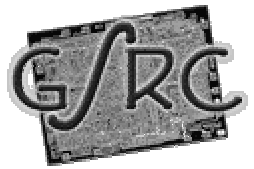

The GSRC Bookshelf

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September 2, 1999

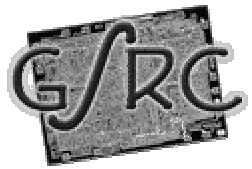
Outline

- **Observations**
  - **barriers to entry into research**
  - **wrong incentives for publishing research results**
- **Bookshelf as a new medium**
  - **possesses features of an e-publication**
  - **what bookshelf is and what it is not**
  - **adds value through policies and availability**
- **Implementation**
  - **structure, types of entries and acceptance standards**
- **Use scenarios**
- **Current progress and futures**

Barriers to Entry/Access

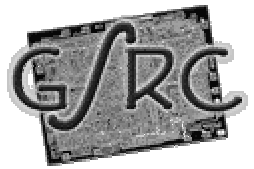
- **Difficult combinatorial optimizations require complex metaheuristics to satisfy runtime/QOR requirements**
  - **theoretical analyses cannot distinguish good approaches from bad**
  - **30+ year history for some formulations; very sophisticated techniques**
  - **entry into field, testing ideas requires reuse (hopefully w/understanding)**
- **Where is the leading edge?**
  - **implementations unavailable ("competitive advantage")**
  - **methods not replicable from descriptions ("omitted for space reasons")**
  - **reported results not verified ("trusted")**
  - **comparisons to recent previous work not required (no excuse)**
- **Barriers to entry/access limit the rate of advance**
  - **best new ideas cannot be identified**
  - **new work cannot build on previous work**
  - **informed adoption of existing techniques by industry is impossible**

You Get What You Incent



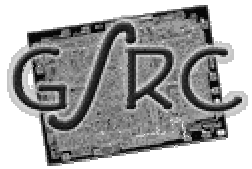
- **Traditional publication in conferences/journals**
  - **biased toward theoretical results, descriptions of "novel techniques"**
    - no reward for reusable practical contributions (e.g., source code for good implementation of old algorithm), nor for confirming work
    - easy to publish "novel" but poorly-performing heuristics
    - implicit assumption: value lies in description of algorithm (rather than understanding or implementation)
  - **on the other hand: undocumented/implicit implementation decisions far outweigh most claimed "advances" ("FM", "annealing", …)**
- **Key problem: no incentive to "do the Right Thing"**
  - **no respectable electronic publications in VLSI CAD (cf. physics, math)**
  - **no credit/compensation for distributing implementations, relevant details**
  - **no downside to ignoring previous work, available comparisons, and practical use models (runtime/QOR context)**
- **GSRC Bookshelf == incentive-/infra- structure to fix this !**

The Bookshelf Initiative



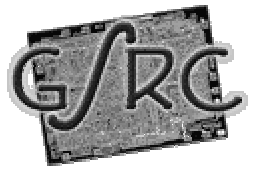
- **Standardizes data formats**
- **Focuses on algorithm implementations**
  - **collects what's available**
  - **encourages openness and competitiveness**
  - **solicits "missing" implementations**
- **Adds value**
  - **24x7 availability and automation, encyclopedic coverage**
  - **impartial policies and scalable user interfaces**
  - **forward-looking acceptance standards and work with authors**
  - **all implementations available for free for any purpose (?)**
  - **ranking**
- **Offers parallel publishing/ranking mechanisms:**
  - **"cathedral": fully controlled and ranked by steering committee**
  - **"bazaar": relies on immediate publishing and ranking by community**

Bookshelf as a New Medium



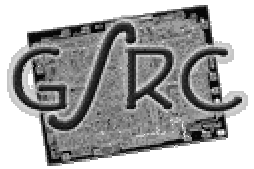
- **Publication medium and review process for implementations**
  - **electronic infrastructure permits archival, "arbitrarily large" publications**
  - **credit for leading-edge work via respectable, referable nature**
    - compensates "loss of competitive advantage"
- **Facilitate review**
  - reviews/evaluations, returns for fixes → preserve conference/journal quality
  - establish easy comparisons to catch novel but useless algorithms
- **Backed by other incentives, openness**
  - encourage simultaneous contributions from all researchers in a given area
  - flexible, non-draconian acceptance standards
  - targeted (possibly funded) areas for contributions
- **Backed by culture change**
  - penalize non-use of available comparisons to previous work
  - penalize withholding of detailed descriptions, evaluatable implementations

