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Keping Liu

Software Quality Assurance Methodology for Hybrid Waterfall and Agile Development (HWAM)

Keping Liu

- 14+ years at Software Quality Assurance, Technical Leader, Intel Cooperation, Shanghai, China.
- Certified CMMI assessor, ISO internal assessor, ASPICE internal assessor, CSQE, 6 Sigma Orange Belt and CPMP.
- Knowledge Base: PMP, ISO9000, CMMI, TS16949, ASPICE, VDA6.X, 6 Sigma, CSQE.
- Master Degree in Computer Science and Technology from Central South University in China.

Co-Author: Felix Eu, Ooi Mei Chen, Peh Wei Wooi

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Software Quality Assurance Methodology for Hybrid Waterfall and Agile Development

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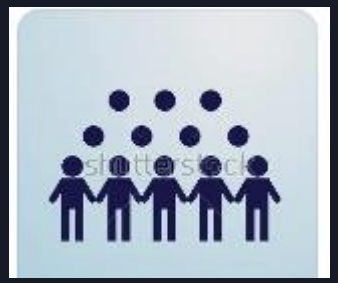
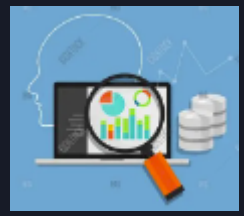
Abbreviations

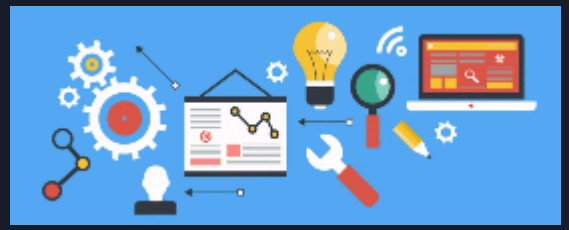
- Hybrid Waterfall and Agile Development (HWAD)
- Software Quality Assurance Methodology for Hybrid Waterfall and Agile Development (HWAM)
- Software Development Life Cycle (SDLC)

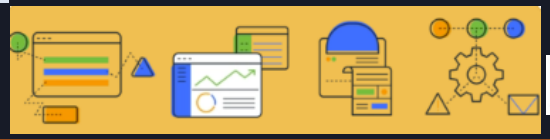
What is Software Quality Assurance Methodology?

- **Software Quality Assurance** is a systematic software practice, which used to **monitor** and **control** the processes and work products, to **comply with** defined standards, and **meet** software release targets.









