HP's Assessment of the OpenAccess Standard

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Presentation Roadmap

- Why was the OpenAccess Coalition necessary?
- Who benefits from OpenAccess?
- HP Contributions to the OAC
- Details of the OAC working groups
- Assessment of the current industry release of OA 2.0
- Where do we go from here?

Setting the Stage

- **Compared to other industries, the EDA industry has been less willing to drive broad industry standards.**
  - **File-format standards have reached their limits**
  - **The integration of a wide range of different aspects of the design data is essential for 21st century EDA systems**
  - **“Paper standards” have seldom been successful**
  - **Broad industry adoption is essential to acceptance**

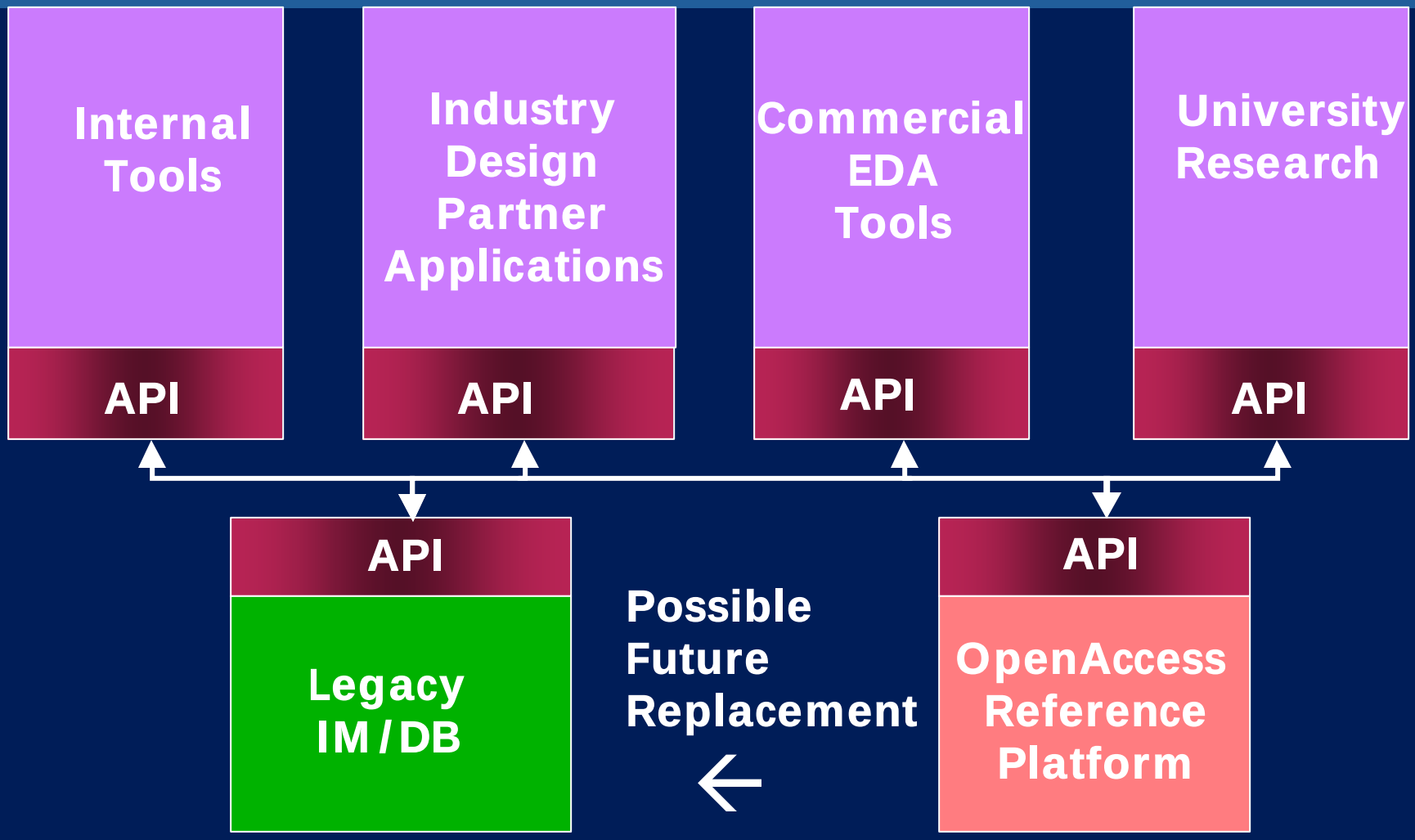
By 1999, >16 companies were engaged in developing an internal, proprietary EDA infrastructure consisting of database, Information model and some form of API.

