Boost Verification Efficiency with VC Execution Manager

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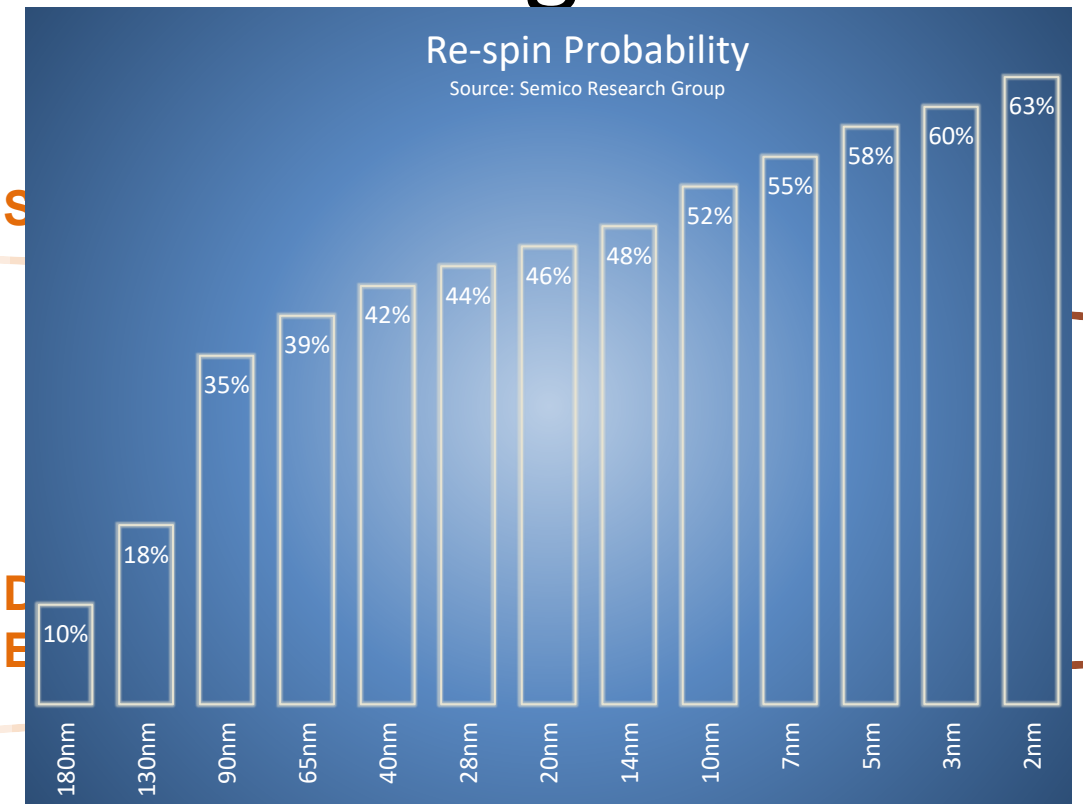
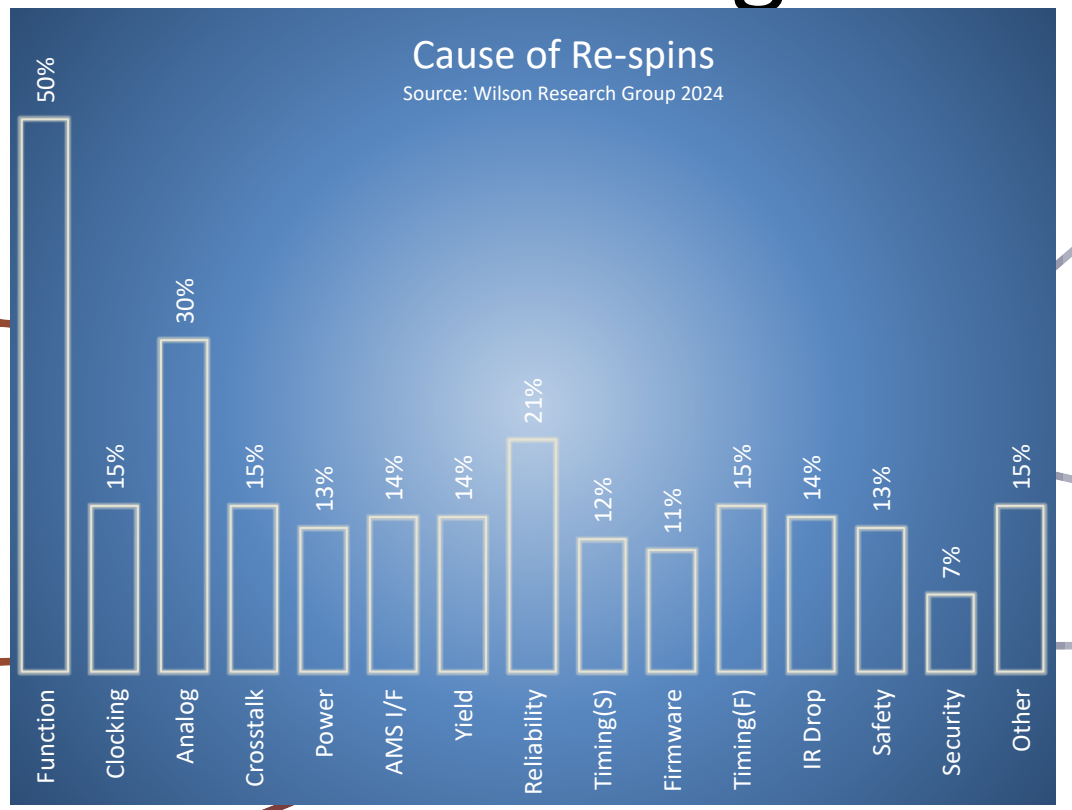
Agenda

- Introduction to VSO.ai (Verification Space Optimization)
- Verdi RDA (Regression Debug Automation)
- VC Execution Manager
- Benefits
- Demo
- Conclusion