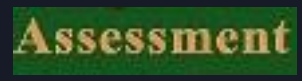


Figure-1 Software Quality Assurance

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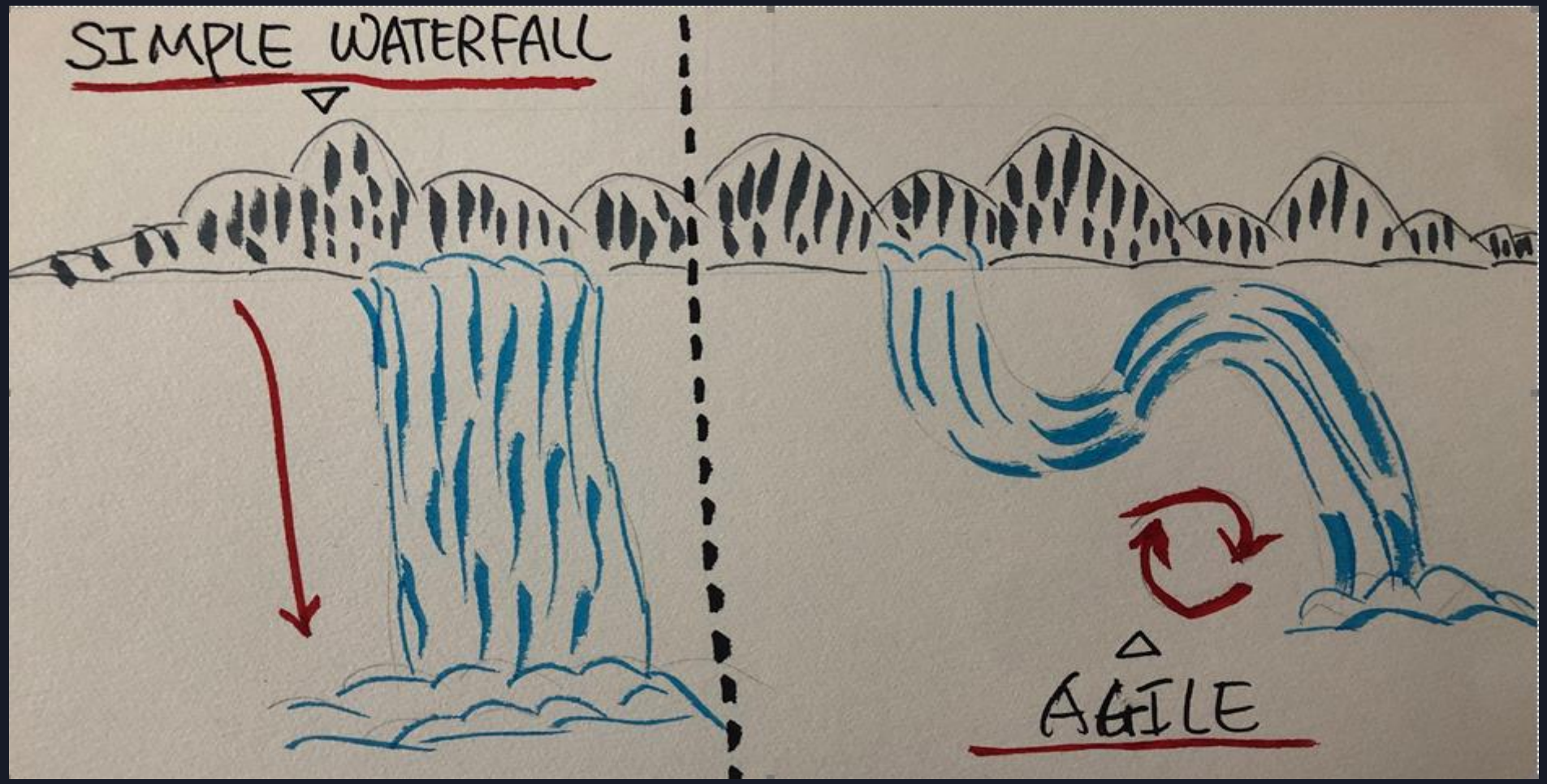
Waterfall and Agile



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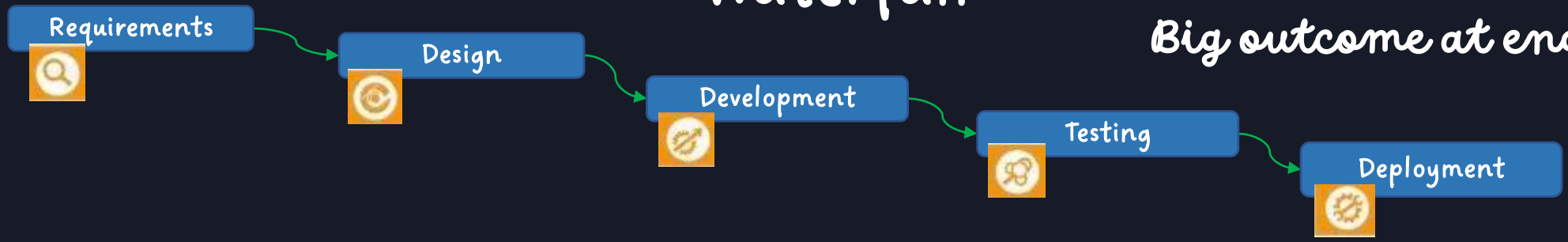
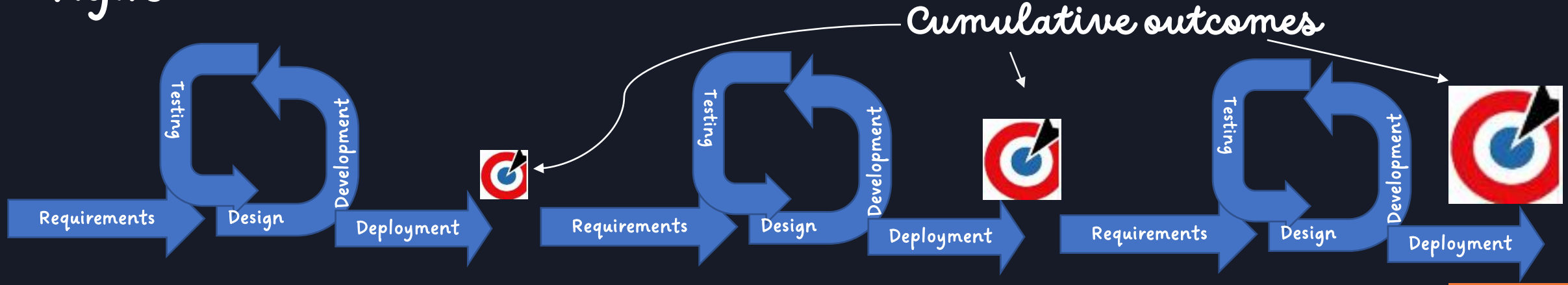
Waterfall and Agile

