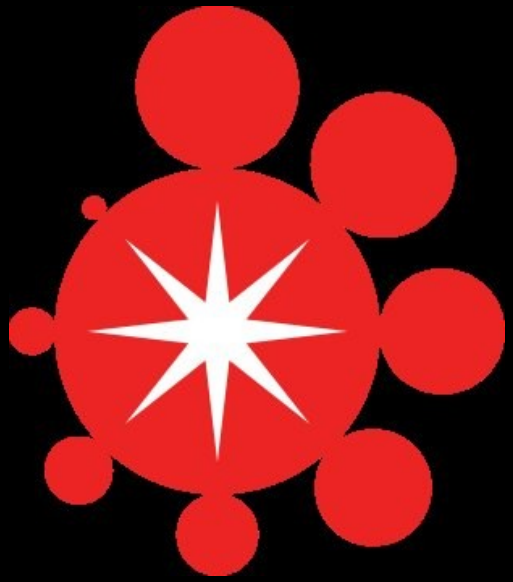
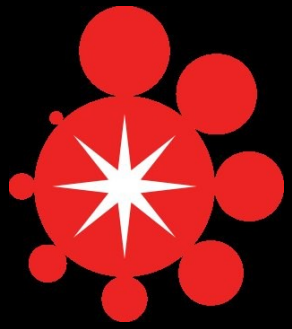


StarExec

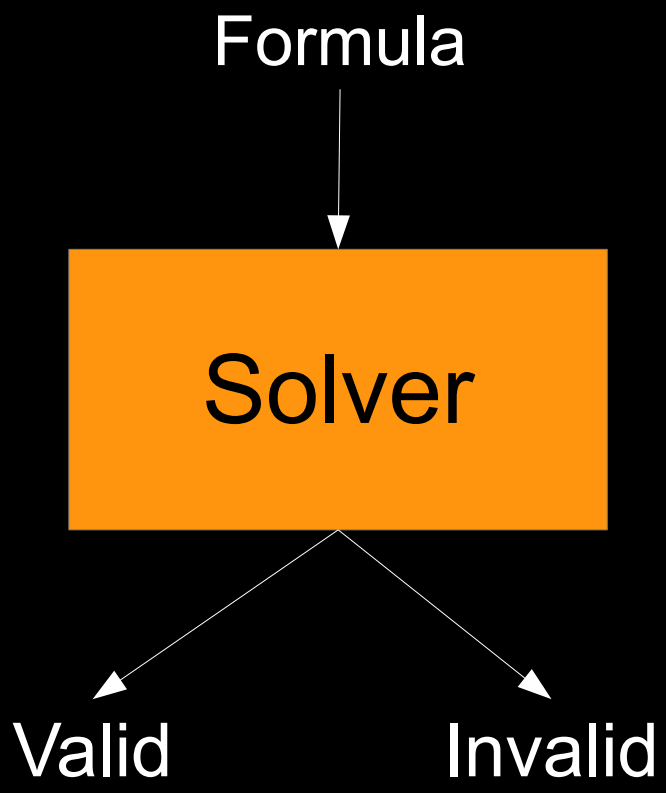
A Web Service for Evaluating Logic Solvers

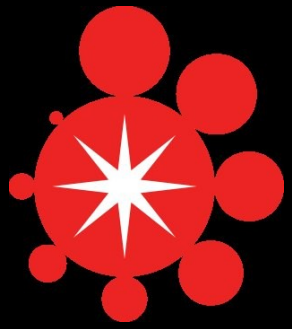
Aaron Stump, CS, U. Iowa
Geoff Sutcliffe, CS, U. Miami
Cesare Tinelli, CS, U. Iowa



What is a Logic Solver?

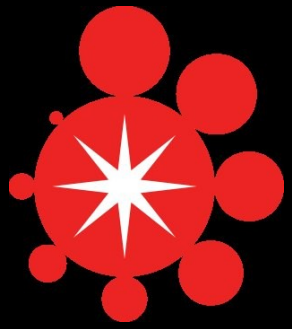
Program to test validity of formulas





Why are Solvers Useful?