The Right First Time Silicon Challenge

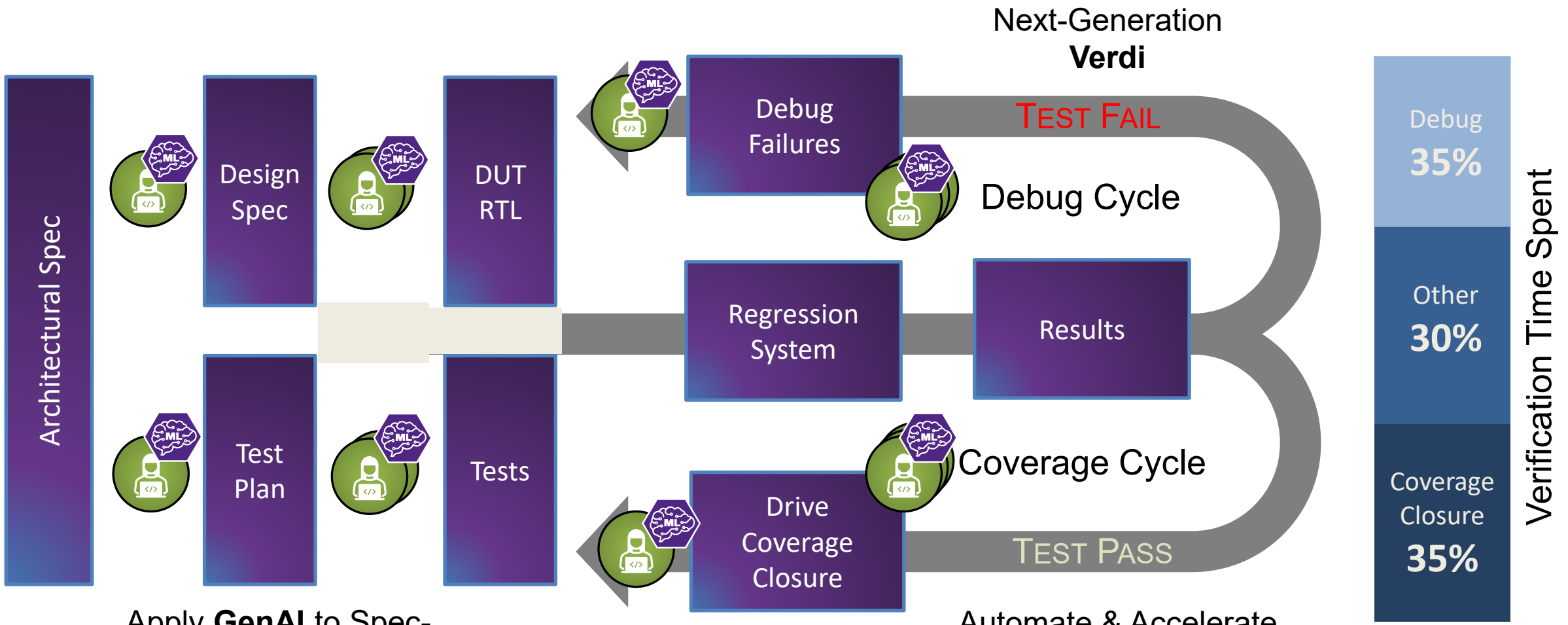




Design size & Verification

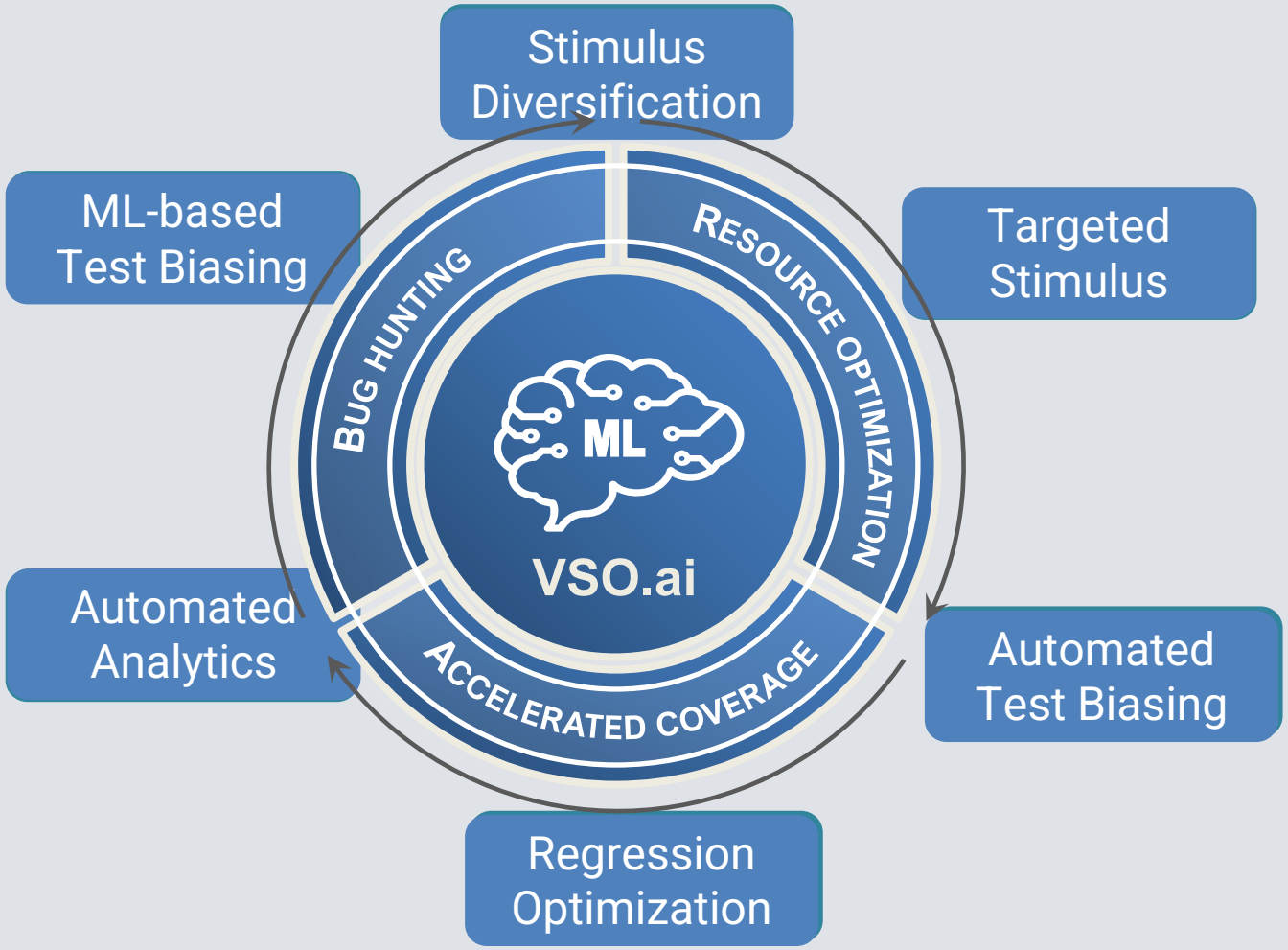
Find More Bugs with Limited Time & Resources

Where Are The Opportunities for Automation?



AI Driven Verification Space Optimization - VSO.ai

Faster, Higher Coverage Closure & Analytics



Stimulus Diversity: *Uncover bugs earlier while stressing the design*

Productivity Boost: *Advanced dashboards, metrics to analyze to converge on goals*

Improved HW Utilization: *Maximum coverage for the compute budget*

Higher Verification Efficiency: *High ROI tests to achieve coverage targets*

See What Customers Are Experiencing with VSO.ai

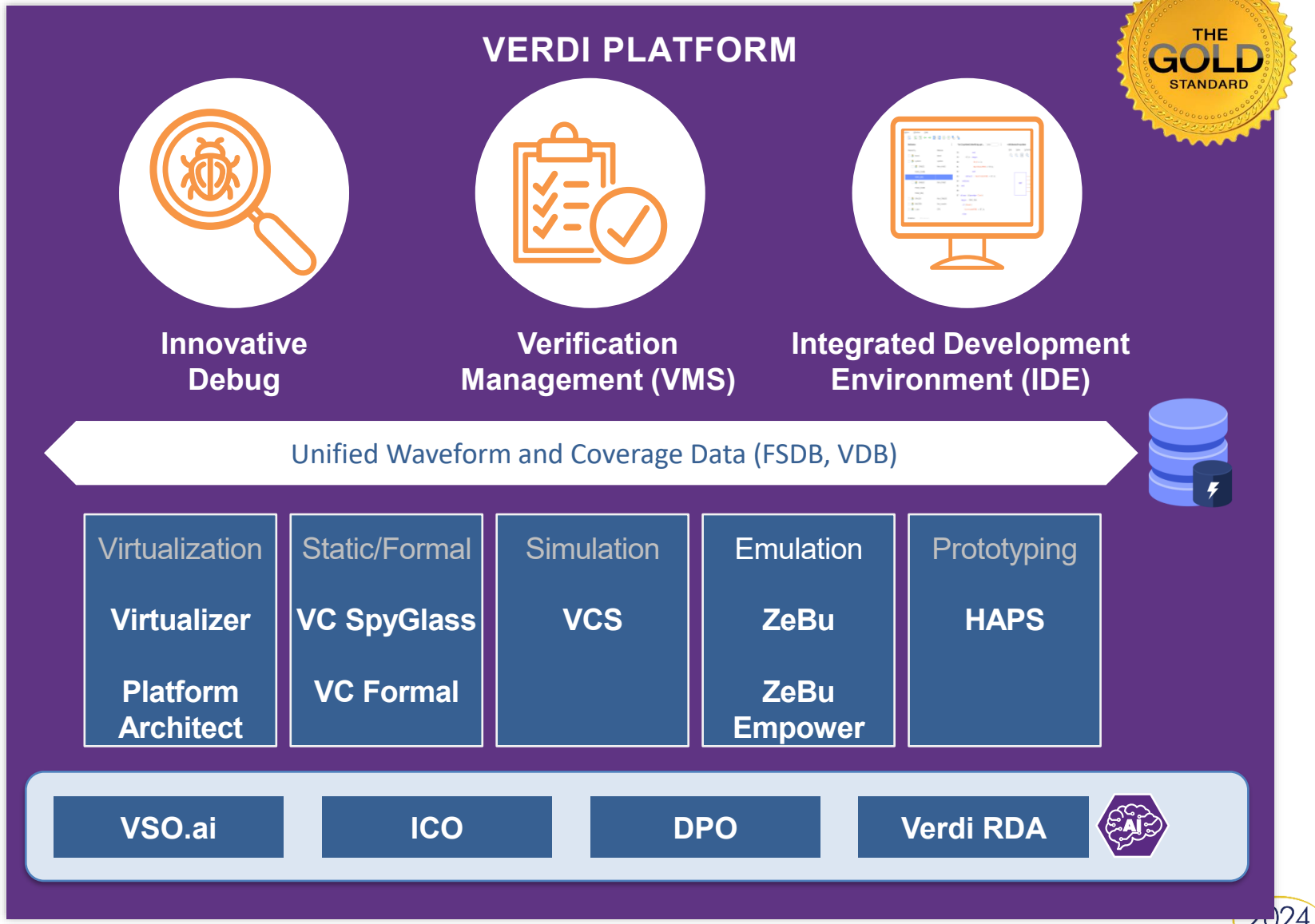
	REGRESSION	COVERAGE	
Automotive SoC	REDUCED TAT BY 2x	IMPROVED BY 10%	HIGHER QoR BY 50%
High-Performance Data Center CPU	REDUCED TAT BY 16x	IMPROVED BY 5%	FASTER TTR IN 1st ITERATION
High-Performance Wireless MCU	REDUCED TAT BY 10x	IMPROVED BY 20%	2000 RARE COVERAGE TARGETS IDENTIFIED
Mobile SoC	REDUCED TAT BY 8x	IMPROVED BY 3%	2600 ILLEGAL BINS EXPOSED

