



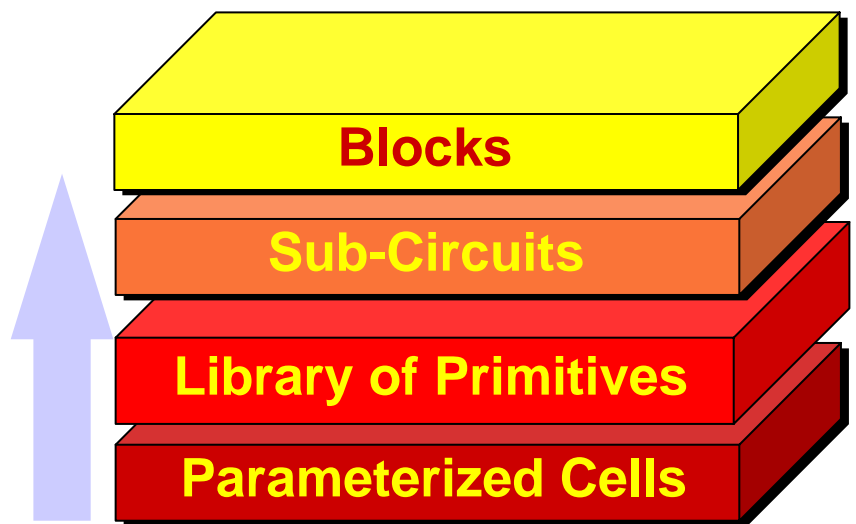
CIRANOVA®

OpenAccess PCells

**Ed Petrus
VP Engineering**

What is CiraNova about?

- ▶ CiraNova enables analog designers to create migratable, re-usable analog objects...
- ▶ ...from primitive cells up to PLLs and data converters...
- ▶ ...using OpenAccess plus other industry standards



CiraNova's products and tools start at the foundation, enabling designers to incrementally build reusable design libraries and circuits

Universal Parameterized Cells

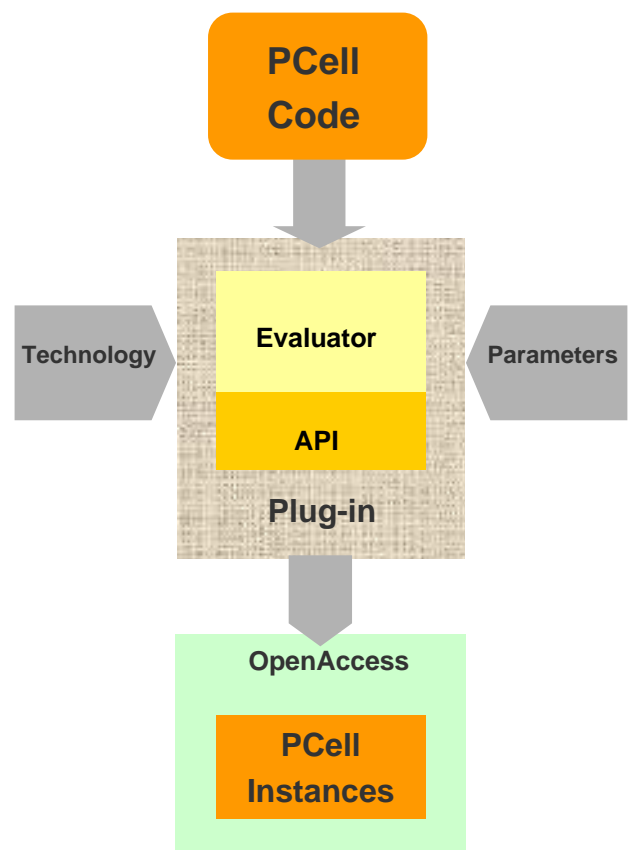
- ▶ **The quest: PCells that can be instantiated in any EDA tool**
 - Historically difficult to achieve
 - Lack of a standard data model
 - Lack of a standard plug-in mechanism
 - Lack of a standard programming interface for generating desired PCells
 - etc.

- ▶ **The quest: PCells that can be instantiated in any EDA tool using OA as the native in memory data model**
 - *With OA we now stand a chance to make universal PCells*
 - *Write once instantiate everywhere !!*

The advent of OpenAccess makes Universal PCells possible

Anatomy of PCells

- ▶ **A mechanism for specifying cell parameters**
 - Parameter name, value type, value range, etc.
 - Default parameter values specified at time of authoring
- ▶ **Programming language for scripting geometry construction**
 - Access parameter values
 - Access Technology information
 - Calculate object dimensions and distances between objects
 - Call on interfaces of various subsystems to make instances of PCell
- ▶ **Programming interface for geometry construction**
 - Create, place and manipulate shapes
- ▶ **Programming interface to access technology information**
 - Minimum spacing rules, etc.
- ▶ **A plug-in mechanism and protocol to execute PCell scripts and create parameterized instances of cells**



