2020 DESIGN AND VERIFICATION™ DVCON CONFERENCE AND EXHIBITION UNITED STATES

THE VERIFICATION COCKPIT - A ONE-STOP SHOP FOR YOUR VERIFICATION DATA

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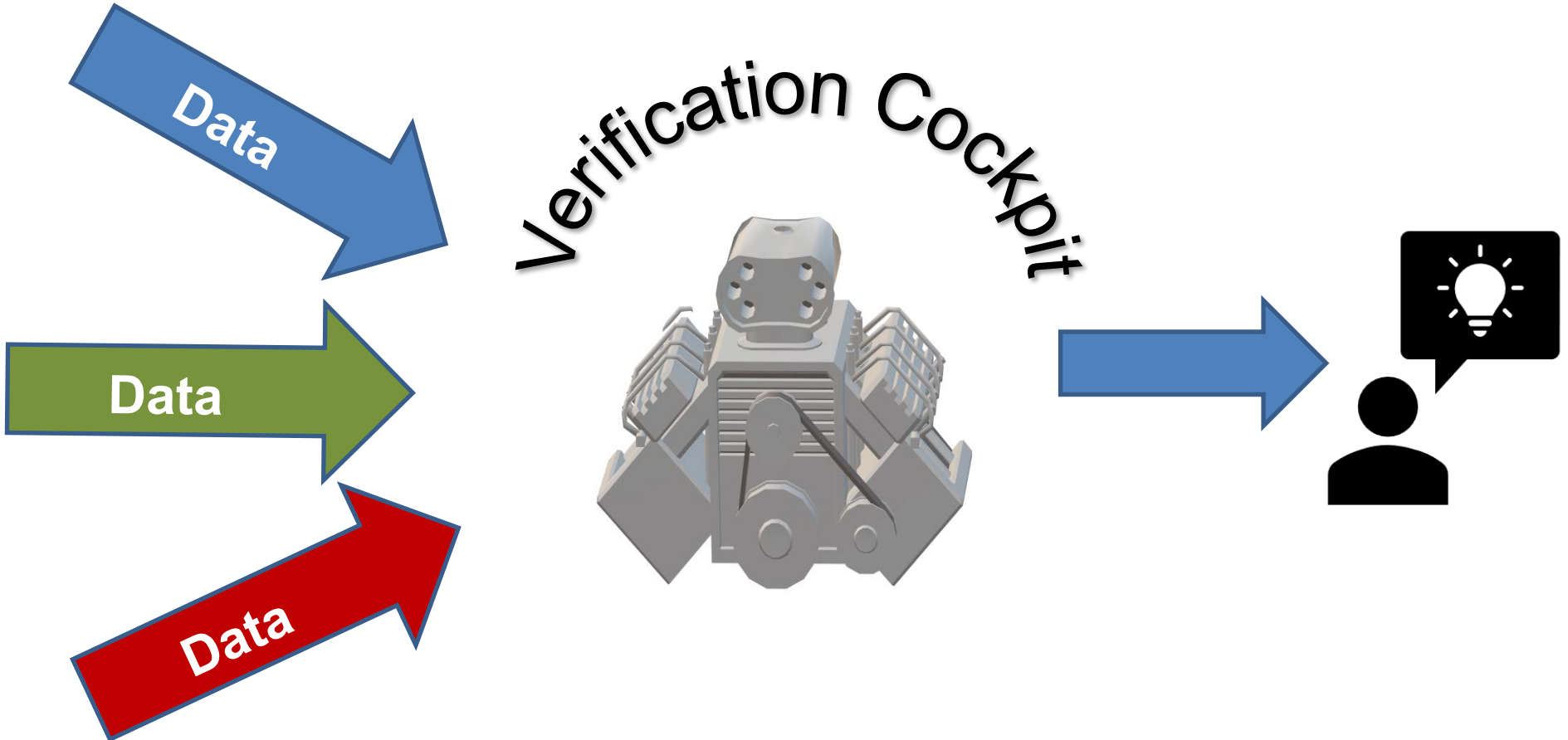
accellera SYSTEMS INITIATIVE

"Information is the oil of the 21st century, and analytics is the combustion engine."

– *Peter Sondergaard, senior vice president, Gartner Research.*




Project A

Introduction

Modern day verification is a highly automated process that involves

- Tens or hundreds verification engineers
- Tens of different tools
- Compute farms with thousands servers

The verification process is becoming increasingly interconnected, intelligent, and instrumented

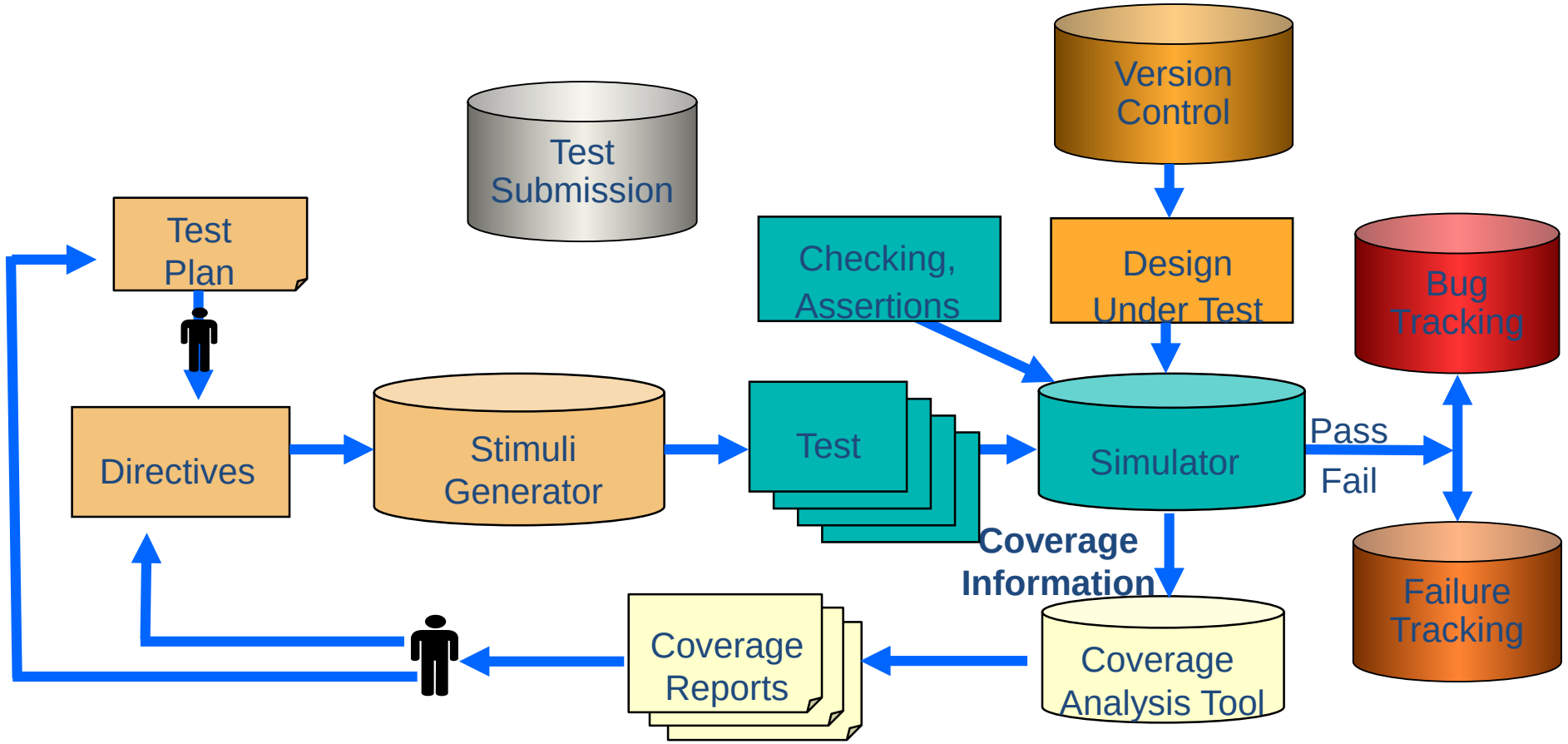
Control and management of the verification process are among the biggest challenges faced by verification teams

While more data is available, less of the data is being effectively captured, managed, analyzed, and made available to the people who need it

Dynamic Verification Main Components

Execution platform	• Simulation, acceleration, emulation, and silicon
Stimulus generation	• Legal, useful input data and sequential patterns • Constrained random generation, directed tests
Response checking	• Does DUV behavior fully conform to specification? • Reference model, assertions, behavioral rules, manual checking
Coverage measurement and analysis	• Has the DUV been fully exercised? • Quantify behavioral spaces of DUV features

Dynamic Verification Flow



Monitoring and Controlling the Verification Process

As a verification engineer, I would like to know if the test template I created for the new feature is doing its work.

As a verification lead, I would like to know when ...g rate increases or decreases.

As a verification lead, I would like to see a quick, concise and informative view of my unit status.

... I would like to know which ... to maximize

As a verification lead, ... coverage of hard-to-h...

As a project manager, I would like to know if I will meet the reliability requirements on tape-out date.