Bookshelf and Electronic Publication



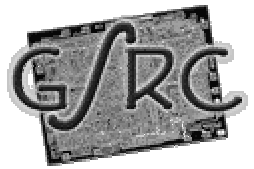
- **E-publication is common in physics, mathematics communities**
  - low-volume refereed periodicals (www.ams.org/era/ and www.cs.brown.edu/publications/jgaa/), high-volume archives (xxx.lanl.gov)
  - well-known editors, NSF funding, community acceptance…
  - example: xxx.lanl.gov
    - started in 1991, NSF-funded, ~2500 submissions in January 1999
    - complex hand-made infrastructure, submission via Web upload, MIME-aware email, ftp, vanilla email
- **Bookshelf**
  - **aims for thorough coverage of a domain ("institutionalized community memory" for VLSI CAD)**
  - **clear focus areas**
    - working algorithm implementations, implementation techniques
    - practical usage/use-model contexts, evaluation and comparison methodologies
    - eventually: implementation reuse
  - **activist approach**
    - incentivizing particular areas for implementation (cf. "special issue")
    - finding, improving, integrating available implementations ("invited/edited")

What the GSRC Bookshelf Is



- **Repository for released/published algorithm implementations**
  - **(with accompanying documentation, evaluation, etc. material)**
  - **most likely scenario for any given entry: one write, many reads**
    - note: publications are generally static!
- **Open, maximally inclusive**
  - **Occam's Razor applied to all formal "standards" and "rules"**
  - **hypersensitive to perceptions of arbitrariness, exclusionary behaviors**
  - **standards rely on informal peer review, policies of Steering Committee**
- **Focused on underlying motivations, goals**
  - **improved effectiveness, impact of VLSI CAD heuristic algorithm research**
  - **more rapid, complete communication between research groups**
  - **more rapid adoption of research advances by industry**
  - **appropriate coverage, demonstrated utility, community acceptance**
  - **overall maturation and culture change in the VLSI CAD field**
  - **achievement of goals by providing infrastructure, examples, incentives**

What the GSRC Bookshelf Is Not

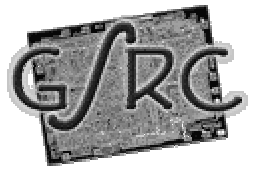


- **Not concerned with development processes**
  - **doesn't matter whether paper was written w/ typewriter, troff, Word**
  - **focus is on results, relevance, usability**
  - **e.g., authors may use confidential and unpublishable source code**
- **Not concerned with teaching of development processes**
  - **separate from enforcement of standards**
  - **possibly useful to improve quality of implementations (saves us work)**
  - **may be pursued given explicit demand**
- **Not concerned with infrastructure for frequent maintenance**
  - **emphasize initial quality of submissions**
  - **avoid "maintenance wars"**
  - **little need to support versioning**
    - qualitative improvements should be credited as new submissions (e.g., DAC97 paper on HMetis1.0, DAC99 paper on HMetis1.5)
    - authors support versioning independently and make consistent releases

Bookshelf Structure (high-level)

- **Data hierarchy**
  - a bookshelf covers a “domain” e.g., VLSI CAD
  - slots cover the domain by “areas”
  - each area is covered by submission in the respective slot
  - individual submissions represented by “entries”
- **Steering committee**
  - interprets what belongs to the ‘domain’ and what does not
  - formally introduces new slots
  - solicits entries necessary to improve coverage
  - organises reviews of submissions
  - makes acceptance decisions
  - works with authors on revising submissions

Types of Entries by Function

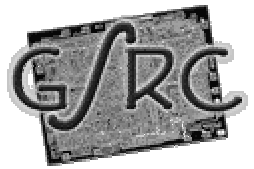


- Generic problems
  - **standard file formats**
  - **standard in-memory representations (classes)**
  - **passed to optimization engines**
  - **integrated I/O including parsers of standard benchmark formats**
  - **standard (benchmark) instances**
  - **some information about solutions, best known solutions**
- Reference solver implementations
  - **usable in successful applications and comparable to best reported**
  - **support modifications and performance analysis**
  - **accommodate alternative modules to determine best combinations**
- Independent evaluators
- Heuristic evaluation and comparison methodology
  - **descriptions of testing procedures and best known results**
  - **precepts for experimental evaluation of metaheuristics**
  - **references to relevant benchmarks and reference implementations**

What Can Be Mapped Into Entries

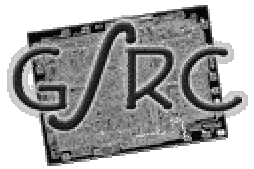
- Bibliographies, hyperlinks and other lists of resources
- Expositions
- Research papers, including experimental studies
- Descriptions of standard data formats
- Implementations
  - testcase generators, optimization algorithms
  - evaluators, consistency checkers
- Standard testcases and known good solutions
- Statistical data
  - characterisations of real-world instances
  - distributions of solution costs for known methods
  - best known solution costs etc