All were (of course) incompatible!!

The Vision

- **What the Industry Needs:**
- **Standard representation of Design Data is among the most important types of standardization.**
- **Common API/IM that is an Open industry standard.**
- **Availability of a reference implementation that is widely used in the industry is essential for adoption. This should be an open standard.**

HP Ideal Vision, circa 1999



Approach to Achieve The Vision

- **HP has actively participated in many efforts to define standards for the industry…** **Do it again!**
- **Establishment of Design API Coalition (DAPIC)**
  - **DAPIC solicited potential technology suppliers.**
  - **Found one which met criteria: Cadence**
    - **Capable supplier**
    - **Would be an large industry platform (had natural pull)**
    - **“Next Generation” implementation approach**
    - **Willing to donate work as an Open standard**

- **Resulted in launch of the OpenAccess Coalition (OAC)**

Who will Benefit: The Entire Industry

- **Large Commercial EDA**
  - easier access to customers
    - simpler integration into their flows
  - less interfacing effort
    - focus on tool development
  - Easier to integrate tools when purchasing small vendors.
- **Universities**
  - access commercial database
  - influence standard
  - access industry examples
  - research tightly-coupled apps
  - streamline industry transfer
- **EDA User Companies**
  - Leverage investment of industry
  - eliminate inefficient file translators
  - “plug-and-play” access to new tools
  - lower integration costs
  - not locked into proprietary interfaces
- **Small Commercial EDA**
  - quicker “startups”, faster ROI
    - less infrastructure to develop
    - focus on tool development
  - less interfacing effort
    - Quickly sell to a larger market

Success! Momentum is building

- **OAC released the open, industry standard API and IM in 2002, and the OpenAccess reference database Community Release in January, 2003.**
- **Customer involvement and direction has been key.**
- **Customers have engaged positively with Synopsys as well as they move toward an Open Milkyway API.**
- **Golden Gate Working Group will create a bridge between Milkyway and OA.**
- **Ideally, a common industry API is the long-term goal.**

HP involvement in OAC

- **Chaired the Design Technology Council which founded DAPIC.**
- **Founding member of OAC**
- **Member of the OAC change team**
- **HP has participated in all OAC working groups.**
  - Extensibility and Occurrence Models
  - Technology Data and Parasitic Models
  - Hierarchical Mapping Technology
  - Golden Gate Working Group
- **HP was an early Beta partner on the recently released OpenAccess 2.0 release.**
- **HP chairs the Golden Gate Working Group**


