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SHANGHAI | MAY 26, 2021

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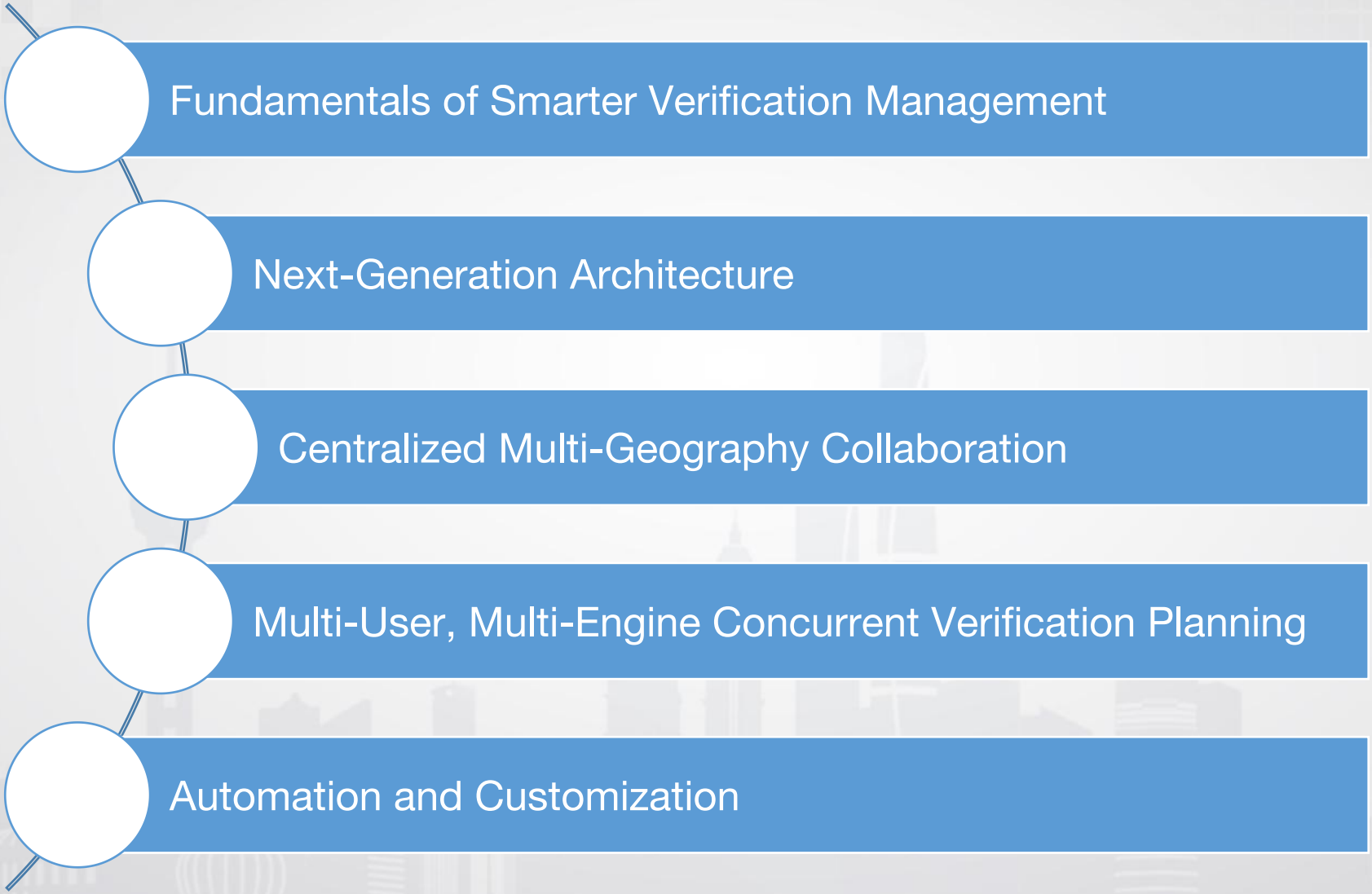
cadence

Smarter Verification Management with vManager Platform

David Zhang, AE Director, Cadence

Agenda


Fundamentals of Smarter Verification Management
Next-Generation Architecture
Centralized Multi-Geography Collaboration
Multi-User, Multi-Engine Concurrent Verification Planning
Automation and Customization

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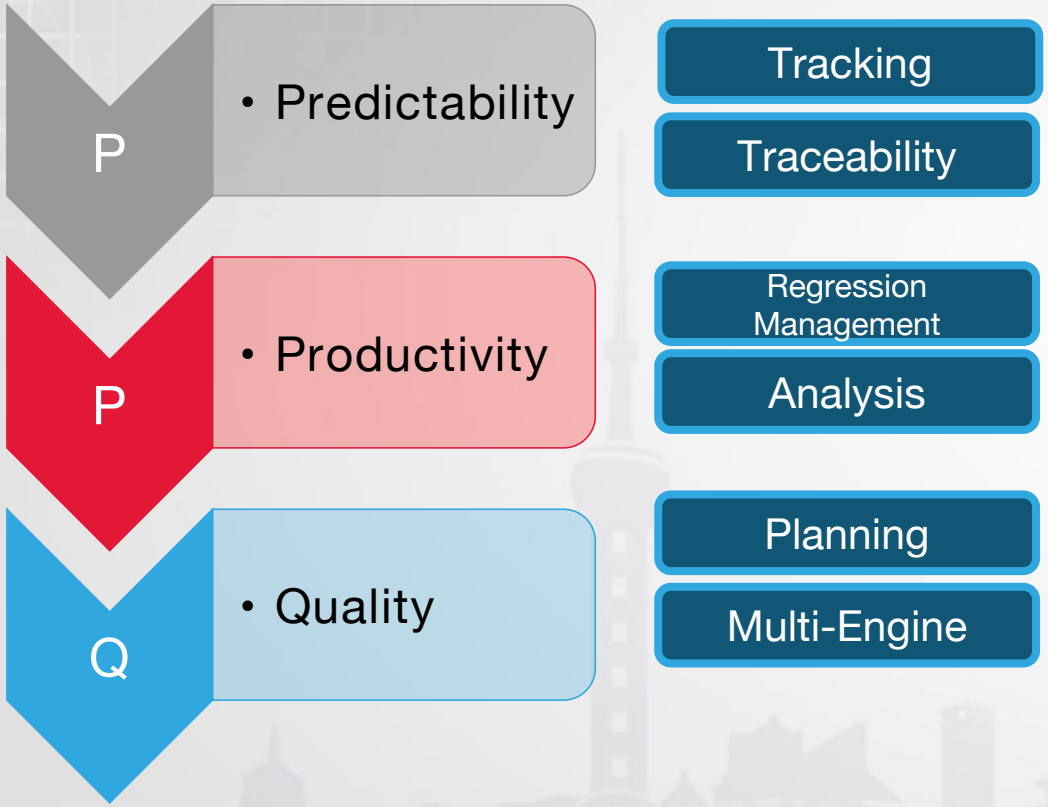
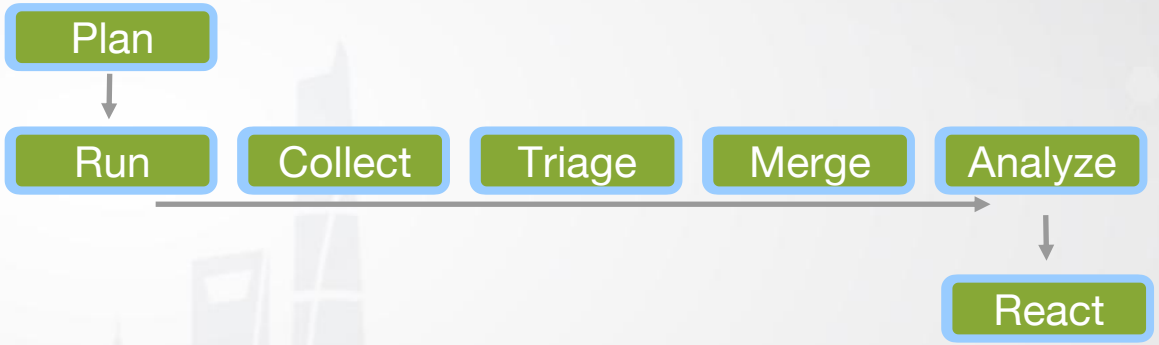
Fundamentals of Smart Verification Management

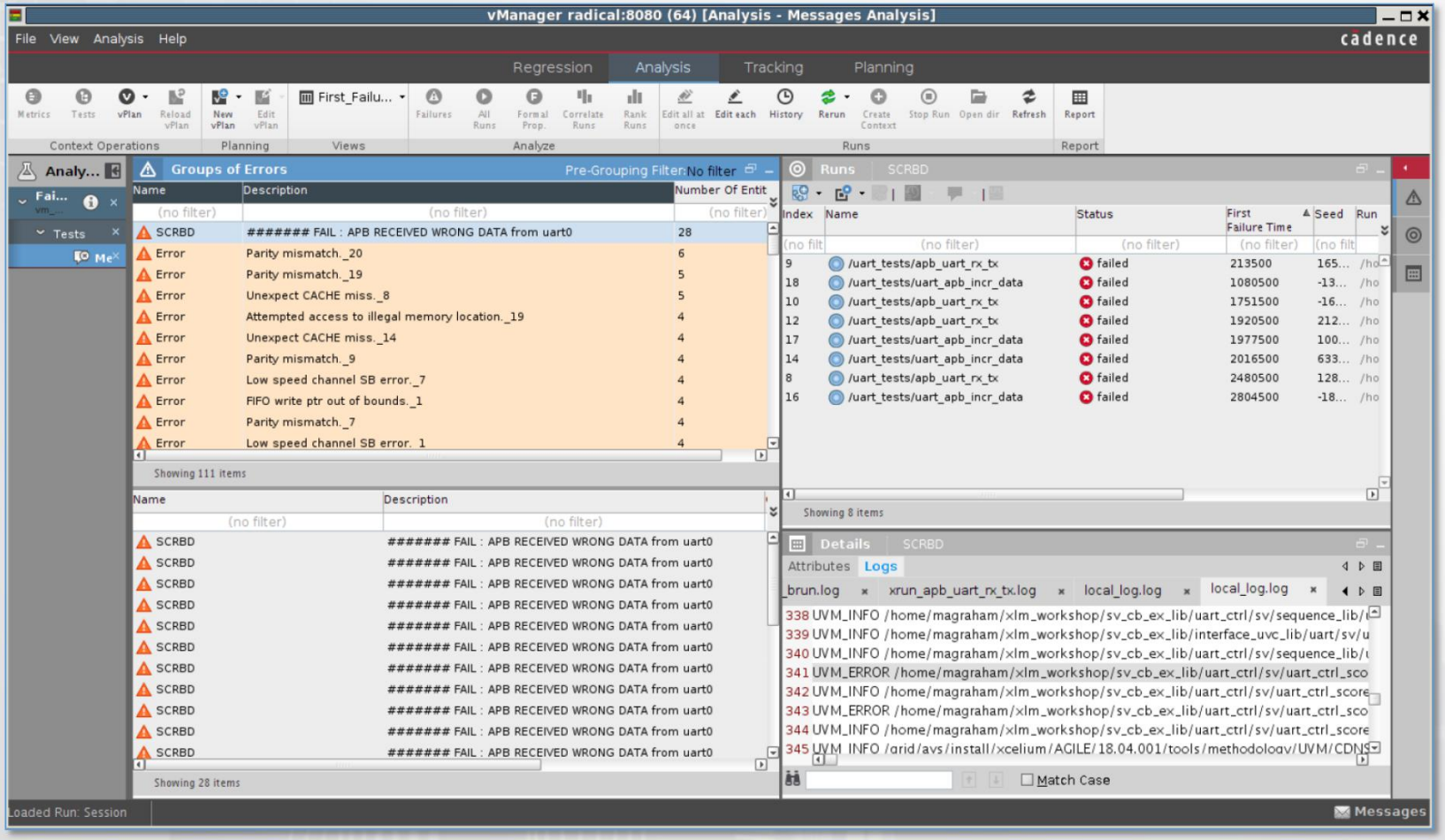
It’s all about predictability, productivity and quality