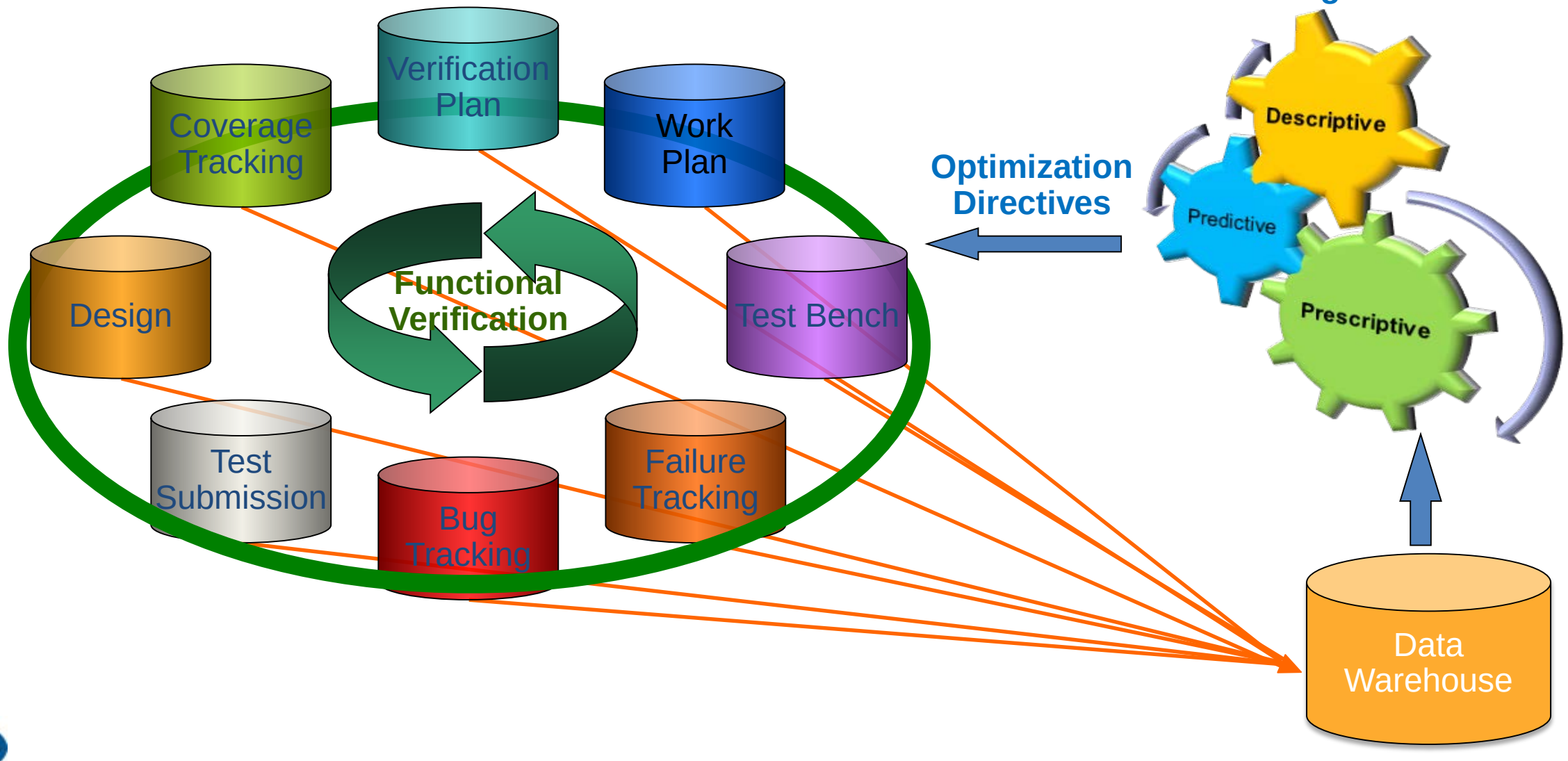
...erted when events that were previously hit are no longer hit by designated test templates.

As verification lead, I would like to know what areas / functions are at risk (low coverage, high defect rate, high defect backlog)

...n lead, I would like to know ...ual volume of bugs (high or low) is found today.

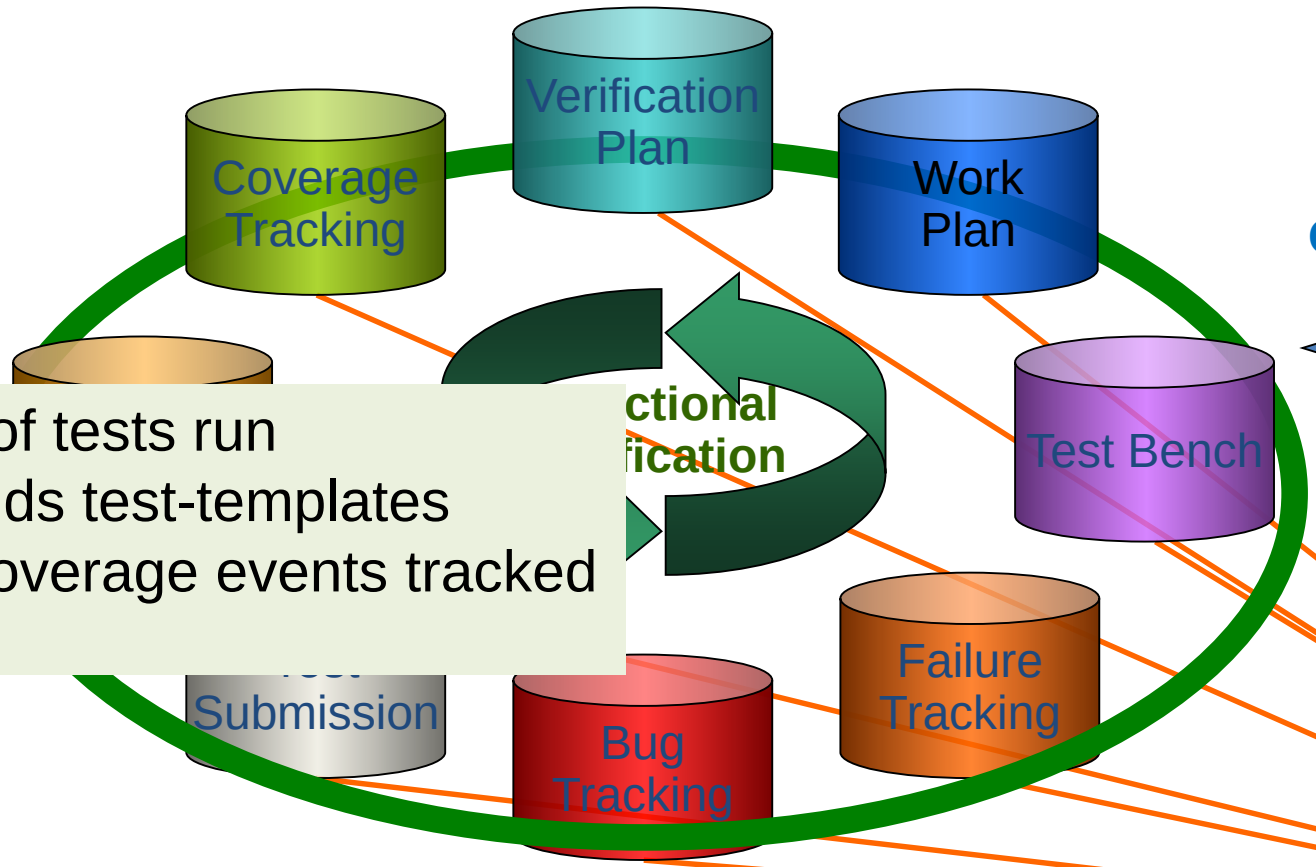
Vision

A consolidated platform for planning, tracking, analysis, and optimization of a large scale verification project



Vision

A consolidated platform for planning, tracking, analysis, and optimization of a large scale verification project



Reporting and Analytics Engines

- Runs daily, some hourly
- Run-times vary from few min to hours
- ETL run is “non blocking” for using the data

