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**KPIT**

# Continuous Integration & Code Quality



**ECoDe**

Education & Competency Development

**Tools & Workflow**

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Significance of code quality & parameters

Coding standards & conformity

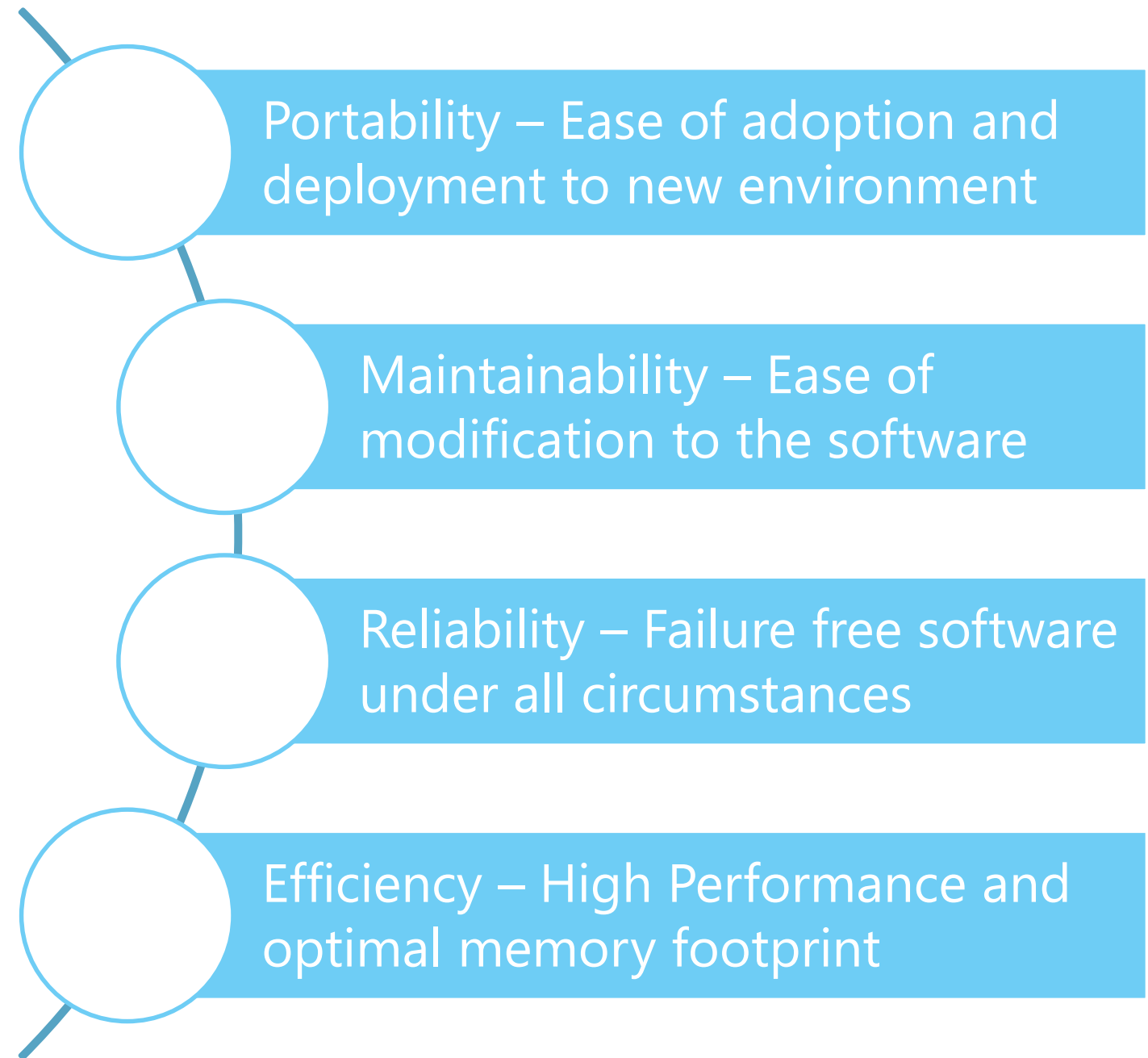
Source Code Management(SCM)

Continuous Integration - Process & Tools

In House Implementations & Workflow

# Code Quality Metrics

## Challenges in Realtime Projects



Code Violations (Static Analysis)