Introducing Jim Wilmore:
Golden Gate Working Group Chair

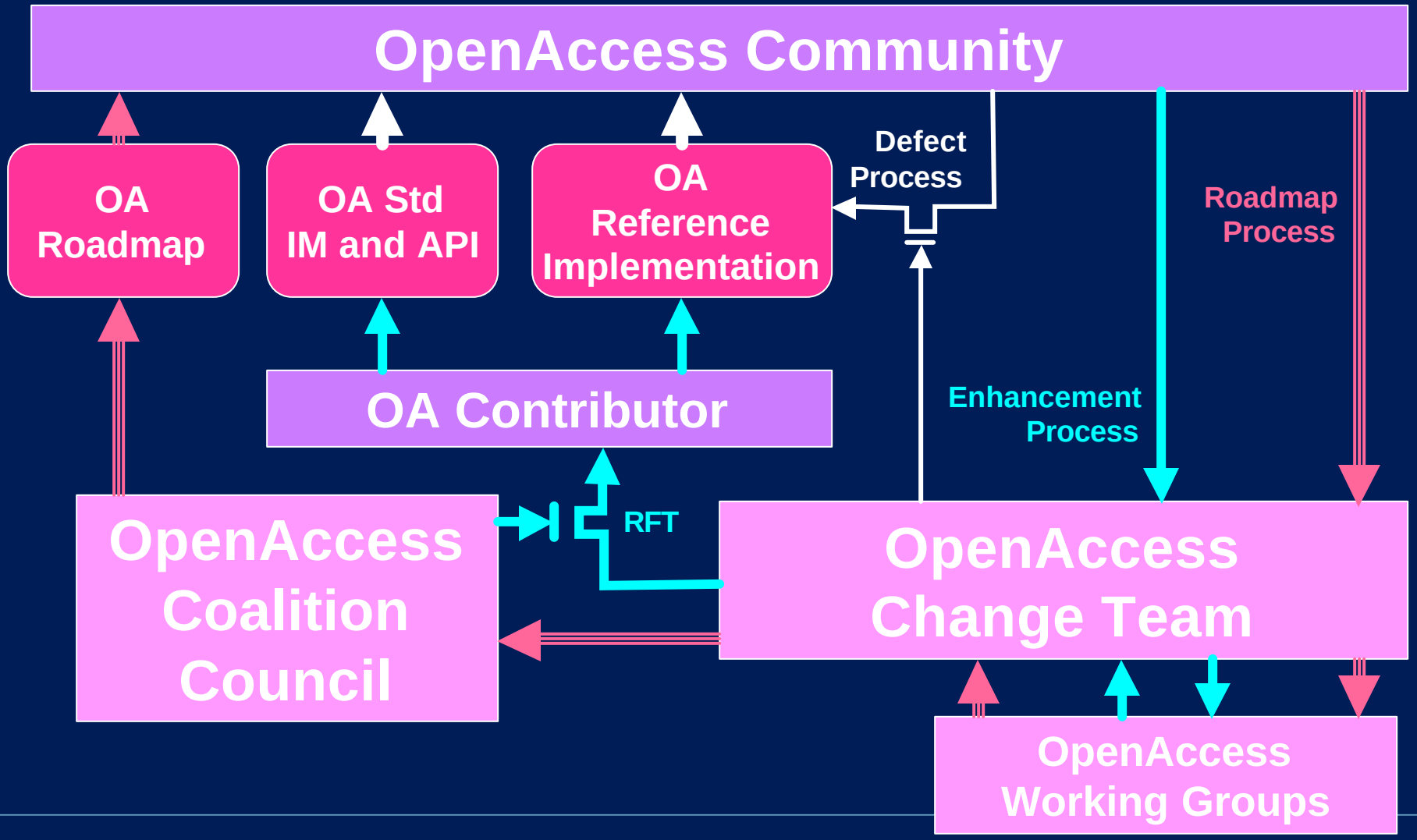
The Golden Gate Working Group

- **Goal:** To build an effective bridge between OpenAccess-based applications and Milkyway-based applications for more efficient EDA-user design flows.
  - Participants include: Cadence, HP, IBM, Intel, LSI Logic, Motorola, Philips, Si2, Synopsys, ST Microelectronics
  - ➢ Synopsys participation with OA members is extremely valuable for accurate mapping of Information Models and APIs
  - Weekly meetings beginning in January, 2003, with initial focus on mapping the OA and MW technologies

The Working Group Experience in OpenAccess

- Participation in an OA Working Group is very similar to working in a regular infrastructure design team
  - Requirements specification, use-case scenarios
    - Design principles: functionality, integration
  - Information Modeling, API and header file design
    - Design principles: clarity, cleanliness, consistency, efficiency
    - Implementation considerations cannot be entirely ignored
- Typically 4 to 6 companies participate
  - Most meetings are weekly by phone conference
    - Preparation is important; slides are very valuable
    - Phone calls span multiple time zones

The OpenAccess Change Team in the OA Evolutionary Process



HP's Reasons for Participation in the OpenAccess Beta Program

- Develop working familiarity with OA Information Model and API
- Begin long process of evaluations necessary to assess OA Reference Implementation
- Take advantage of the Window of Opportunity to influence standard, especially in areas important to HP
  - Information Model and API
  - Reference Implementation
    - Quality, Portability, and Usability
    - Performance and Capacity
- Contribute to the level of interest in the industry to advance early adoption of the standard.

HP's OA Beta Project - Getting Started

- Attend OpenAccess Class taught by Si2 and Cadence
- Download latest Documentation, Libraries, Examples, and Tests
  - Install Documentation on Web site
- Download Beta Source Code
  - Install Source Code in Manufacturing System
  - Initiate Local Nightly Builds

HP's Focus for Beta - Planned Software Experiments

- Focus on Layout Arena
  - Simple model to understand however…
    - OA Model is missing Key Object in HP's Proprietary IM
      - Test OA Standard Extensibility for *AreaShape* object
- Measure Performance of Creation, Iteration, and Deletion of Layout Objects
- Build and Test Layout Engine
- Check Run-time Capacity
- Test Persistence for Capacity and Performance

HP's Beta Experience and Results - Initial Exposure

- OpenAccess Programming Class was well taught and gave good, practical exercises for learning and using the OA API.
- The download of all materials went very well.
- The Documentation of the API is very friendly to browse
  - This is a large, complex API...