Millions of tests run
Thousands test-templates
100Ks coverage events tracked

~2T, ~5G per day
~200 tables, biggest with 0.5M lines

Data Warehouse

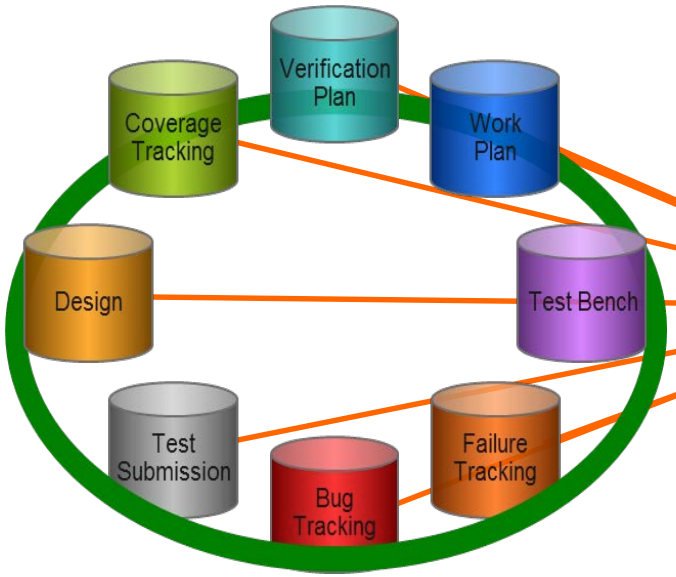
Challenges

Many independent tools - data sources

Tools are optimized for operational work

Vast amount of data

Our Platform



ETL - Extract, Transform, Load
Java, JDBC

IBM Verification Cockpit
Configuration Hub

Data Warehouse

IBM DB2
BLU Acceleration

IBM Verification Cockpit
Advanced Analytics Engines

IBM Cognos Analytics

IBM Verification Cockpit
VC REST API

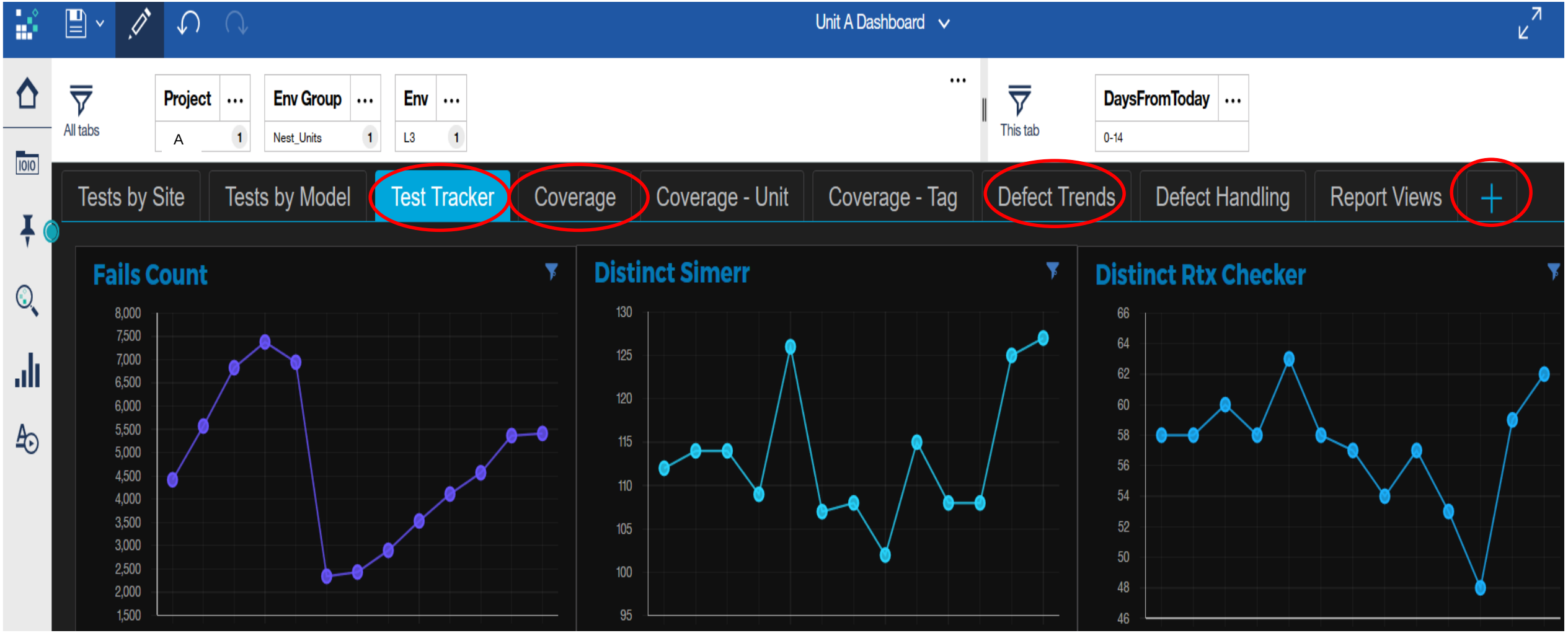
Main User Objectives

- Comprehensive Test Bench
- Project is Converging to Support the Tape Out Schedule
- Effective Use of Computer Resources

Analytics Examples

User
Perspective

Dashboard


Unit A Dashboard
All tabs
Project
A
1
Env Group
Nest_Units
1
Env
L3
1
This tab
DaysFromToday
0-14
Tests by Site
Tests by Model
Test Tracker
Coverage
Coverage - Unit
Coverage - Tag
Defect Trends
Defect Handling
Report Views
Fails Count
8,000
7,500
7,000
6,500
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5,500
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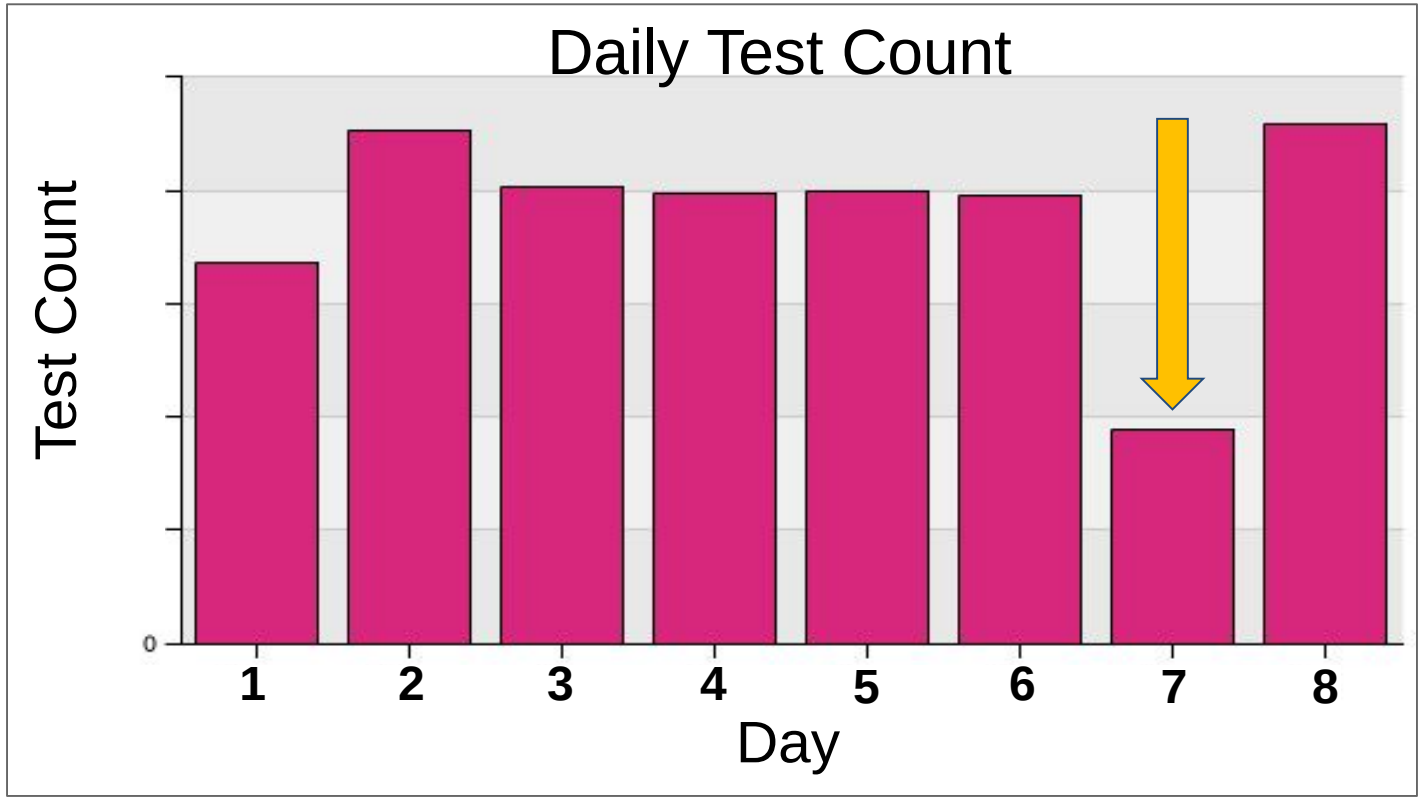
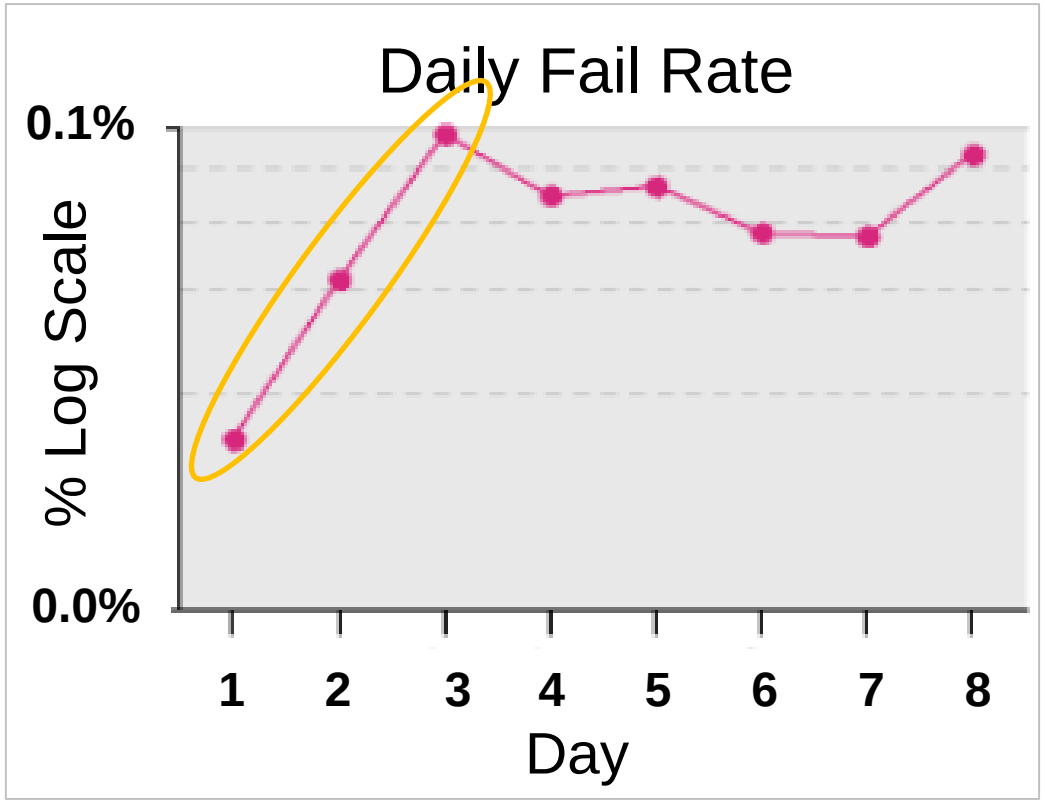
Distinct Simerr
130
125
120
115
110
105
100
95
Distinct Rtx Checker
66
64
62
60
58
56
54
52
50
48
46