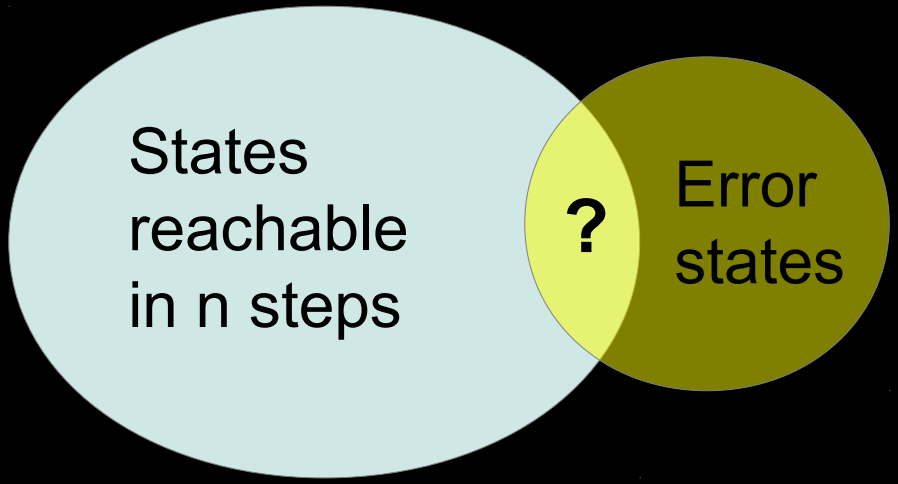
- Can encode many problems in logic
  - Verification, static analysis
  - Testcase generation
  - Planning, knowledge representation, etc.
- Efficient implementations
  - Boolean reasoning (SAT) is NP-complete
  - Still: can handle huge (megabytes) formulas
  - Many optimizations, heuristics



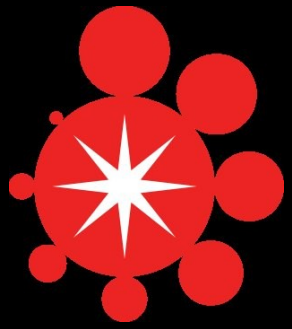
Verification & Solvers

Logic solvers used heavily for verification

- Express verification problem in logic
- Dispatch formulas to solver

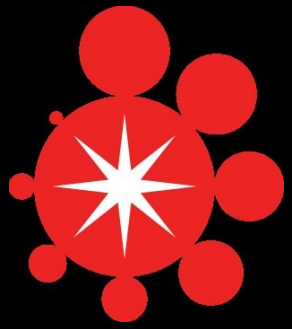


SAT(Reachable(n) $\wedge$ Error)?



Different Logics

- Many different kinds of logics, solvers
  - Restrictions, assumptions => different logics
  - SAT, SMT (SAT Modulo Theories)
  - First-order (subkinds), QBF, MAXSAT, etc.
  - Different research communities
- Different algorithms, characteristics
  - NP-complete, worse (SAT, SMT, QBF)
  - Undecidable (First-order, certain theories)



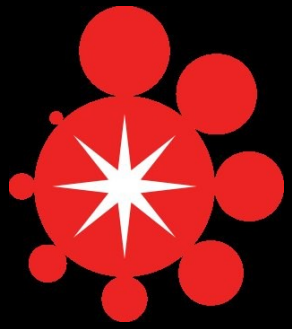
Example logic: SMT

Propositional logic + theories + quantified axioms

$(\text{data\_in} \wedge \neg \text{queue\_full}) \rightarrow \text{enqueue\_next}$

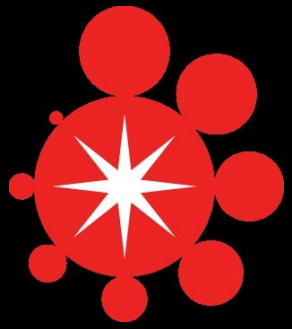
$(x = y + z \wedge f(x) > f(y) > f(0)) \rightarrow x \neq z$

$\forall x, y.\ \text{len}(\text{nil}) = 0 \wedge \text{len}(\text{cons}(x,y)) = 1+\text{len}(y)$



Community Infrastructure

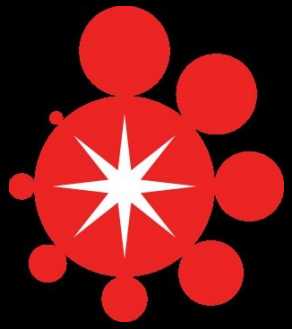
- problem libraries
  SATLib, SMT-LIB, TPTP, …
- recurring competitions
  CASC, HMC, SAT Race, SMT-COMP, ...
- execution services
  SMT-EXEC, SystemOnTPTP, termexec, ...
- standards and utilities
  DIMACS, EIGER, SMT-LIB, TPTP, …



Infrastructure Challenges

For solver users:

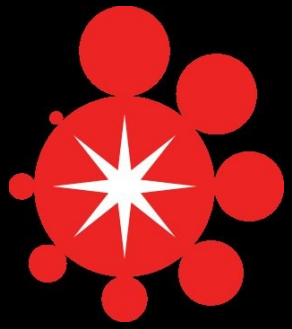
- What are the available solvers?
- Which solvers work best for my problem?
- Where can I run my experimental evaluations?