Better PPQ Verification Management Across the Flow





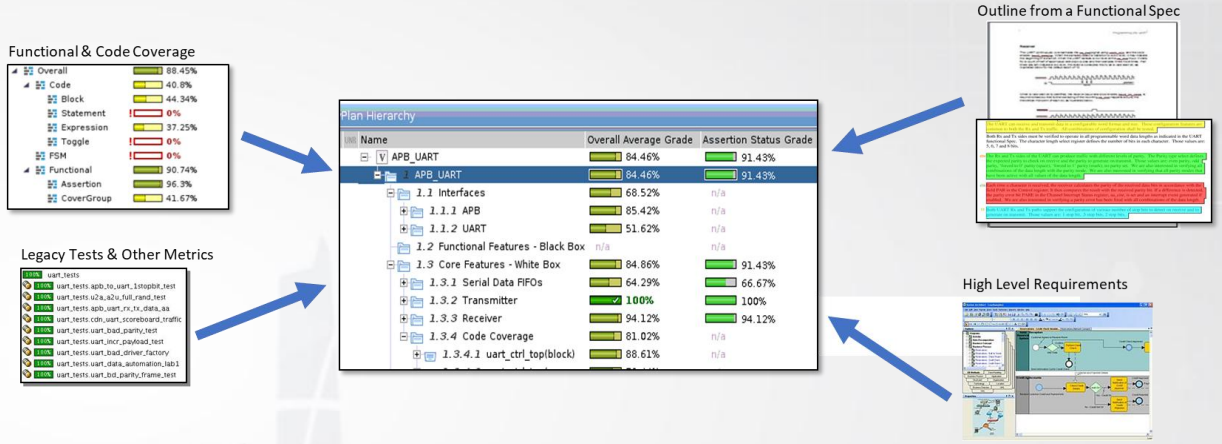
Productivity: Regression Round Trip



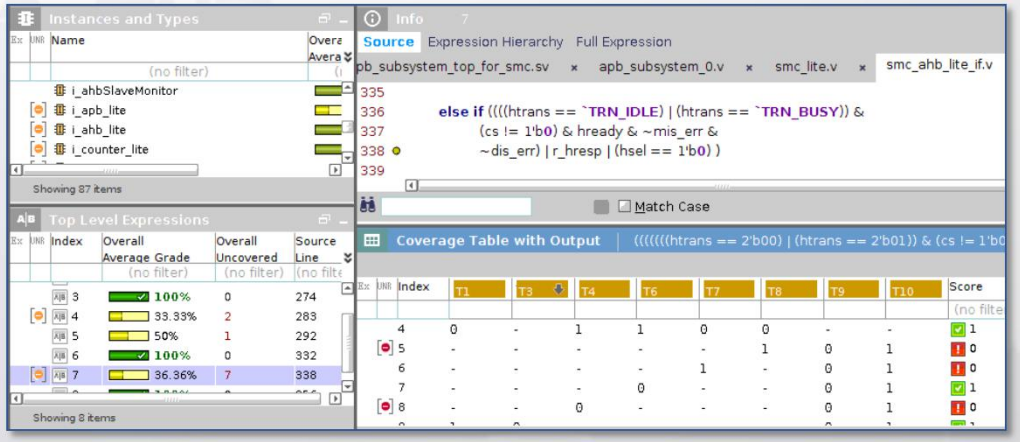
- Prioritize highest impact failure modes
- Identify shortest test for each failure mode
- Automated rerun to generate debug data

Predictability: Traceability

- Requirements traceability
  - Requirement import to seed verification plan creation
  - Link requirements and verification plan
  - Visibility of changes to requirements



- Coverage analysis
  - Multi-engine coverage merge/combine
  - Refinement (unreachability (UNR), UNR crosses)
  - Analysis of coverage vs. plan



Quality: Defined and Agreed Goals and Metrics for Entire Team

Identify Tests

Verification Plan

Link Specs

Plan Hierarchy

UNR	Name	Overall Average Grade	Assertion Status Grade
	APB_UART	84.46%	91.43%
	1 APB_UART	84.46%	91.43%
	1.1 Interfaces	68.52%	n/a
	1.1.1 APB	85.42%	n/a
	1.1.2 UART	51.62%	n/a
	1.2 Functional Features - Black Box	n/a	n/a
	1.3 Core Features - White Box	84.86%	91.43%
	1.3.1 Serial Data FIFOs	64.29%	66.67%
	1.3.2 Transmitter	100%	100%
	1.3.3 Receiver	94.12%	94.12%
	1.3.4 Code Coverage	81.02%	n/a
	1.3.4.1 uart_ctrl_top(block)	88.61%	n/a

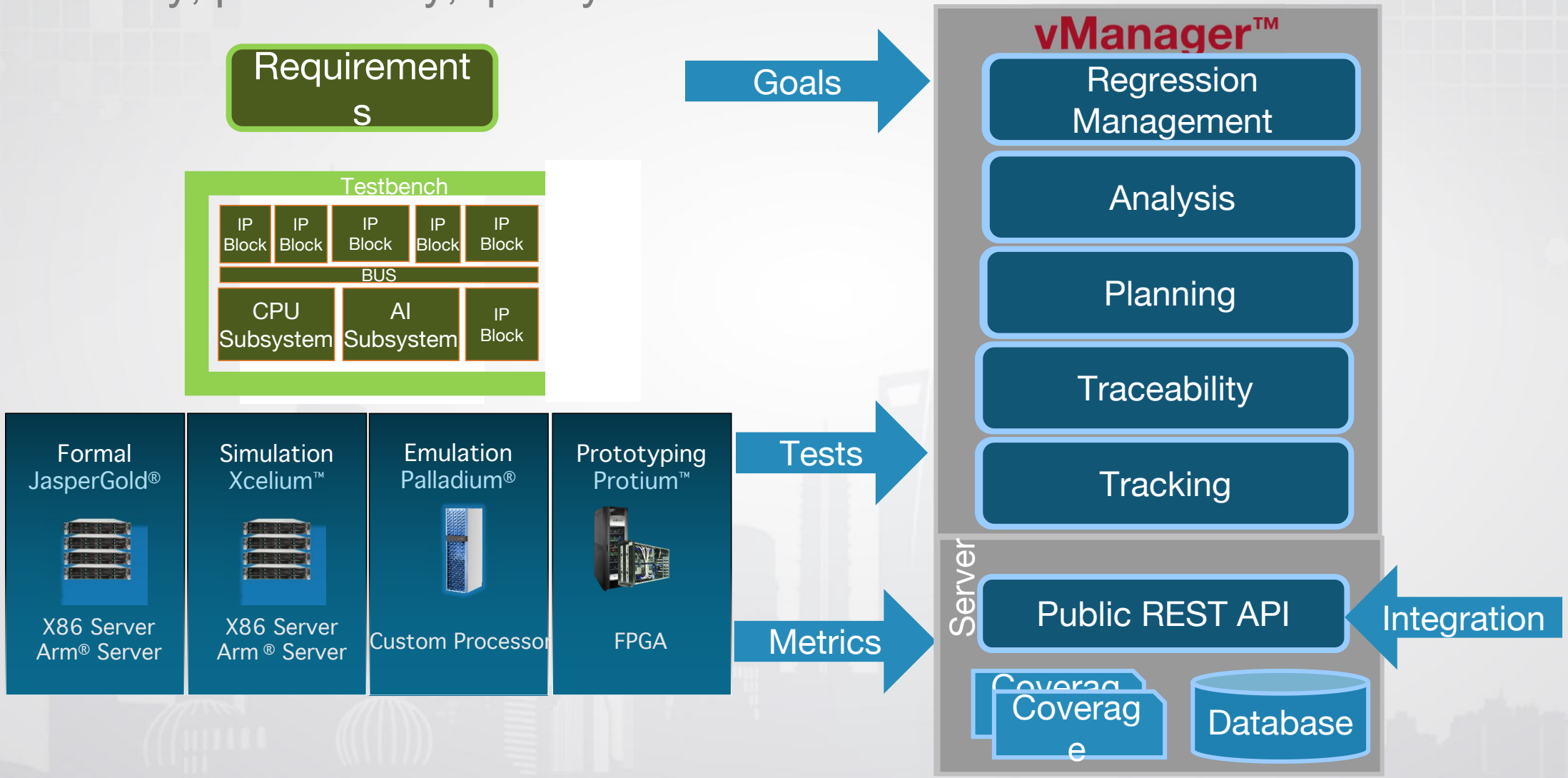
Identify Coverage

Import vPlans

Common Understanding

Smart Verification Management

Predictability, productivity, quality



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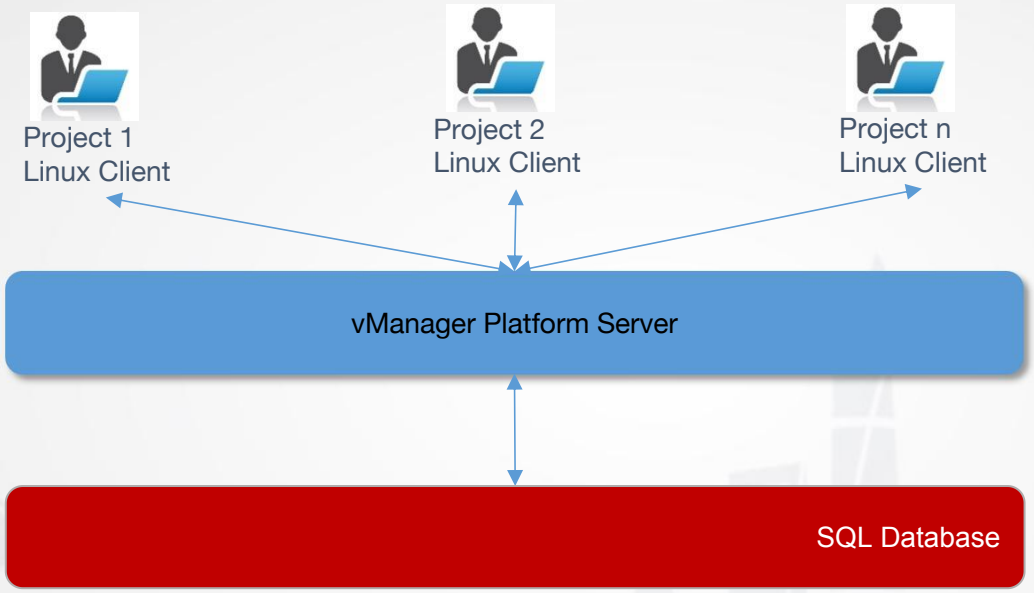
Verification Management System Architecture

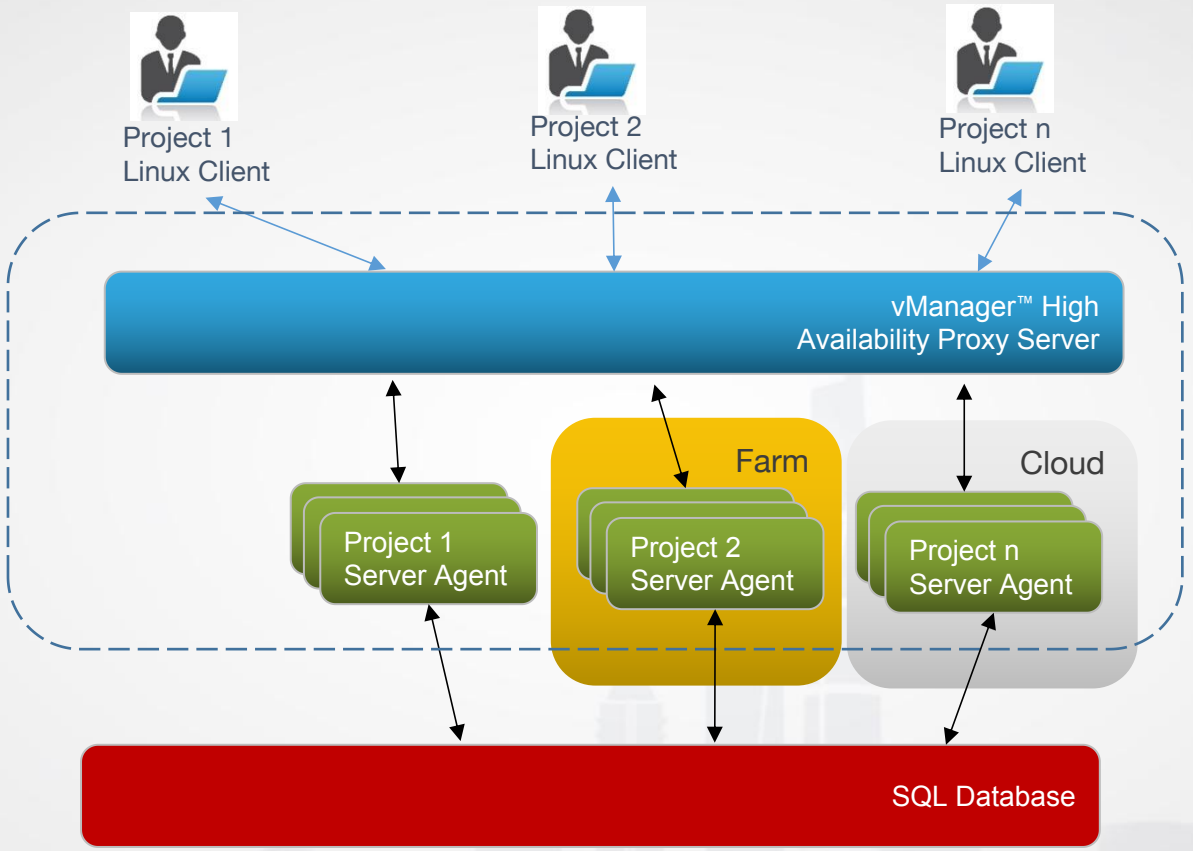
Scalability, reliability, and ease of admin