Waterfall



Agile



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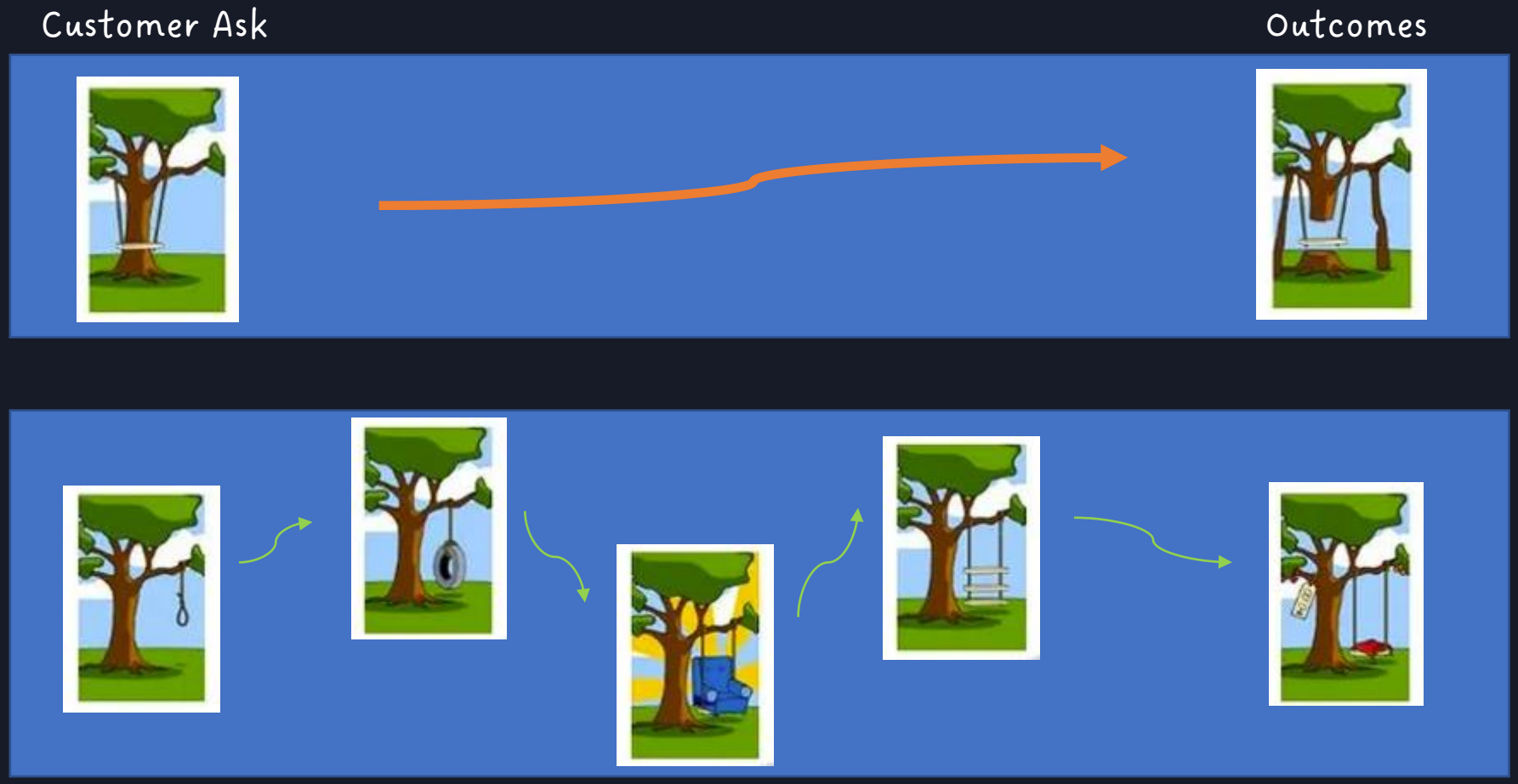
Outcomes