Infrastructure Challenges

For solver implementers:

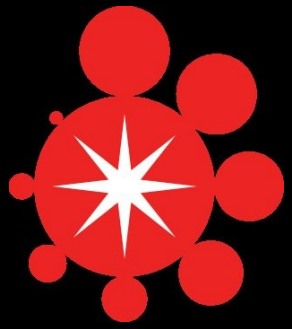
- How can I compare my solver with the state of the art?
- How can I conveniently test my solver on benchmark problems?



Infrastructure Challenges

For *community leaders*:

- Where can I store my library of benchmark problems?
- How can I run a periodic solver competition?
- How can I build infrastructure for my community?

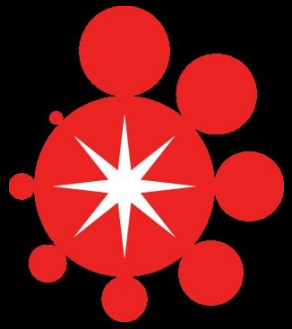


StarExec: Cross-Community Service and Infrastructure

Main Idea: create single shared infrastructure

- Avoid duplication across communities
- Reduce start-up costs for new communities
- Invest more resources in shared infrastructure
- Create a single destination for solver users

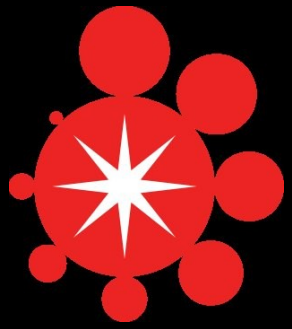
- Bring communities together (LFSC)



StarExec: Cross-Community Service and Infrastructure

Planned functionality

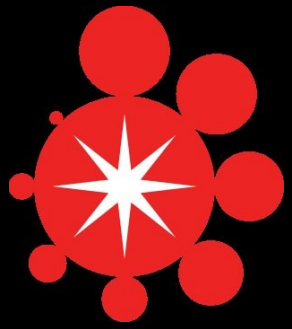
- ~200 processors, web service frontend
- Registered users can upload solvers, benchmarks; run jobs; download results
- Community leaders control community registration, run competitions, host benchmark libraries



Current Status

First Round of hardware acquisition

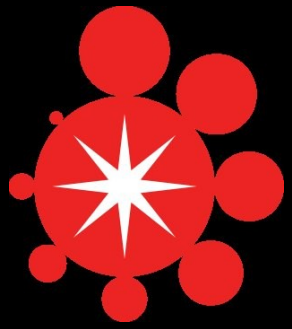
- 32 dual processor quad-core compute nodes
- 3 head nodes for web service requests
- 5 software development nodes
- 2 mirrored network storage units (22TB)
- Offsite back up facility



Current Status

Software development

- Web service (JSP, Javascript, MySQL)
- Job management (Oracle GridEngine)
- Features in progress:
  - Access control, permissions
  - Organization into spaces
  - Public access
  - Monitoring and administration



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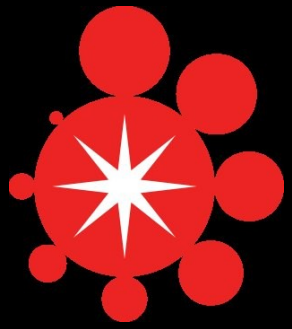
- Todd Elvers, Clifton Palmer, Vivek Sardeshmukh, Skylar Stark, Ruoyu Zhang
- JJ Urich, Hugh Brown (sys admin)

Advisory Board

- Daniel Le Berre, Nikolaj Björner, Ewen Denney, Aarti Gupta, Ian Horrocks, Giovambattista Ianni, Johannes Waldmann



Conclusion

StarExec: shared logic-solving infrastructure

- Encourage adoption of solvers
- Foster innovation in logic solving
- Bring solver communities together
- Collect benchmarks
- *Increase power for applications*

http://www.starexec.org