements to platform components
  - Verification more coverage based, rather than against req's

Techniques we (want to) perform in ESL domain

- Early access to HW platform for SW teams
  - Virtual Platforms
- Ensure common understanding of system requirements for HW and SW
  - Golden TLM reference model
- Allow functional verification before detail design phases
  - Verification on top of transaction level modeling
- Algorithm to Architecture mapping
- Architecture exploration
  - Selection of
    - Processors, Interconnect protocols and topology, and Memory architecture
- Performance analysis
  - Allow fast analysis of random use scenario against platform architecture

- If these activities are done separately
  - huge resources
  - Challenging to maintain
- Common model base mandatory!

Unified design approach for ESL

- Common modeling base for all the targets
  - Strong separation of IP model internal and external interfaces
  - Internal structure is common, external interfaces adapted for modeling targets
- Modeling to be part of normal design effort, not a separate activity
  - Golden reference is the ESL model
- Strong connections to requirements management
  - Bring together the design flow
  - Allow solid base for verification
- In a longer run, the maintainable models more XML, less actual C++

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Availability of interoperable ESL models is essential

- Any ESL flow will require models from IP providers
- IP providers need more comprehensive specifications on models they need to provide
- ESL vendors need to build their technology on open models, not e.g., on proprietary processor core models
- Will require more agreement on modeling conventions to enable tool agnostic modeling
- Needs more standardization
  - OSCI, OCP-IP, Spirit XLM
  - Standards for processor models?

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Key requirements for IP and ESL tool providers

- **Consistency:** Ability to reliably move IP through different tools
  - Compliant to open model interface standards
    - OSCI, OCP-IP
  - Adoption of SPIRIT standard for tools and IP / models
    - Ensures structural and configuration consistency across all levels of design abstraction
- **Equivalence:** That the IP will be accurate and reliable at different levels of abstraction
  - Models benchmarked against functional and RTL test-suites
- **Interoperability:** ability to connect tools for a complete design flow
  - No ‘proprietary standards’ or APIs : fully open

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ESL in Nokia

- Currently:
  - Nokia is investing into ESL, starting from Protocol SW/HW, but expanding to multimedia
    - Virtual platforms
    - Architecture performance validation
  - ESL activities are an integral part of product programs, not separate activity
  - Seamless flow is needed: ESL –> ASIC/SW implementation -> Validation
  - Will require SystemC/Spirit models from the key IP providers
  - Standards/definitions on which we want to build our solutions
    - OSCI, OCP-IP, Spirit XLM

  - Looking open source forum, GreenSocs, to help bring ESL more end user driven

- Longer term:
  - In longer term RTL/SW creation from high level description will become important
  - How can we model mixed signal and RF designs ?

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