Current vManager Architecture



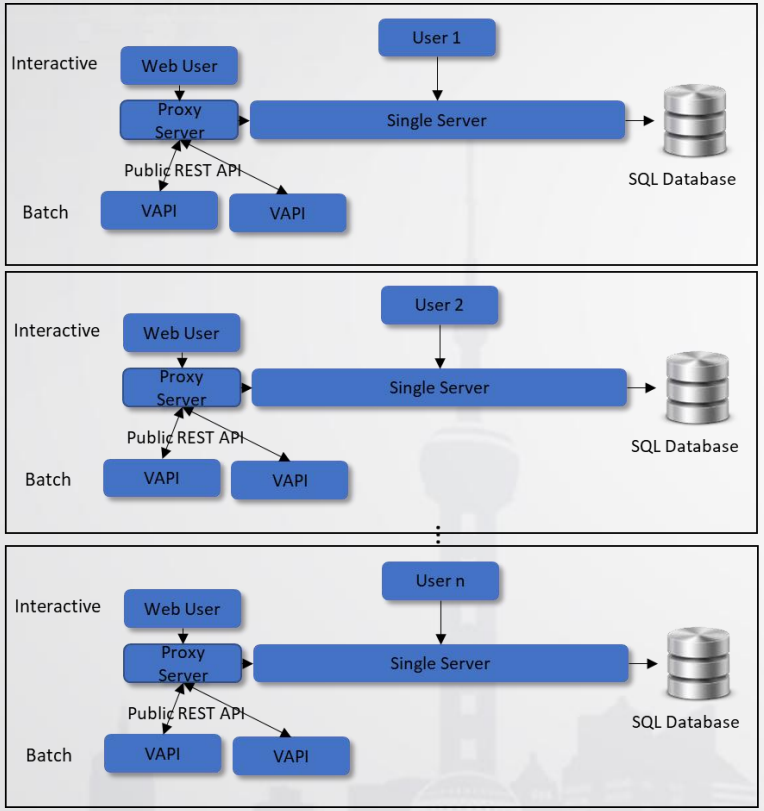
- Minimum requirement for a verification management system
  - Multi-user
  - Centralized database
  - Multiple project support

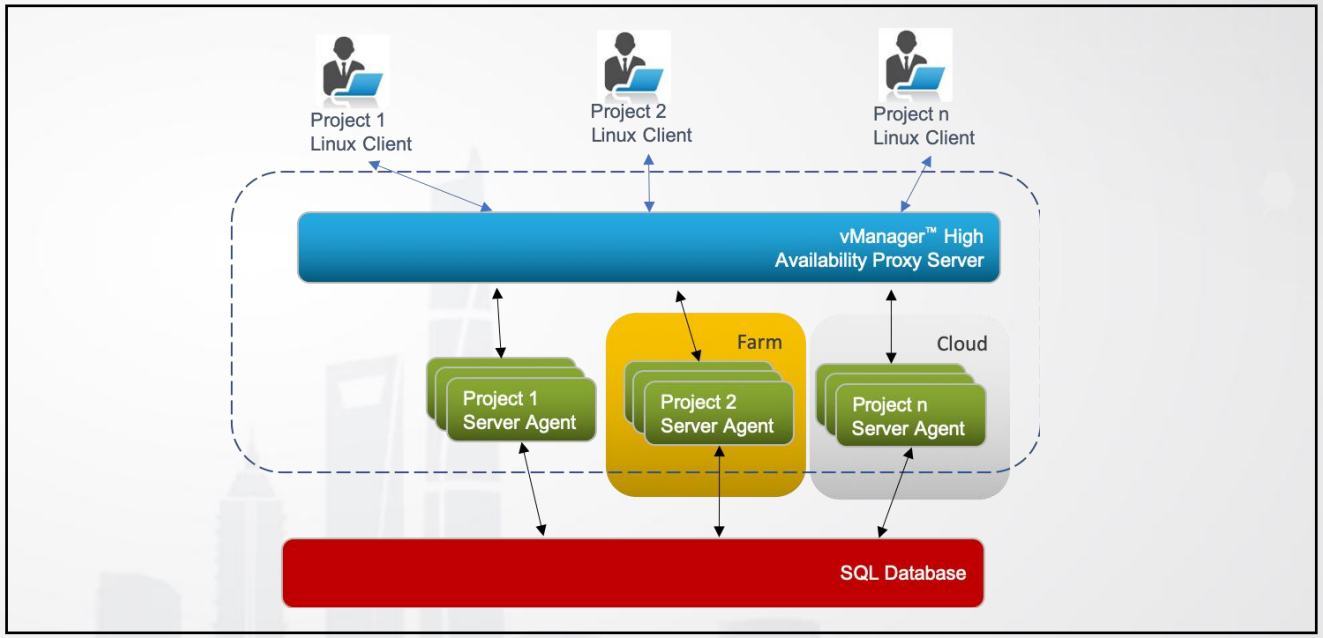
Next-Generation Architecture



- Load balancing and resilient routing
- Distributed processing for redundancy, scalability, and fault tolerance
- Provide scalable, resilient, reliable replacement for previous single, monolithic system

Distributed Architecture = Consolidation Opportunity





- Reduced maintenance overhead
- Lower IT infrastructure requirements
- Improved reliability and scale

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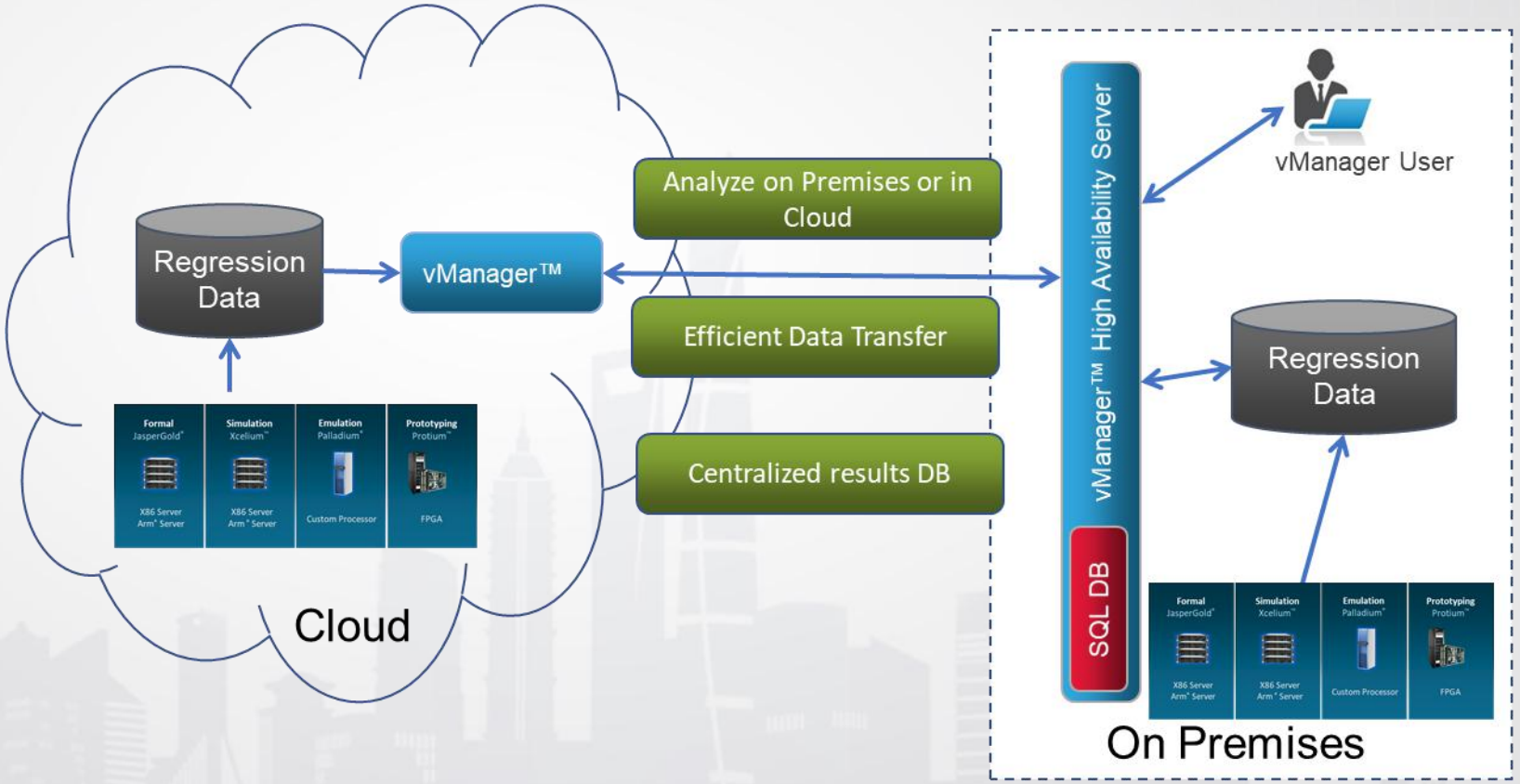
Multi-Geography Verification Management

Utilizing the advanced architecture to enable data centralization

Review – Basic Summary Data Sharing

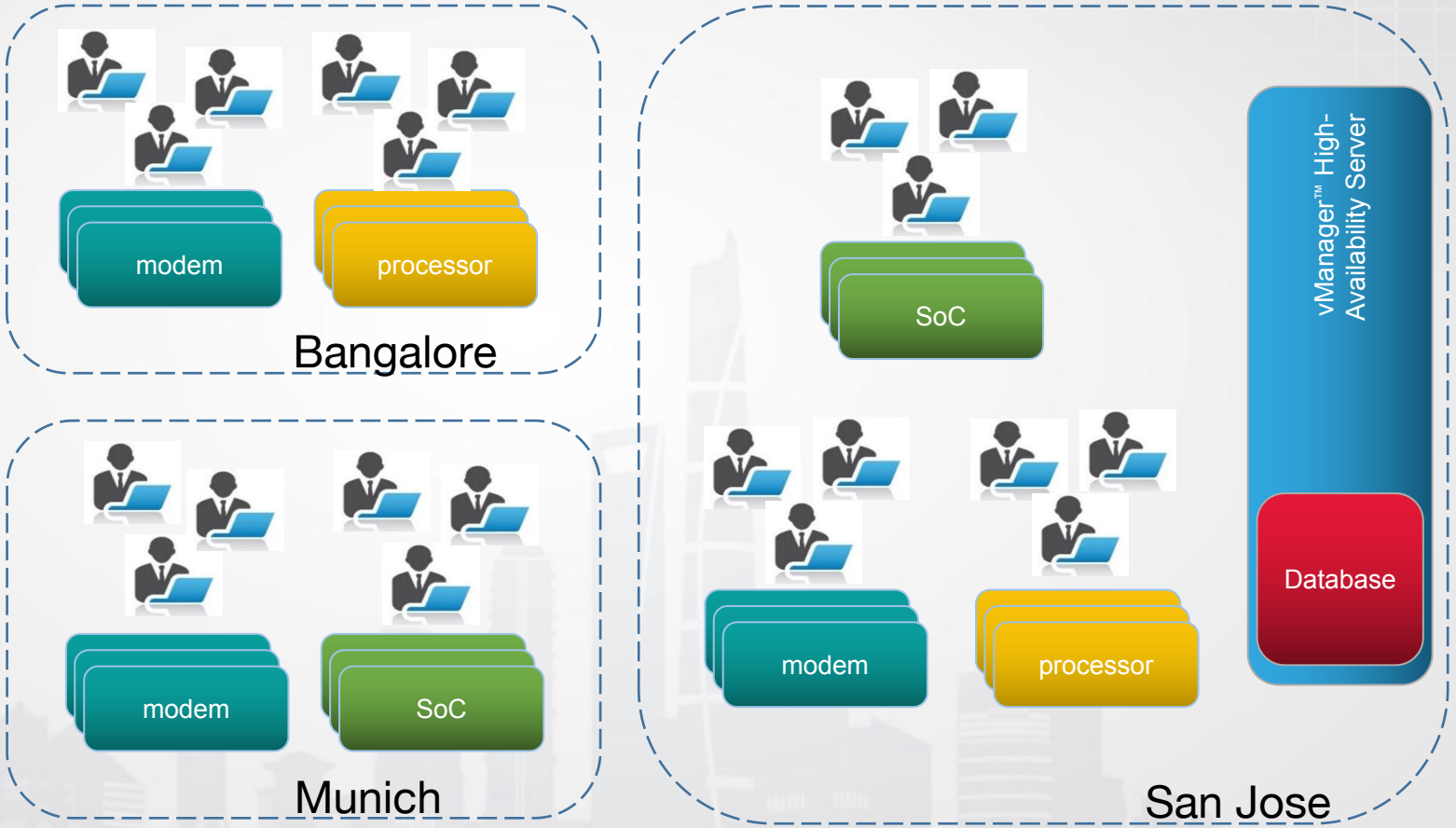
True Multi-Region Capability

- Distributed, enterprise ready architecture
- Scale across multiple sites and into cloud
- Centralized regression database for collaboration