Test Submission – Regression Cycles

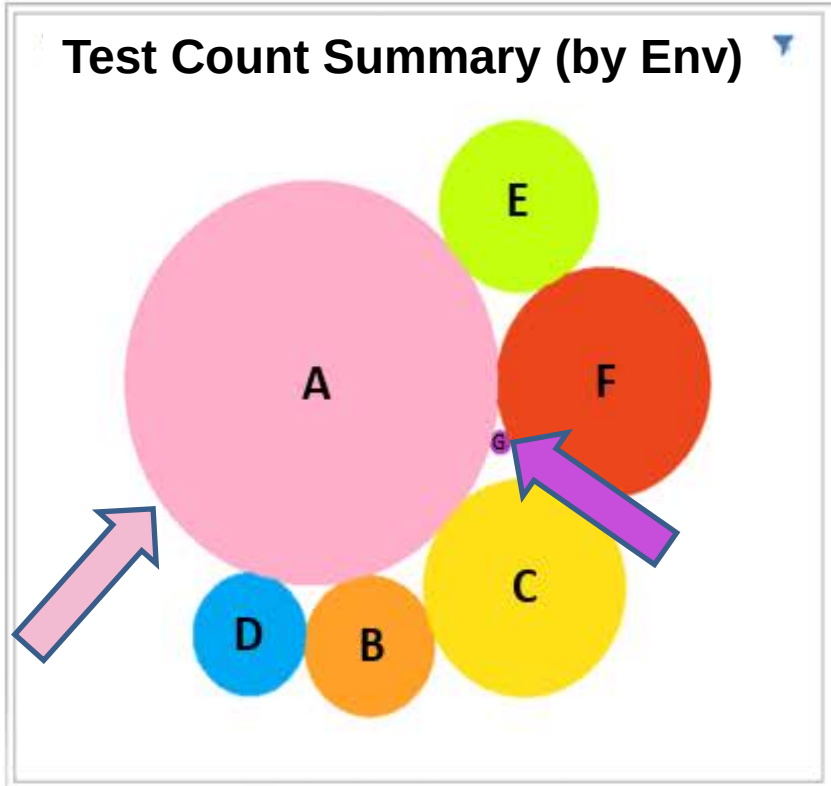
How many tests did I run?

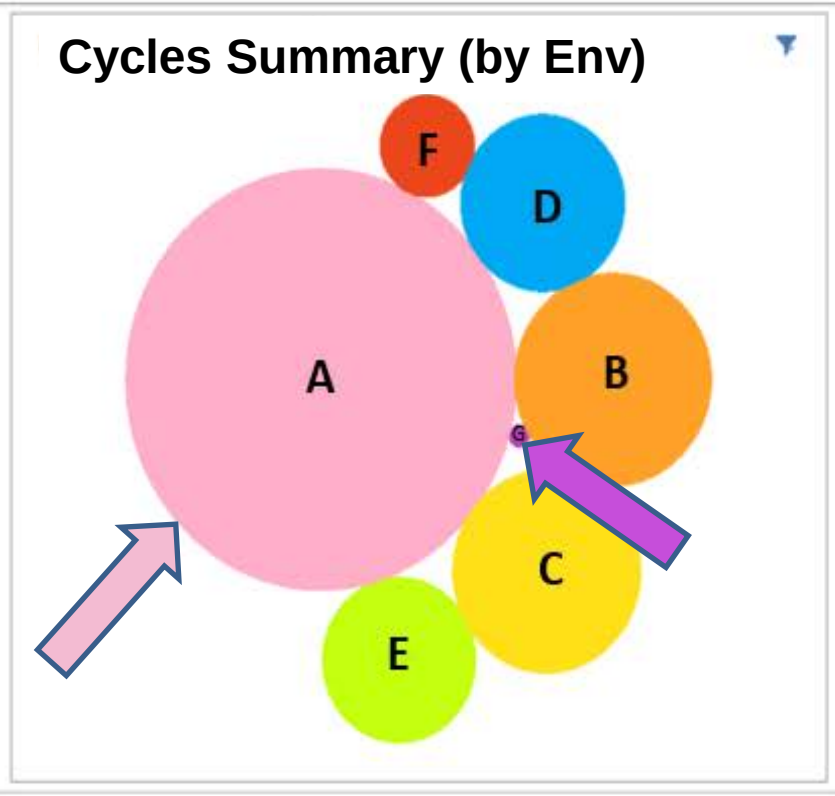


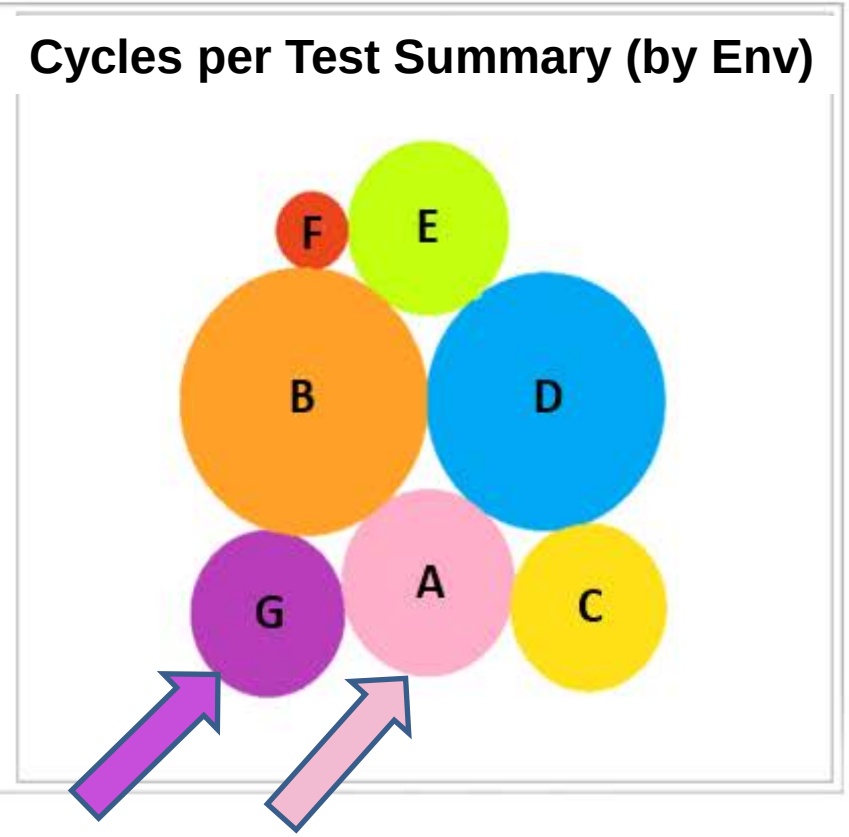
What's my fail rate?