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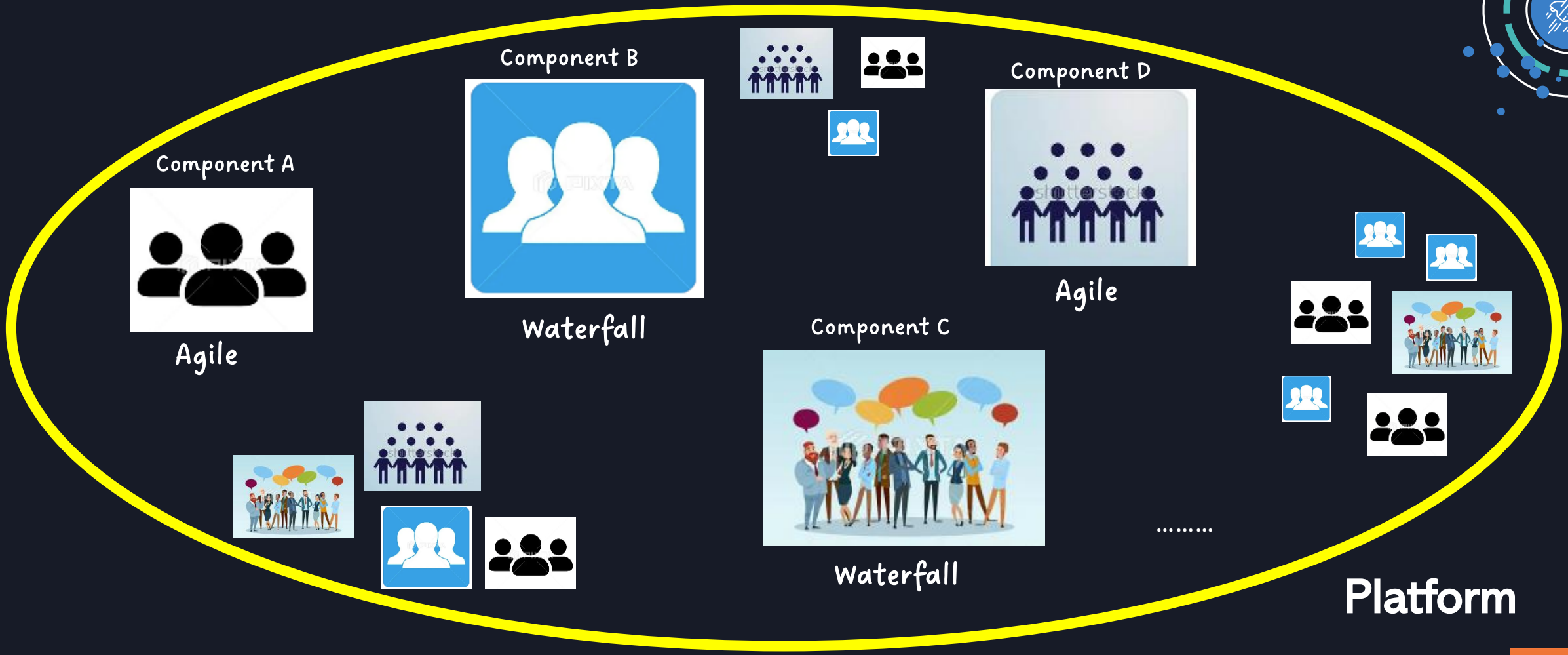
Evolvement - HWAD



