

Lessons Learned as an APC Product Supplier: A Framework Retrospective

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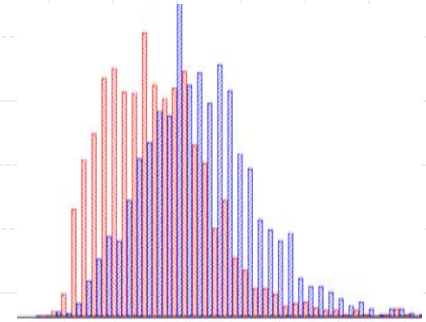
Outline

- ◆ Background and summary
- ◆ Lessons learned
 - Technology/architecture
 - Semiconductor APC market
 - Business/organization
- ◆ Acknowledgements and thanks

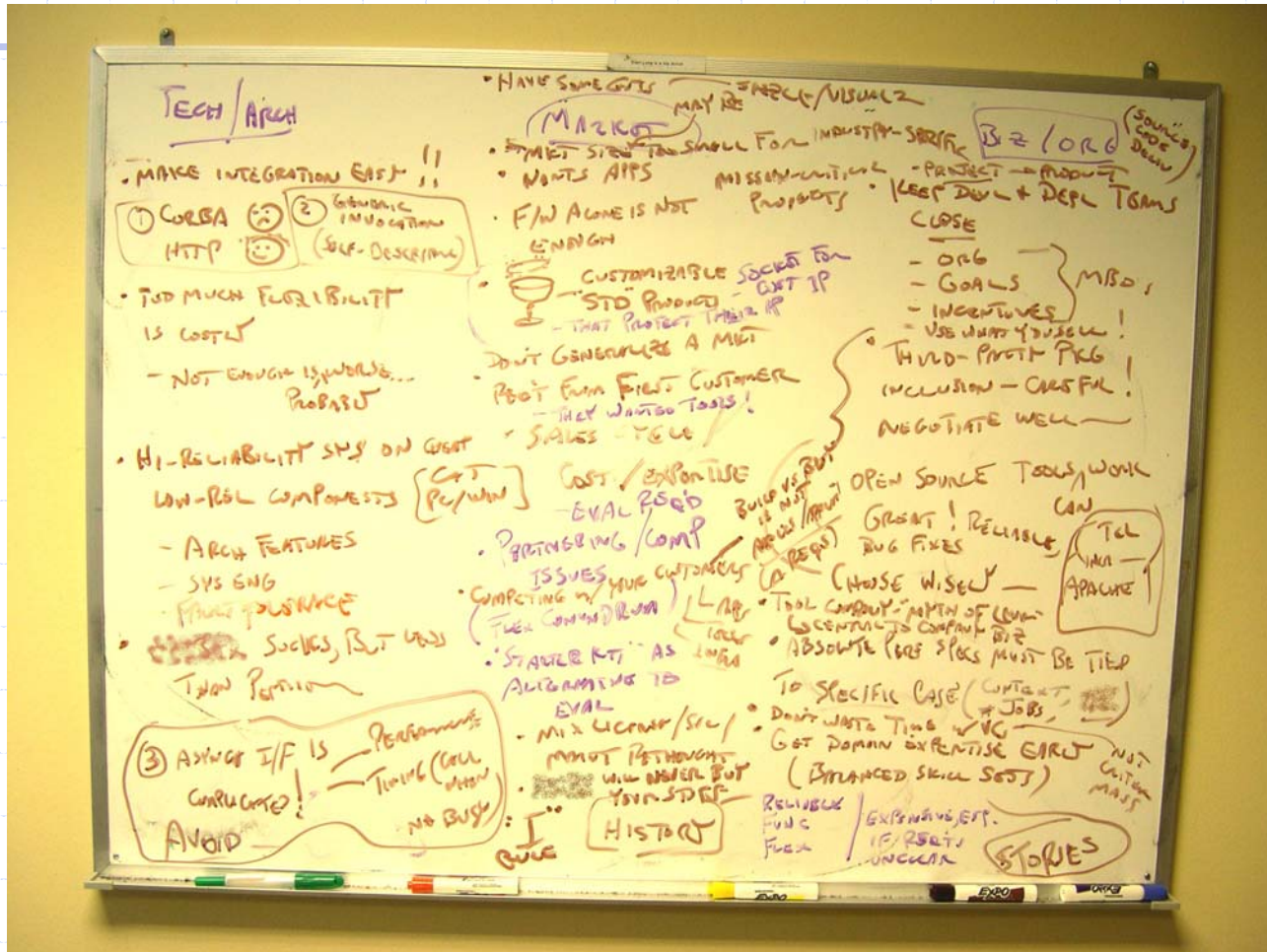


Presentation/Presenters' Background

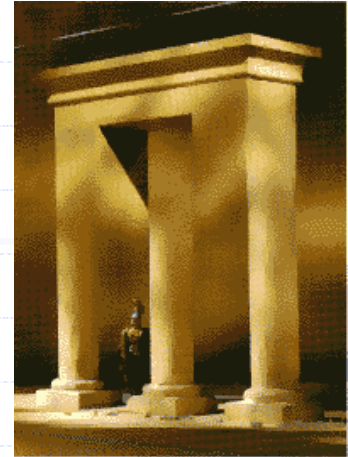
- ◆ Seven years of experience in the first generation fab-level APC framework product business
 - Requirements gathering and analysis
 - Development and validation
 - Commercialization and marketing
 - Production deployment and support
 - Acquisition and metamorphosis
- ◆ Three years providing APC-related consulting services
 - Customer implementation planning, systems engineering
 - APC market analysis, strategic planning, product planning
 - EDA/DDA interface product design and development



Summary

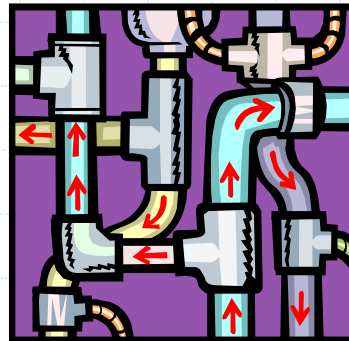


Technology/Architecture



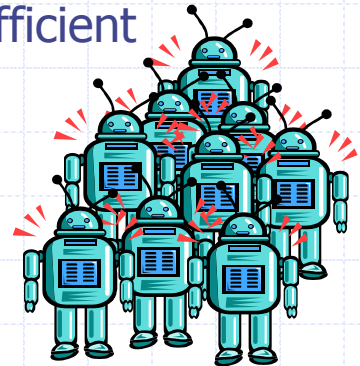
◆ Make integration easy

- Generic invocation paradigm
 - ◆ "Self describing" – name/value pairs