Requirements for a Universal OA PCell solution

- ▶ **Neither authoring nor instantiation of PCells should be locked into a specific vendor solution for physical design**
 - Should be based on industry or technology wide standards
- ▶ **Offers a programming interface for specifying cell parameters that is compatible with OA and fits well with popular physical design tools**
 - Better still is to have a published specification
- ▶ **Offers a procedural layout programming interface with a gradation of abstraction levels**
 - Place(Obj-1 , eastOf , Obj-2)
 - Place(Obj-1 , eastOf, Obj-2, 0.5u)
- ▶ **Offers a programming interface to access technology information**

Requirements, continued

- ▶ **PCell executable code should be OS and CPU architecture independent**
 - Otherwise library creators must create PCell executables for every version of OS/CPU/Compiler in play
- ▶ **The source of PCell code should be embedded in OA databases (associated with the SuperMaster)**
 - Otherwise it makes existing design management headaches worse
- ▶ **Should work great with at least one good programming language for coding PCell scripts**
 - Clearly no one language can satisfy everyone but lessons of the past 20 years can help point us in the right direction
- ▶ **PCell executables should be “IP” protected**

CiraNova PCells

- ▶ **OA PCells are the building blocks of CiraNova's Analog Circuit Generator solution.**
- ▶ **CiraNova is developing sophisticated authoring tools for PCells which will become the building blocks of re-usable and re-targetable circuits**
- ▶ **CiraNova is developing easy to install and use run-time support for instantiating PCells**
 - **The CiraNova PCell Plug-in**

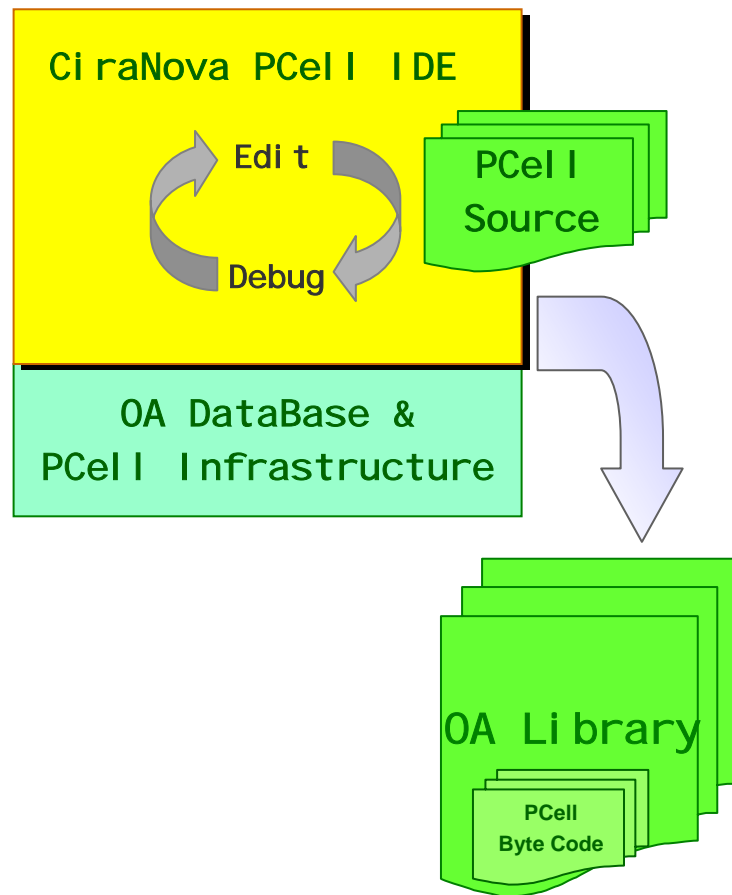
CiraNova PCell Authoring Tool

- ▶ **OA is the underlying in memory data model**
 - No emulation layers or translation steps involved
- ▶ **CiraNova PCells are written in Python**
 - The underlying infrastructure is written in C++
- ▶ **Provides a high level programming interface specifically designed for PCell authoring**
 - Parameter specs, geometry creation, place, connect, etc.
- ▶ **Provides access to technology information that goes beyond TechFiles**
- ▶ **Comes with a dedicated OA viewer**

Authoring, continued

- ▶ **Comes with an integrated Python development environment**
 - Source code debugging, tracing, break points, watch points, etc.
- ▶ **PCell packaging and deployment capability**
 - Compiled Python byte code is embedded in OA libraries ready for deployment
- ▶ **Deployed PCells are platform independent**
 - EDA tools independent - provided the tools run native on OA
 - OS/CPU/Compiler independent