VERDI RDA (REGRESSION DEBUG AUTOMATION)

Verdi Debug and Verification Management Platform

Widest-Adopted Debug Solution

- Full-featured debug spans gates to software
- Infused with AI-based root cause analysis
- Integrated with Synopsys/third-party tools
- Extendible with user-defined apps
- Provides full verification management
- Enables IDE extension for VS Code



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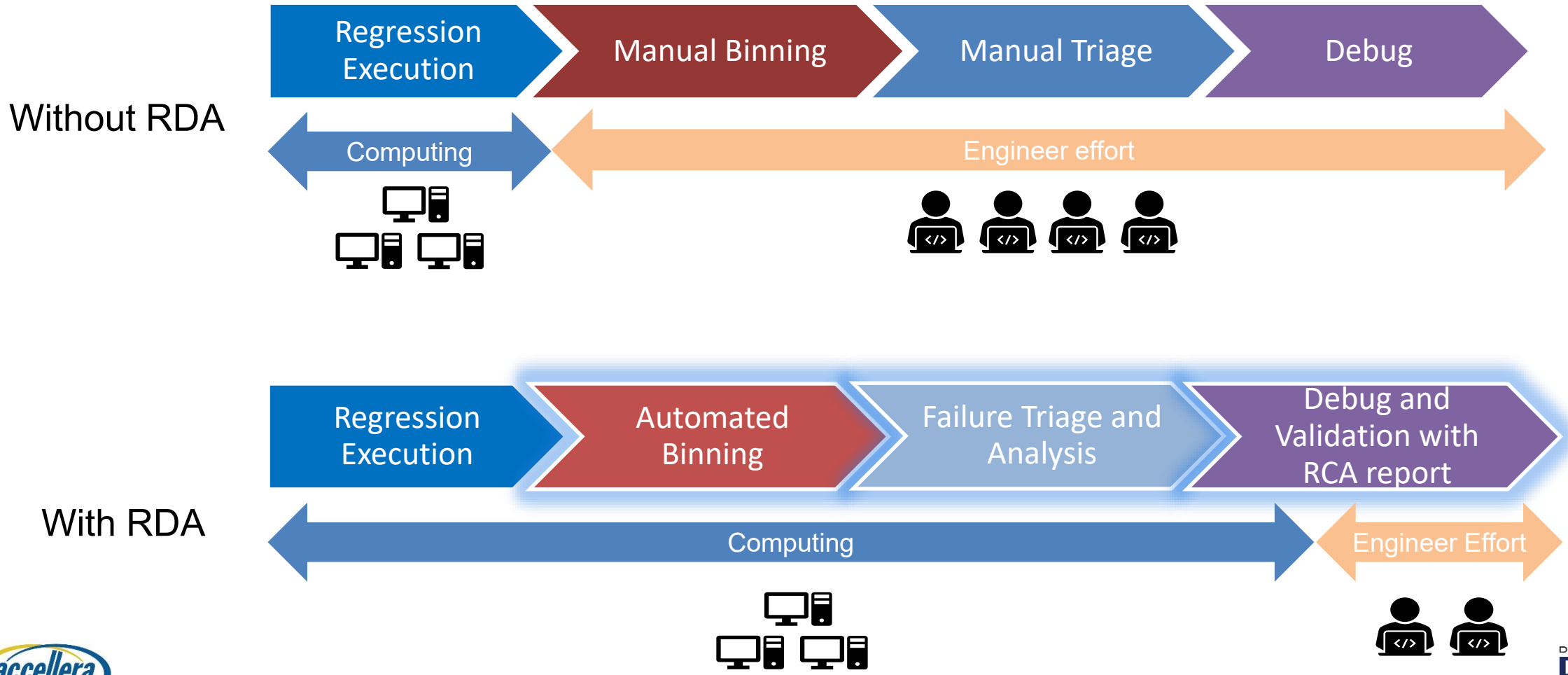
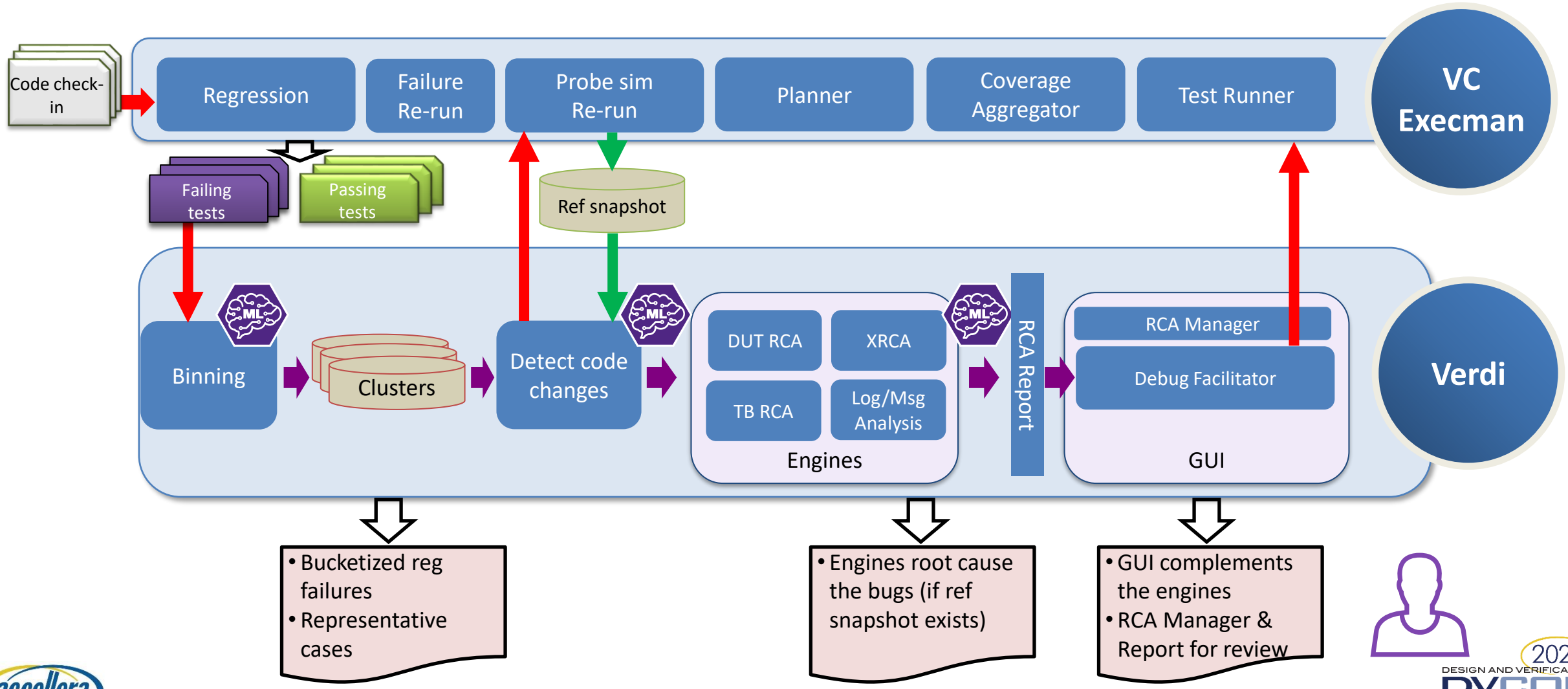
Regression Debug Automation (RDA) Motivation