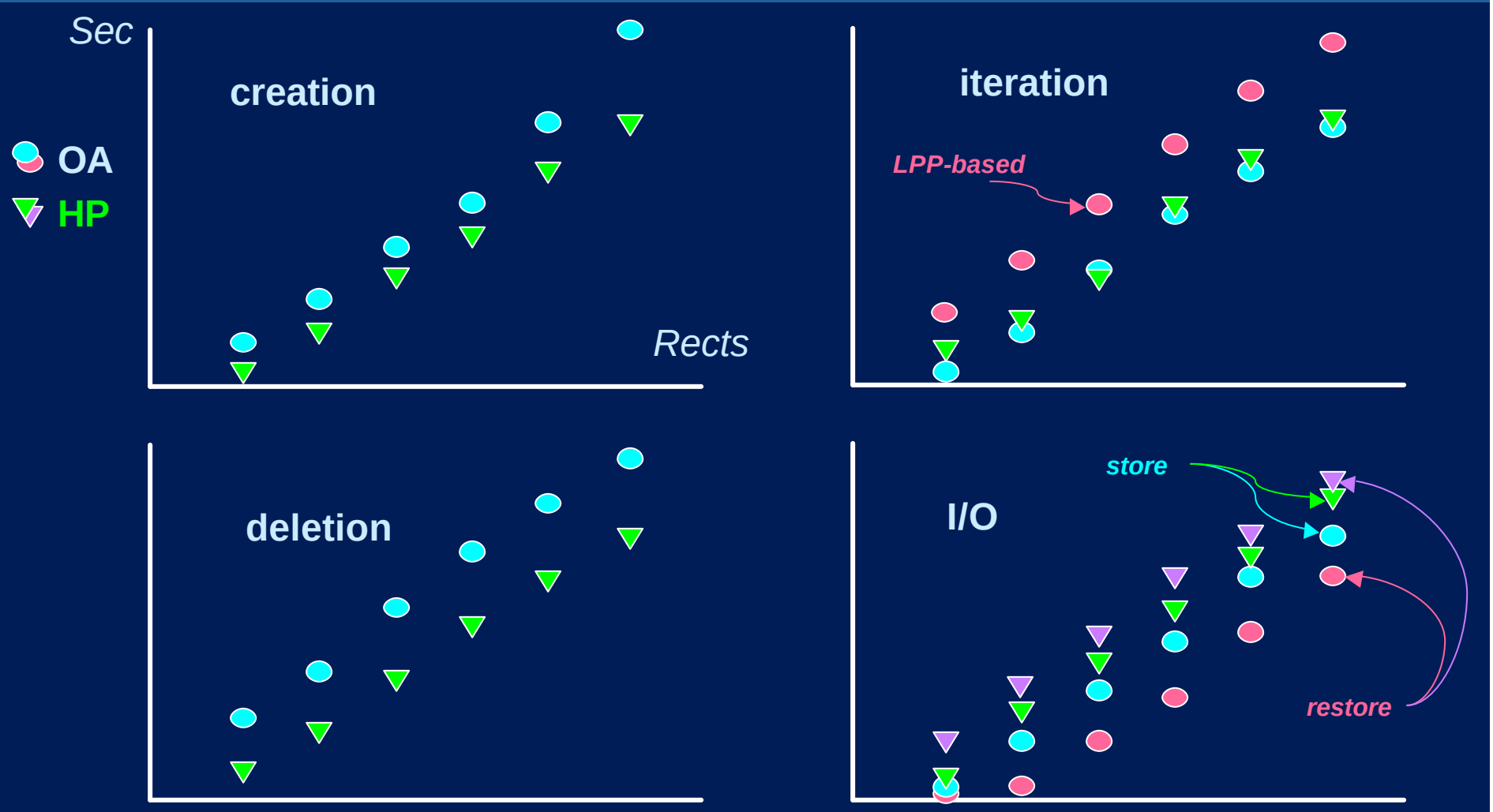
    ...which reflects the sophisticated, integrated IM of OA.
  - Hyperlinks make descent for more detail as well as cross-referencing quite easy.
  - More subtle semantics still need to be documented...