 - ◆ Includes command type and required parameters
- Synchronous is adequate and much simpler
 - ◆ Requires predictable, quick control job performance
 - ◆ Must be able to call when you can wait...
- Choice of plumbing
 - ◆ CORBA – yech !
 - ◆ XML/HTTP – yes !



Technology/Architecture (2)

- ◆ Building high-availability systems (>99.9994%) using low-reliability components (PC hardware, Win2K OS)
 - Reliability is an architectural feature
 - Requires “replication-aware” system engineering
 - Simple approach to fault tolerance
 - ◆ Let it fail; then recover
 - Simple approach to redundancy
 - ◆ Make servers interchangeable and self-sufficient



Technology/Architecture (3)

Flexibility Required



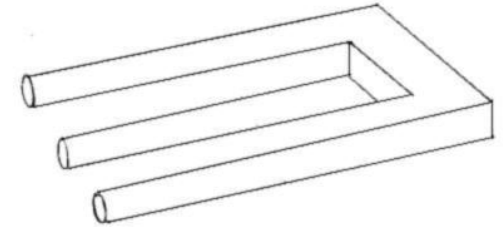
◆ Wide applicability

- Across process types/applications
- Across process tool models and settings
- Across metrology tool models and measurements
- Across control approaches
- Batch/lot/wafer level handling and control
- Accommodate production variabilities

◆ User customizability

- Process models, data definitions, parameters, control logic
- Sampling, filtering and summarization logic
- Business logic (rework, sendaheads)