Memory errors (Heap issues)

Average Complexity

Cyclomatic Complexity

Test case failures & Code Coverage

Documentation (comments)

Technical Debt

Code Duplications



Returning address of a local variable

Usage of uninitialized variables/pointers

Memory access after releasing heap block

Ambiguous code without sequence points

String operations beyond allocations

# Cyclomatic Complexity

- This metric is used to evaluate the complexity of a program
- It measures independent paths through program source code.
- Formula

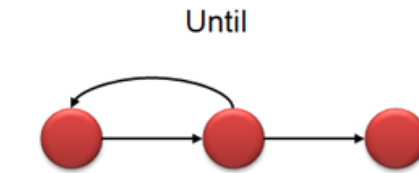
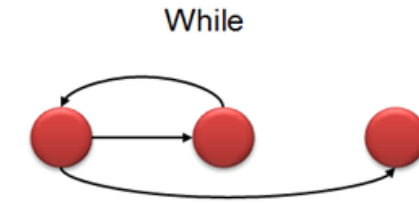
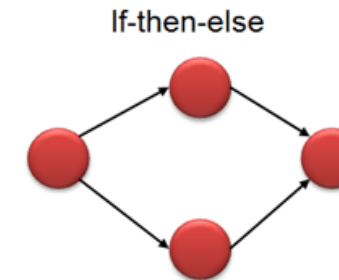
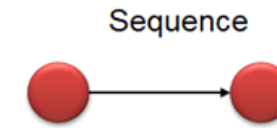
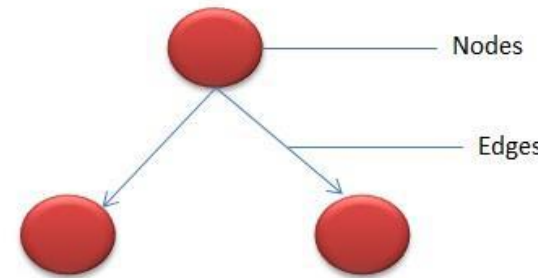
$$V(G) = E - N + 2$$

Where

E – No.of edges

N – No.of nodes

- Lower values of Cyclomatic complexity means
  - Code is Structured and written well
  - High Testability
  - Better readability
  - Lesser cost and efforts for improvements



## C and C++ Code Counter(cccc)

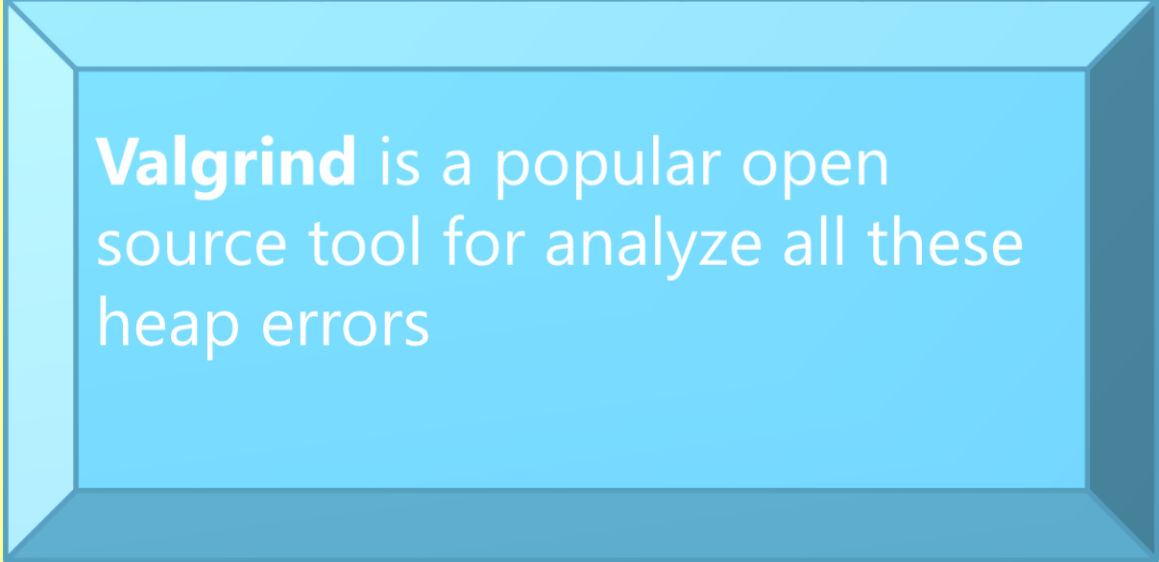
A open source tool to measure Cyclomatic complexity