Multi-Project, Multi-Region Topology

- Single vManager Server
- Central data management across projects
- Aggregated analysis and reporting across geographies



Case Study: vManager实际部署及系统性能

- 项目部署数量: 15+
- vManager server 部署规模数量： 10+
- vPlan更新性能：实时
- vAPI运行稳定：全年零故障
- 看板提取数据性能
  - 和实际项目规模强相关
  - 完成一个项目的数据提取需约0.5~1小时

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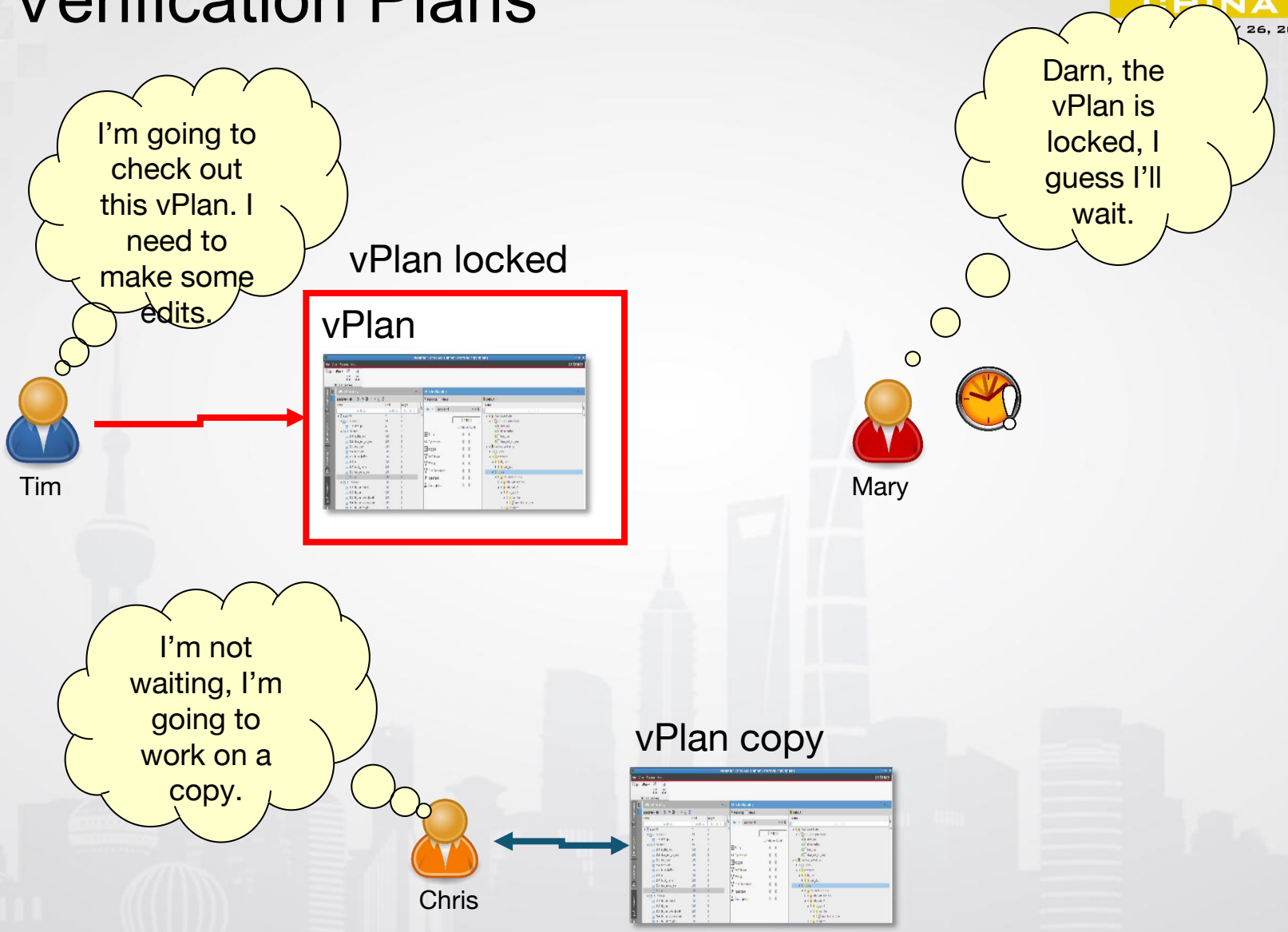
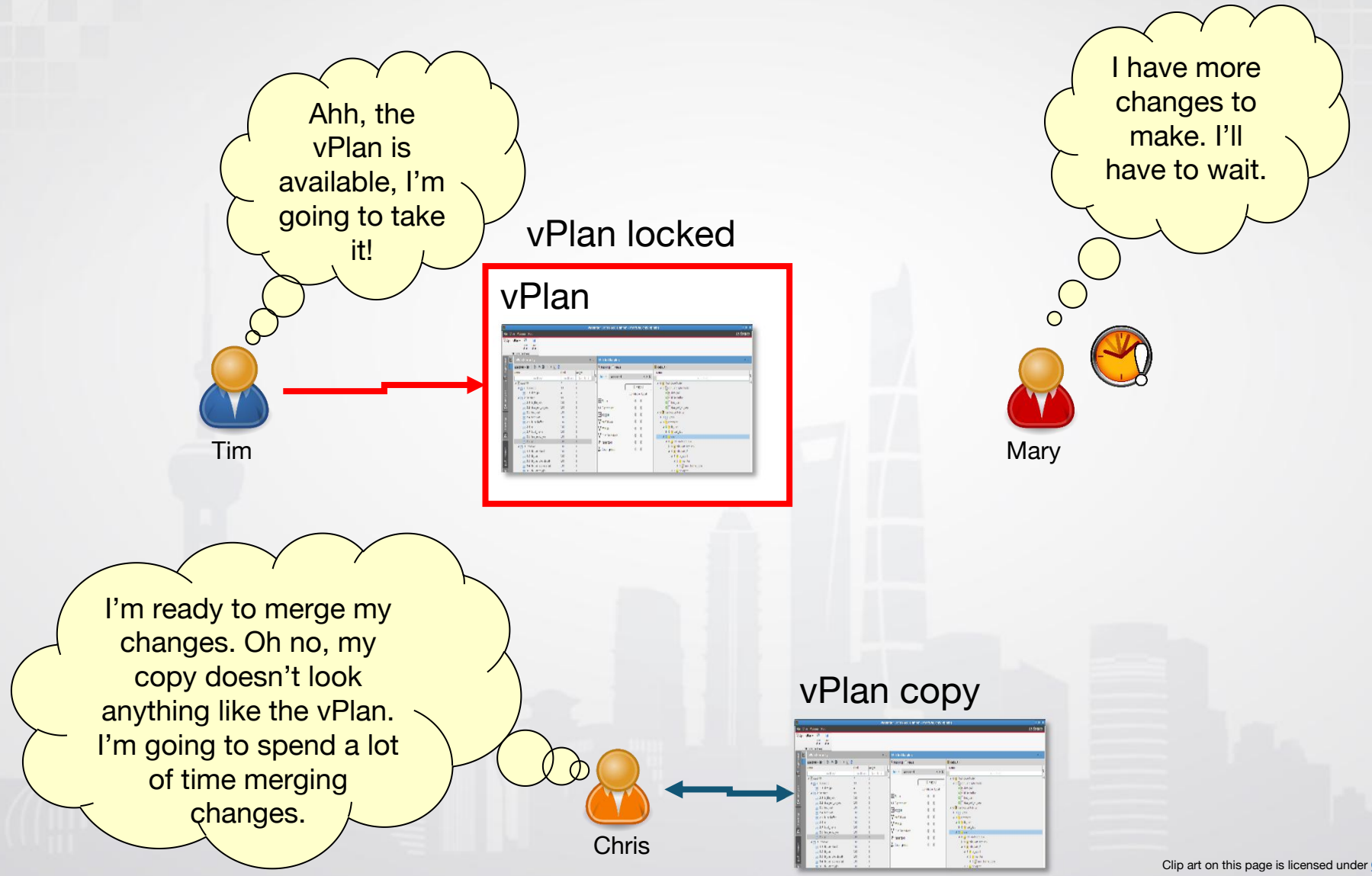
Multi-User, Multi-Engine, Multi-Region Verification Planning