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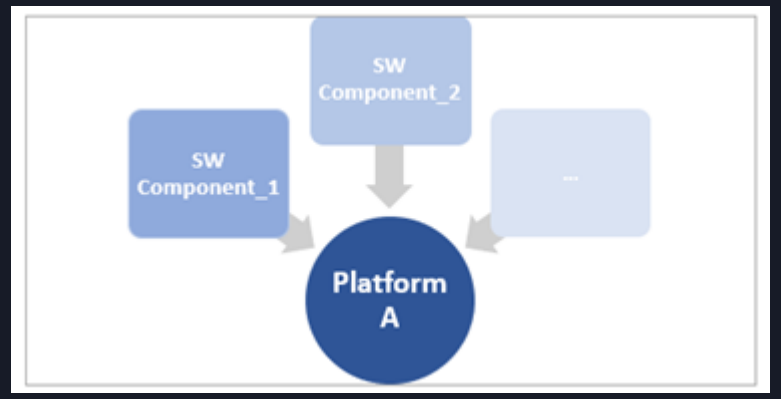
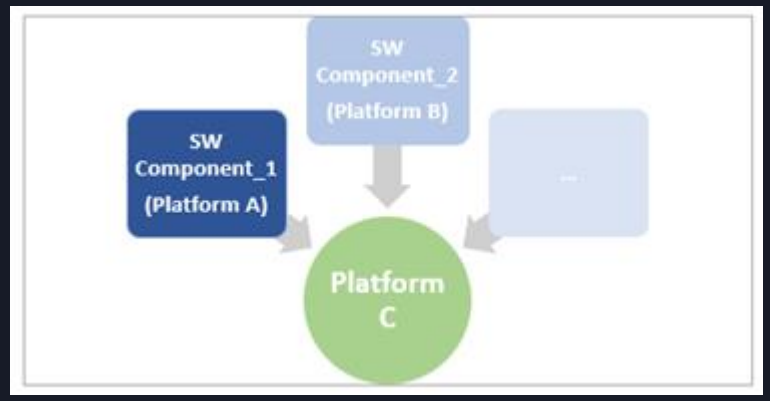
Hybrid Waterfall and Agile Development (HWAD)

- Waterfall and Agile software development life cycles used at the same time by different software components within a big platform, which is called **Hybrid Waterfall & Agile Development** (**HWAD**).

- **Team structure**



- A platform can have multiple software components within it.



- While a platform could turn into a software component for another platform when it becomes a base for others.

What are the Challenges of HWAD?

CH1: Schedule Alignment between Software & hardware, Platform and Components

CH3: Team Resist to Change and need Role Clarification

CH2: Software Release Acceptance Criteria Alignment between Platform and Software Components