<http://sarnold.github.io/cccc/>

<http://sourceforge.net/projects/cccc>

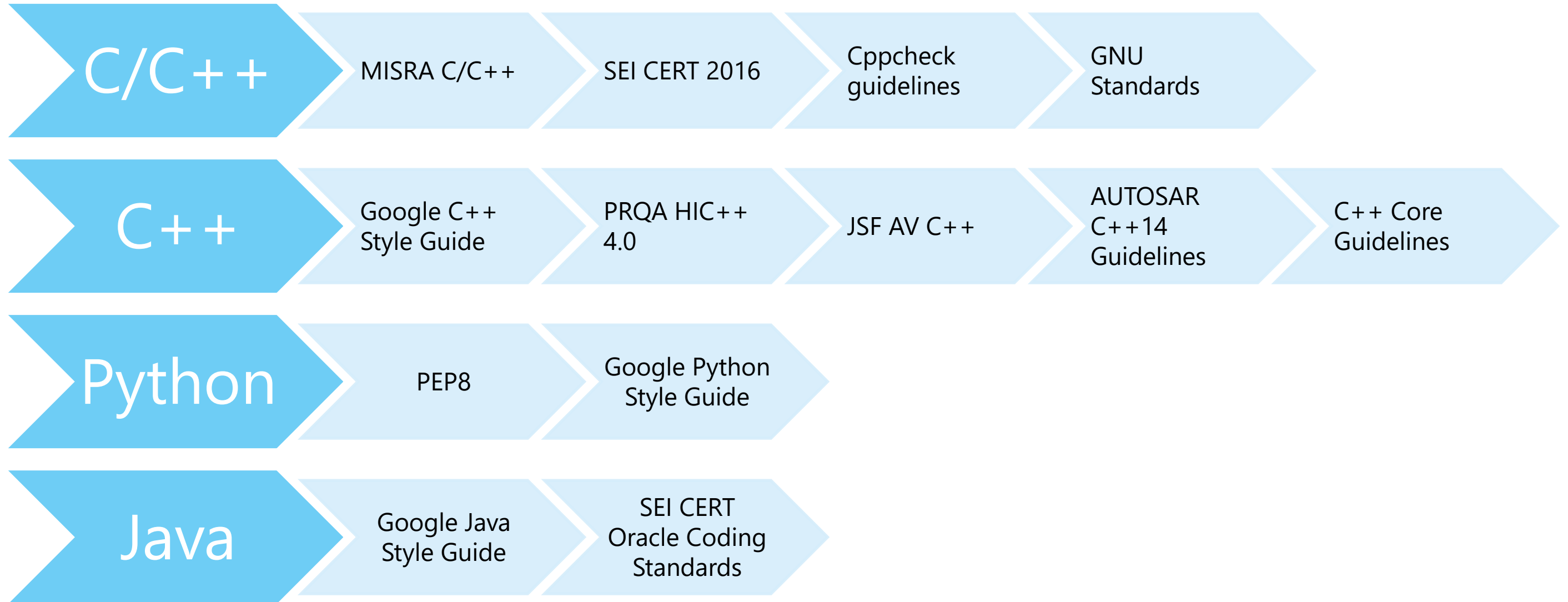
# Memory leaks & Other Heap errors

- Memory leak – A heap block which is allocated but not released
- Other Heap issues
  - Memory access after free
  - Read/Write operations beyond heap blocks
  - Invalid free/delete/delete[]
  - Double free problem



**Valgrind** is a popular open source tool for analyze all these heap errors

# Coding Standards



# Conformity Tools – Free and/or Open Source

cppcheck

cpplint

Clang Analyzer (part of llvm)

splint

checkstyle

pylint

Klocwork

QAC and QAC++

Polyspace

PCLint

SonarLint

Prepare some source code on a case study like Instrumentation Cluster or weather with multiple files

Install cppcheck for your target environment (Windows/Linux)