Comparison of Tests and Cycle Distribution Across Environments

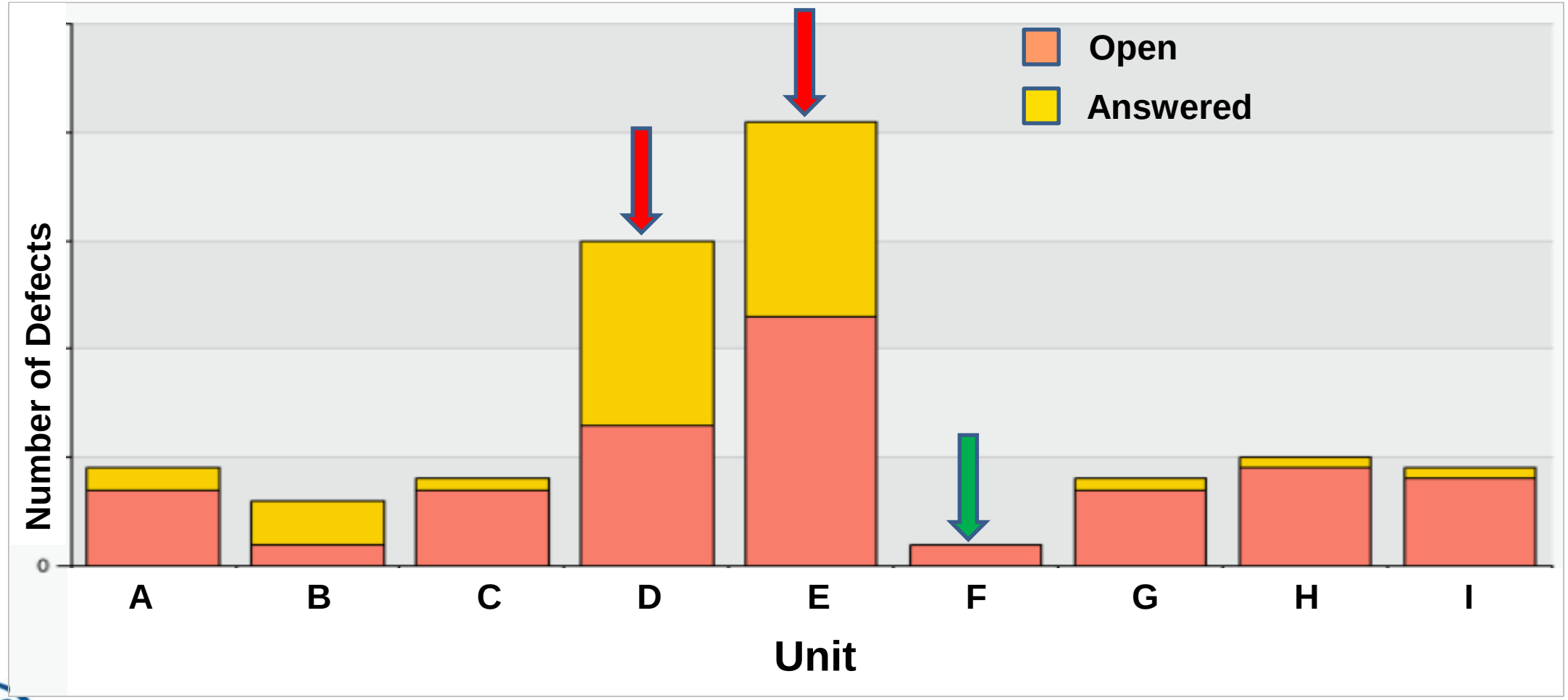




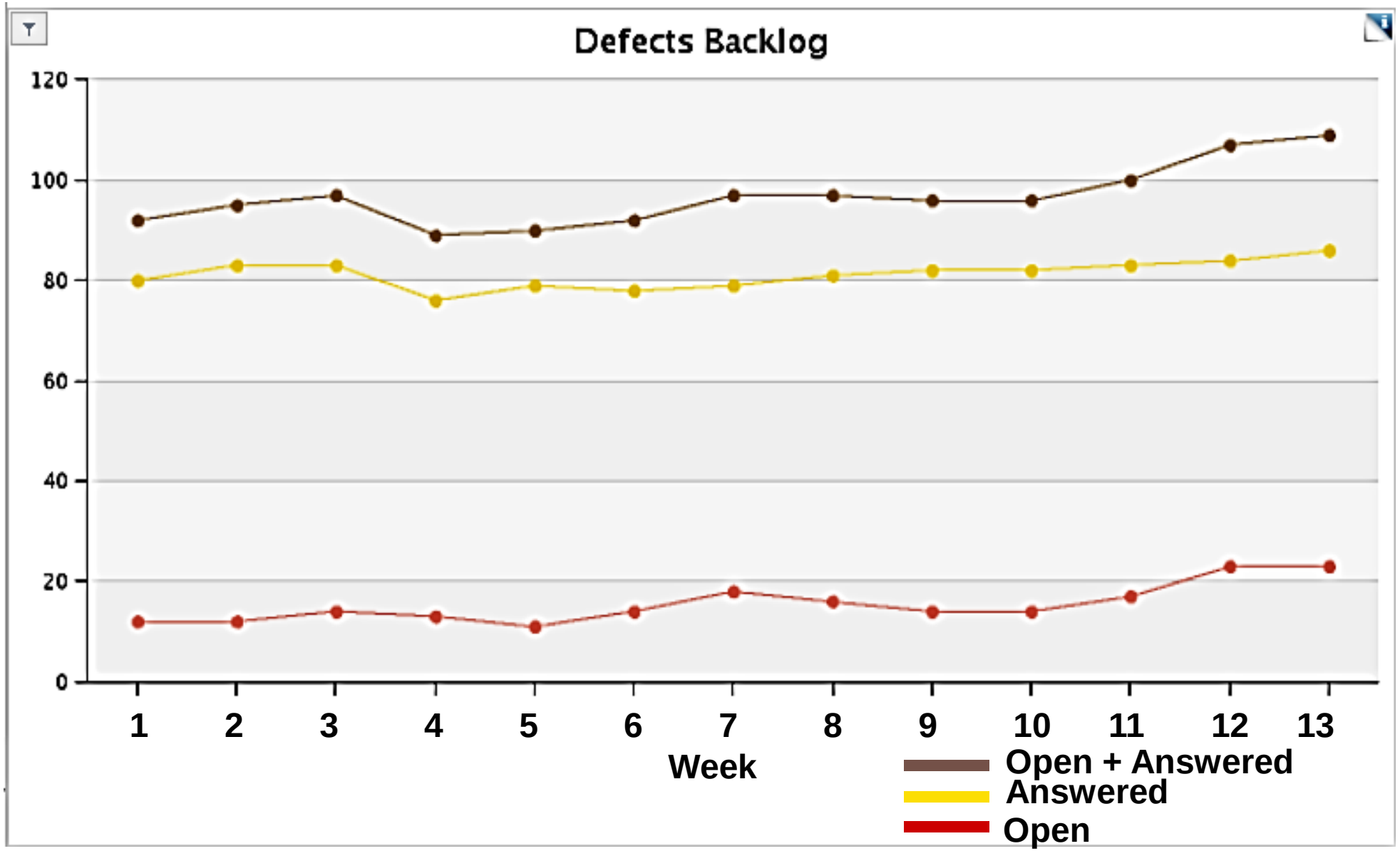


Defect (Bugs) Tracking

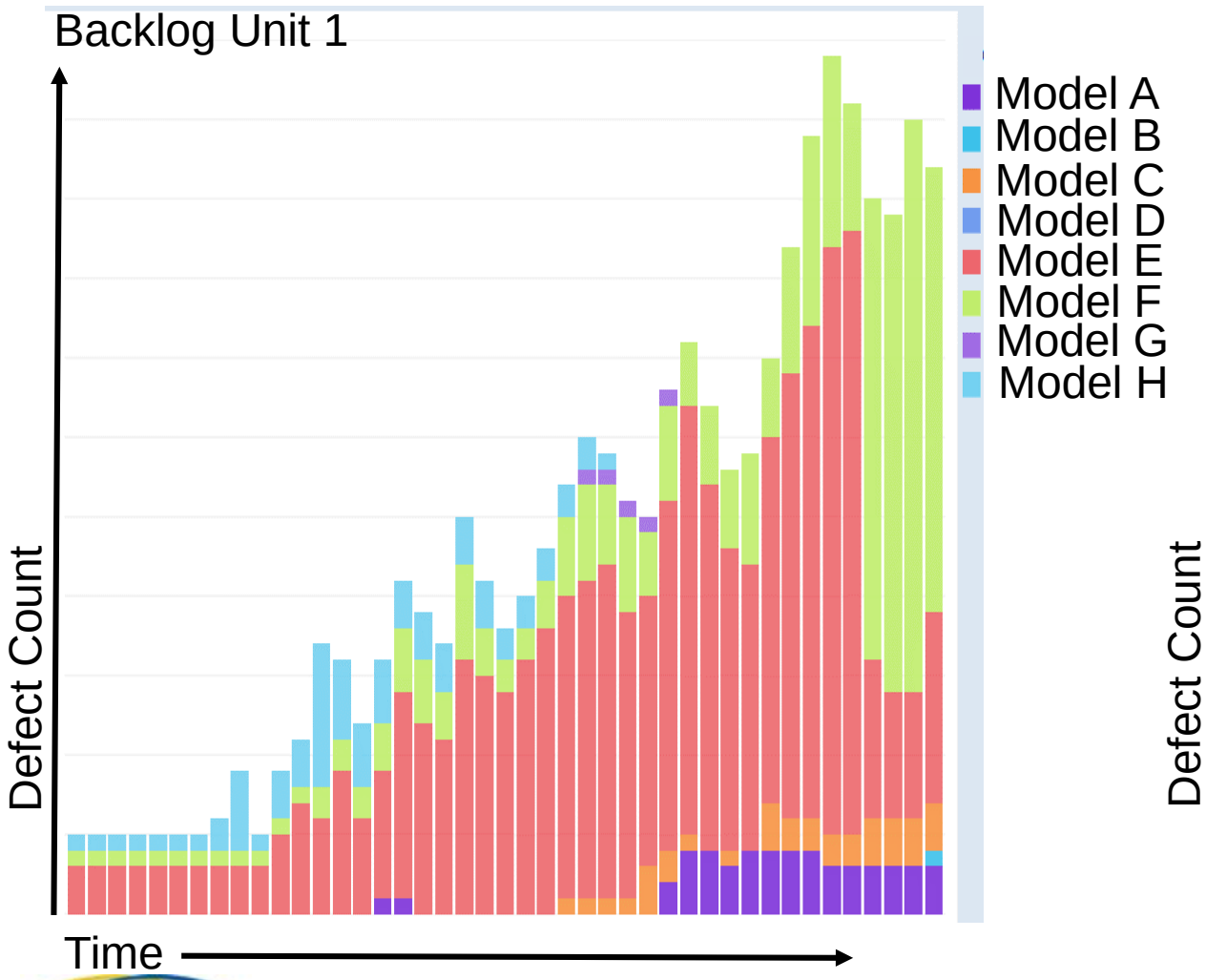
How big is my backlog –
open and answered issues?