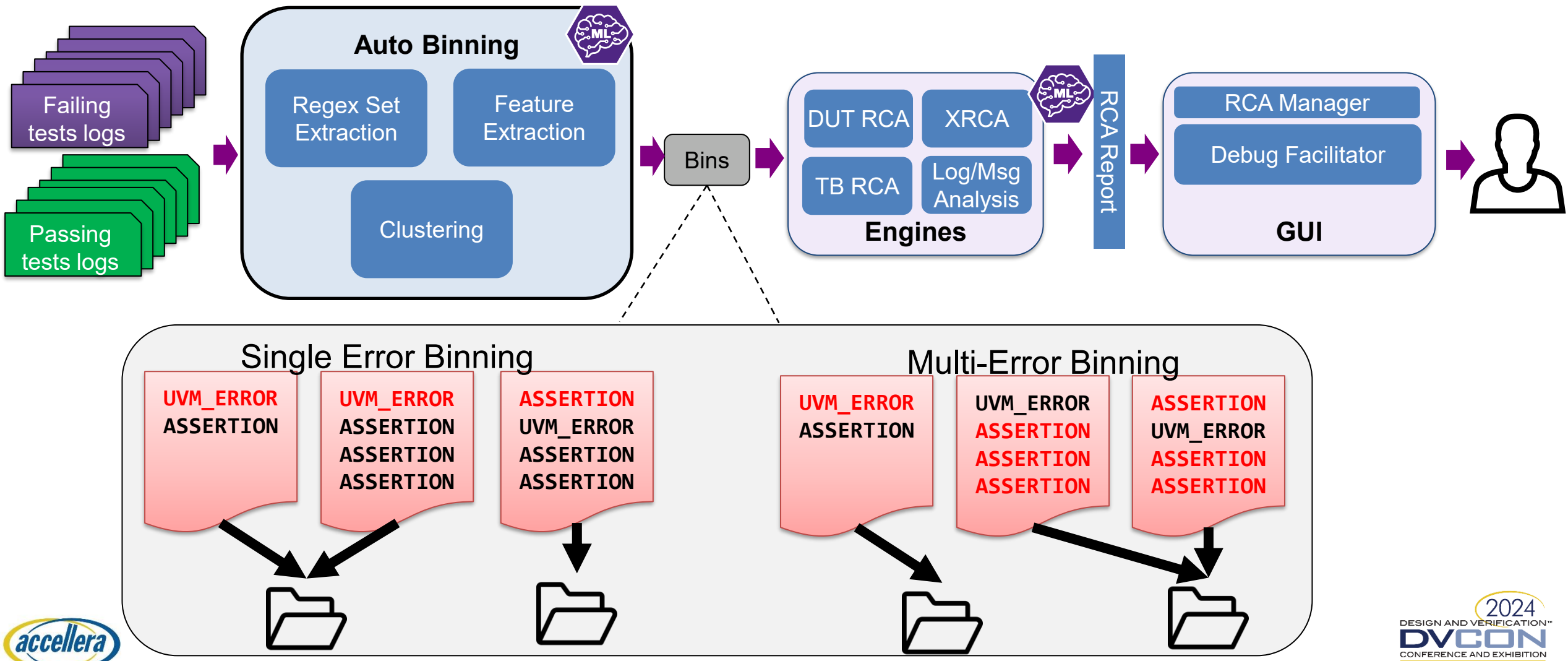
Reduce engineering effort/TAT with AI and advanced RCA technologies



ML-Based, Automated Regression Debug

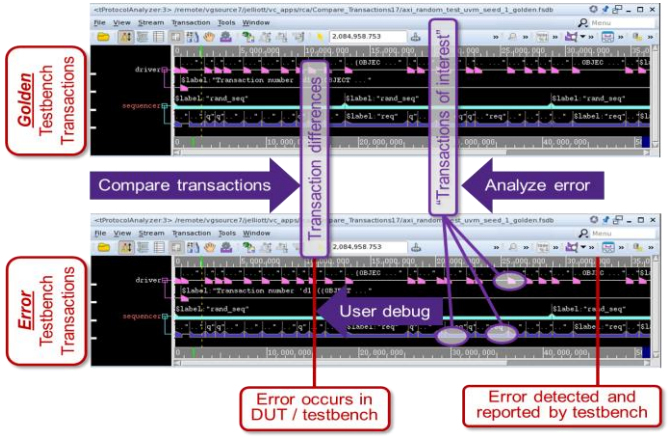


Verdi Regression Binning with ML



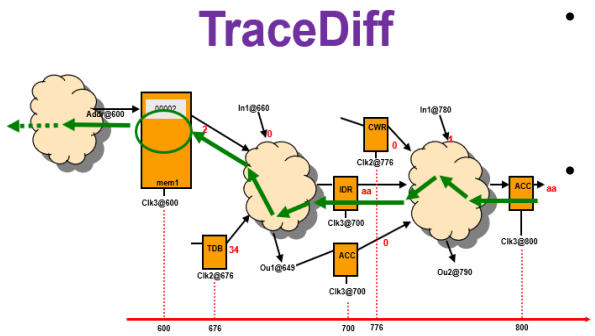
Verdi Root Cause Analysis (RCA) Engines

TBRCA



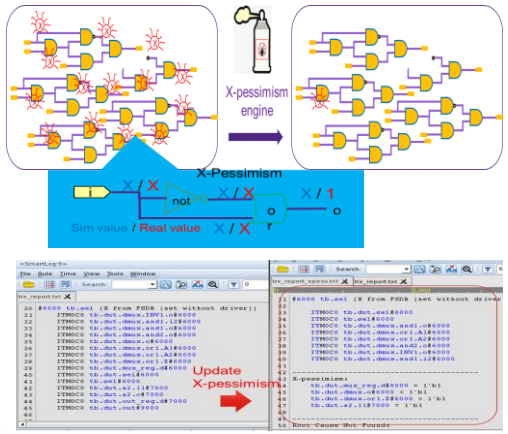
- Transaction Diff – Diff the transaction in the reference vs failing FSDB
- Message Analysis – No ref FSDB required. Analyze info from the “error” message.
- Report transaction of interest linked to the error

DUTRCA



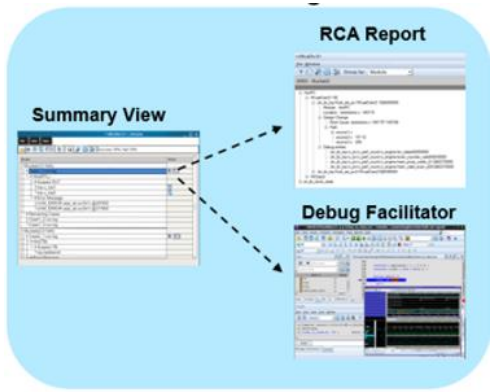
- Adopt roll back mechanism and TraceDiff technology to narrow down DUT problem
- Temporal Flow View to analyze root cause path

XRCA / with X-Pessimism



- Scan X signals in FSDB and trace the root cause of X.
- Handle large amount of X signals in batch mode
- Formal engine to identify X pessimism to remove the noise

Debug Facilitator



- Generates debug data nightly for each bin.
- Facilitates user to debug with “Protocol Analyzer” and “TB Reverse Debug”
- Reduces about 30 ~ 40% debug effort for TB debug

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Verdi Next-Gen: Accelerate Debug Automation