Providing collaboration along with advanced planning features

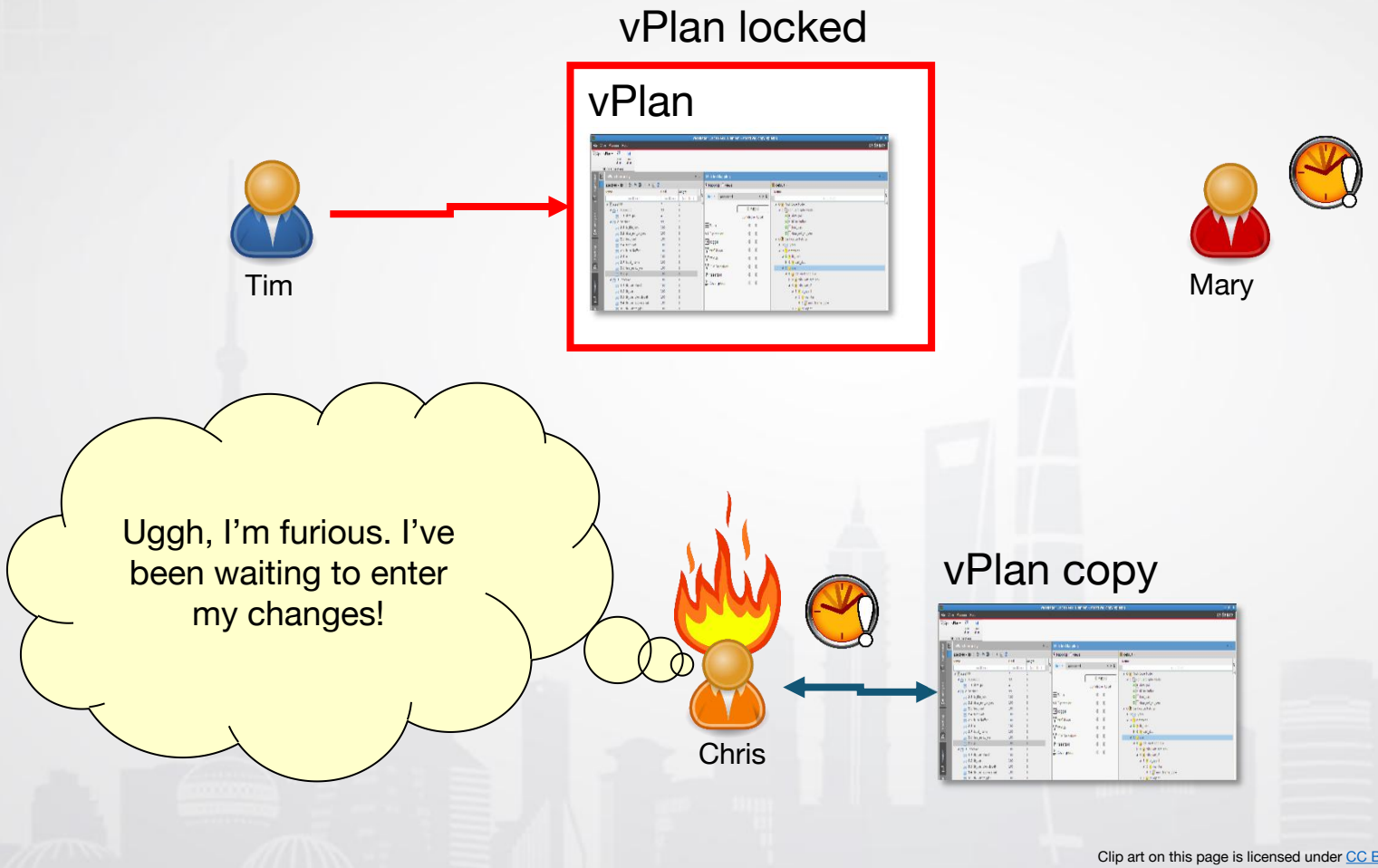
File-Based Verification Plans



File-Based Verification Plans

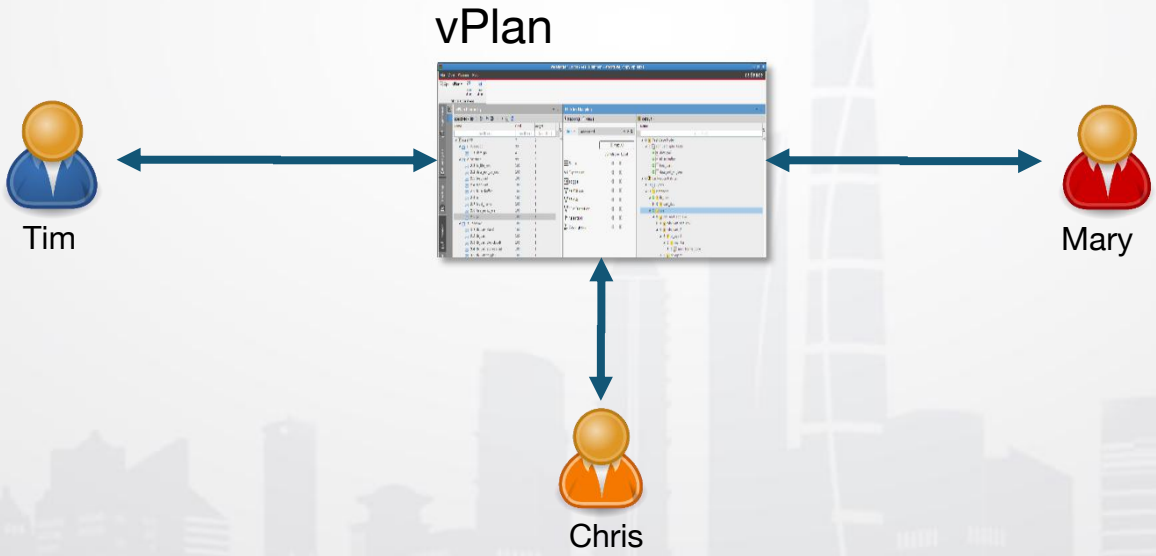


File-Based Verification Plans

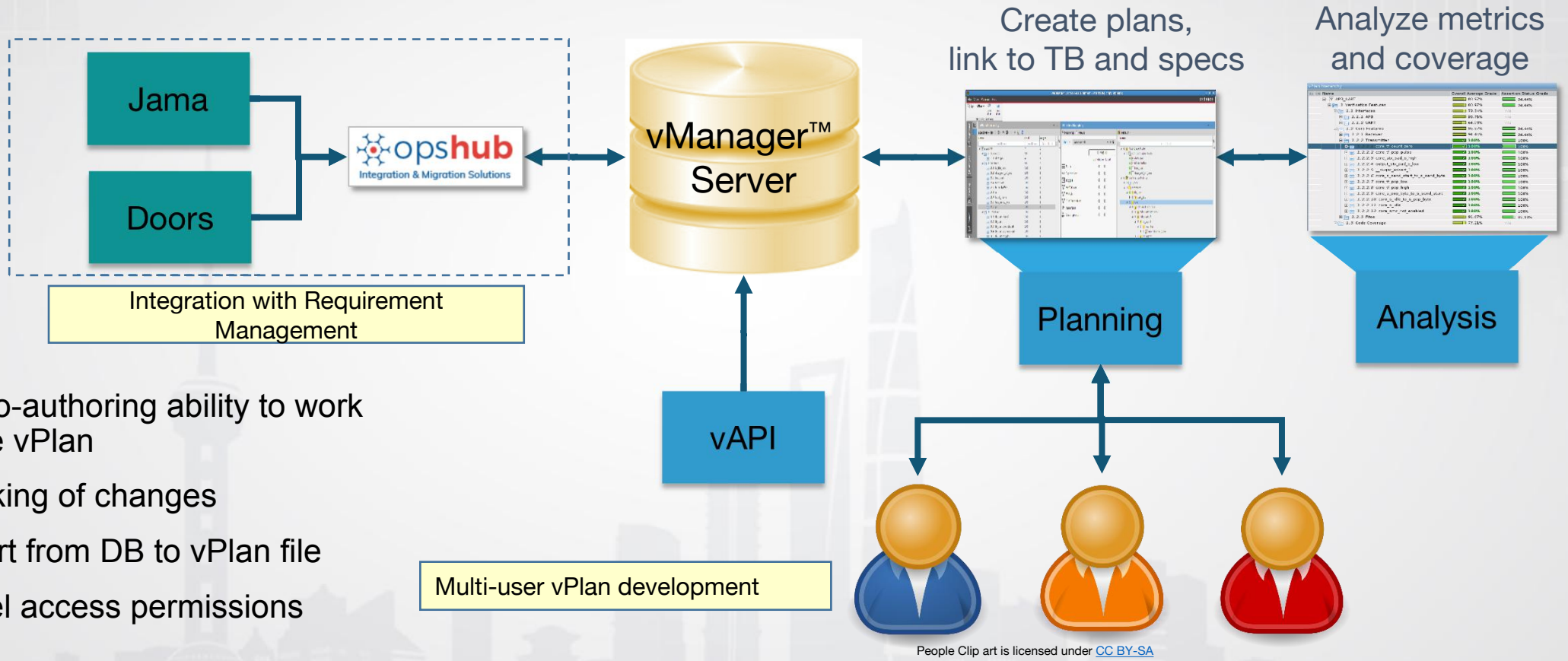


Co-Authoring Verification Plans

- Move verification plan storage to the centralized database
- Enable co-authoring for multi-user, multi-region verification plan creation



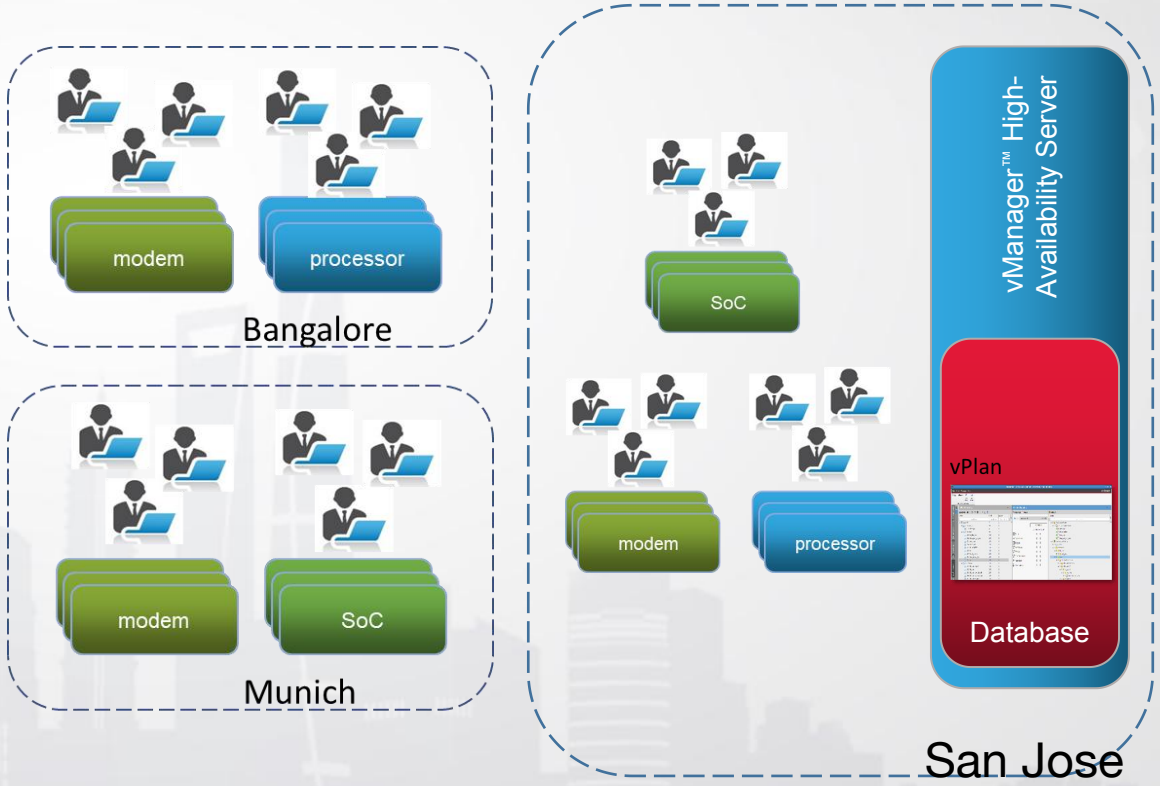
Verification Plan in Database



- Multi-user co-authoring ability to work on the same vPlan
- History tracking of changes
- Import/export from DB to vPlan file
- Section-level access permissions

Multi-Region vPlan Collaboration

- Single vPlan acts as Verification Contract for diverse teams
- Automatically in sync – no need for problematic cross-site document merge
- Central persistence for connection to external systems (e.g., req. mgmt.



Case Study: Microsoft TFS 与vManager的数据交互

- TFS负责市场需求和产品需求的管理和跟踪
  - 提供源代码管理、数据收集 、 报告和项目跟踪
- TFS里的产品需求点能够自动转换成vPlan的验证需求条目
- TFS里的验证需求点产生变更，则vPlan的内容需要进行迭代更新，特别地，需要支持产品需求点被删除，取消，挂起，新建四种状态
- 验证需求完成情况自动翻转TFS中产品需求的完成状态