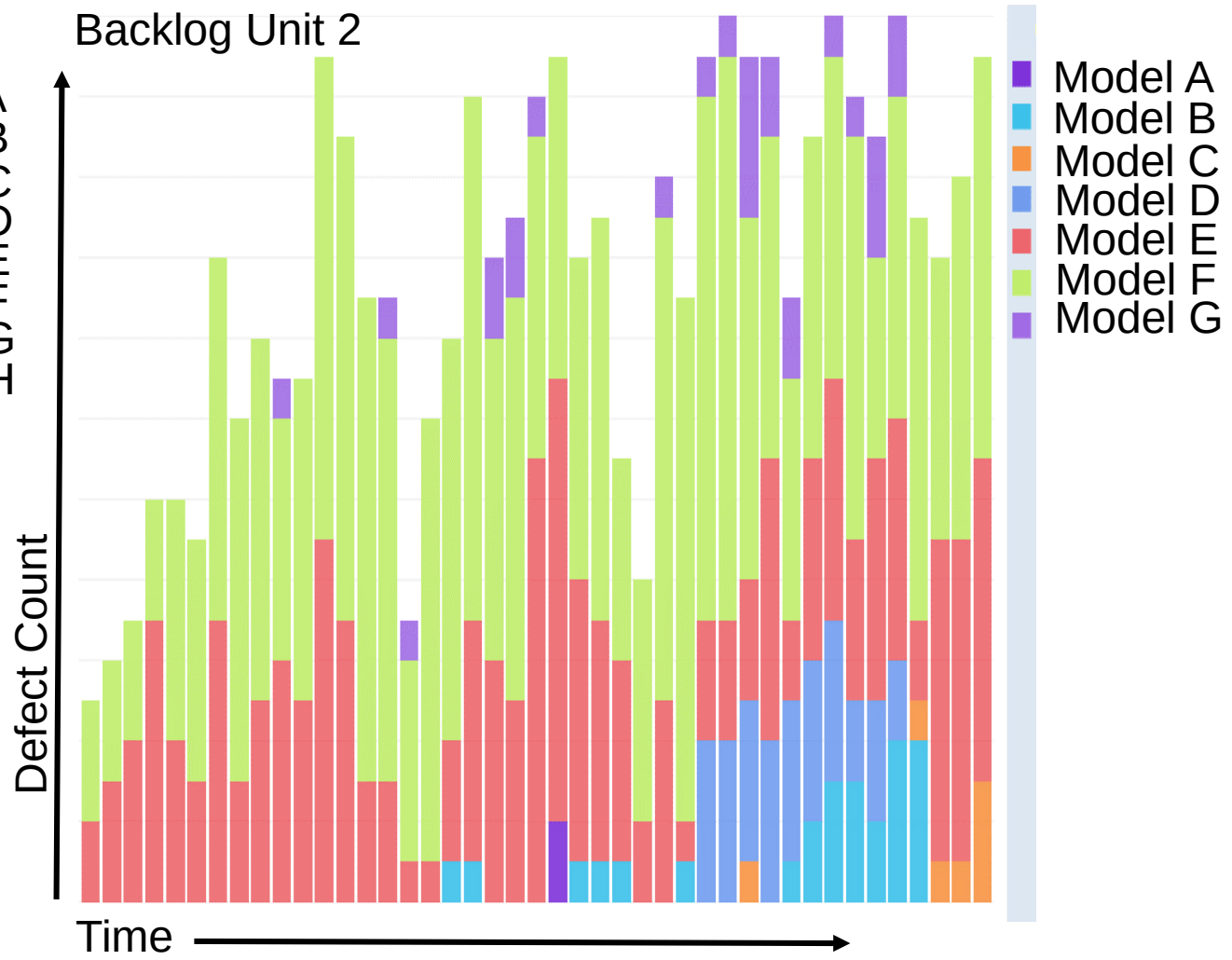


What is the trend?

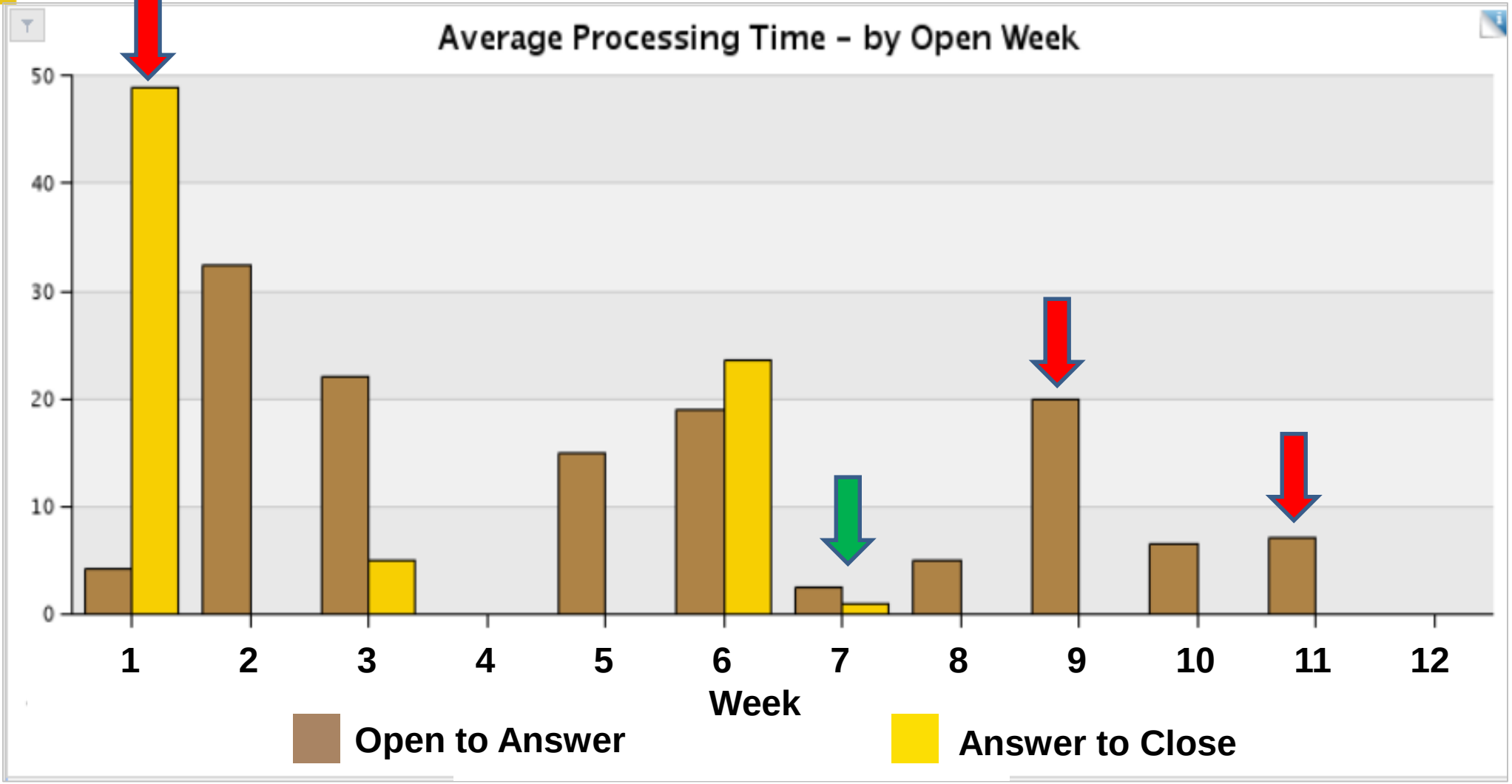


Backlog Trend on Various Environments





What is the average processing time for issues ?