Customer Examples

Automotive

Gate-level with Many Xs

60x

XRCA Engine

Video

DUT Code Change

20x

DUTRCA Engine

Server

Multiple Failing Assertions

10x

DUTRCA Engine

Graphics

DFT with X Monitors

10x

XRCA Engine

Large SoC

Massive Log Files

5x

ML-Binning

Video

DUT Hang

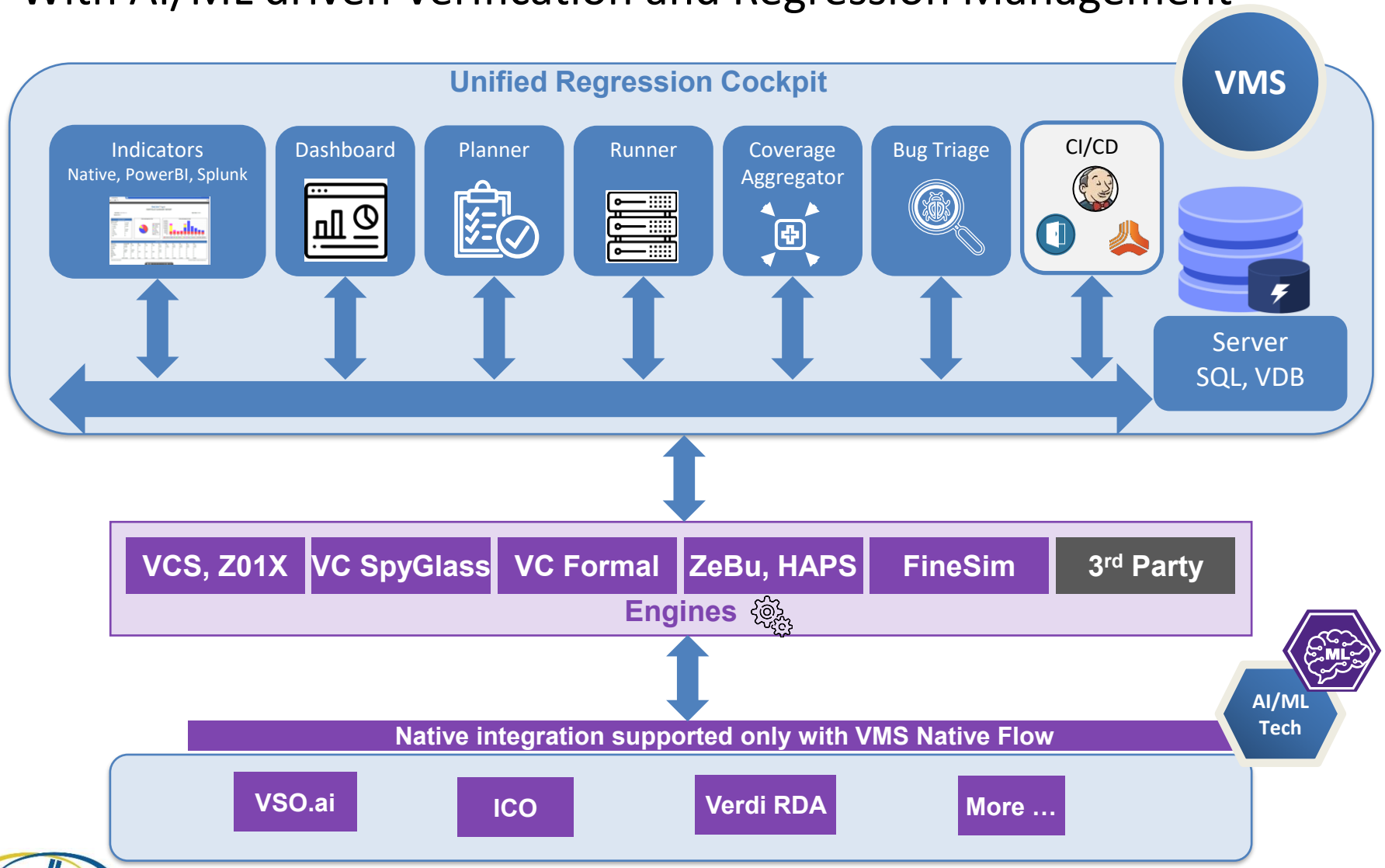
48x

DUTRCA Engine

VC EXECUTION MANAGER

VC Execution Manager

With AI/ML driven Verification and Regression Management



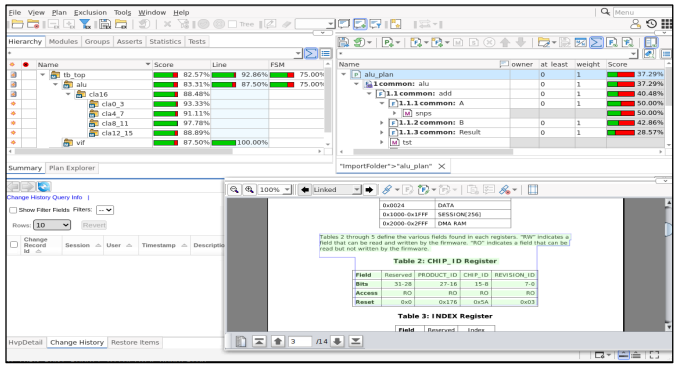
- Cockpit GUI based on Verdi
- Native indicators with open database support for PowerBI & Splunk.
- Comprehensive dashboards
- Scalable multi-user Verification/Coverage Planner
- Unified and extensible Runner
- 24x7 Coverage Aggregation
- Native failure binning, triage and debug assistance
- Unified AI-enabled technologies
- Enables CI/CD methodology support for verification
- Cloud support
- Supports industry standard APIs – Rest, CLI, Python etc.

VC Execution Manager – Key Modules

Dashboard

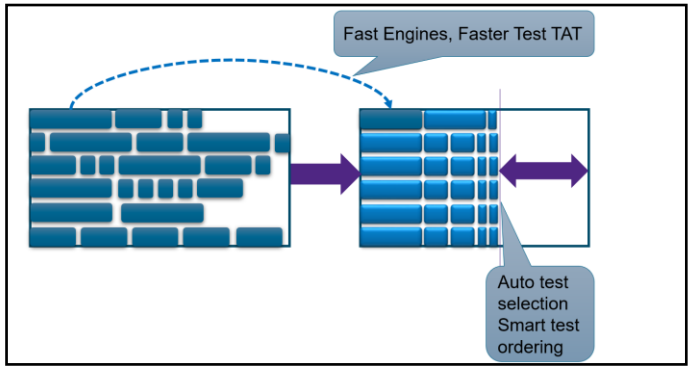
- Test planning, execution & debug, coverage merge and annotation
- Enables verification data-over-time to be mined for analytics

Planner



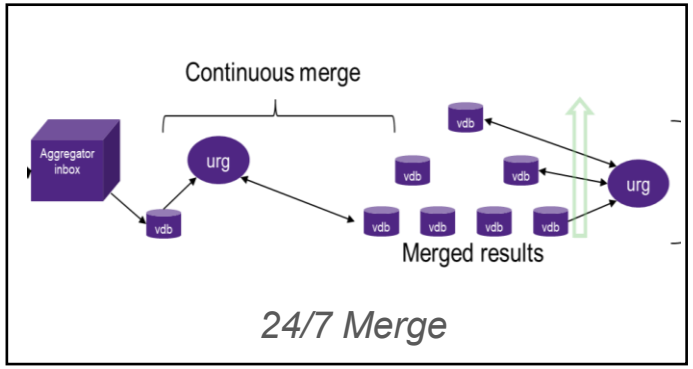
- Multi-user test scheduling/planning
- Supports change history and restore
- API for automated report generation and updates

Runner



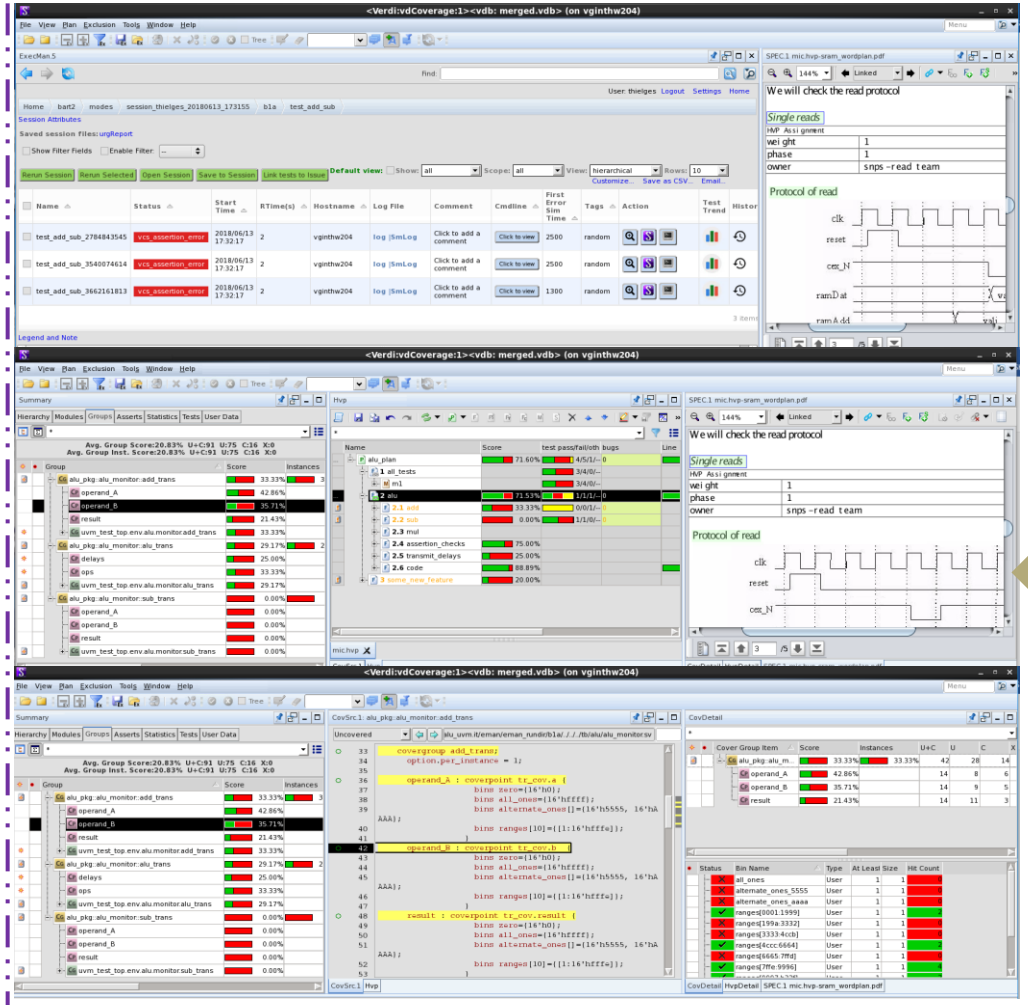
- Runs and optimize regressions
- Order tests to eliminate long tail