Run cppcheck on your source code

Explore various static analyzers and supporting coding standards

Identify some rules followed by cppcheck

Have a glimpse of PEP8 Guidelines

## Optional Activity:-

1. Try to use **valgrind**, **ccccc** tools if you have a Linux instance locally or on cloud
2. Try to use PEP8 tool if you are familiar with Linux



# Source Code Management

## Version Control System

- Also known as Version Control System(VCS) or Revision Control System(RCS)
- Some Popular Implementations
  - GIT
  - Subversion (SVN)
  - Mercurial (Hg)
  - CVS (Sunset Implementation)
- SCM Models
  - Client Server Model
  - Distributed Model

## Interactive Tutorials

- <https://learngitbranching.js.org/>
- <http://git-school.github.io/visualizing-git/>
- <https://lab.github.com/>

## Tutorials with detailed steps

- <https://www.atlassian.com/git/tutorials>

## Tools

- Git Shell <https://gitforwindows.org/>
- GitHub Desktop <https://desktop.github.com/>

init

branch

checkout

commit

clone

push

remote

rebase

diff

## In case of fire



(C) google.com/t5StephanSchmidt



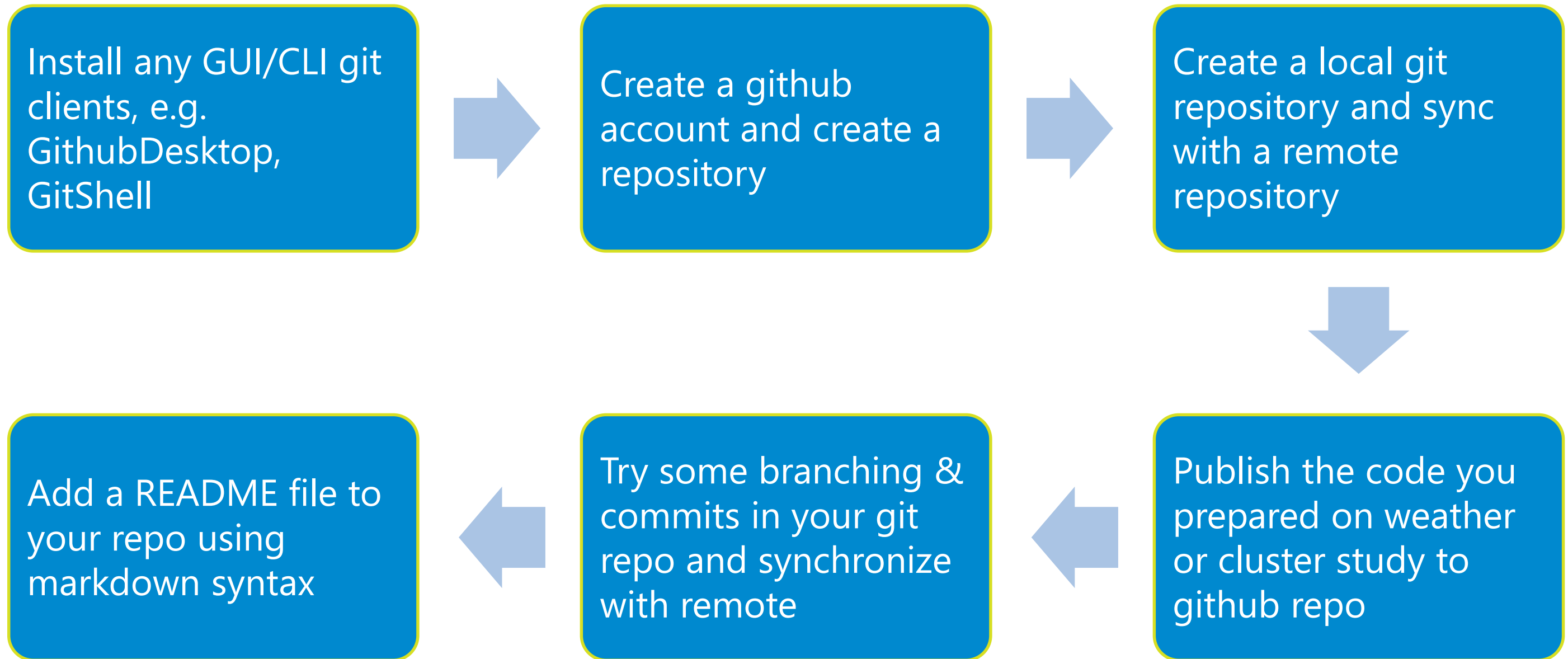
1. **git commit -am "untested due to fire"**



2. **git push -f**



3. **leave building**



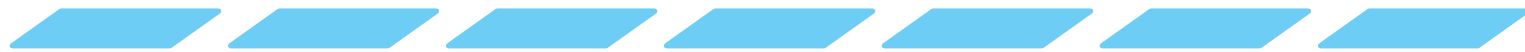
What are the advantages of remote git repos?