Multi-Engine Case Study: Mobile SoC

Interconnect Workbench

Xcelium™ with UVM

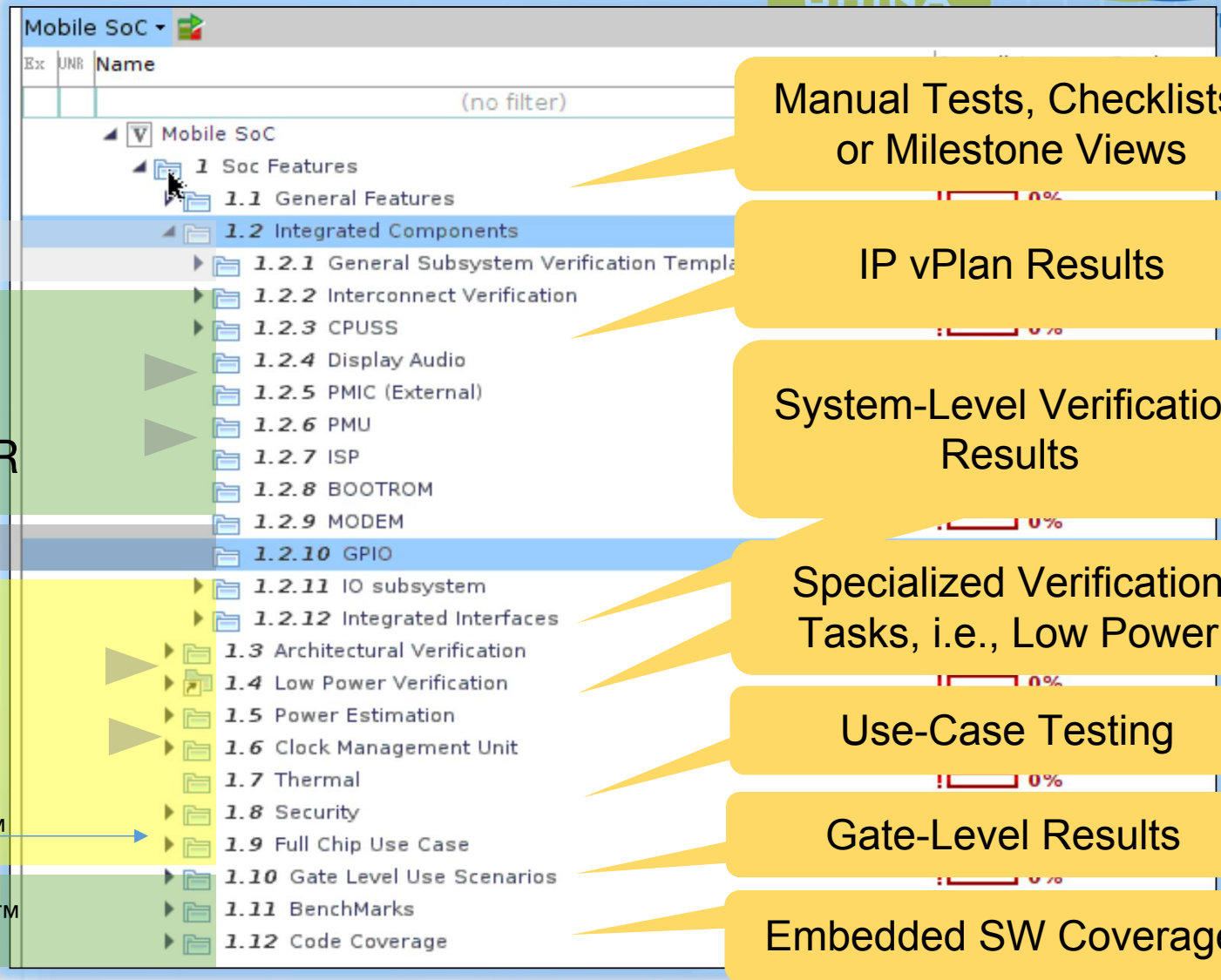
JasperGold® UNR

JasperGold Formal

Palladium®

Perspec™

Protium™



Manual Tests, Checklists, or Milestone Views

IP vPlan Results

System-Level Verification Results

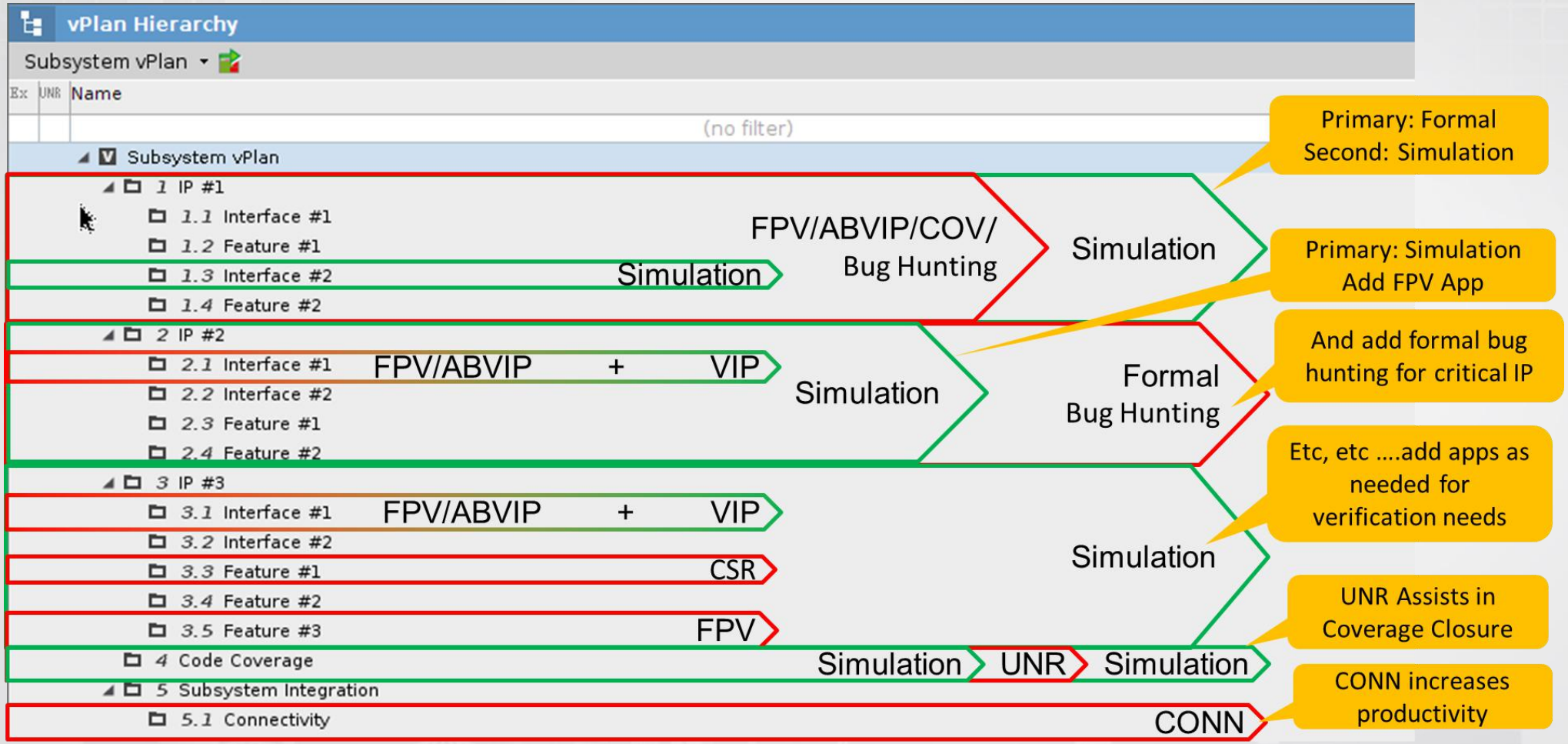
Specialized Verification Tasks, i.e., Low Power

Use-Case Testing

Gate-Level Results

Embedded SW Coverage

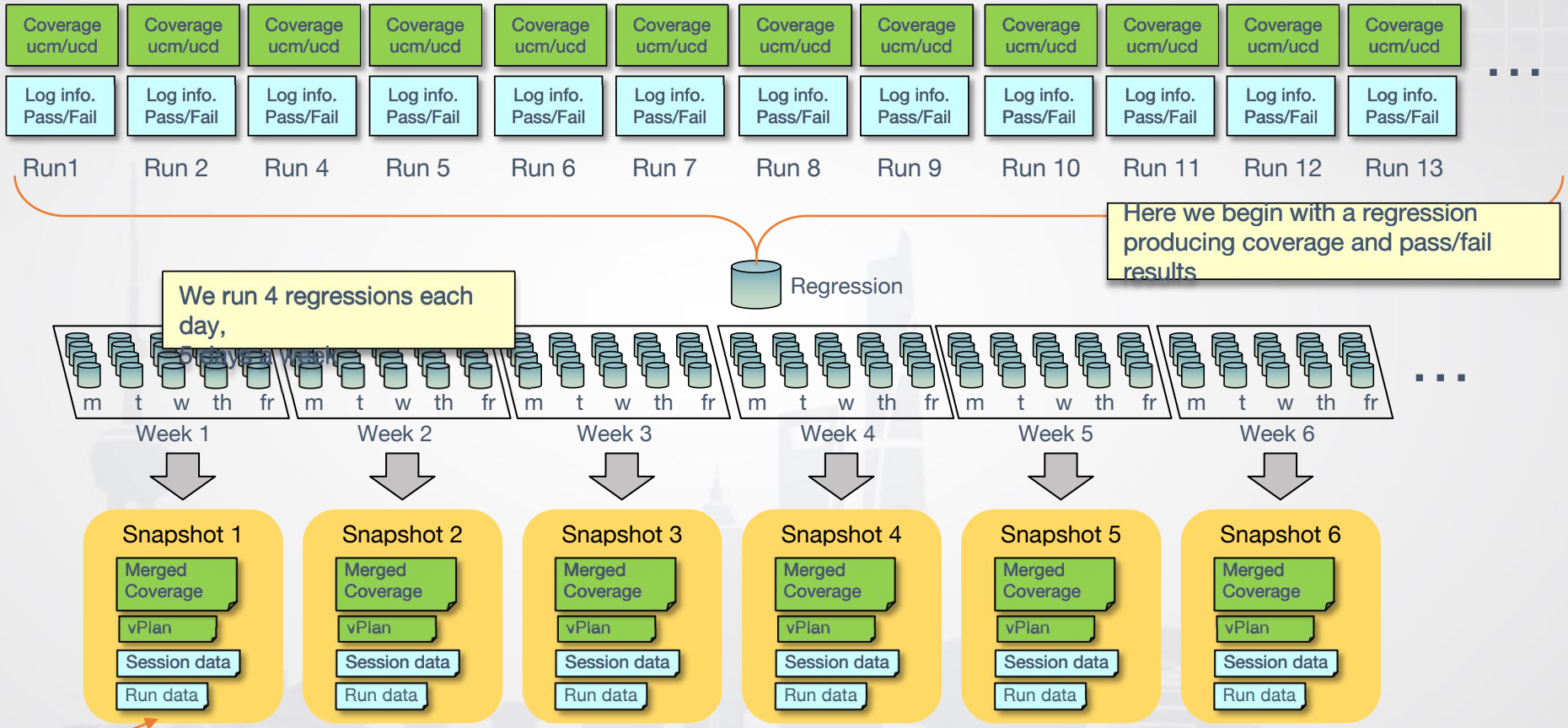
Sim + Formal Combined vPlan



Multi-Engine vPlan Usage Example - http://events.dvcon.org/events/proceedings.aspx?id=234--1
“A Mutually Exclusive Deployment of Formal and Simulation Techniques” - Devarajegowda, Vliegen et al – DVCon Europe 2017

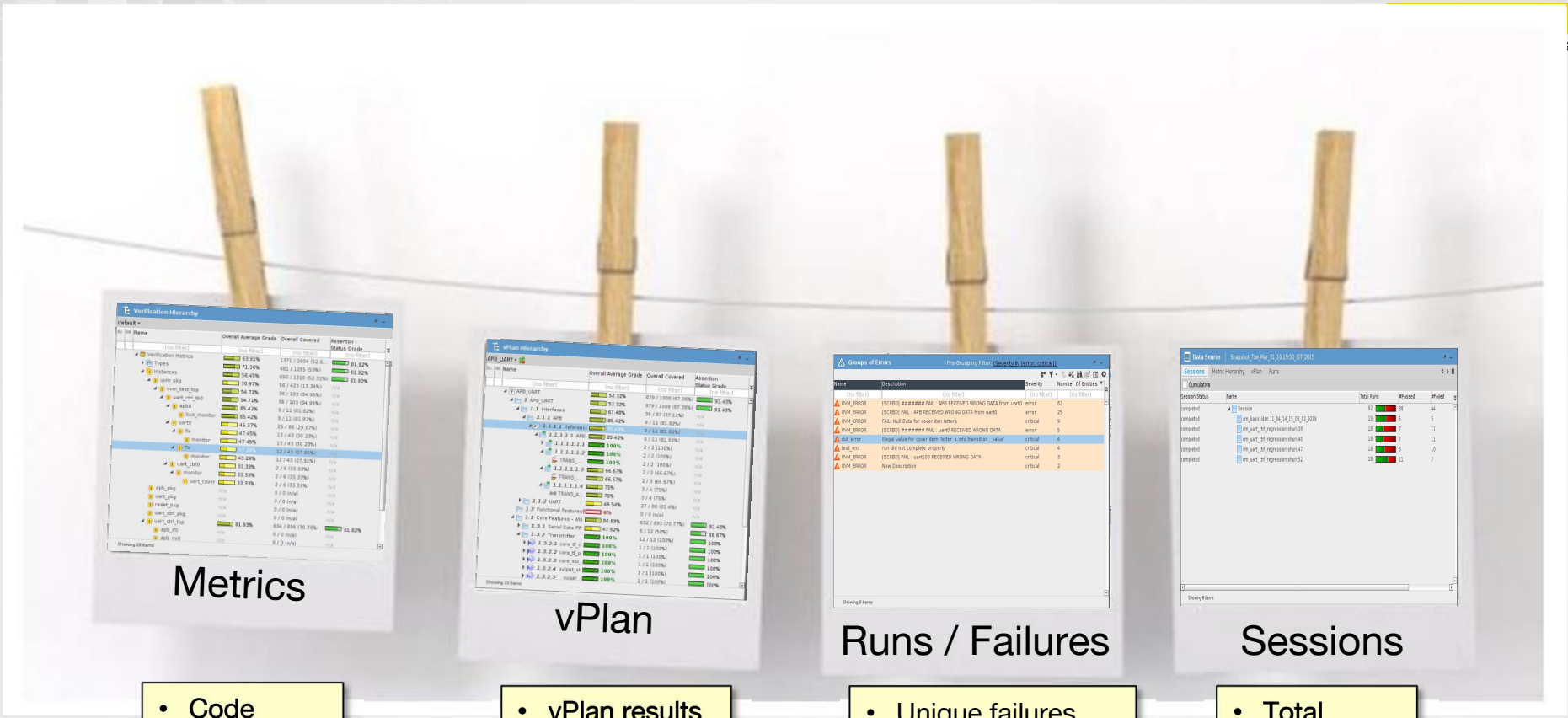
Automation and Customization

Summarizing Regression Data – Tracking



- Automate to easily capture into snapshots the important data from each regression
- Once captured the regression results are no longer needed for tracking, freeing up disk space and capacity
- Summarized snapshot data can easily be charted

What Data Is Interesting to Track?