Coverage Aggregator



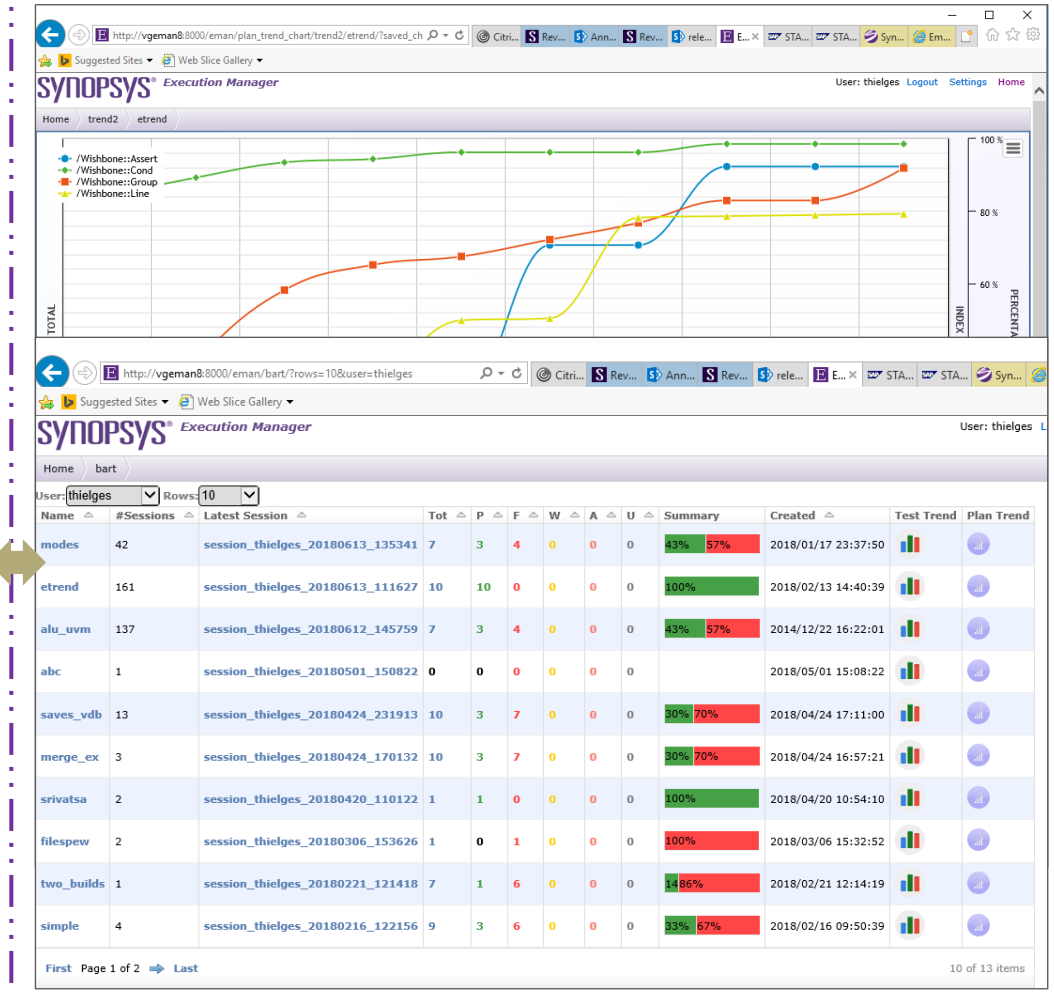
- Continuously merges incoming coverage
- Integrated tagged VDB from ad hoc regression runs
- Can generate moving window merge VDB