Dependency Model



- **Optimised for multiple independent submissions**
  - **main goal: availability of implementations**
  - **considerable reuse not expected at the beginning**
  - **unnecessary complications considered a burden**
  - **duplication allowed to simplify dependencies**
  - **refusing versioning support simplifies dependencies**
- **Extensions for reuse**
  - ***scalability is a requirement***
  - but ***we do not want to frighten the illiterati***
  - **implement extensions for reuse**
    - ***only when necessary***
    - **after establishing a reliable author/user base**

Acceptance Standards



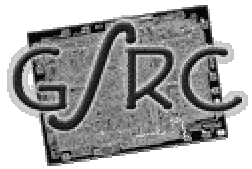
- Enforced by individual reviewers (by decr. criticality)
  - **availability**
  - ***fitness***
  - ***consistency***
  - **documentation and examples of use**
  - **availability of tests**

- Enforced by steering committee (by decr. criticality)
  - **accurate labeling**
  - **focus and utility**
  - **compatibility with common data formats**
  - **ease of evaluation using published mechanisms**
  - **acknowledgement of contributions, prior publications and support**
  - **compliance with copyright laws**

Technical Requirements

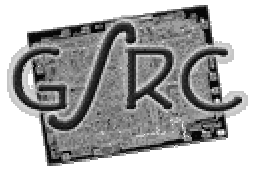
- Single-file submissions: **tar.Z** or **tar.gz** (**tar.bz2** ?)
- Consistent choice of **Unix, DOS or Mac-type line-end**
- Accurate labelling of file types
  - **non-ASCII files**
    - **graphics, e.g., postscript, PDF, GIF, JPEG**
    - **executables**
    - **data in publicly available formats (e.g., GDSII)**
    - **data in submission-specific formats**
  - **executables**
    - **interpreted language(s) used, e.g., sh/csh/per**
    - **platform for compiled binaries**
    - **type of libraries: static or shared**
    - **executables linked: statically, dynamically, semistatically**
- At least 1of 3: Linux, Solaris, NT
- Interpreted languages
  - **must be supported by 1 of 3 platforms out-of-the-box**

Reusing Existing Infrastructure



- **Leverage the WWW for display, access and docs**
  - **convenient and unavoidable**
  - **allows submissions with content-specific GUI**
  - **prospective entries may already have nice Web site (esp. for docs)**
    - **e.g., http://cadlab.cs.ucla.edu/~trio/ (can link to it or copy)**
- **Use CVS for storage/retrieval ?**
  - **easy since everything is likely to be stored in a tree**
  - **CVS features barely used (versioning, comments, ownerships etc)**
  - **entries = compressed releases *or* hyperlinks, <u>not development trees</u>**
  - **submissions may not be produced from development trees**
  - **we do not wish to impose use of CVS on contributors**

Use Scenarios

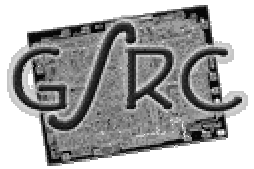


- **Steering committee solicits submissions**
  - bookshelf supports encyclopedic and unbiased coverage
- **Researchers volunteer to submit their codes as entries**
  - bookshelf gives additional credit to past work
- **Industrial affiliates publish benchmarks**
  - publicity to the company and a boost for academic research
- **Students using bookshelf working on dissertation**
  - bookshelf offers reference and educational help
- **Reviewers use Bookshelf to evaluate a new paper**
  - bookshelf helps easy evaluation
- **Researchers compare new algos to what's in Bookshelf**
  - bookshelf ensures competitiveness

Current Progress

- **Creation of several "charter" slots**
  - **hot areas: hypergraph partitioning, standard-cell placement, single-tree interconnect synthesis, block placement/packing**
  - **emphasis on high quality, exemplary behaviors (e.g., source code release)**
  - **will meet stated goal for December (3-5 slots instantiated)**
- **Outreach to academic groups and industrial affiliates**
  - **advisory role for slot definition**
    - problem statements
    - format specifications
  - **contribution of reference data, entries**
  - **prototype content of file format slots has been distributed**
- **Current infrastructure is Web-accessible tree**

Open Issues



- **How to achieve visibility, critical mass ?**
  - **support by contributions**
  - **support by editorial policies, conference review policies**
  - **need publicity and consistent message (N.B.: embedded tutorial at ICCAD99 was dinged)**
- **Integration of the bookshelf**
  - **with the development model supported by GSRC**
  - **common data models and file formats**
- **Scalability and infrastructure for reuse**
  - **not frightening anyone away with excessive requirements**
- **Policy for dealing with restrictions on reuse**