    ...and I *expect* the Coalition to contribute to this work.
  - The IM "schema" diagrams need(ed) improvement.

HP's Beta Experience and Results - Source Code

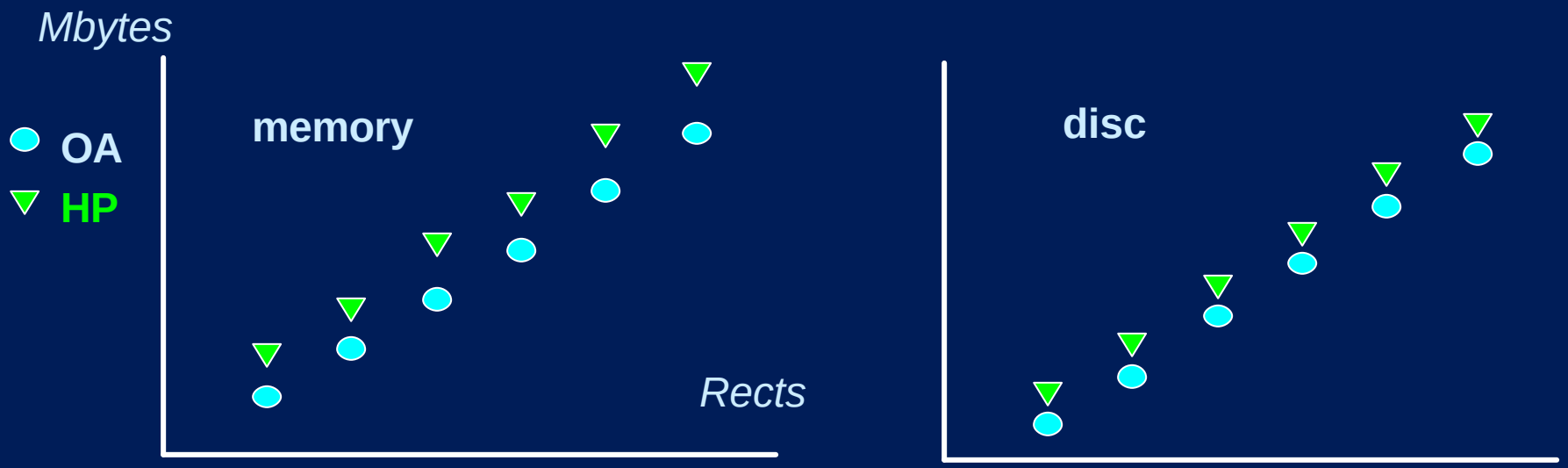
- The source code quality is quite high and very portable!
  - Integration into our internal tools' nightly builds was quite straightforward
  - Multiple software platforms: HP-UX 11x, Linux
  - Multiple compiles: Debug, Opt, Purify, Quantify
  - Multiple hardware platforms: PA-RISC, Itanium (IA-64)
- Debugging can be somewhat problematic
  - OA class structures are distributed in the reference implementation technology
  - May be able to leverage XML dumping functions or even use them directly.

HP's Beta Experience and Results
- Performance -- *Seconds vs Rectangle Count*



(lower is better)

HP's Beta Experience and Results - Capacity -- *Mbytes vs Rectangle Count*



(lower is better)

HP's OpenAccess Evaluations - What's Next?

- Complete Other Planned Beta Activities
  - Use of Extensibility Features
  - Implementation of Layout Engine
- Begin Evaluations with Larger Scope...
  ...and More Resources
  - Connectivity Arena with Vectored Signals and Instances, Parasitics, and *hopefully* Occurrence Model
  - Layout Arena with Routes, Vias, Hierarchy, and P-Cells
  - System Design Flows

HP Criteria for OpenAccess Usage

A Database under HP control
is *critical*
to our CAD System Functionality
…
and Support.

HP Planning Matrix for Evaluating Use of OpenAccess Technology

Implementation	Information Model / API: HP Internal IM / API	Information Model / API: OA IM / API
HP Internal DB Implementation	*Current HP Internal Solution*	***Leverage*** *the Standard API*
OA Reference Implementation	*Retain Support For Existing HP Tools*	***Full OA Adoption***