Dashboard Users View – Usability



VC Execution Manager

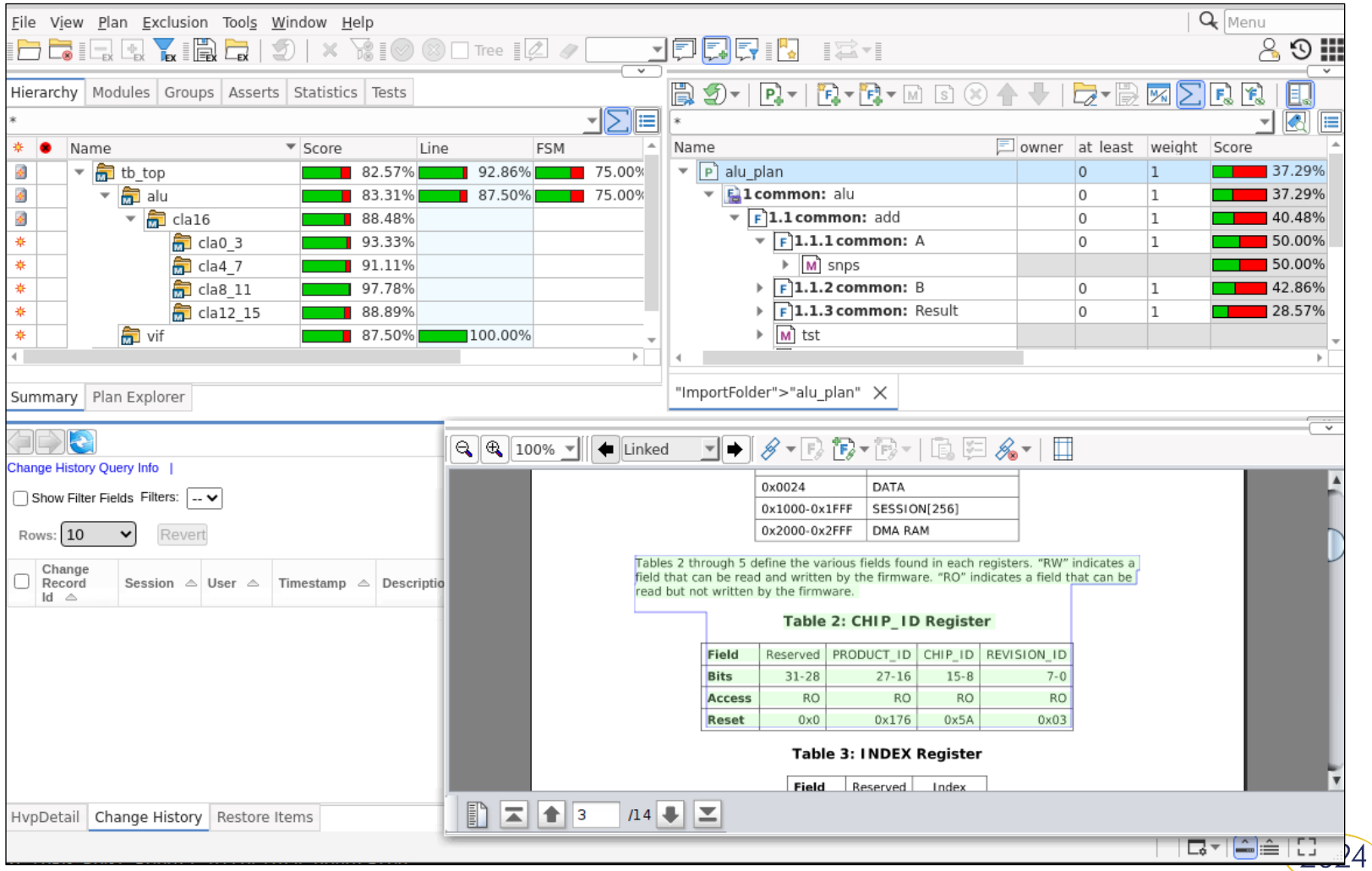
API



Planner

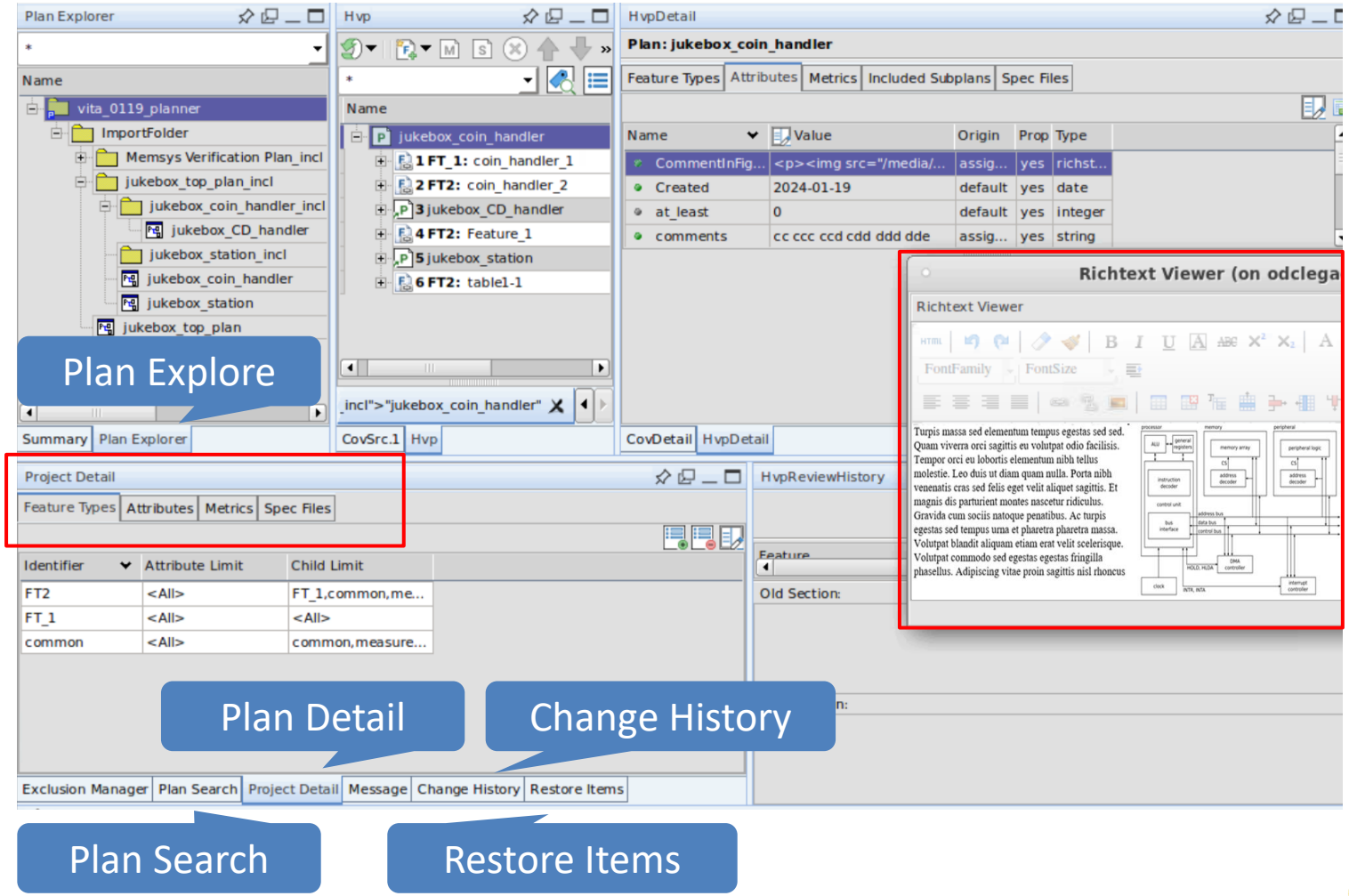
DB based Verdi Hierarchical Verification Planner (HVP)

- Verification plans created/viewed by multiple users
- Organizes content by projects and projects hierarchically
- Scalable for large designs and users and cloud compatible
- Smart editor with rich text support, inline mages, tables; bulk edits; API



Planner - Details

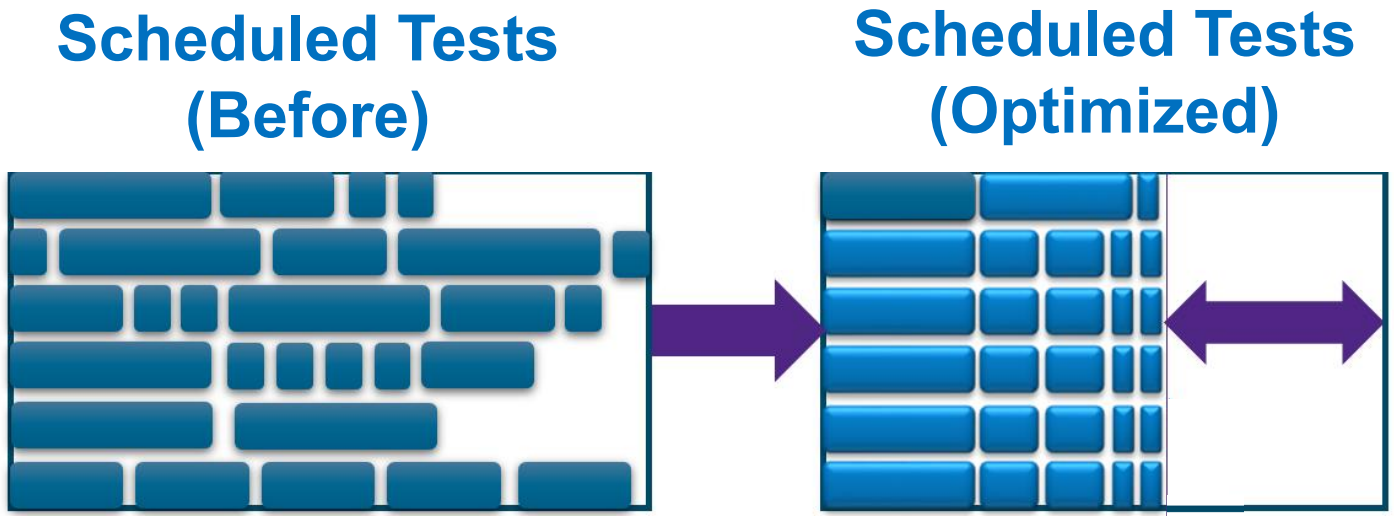
- **Database** backed application enables real time collaboration
- **Typed features** ensures that all plans satisfy project template requirements
- **Rich text fields** to describe detailed descriptions
- **Project-wide queries and bulk updates**
- **Change history and restore**
- **API** for automated report generation and updates
- **Verdi UI** (Linux) and **Web UI** (all platforms)



Optimize Regressions

Runner

- Reduce regression TAT and resources
- Schedules tests based on history to eliminate long tail
- Improves compute resources utilization, reducing costs
- Native cloud support