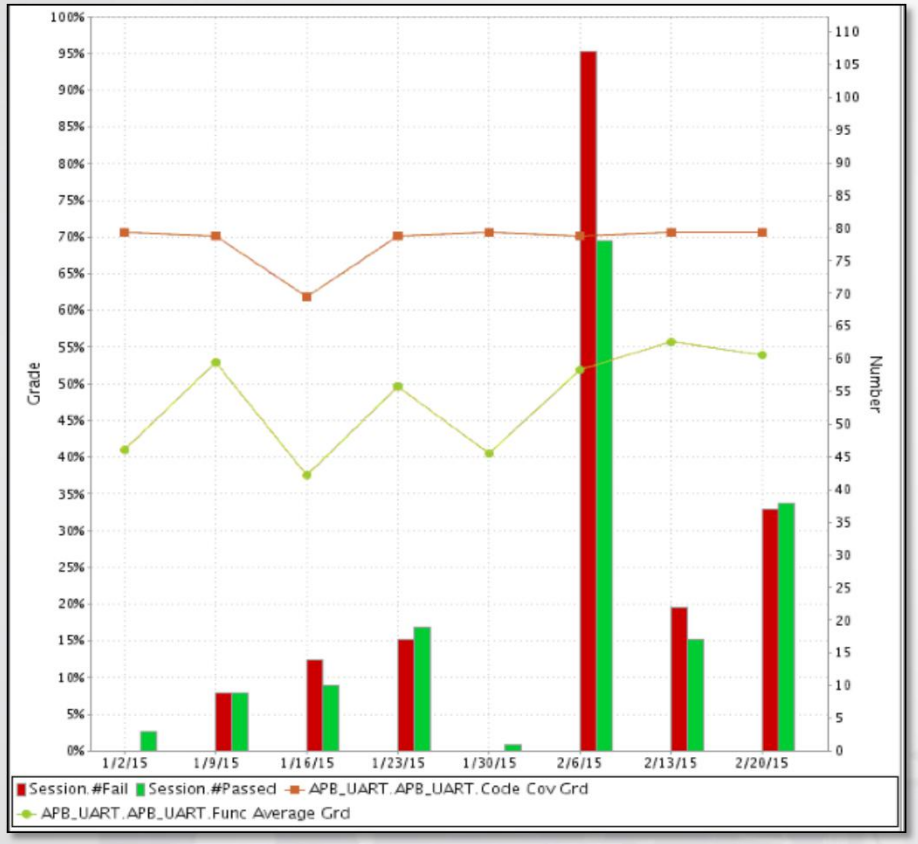
- Code coverage results for a particular module

- vPlan results for a particular perspective

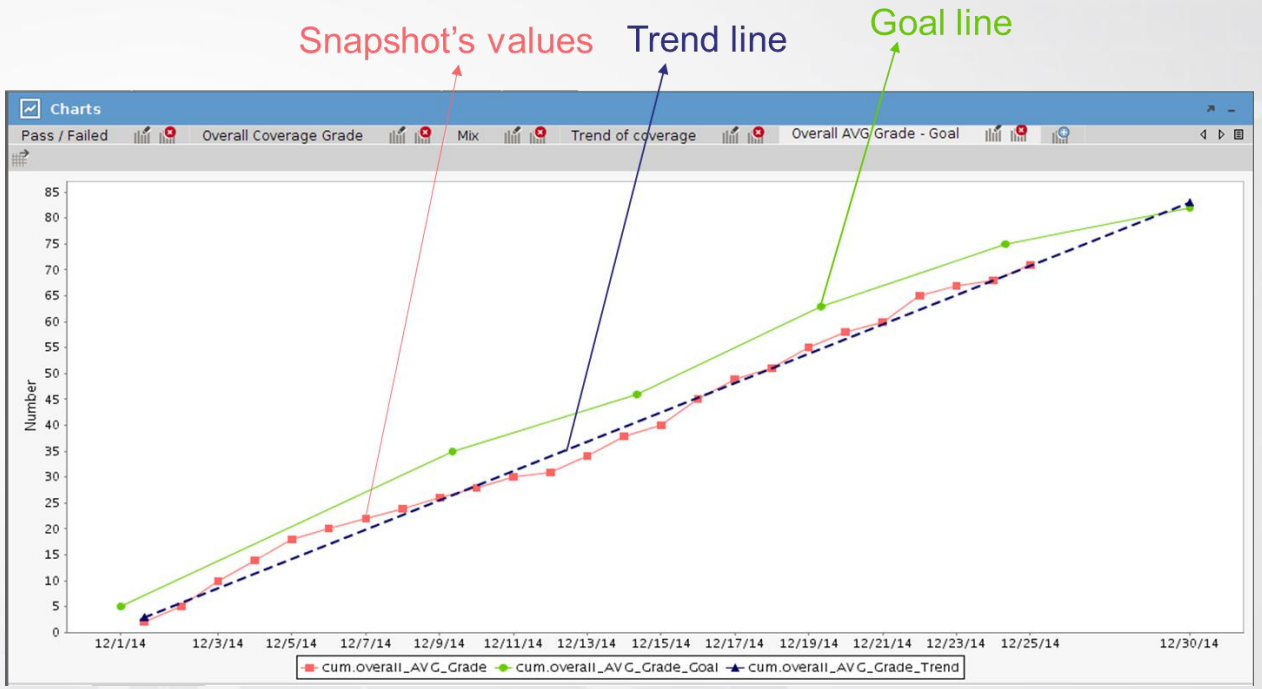
- Unique failures produced by each run for the entire project
- Who owns the most failures historically
- What are the most common tests in the regression

- Total number or runs, passed and failed

Charting Tracked Data
Quickly spot trends and anomalies



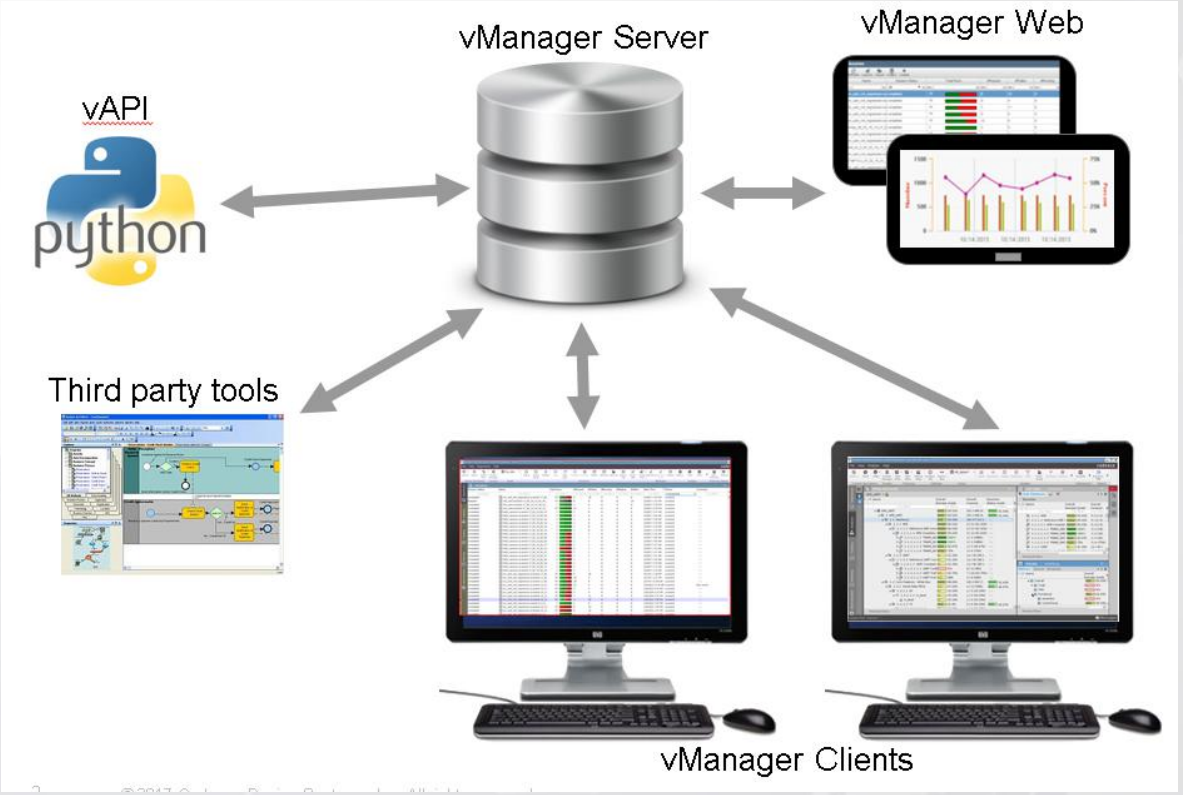
More Tests = More Coverage??



On Schedule??
Converging??

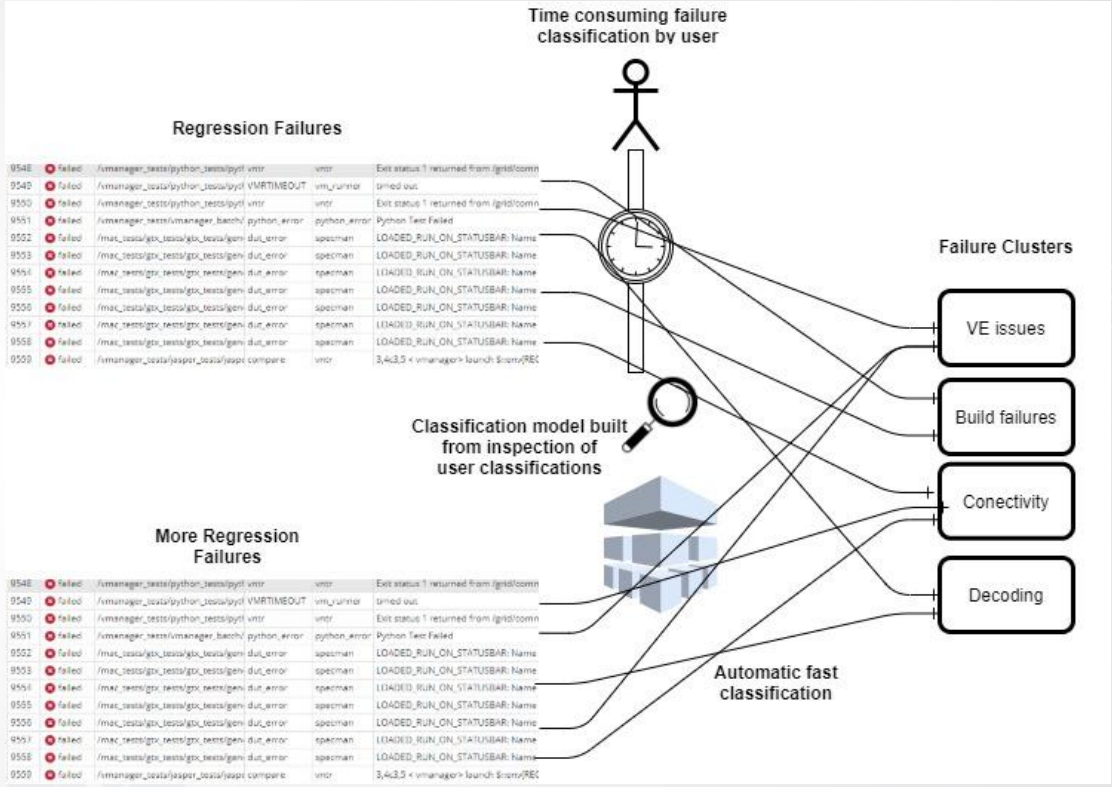
Customization – vManager API: vAPI

- vAPI implements programmatic access to *Verification Management*
  - vManager™ database provides centralized data repository
  - Verification-specific abstraction of database content
- Query and mine verification specific data, with automation around tasks like coverage merge
  - “what is the toggle coverage on top.sig1 from all failing tests from last Tuesday”
- Execution of verification management actions on specific datasets
  - “rerun all tests that failed with parity error in the past 5 days”