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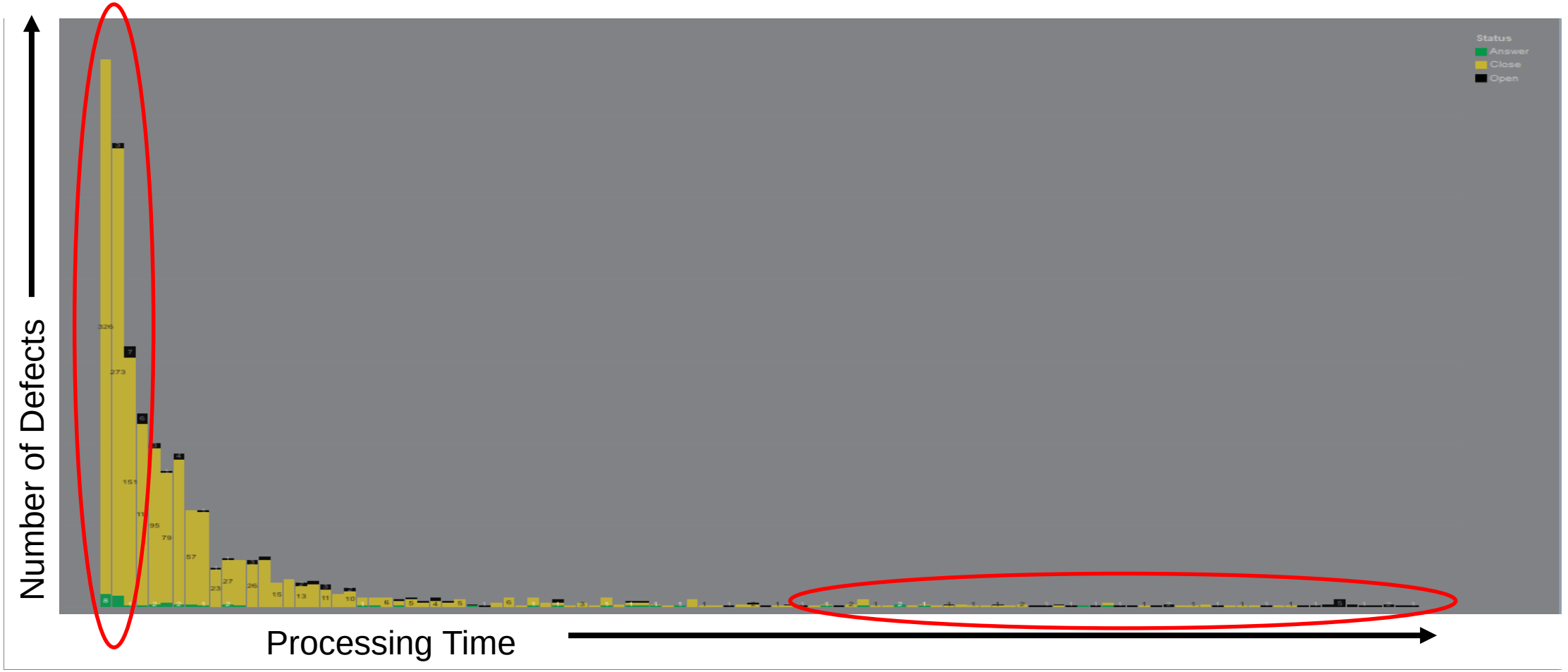
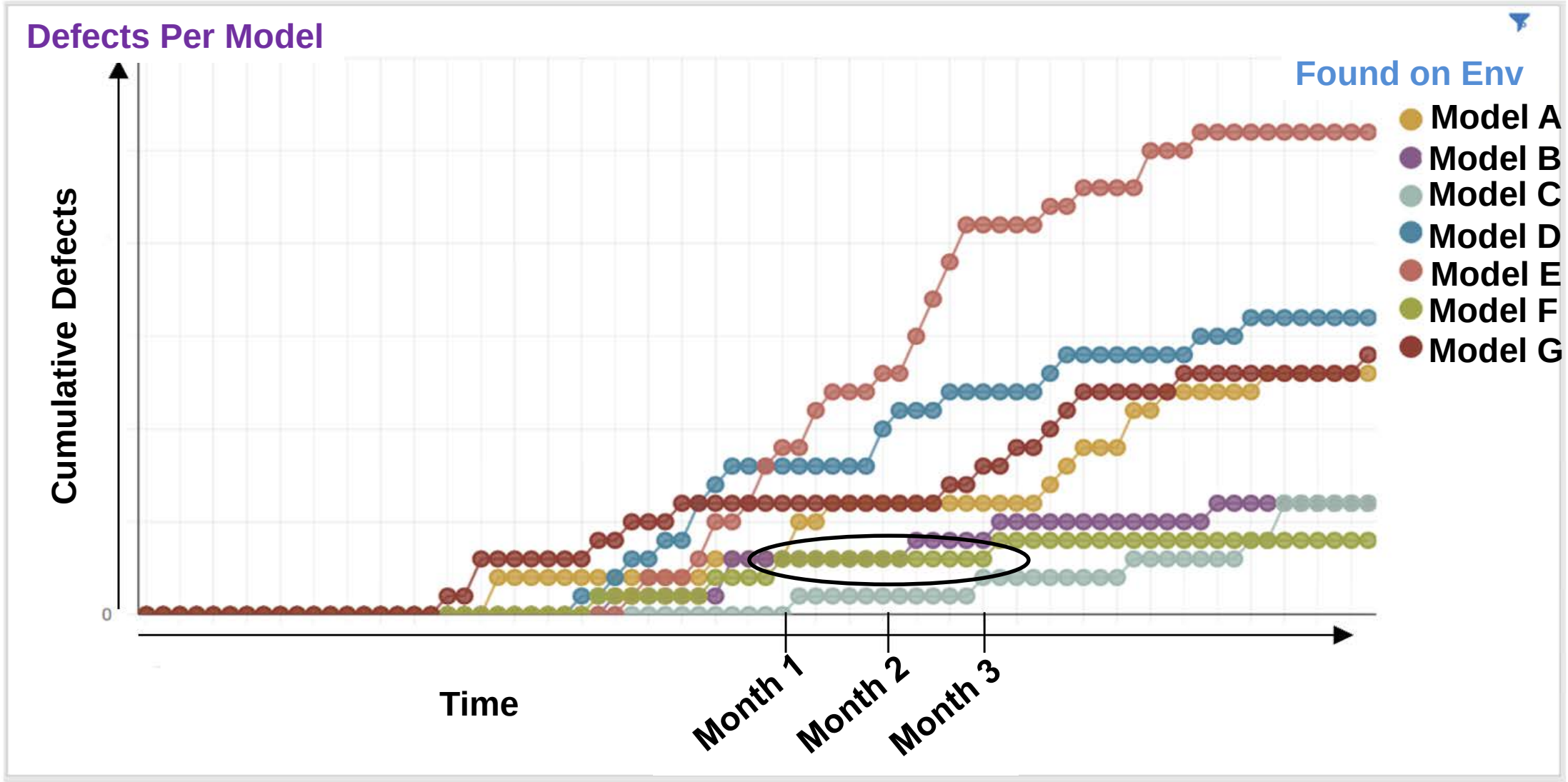
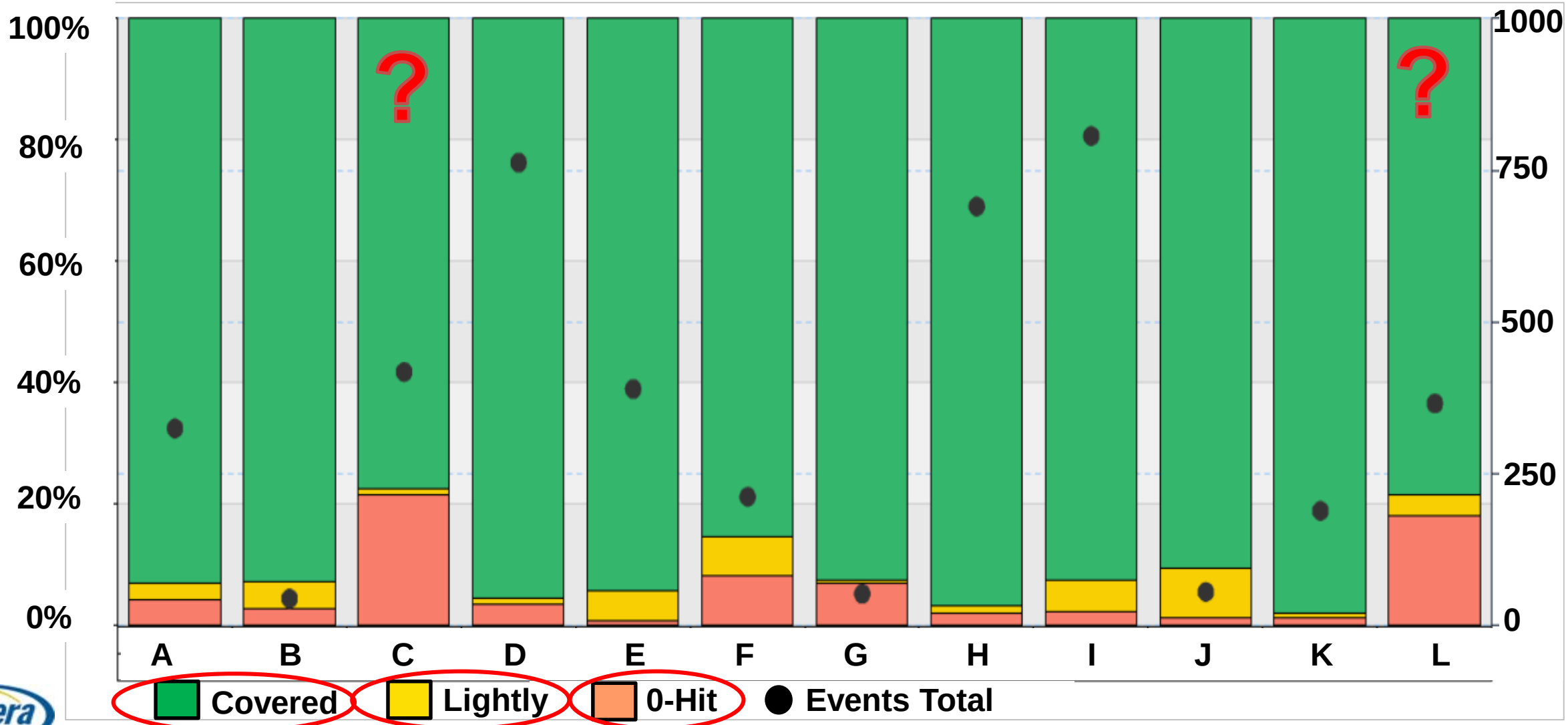


How effective are each of the models at finding defects?