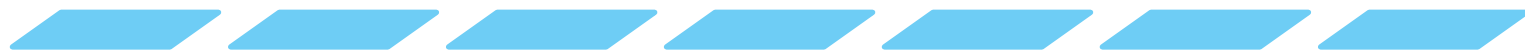
How do you clone a specific branch from a git repo?



How do you generate a patch from a git repo?



When do git push fails/rejected?



What is git stash?

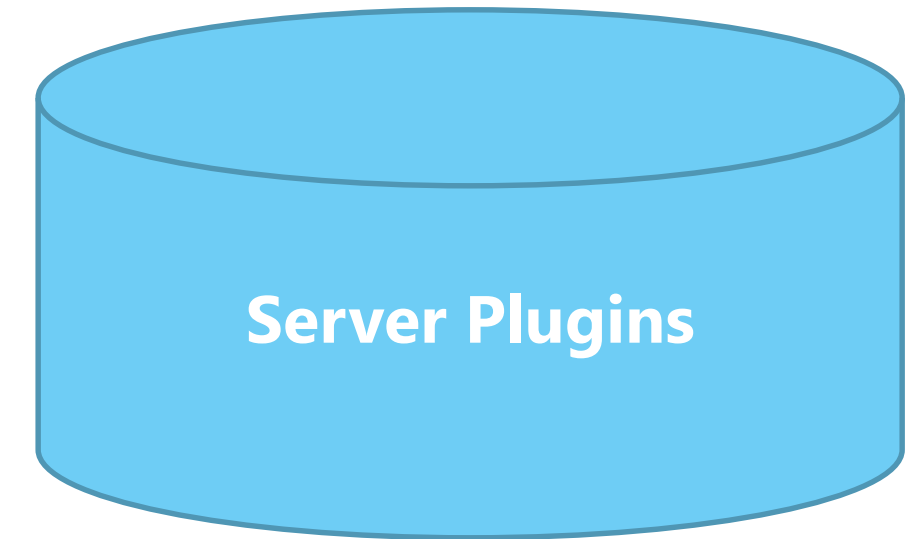
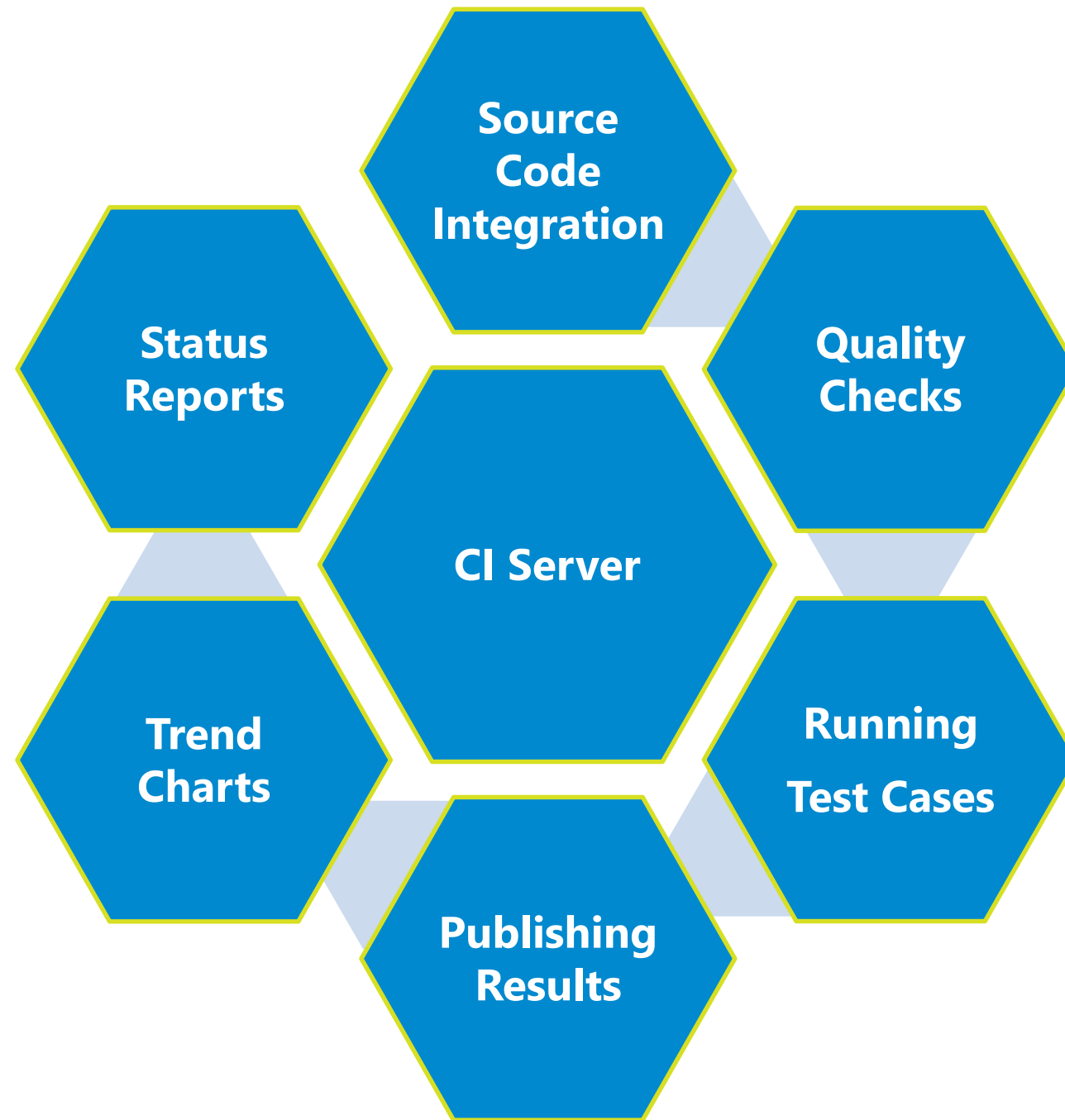