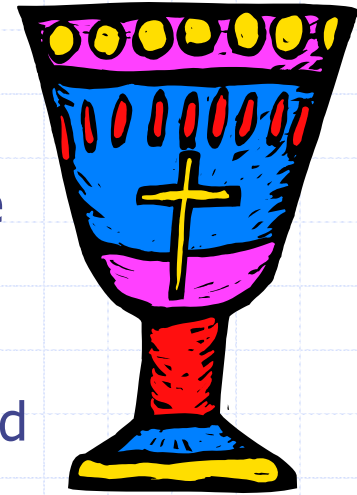
The Flexibility Conundrum

- ◆ Too little flexibility ignores a key requirement – bad idea !
- ◆ Too much flexibility results in an entirely different set of problems
 - Complexity of solution – never underestimate an engineer's ability to overcomplicate a problem
 - Deployment project time/cost – whenever custom software development is required
 - Diversity of solutions – little/no commonality from customer to customer, no industry synergy
 - Service and support issues – difficulty isolating problems
- ◆ Business model issues
 - Service business competes with customer's application team
 - Evolving standard product competes with one's own service business



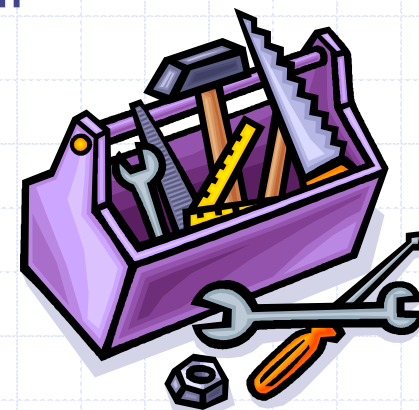
Semiconductor APC Market (1)

- ◆ Customers seek the Holy Grail of manufacturing software
 - Standard off-the-shelf product (i.e., inexpensive, quick-to-deploy)
 - BUT, also customizable - supports in-house addition/protection of customer-specific IP
 - Easily integrated and configured
 - Plugs in and works easily with best-of-breed commercial packages



Semiconductor APC Market (2)

- ◆ Can't generalize a market requirement from a single customer
 - First one is usually on the bleeding edge, "power user"
 - Satisfied with toolkit approach – for awhile
- ◆ Toolkit approach delivers flexibility BUT puts you in position of competing with your customers
 - IT folks
 - Software tool developers
 - Control application engineers



Semiconductor APC Market (3)

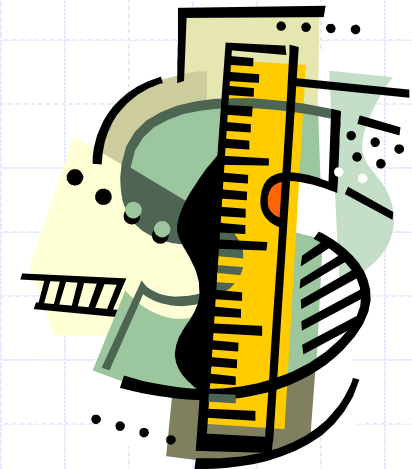
- ◆ "Build vs. buy" is often oversimplified
 - Requirements differ greatly for custom solution vs. standard product
 - Life cycle costs often overlooked or underestimated
- ◆ Working control applications required to reach acceptable margins
 - More perceived value than infrastructure technology
 - Accelerates return of benefits to customer
 - Must include GUIs for product visualization & sales "sizzle"
 - Framework/platform is necessary but not sufficient



Semiconductor APC Market (4)

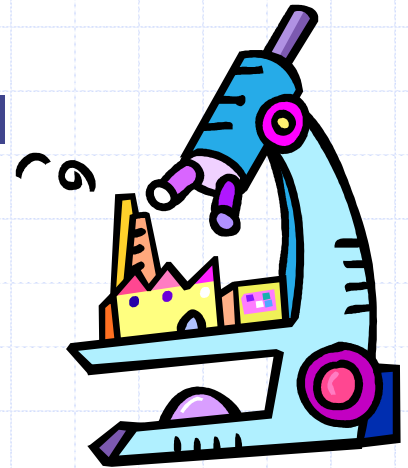
◆ Sales cycle characteristics

- Long, costly – technical expertise required
- Detailed product evaluations expected
 - ◆ Principally to address functional and performance questions
 - ◆ But integration questions may need to be addressed as well
- "Starter Kit" approach could shorten time/cost