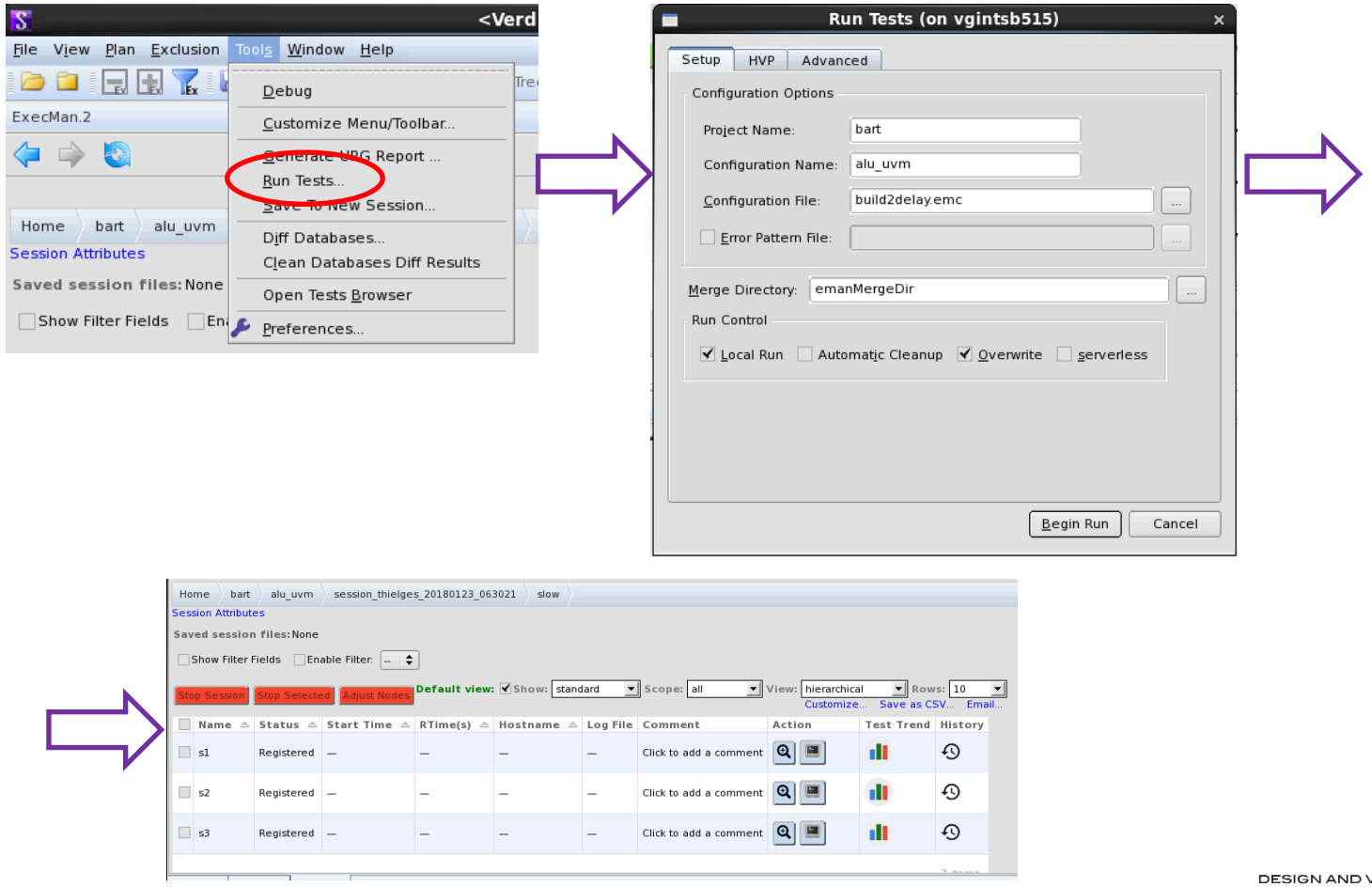


Considers: coverage, engine speed, smart test ordering

Runner - Launching Regressions

Methods

- Interactive
  - Easiest way to launch regressions
  - Includes live controls to kill, rerun, and adjust sessions
- Batch
  - Useful as part of complex scripts or launched as cron jobs



Coverage - Beyond Simulation

VC Formal example

- Coverage from additional verification tools can be incorporated
- Annotate VC Formal results in the coverage database
- Display VC Formal assertion status in the coverage report
  - Verdi coverage and URG
- Measure VC Formal assertion status in HVP

Assert	Type	Success/M	Attempt	Failure	Incomplete	Vacuous	Category	AllMatch	Severity	FirstMatch	FVtype	FVstatus	FVdepth
fsm.a1	Assertion	1	0	0	0	---	0	---	0	---	assert	proven	
fsm.a2	Assertion	0	0	0	0	---	0	---	0	---	assert	falsified	65
fsm.a_complete_frame	Assertion	1	0	0	0	---	0	---	0	---	assert	proven	
fsm.a_loop_break	Assertion	0	0	0	0	---	0	---	0	---	assert	inconclusive	70
fsm.a_onehot	Assertion	1	0	0	0	---	0	---	0	---	assert	proven	
fsm.a_trans	Assertion	0	0	0	0	---	0	---	0	---	assume		
fsm.c1	... Property	1	0	---	0	0	0	---	0	---	assert	proven	
fsm.c2	... Property	0	0	---	0	0	0	---	0	---	cover	inconclusive	70
fsm.c_blk_cnt	... Property	1	0	---	0	0	0	---	0	---	cover	covered	1
fsm.c_onehot	... Property	1	0	---	0	0	0	---	0	---	cover	covered	1
fsm.c_trans	... Property	0	0	---	0	0	0	---	0	---			

Merge |

Merge Name	Status	Spool Log(s)	URG Report	Score
merged.vdb	merge_passed	60.log	urgReport	51.59

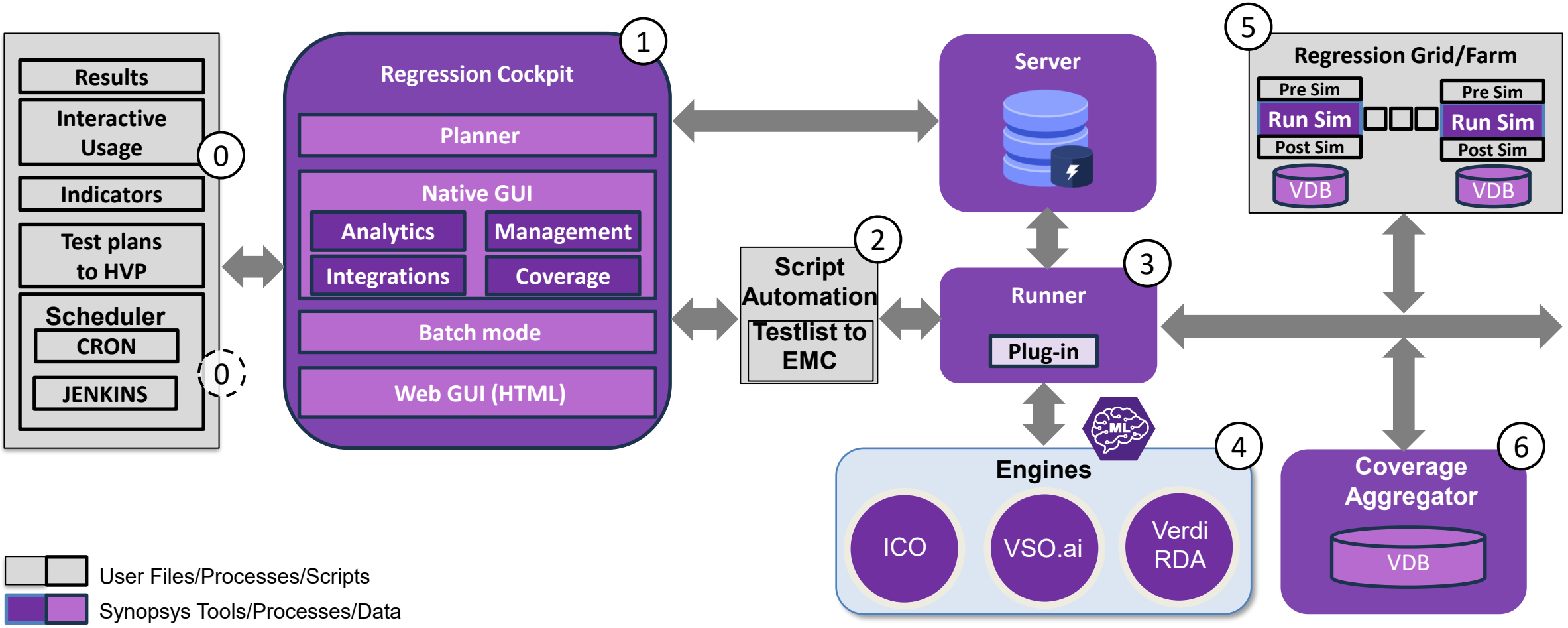
Scores for Verification Plan

SCORE	ASSERT		FVAssert	NAME
36.84	31.58	6/19	42.11	top

NAME	SCORE	ASSERT		FVAssert	fvassert_expected_status	fvassert_expected_mindepth	fvassume_status
top	36.84	31.58	6/19	42.11	proven	-1	notreviewed
f_default	37.50	37.50	6/16	37.50	proven	-1	notreviewed
f_expected_assigned	25.00	0.00	0/2	50.00	inconclusive	50	notreviewed
f_assume	50.00	0.00	0/1	100.00	proven	-1	reviewed

AI/ML INTEGRATION AND BENEFITS

Integrated View: VC ExecMan with VSO.ai & Verdi RDA



Unified Verdi VMS with AI/ML Technologies

Optimized verification with reduced resources, risks and maintenance

Ease of Use and Data Analytics via Integration

- Faster rollout to project teams (save up to 12 months)
- Seamless integration with native solutions like VSO.ai
- Unified cockpit solution for regression results, data analytics, optimization outcomes and health of ML model

Reduced Risk, Simpler Maintenance

- Reduces incremental support overhead from weeks to days
- One DB/server (vs. multiple machines/DB/servers for hybrid systems with glue logic)
- Up to 2X reduced hardware costs

Regular AI/ML Rollouts and Updates

- 2-10X higher QoR with integrated ML and verification technologies when having full data access/control
- Immediate deployments of updates of VSO.ai, RDA, DPO, ICO and VC Formal rollouts (vs. months of integration effort)

DEMO

Conclusion

- One-stop solution to ease the complexity of diverse verification tasks
- Accelerates the deployment of advanced AI/ML verification and debug technologies
- Scales to accommodate multiple users and manage regressions seamlessly
- Results made simple with a user-friendly, graphical view of results