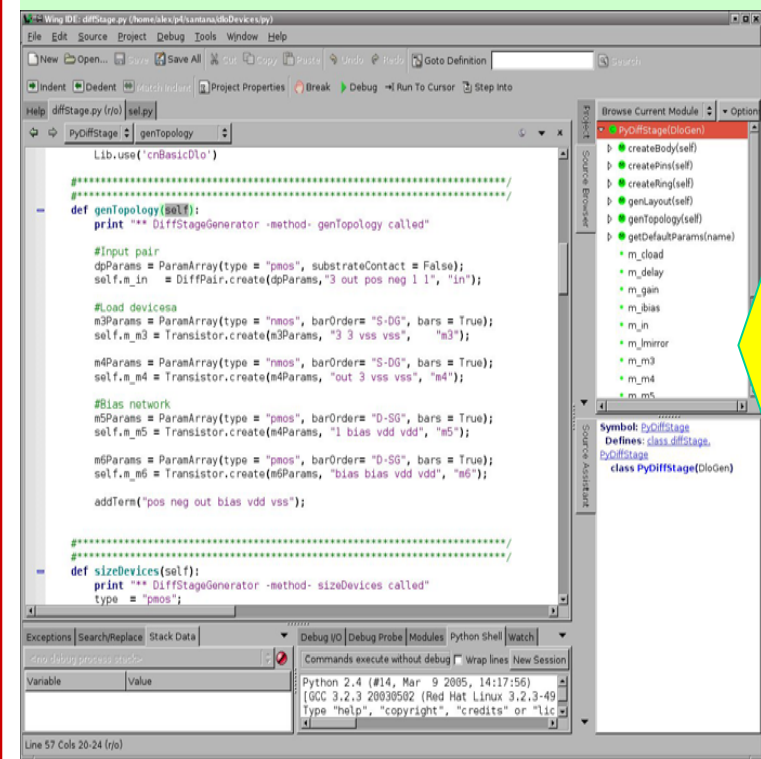
CiraNova PCell Authoring Diagram



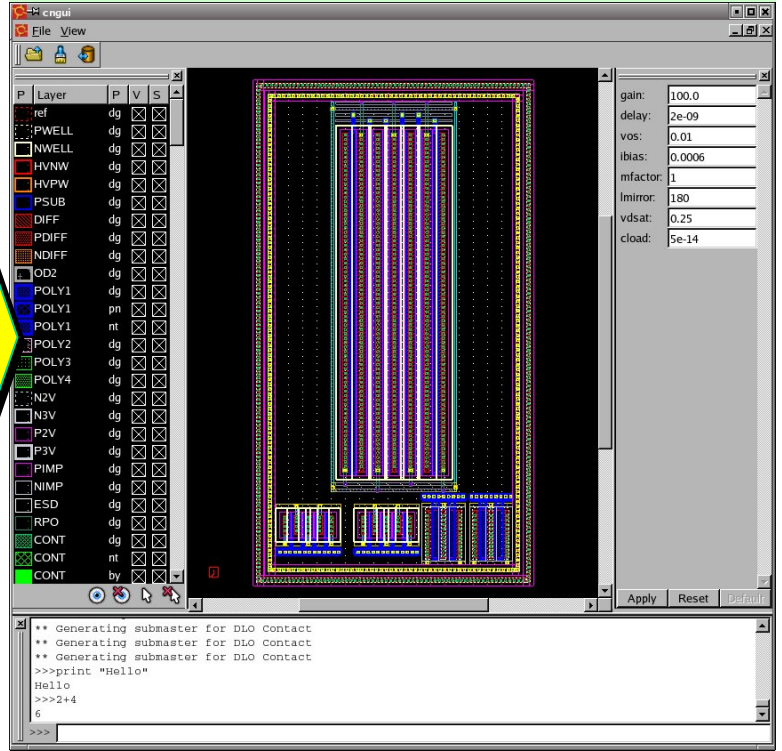
- ▶ PCell source files are used during development
- ▶ PCells are packaged into OA Libraries for delivery
- ▶ OA Libraries contain PCells in Python byte code form
- ▶ Python byte code is saved with SuperMaster structures in OA databases
- ▶ Python byte code is OS and CPU architecture independent

CiraNova PCELL IDE

Working with PCell source code
 Source code view & edit, Break & watch points, trace, etc.