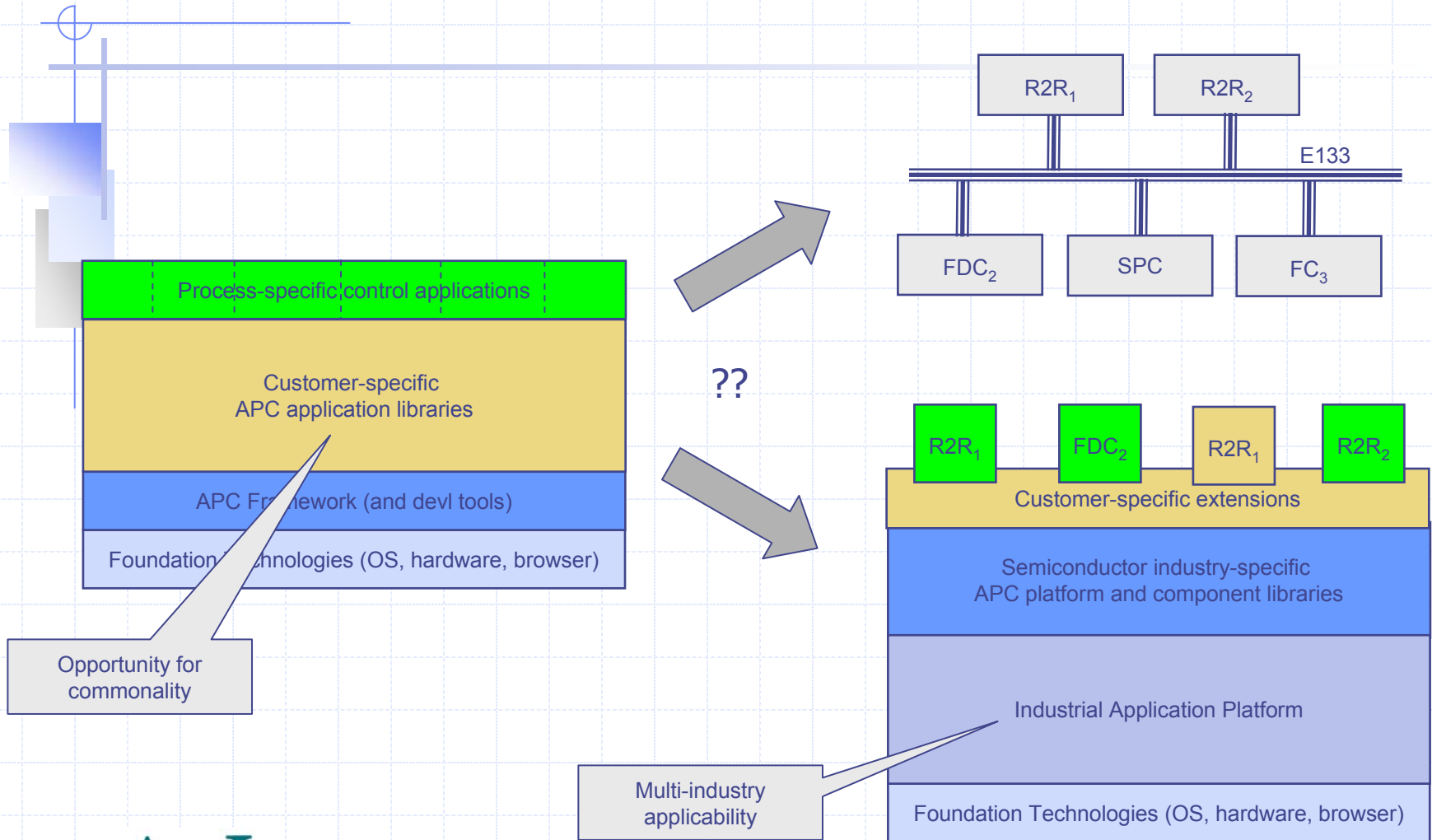


Semiconductor APC Market (5)

- ◆ Attempts to formally standardize a product architecture were unsuccessful for many reasons
 - Non-alignment of technical and commercial boundaries
 - Immature market segment
 - Insufficient demand
 - Competitive agendas
- ◆ Semiconductor market may be too small to sustain an industry-specific platform for mission-critical applications

