Liberty/ALF Harmonization Project

October 16, 2003

Motivation

- Complexity of design flows and tools
  - Multiple library views for increasing number of tools
- Expensive library preparation
  - Frequent version change of tool-specific libraries
- Advantages of standard library description
  - Reduced cost, increased quality
  - Resource and time saving for library creation and validation, leverage 3rd party library sources
  - Facilitate tool interoperability
  - Anticipate and prepare for technology innovations

Assessment

- Liberty and ALF are the strongest candidates for a unified library standard
- Liberty is the most popular library format
  - De-facto standard for commodity libraries
  - Supported by virtually every EDA tool in RTL-to-GDSII flow
- ALF is the most comprehensive library format
  - Approved IEEE standard
  - Designed to support library modeling for next generation applications
  - Supported by sizable number of EDA tools today
  - A true superset of liberty

ALF is more than a format

Scope of IEEE 1603-2003 (ALF) PAR

- ALF shall serve as the data specification of library elements for design applications used to implement integrated circuits. The range of abstraction shall include from the register-transfer level (RTL) to the physical implementation level.
- The ALF language shall model behavior, timing, power, signal integrity, physical abstraction and physical implementation rules of library elements.

EDA tool support for ALF today

Vendor	Tool category	ALF support item	ALF support status
Sequence	Power calculation	power	Pervasive in industry
Tera Systems	RTL analysis & prototyping	timing & physical abstraction	production
Magma	IC implementation	signal integrity, electromigration	production
ASC inc.	Library compiler	all	production
Sequence	Layout optimization, STA & signal integrity analyses	function, timing, signal integrity, electromigration	production
Synopsys	Place & route	electromigration	under evaluation
Cadence	Delay calculation	timing	under evaluation
V-cube	ATPG for power	function, power	new tool
ASC inc.	Behavioral synthesis	power abstraction	new tool

This list is not necessarily exhaustive or complete

Technology library support for ALF today

Vendor	Category
Agere	ASIC vendor
ARM	IP vendor
Artisan	fabless library vendor
Intel	silicon vendor
Library Technology Inc.	library characterization tool vendor
Motorola	silicon vendor
NEC	ASIC vendor
NurLogic	fabless library vendor
Philips	ASIC vendor
Silicon Metrics	library characterization tool vendor
Virage Logic	IP vendor
Virtual Silicon	fabless library vendor

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EDA tool and library support for liberty today

Everywhere, however …

- Although liberty is predominantly used in the industry, it does not cover all modeling domains
- Many EDA vendors invent ad-hoc extensions to liberty or even new tool-specific library formats today
- Library harmonization and interoperability is needed to avoid fragmentation

Modeling domains covered by ALF, but not by liberty

Modeling item	Application
Electrical driver/load model	High-end delay calculation, signal and power integrity
Transient waveform for electrical current	Transient voltage drop analysis
Concurrently activated timing arcs	Advanced timing analysis
Parasitic estimation models with obstructions	Physical design planning and prototyping
Geometric models associated with regions and patterns	Design for manufacturability
Formal declaration of language extensions	Any application

Library harmonization project proposal

- Specify formal requirements and semantics for library description
  - Use ALF and liberty as description vehicles
  - Study commonalities and differences between ALF and liberty to discover and resolve semantic issues
- Started as informal study group in April 2003
  - Created sample libraries to study liberty/ALF xref
- Proposed as official Accellera project in Sep. 2003
  - Approved unanimously by the Accellera board

Library harmonization project plan

- Phase 1
  - Establish a formal cross-reference between liberty and ALF
    - Specification of common semantics
    - Mapping table between liberty and ALF
    - Sample library templates
  - This work has already started
    - Can be completed within 6 months
- Phase 2
  - Develop reference tools/utilities
    - Solicit donations from EDA vendors and users
    - “golden” parser with API suitable for application development
    - Bi-directional translators

Library harmonization benefits

- Win-win situation for the industry
  - Increase in library quality
  - Decrease in library development cost
  - No more destructive competition on library formats
- Establishment of a truly industry-owned library standard
  - Accellera projects will eventually become IEEE standards

Perspective

- Harmonize liberty and ALF in the domain of common applications
  - Accept the fact that de-facto library formats are persistent and hard to change
  - Both liberty and ALF syntax will co-exist
  - Focus on the requirements for library contents and semantics
- Leverage ALF in the domain of new applications
  - Make sure that future liberty extensions are in sync with ALF

More information

- Library harmonization kickoff meeting
  October 20, 2PM – 5PM, hosted by Synopsys
- Documentation available on
  http://www.eda.org/alf
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