Working with PCell Instances
 View layers, pan, zoom, edit params
 Run commands & scripts in console



CiraNova PCell Instantiation

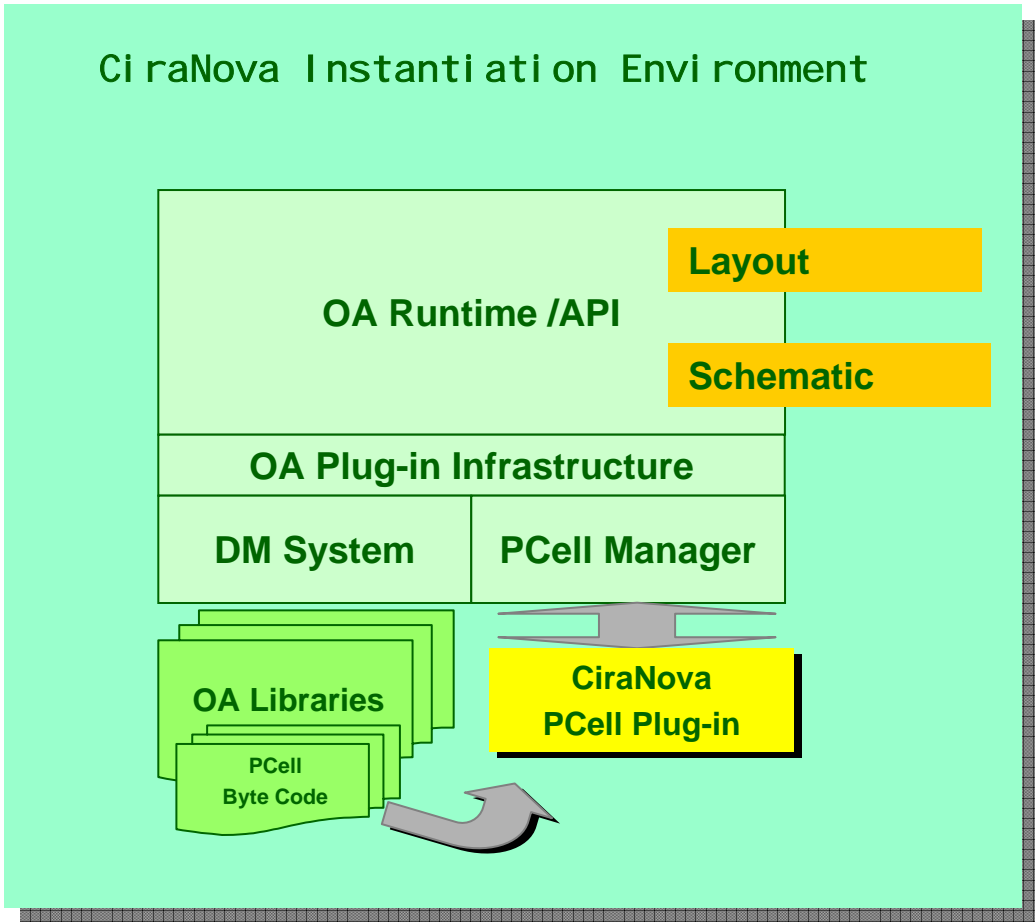
- ▶ **Users reference PCells in OA libraries to create instances**
- ▶ **Byte code associated with the PCell SuperMaster is executed to create new PCell instances**
 - SuperMaster ← SubMaster ← Instances
- ▶ **It will be possible for users to apply modified technology information to instances of PCells.**
- ▶ **It will be possible for users to achieve the effect of “freezing” PCell geometries**
 - Useful to do this after certain project milestones
 - Frozen PCells can be unfrozen

Instantiation, continued

- ▶ **Users will be able to create groups of PCell instances to apply various operations**
 - Apply modified technology information to a group of PCells
 - Freeze the geometry of a group of PCells

- ▶ **CiraNova will make available the PCell plug-in for a variety of platforms**
 - Verified to work with the major physical design tools
 - The usual OS/CPU/Compiler combinations
 - *The run-time plug-in will be web downloadable and available free of charge*

Instantiation Diagram



Future

- ▶ **OA PCells and PDKs**
 - Advanced layout structures
 - Component Definition Format (CDF) and OA PCells
 - Tighter relationship with models

- ▶ **More instantiation time features**
 - Greater flexibility in applying technology information

- ▶ **Think circuit generators**
 - Electrical + Physical
 - IP Packaging and Delivery

**CiraNova would welcome the opportunity to collaborate
with other OA adopters**

Summary

- ▶ **CiraNova is developing the tools to help designers create analog circuit generators**
 - With PCells as the basic building blocks
- ▶ **A powerful universal PCell authoring and instantiation environment is a win for everyone**
- ▶ **CiraNova hopes to play a part in making this vision possible**
- ▶ **We would greatly appreciate feedback and suggestions on what we talked about**

Suggestions and Feedback ..

- ▶ .. would be highly appreciated, please send email to:

OAPCELLS@ciranova.com