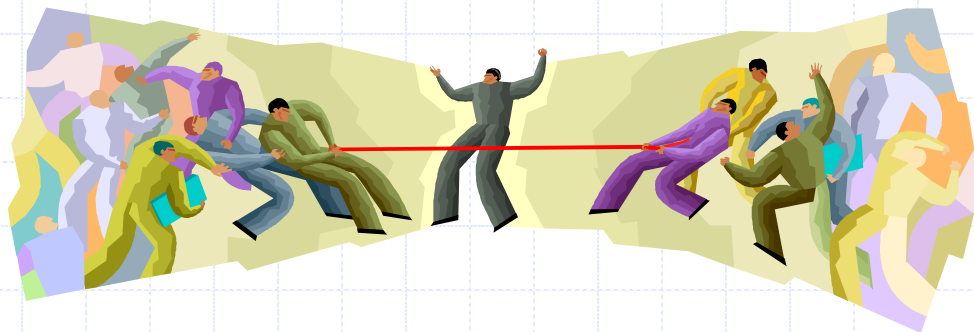


APC Platform Evolution



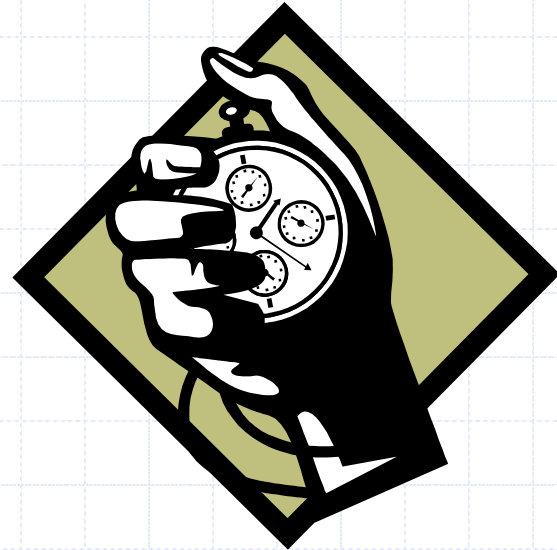
Business/Organization (1)

- ◆ Keep product development and project deployment teams close together
 - Organization structure
 - Goals and incentives
 - Use what you sell !
- ◆ Get domain expertise on the team early
 - Skill set mix required varies as business evolves



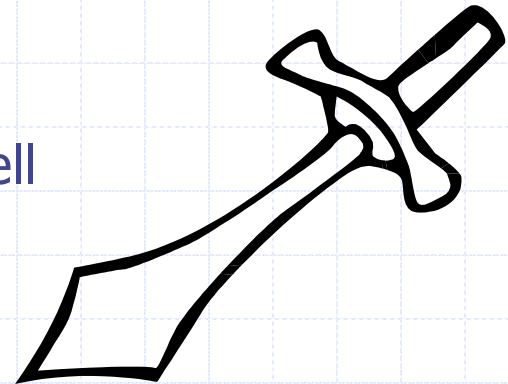
Business/Organization (2)

- ◆ Absolute customer performance specs must be tied to a specific test case
 - Context
 - Complexity
 - Concurrent jobs
 - Data volume
 - Computing environment



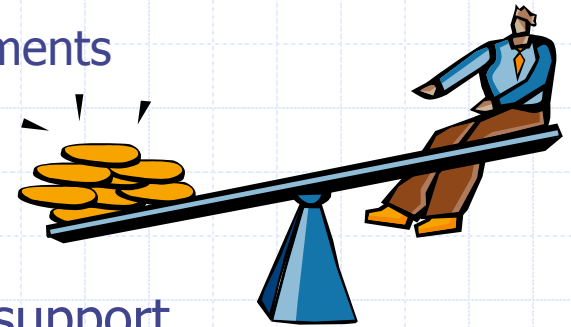
Business/Organization (3)

- ◆ Third-party package inclusion a two-edged sword
 - Choose wisely, negotiate well
 - ◆ Imagine the worst/best cases
 - ◆ Establish multi-year deals with clear renewal terms
 - Open-source tools can work very well
 - ◆ Cheap, reliable, quick bug fixes
 - ◆ Examples: Tcl (script interpreter), Apache/Tomcat (servlet)
 - But choose wisely here, too...



Business/Organization (4)

- ◆ Making the transition from a project services company to a product company
 - Business process and organization requirements are VERY different
 - Beware the "one-hit wonders"
 - Source escrow is false security
- ◆ Mix of license, service, maintenance, and support pricing should be re-thought to ensure viability of an APC product business
- ◆ Don't get bought by an equipment company
 - Beware the "myth of leverage"
 - Stay in the fairway of your company's business



Acknowledgements and Thanks

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- ◆ AMD and all the other Catalyst customers
- ◆ APC colleagues around the world
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