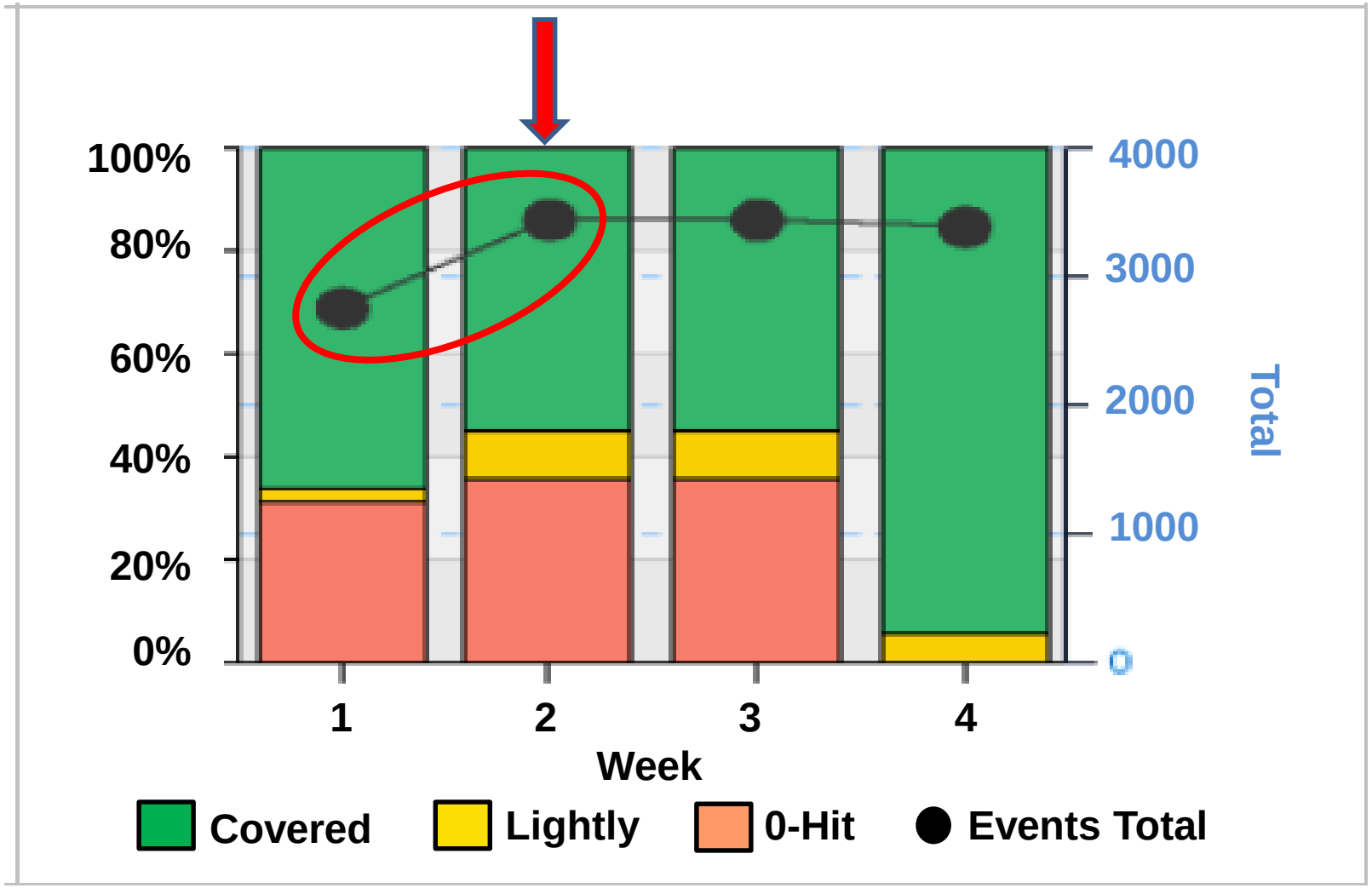


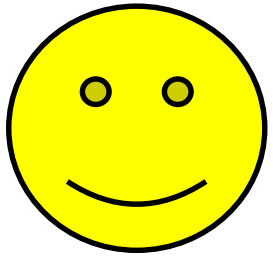
Coverage

What is the coverage status in my units?



What is my coverage trend?





Show me the coverage status by model, with drill down to events

		target:Unit									
#	Entity	S	Total	Covered		Lightly Covered		Zero Hit		Aged Out	Never Hit	Newly Hit
#	name		#	#	% △	#	%	#	%	#	#	#
5	xu_app_zmac		0	0	0	0	0	0	0	0	0	0
13	xu_tlb2_c_zmac		40	17	42.5	2	5	21	52.5	2	19	1
17	xu_tlb2_lru_zmac		73	33	45.2	0	0	40	54.8	23	17	0
21	xu_ztop		3,244	2,050	63.2	23	0.7	1,171	36.1	0	1,171	53
16	xu_tlb2_lkup_zmac		8	6	75	0	0	2	25	0	2	0
14	xu_tlb2_estation_zmac		335	283	84.5	22	6.6	30	9.0	3	25	18
6	xu_async_quiesce_ztop		2,014	1,802	89.5	199	9.9	13	0.6	12	0	0
20	xu_xlate_ztop		431	390	90.5	4	0.9	37	8.6	36	1	0
11	xu_tlb2_a_zmac		109	101	92.7	0	0	8	7.3	0	8	2
9	xu_misc_ztop		644	632	98.1	2	0.3	10	1.6	10	0	1

Regression Test Quality Analysis

Goal

- Run optimized regression in quality (bugs) and resources

Descriptive

- Rank the regression tests according to their ability to fulfill verification goals
  - Target areas in the design that changed recently
  - Find bugs
  - Improve coverage

Regression Test Quality Analysis

Analysis method – simple statistics on measures related to the tests

- Multi sources – Job submission, defect tracking, coverage database, version control
- Cross sources – Probability of hitting rare events, defects per million tests

Prescriptive

- Use the analysis results (manually or automatically) to direct the job submission system

Template Aware Coverage (TAC) Data

Test Templates
$T = (t_i)$

Probabilistic

Coverage Space
$E = (e_j)$

$$P_{hit} = \left.\begin{pmatrix} \cdots & \cdots & \cdots \\ \cdots & p_{i,j} & \cdots \\ \cdots & \cdots & \cdots \end{pmatrix}\right\} templates$$

$$\underbrace{\qquad\qquad}_{events}$$

For test template t_i

$$\frac{\#\ of\ tests\ hit\ e_j}{\#\ of\ tests}$$

$p_{i,j}$ *is the probability that a test instance generated from template* i *will hit event* j

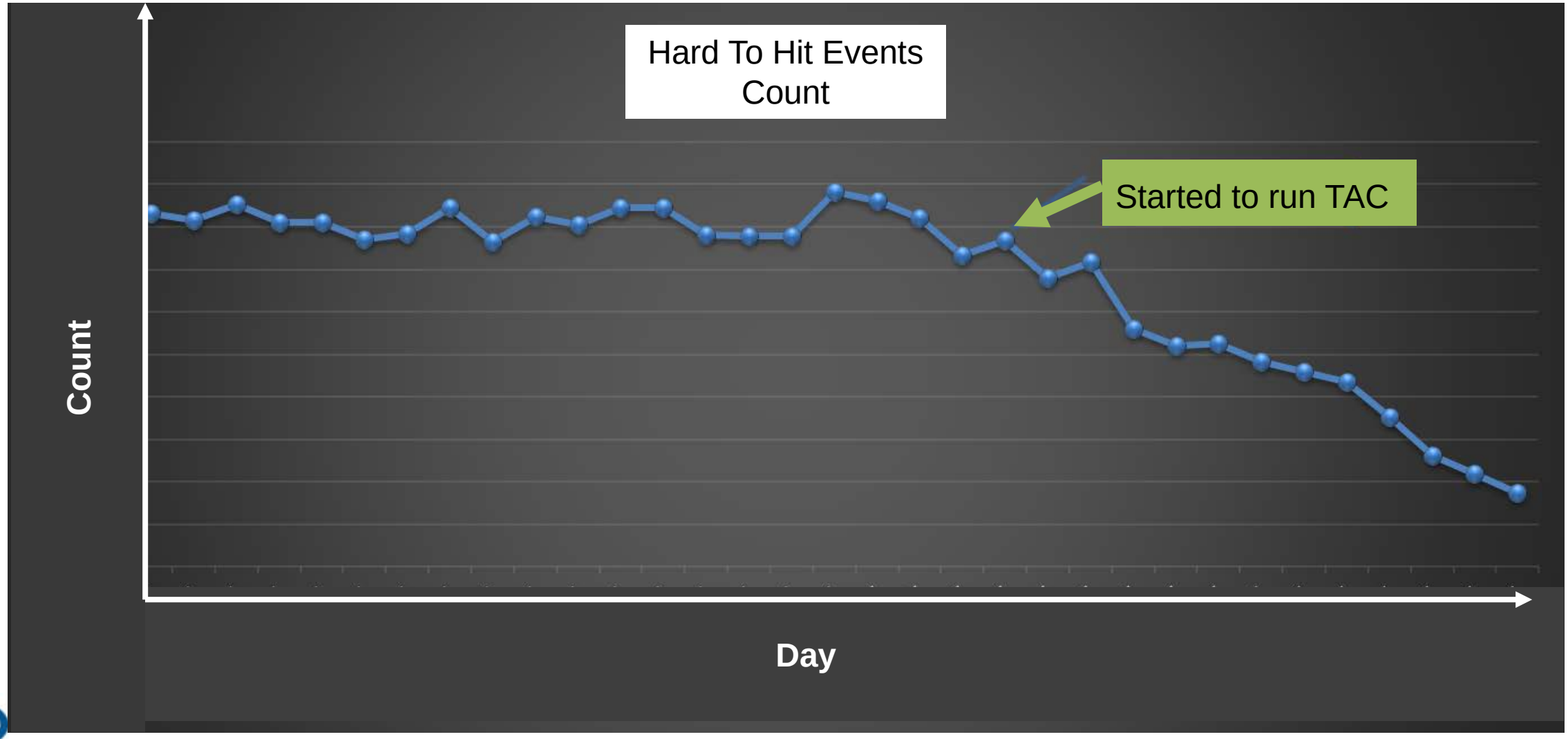
TAC Use Cases

List all Events that are hit by a given Template

Best Templates to hit an Event

List all Events that are uniquely hit by a given Template

Hitting Hard-to-Hit Events



Test Case Length

Long vs Short

VC Summary

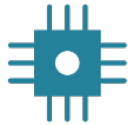
Main objective

- Data science as the backbone of the verification

Key ingredients

Instrumentation

- Identify new data, improve existing data, maintain history



Interconnect

- Data available at central point; model key data relations

Intelligence

- Based on various analytics techniques; by data analysts

Conclusions

The verification process produces tons of data

- Many verification tools with many data items per tool

Extracting useful information from the data can significantly benefit the verification process

- Provides a deep understanding of the data and the underlying world it represents
- Allows speculation over the future and making decisions based on revealed insights

Data analytics is a powerful weapon in extracting such information

- And even simple data analytics methods can go a long way

To build such an information retrieval system, one needs

- Centralized hub to connect data sources (and store the data)
- Verification tools that are open and can be connected to the hub
- Ideas and methods for extracting the information out of the data


Спасибо
Gracias
Grazie
شكرا
Obrigado
Спасибо
Dank U
Ευχαριστω
Danke
Merci
Thank You
Ngiyabonga
Dank U
Diolch
Thank
Obrigado
Ngiyabonga
Tack
You
Merci
Dziękuję
Dziękuję
Danke
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Questions

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