What is detached HEAD state in git?



# Continuous Integration

Jenkins/Travis and others



## Build Types:-

- Manual
- Polling
- On Commit



Setting up Jenkins

Creating a  
Freestyle project

Configuring a  
git/svn repository

Configuring  
Plugins

Triggering  
Builds

Checking  
Results

**cppcheck,**  
**valgrind, cccc**  
etc.

**Activity** – Try these on your own if you can install a Jenkins instance locally or in a cloud environment.

# In House Implementations & Workflow

CBA – Continuous Build Automation

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Our in house implementation of Continuous Integration System

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Build Servers

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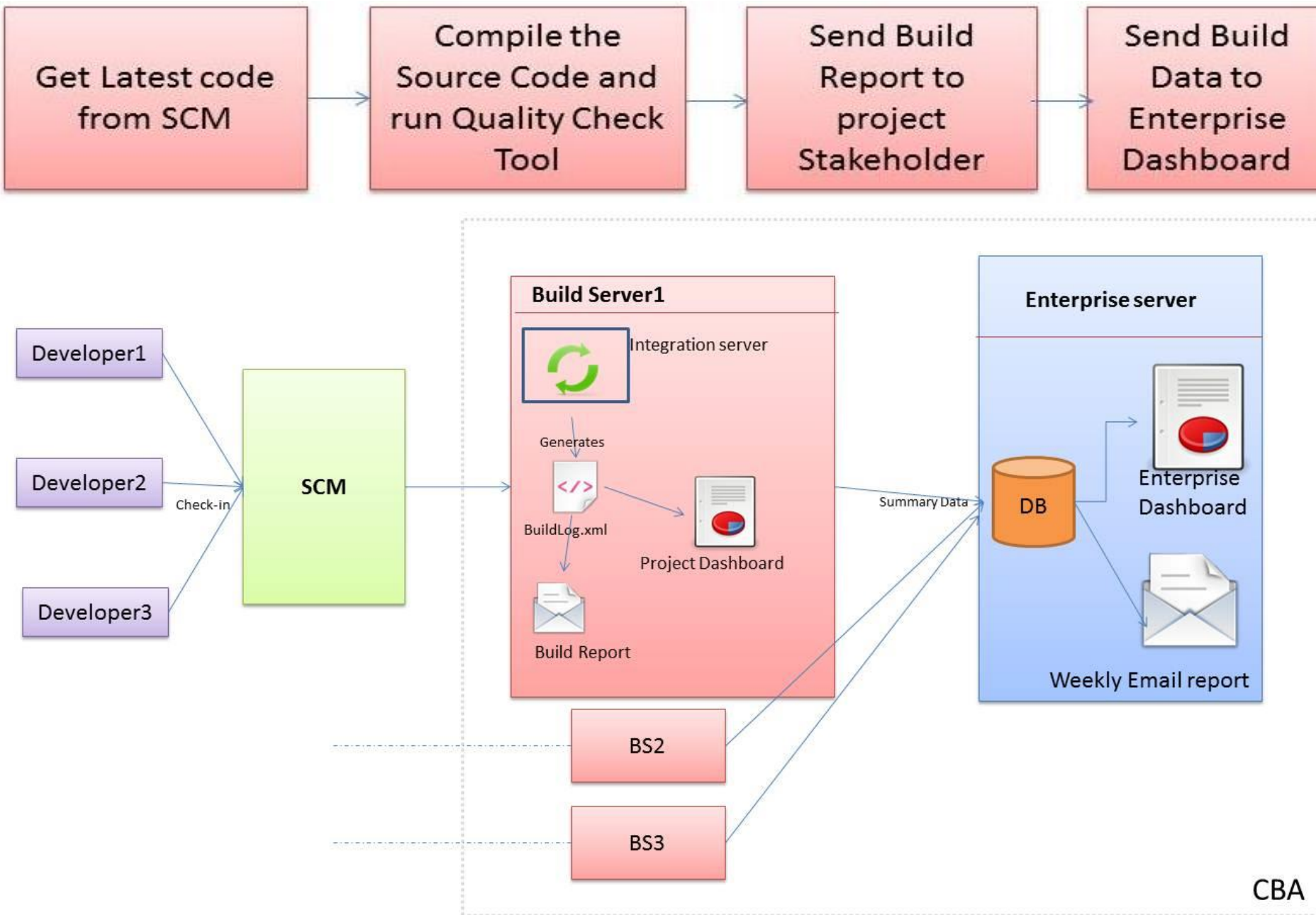
CBA Tools



















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Klarity Dashboard

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[http://hive.kpit.com/cba/index.php/Main\\_Page](http://hive.kpit.com/cba/index.php/Main_Page)



KLARITY 												
<div> <div>Filters</div> <div>Projects Displayed: 255</div> <div></div> </div>												