Failure clustering using Machine Learning

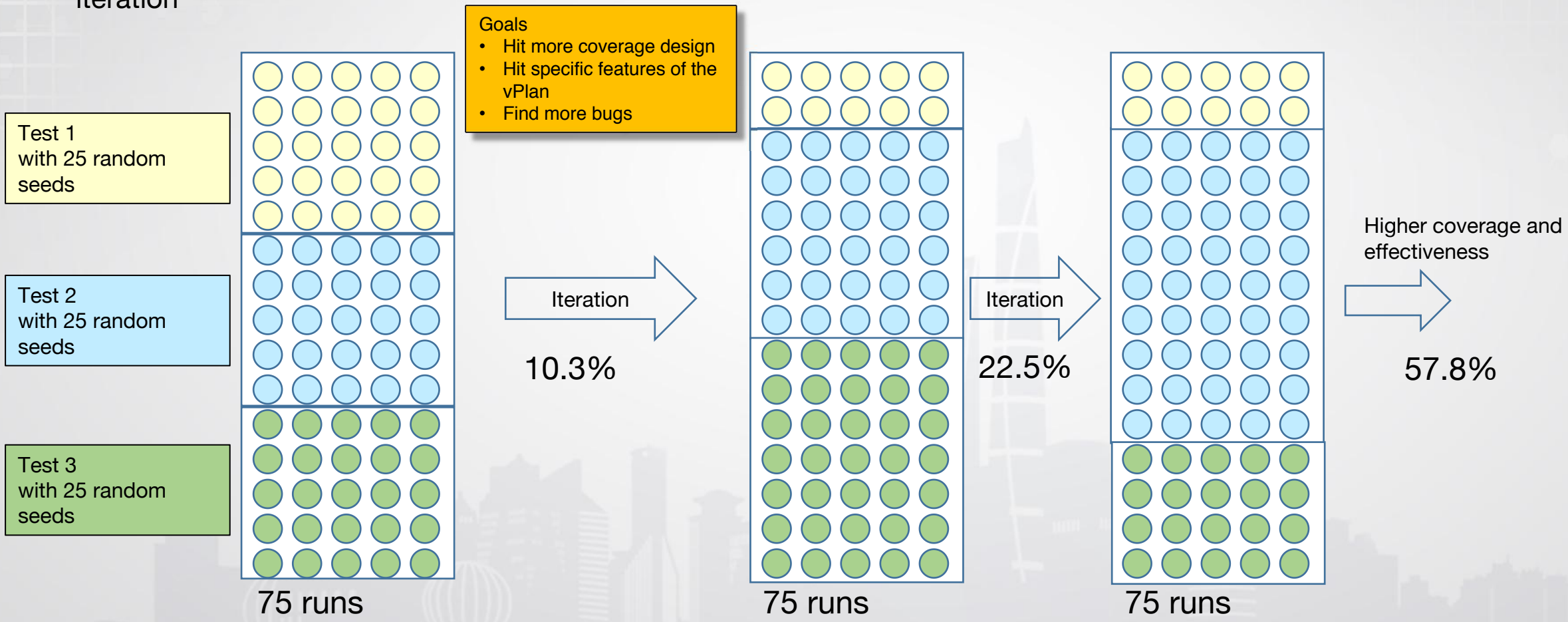
- In today's daily regression failure analysis, the first analysis effort is to go over the failures and identify:
  1. Are they new?
  2. If they look alike, are they really the same as one found before.
  3. First Failure Analysis is not always sufficient:
     1. Error over-generic (Many bugs maps into same group)
     2. Error over-specific (Single bug maps into many groups)



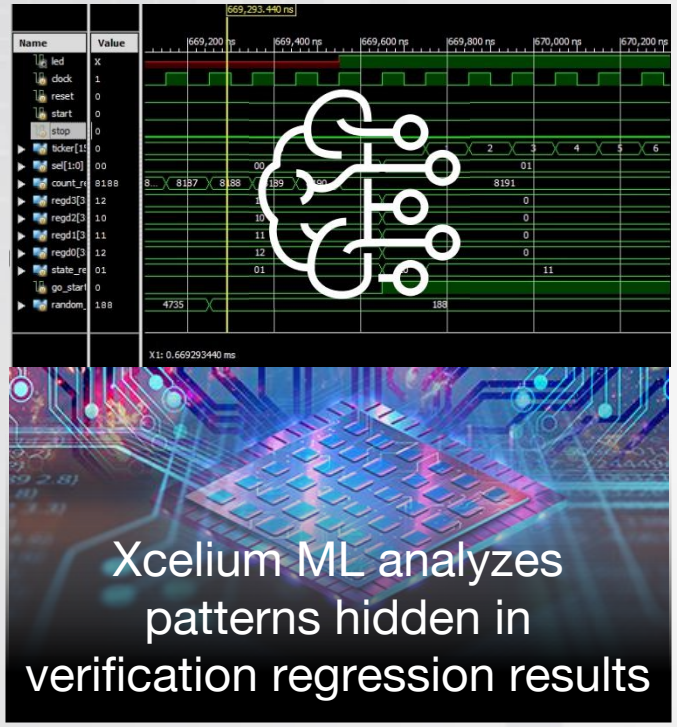
- We are applying Machine Learning (ML) techniques by “learning” from the user manual assignments and “predict” future assignments automatically:
  - user assigns a failed run to a FC (Failure Cluster)
  - The system extract the properties of that run and consider them as characteristics of the FC
  - Whenever a run with “similar” characteristics would show up it could be candidate for assignment to the same FC.

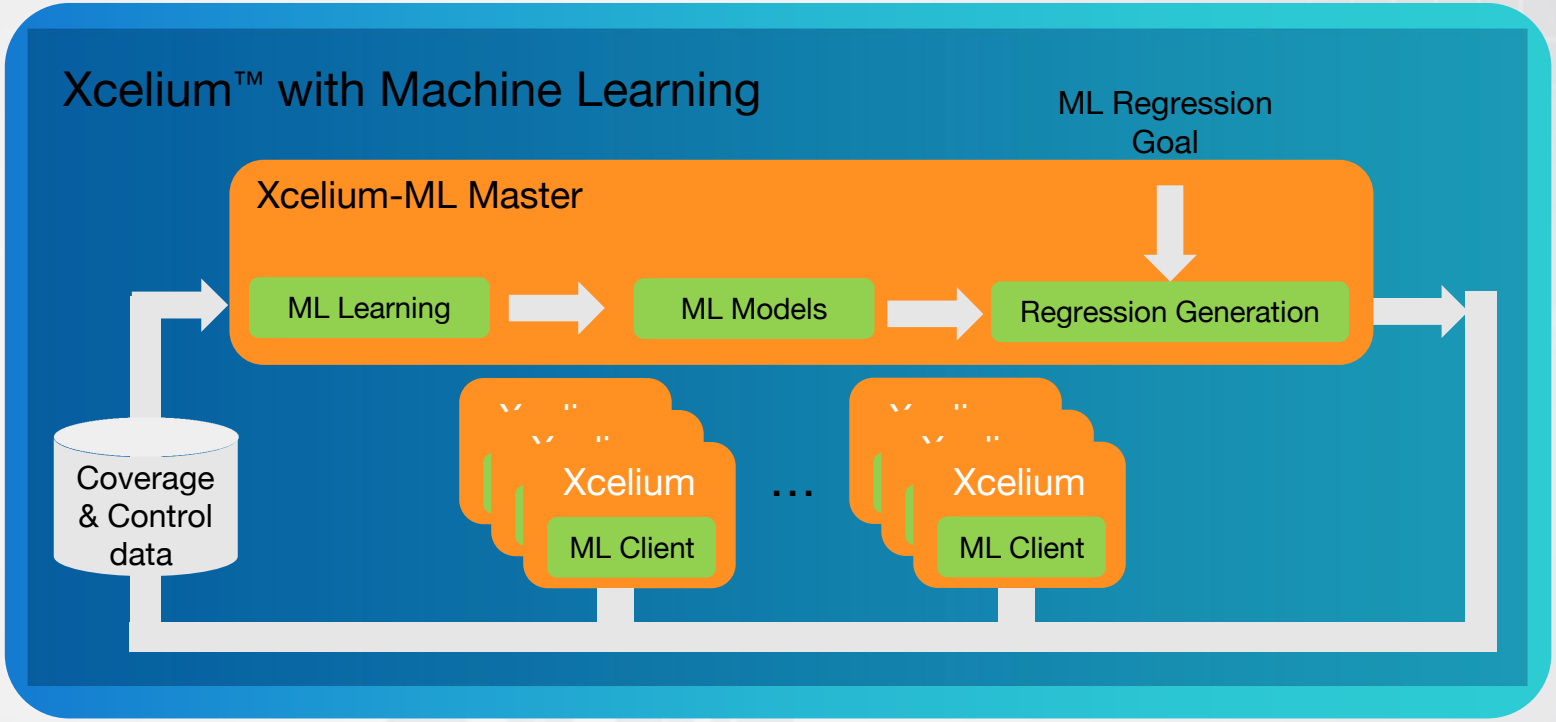
Test Weight Optimization

- Identify and adjust the weighting of stimulus targeting a specific verification goal
- Each iteration results are evaluated against goals, effective tests are given more weight in the next iteration



Xcelium ML User Flow





Xcelium ML – User Feedback

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What the EDA users REALLY think

DEEPCHIP

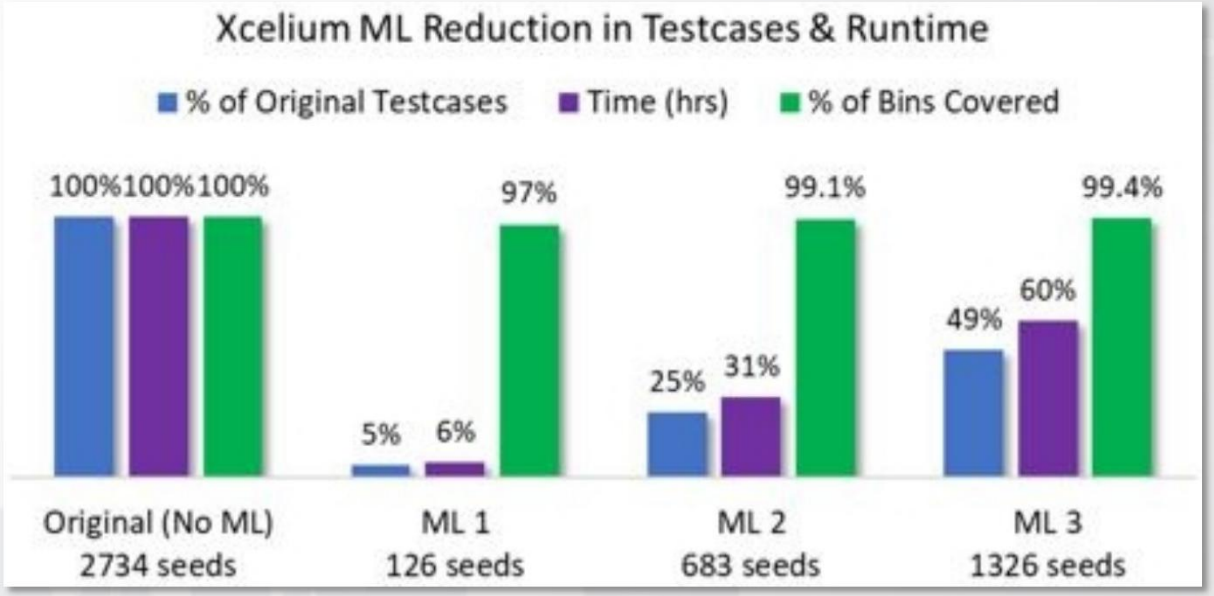
I had yet to find *any* user comments about ML being applied to logic simulators for regressions nor anything simulation related.

That is, until now.

In this year's report, two early ML users share that **Xcelium-ML** got them a 2.5X to 3X speed-up in regression runtimes -- with comparable coverage compared to their constrained random approach.

"Xcelium-ML helped us generate a 3X smaller regression set while retaining 99+% coverage."

"Xcelium-ML improved our regression runtimes by 2.5X vs. Xcelium."



Read the Full report: http://www.deepchip.com/items/dac20-02b.html

Wrap Up

Smarter Verification Management

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- Better Productivity, Predictability, and Quality need more than ever.
- Planning, Collaboration and Centralization needs continue to expand.
- Multi-User, Multi-Engine, Multi-Region, Multi-Project are not optional.
- Thank you!

What the EDA users REALLY think DEEPCHIP

"vManager saves 1hr/day/engineer"
Users Best of 2020

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Q&A