Alert	Practice	Project Name	Lines of Code / No. of Models	Technical Debt (Person Days)	Code Violation	Average Complexity	Max Complexity	Duplication (%)	MPP Errors	Last Build Occurrence	Last Build Status	
									Applicable			
	ASR	C	<a href="#">AUTOSAR R4.0.3 with ISO26262 - Ethlf</a>	4500	0.0	10	2.43	5.0	0.0	Not Applicable	4 hrs ago	
	ASR	JAVA	<a href="#">Development of AUTOSAR R4.0.3 Tools</a>	876085	625.55	26333	3.43	393.0	6.67	Not Applicable	11 hrs ago	
	OTH	VC++	<a href="#">IDEC ODC - WindOINV NV2 5.0</a>	11375918	33.41 	57912 	4.28	601.0	3.9	To Be Decided	22 hrs ago	
	ASR	C	<a href="#">AUTOSAR R4.0.3 with ISO26262 - EthTrcv</a>	3193	0.0	7	7.5	9.0	0.0	Not Applicable	14 hrs ago	
	ASR	C	<a href="#">Development of R4.0.3 AUTOSAR OS (SC 4) for MPC5744P Controller</a>	27979 	8.26	351	4.32	25.0	0.72	27	1 day ago	
	ASR	C	<a href="#">AUTOSAR R4.0.3 with ISO26262 - Dolp</a>	7875	0.0	96	6.53	20.0	0.0	-	11 hrs ago	
	DEF	C	<a href="#">POWER MANAGEMENT UNIT - UAV</a>	14477	0.02	1	3.81	17.0	1.25	159	16 hrs ago	

# Thank you

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