CH4: Big Feature Evaluation and Planning

HWAM Overview

Address CH1

Address CH2

Align on Project Management Plan

Align on SW Quality Assurance Plan

Components Software Release Criteria

Platform Software Release Criteria

Process Workflow

Roles and Responsibilities

Key Actions

Address CH3, CH4,CH1,CH2

Results

Continuous Improvement

Integrate solutions together

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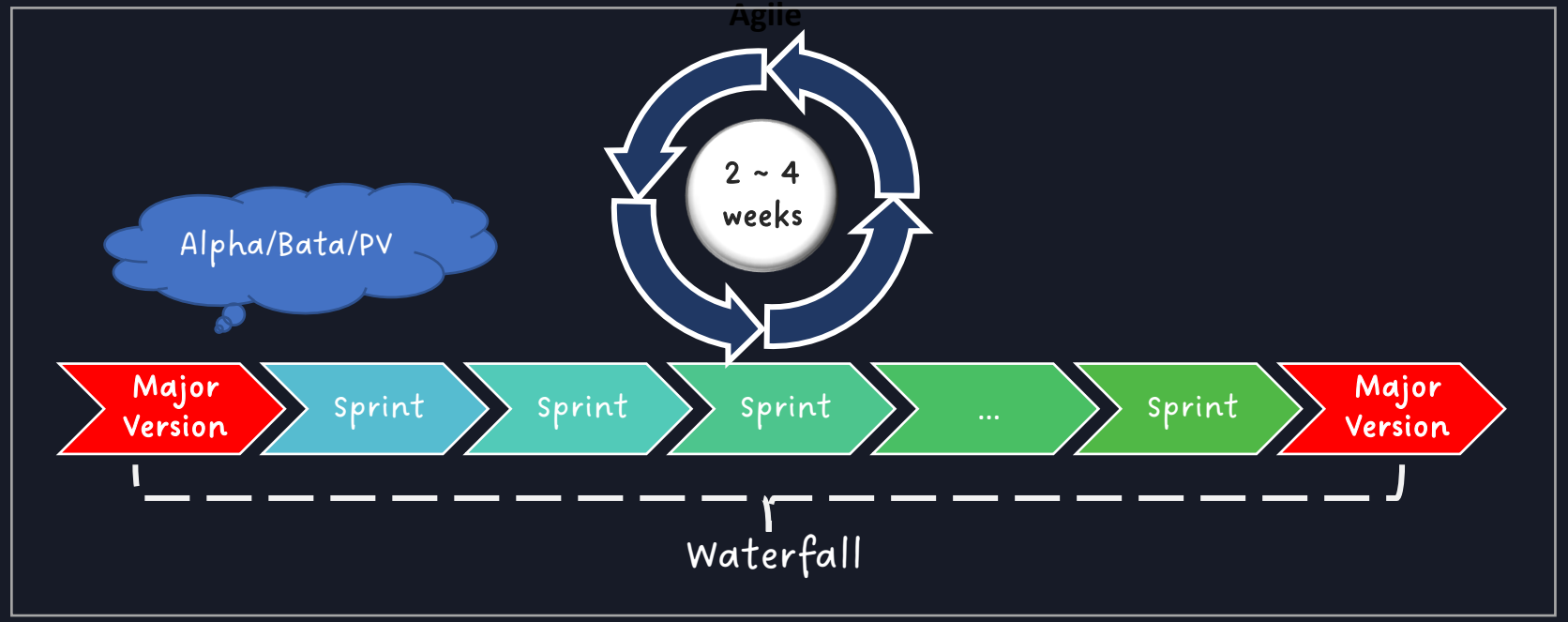
HWAM – Project Planning

- **Map** a certain number of sprints to Waterfall milestones and released it as a **major version**.
- Others will be treated as **intermediate releases** like engineering releases.
- **A major version can be triggered** once **a big feature is complete** or **several big features are integrated**.



Platform

HWAM – Schedule Alignment

- Establish **formal** communication channels, perform **risk analysis** and create **mitigation plans** to **narrow down** the impact of hardware.
- Align hardware **testing** to software '**Iterations**' as close as possible to get hardware function to be tested in a timely manner.
- Create a **dependency matrix** to align release schedule. Make sure software components release **meet platform release target**. **Get** software components team **commitment** to the release schedule.

Example: Dependency Matrix

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HWAM - SW Release Acceptance Criteria

- Create 2 sets of release qualification criteria:

Major Version Release

For each Major Version Release, apply standard Waterfall software release qualification criteria.

See slide15 for details.

Intermediate Sprint Release

For each Intermediate Sprint Release, strategically decompose and reform software release criteria to meet Agile methodology needs.

See slide16 for details.

HWAM - SW Release Acceptance Criteria

Typical software release qualification checkpoints covered in a standard Waterfall development:

Major Version Release

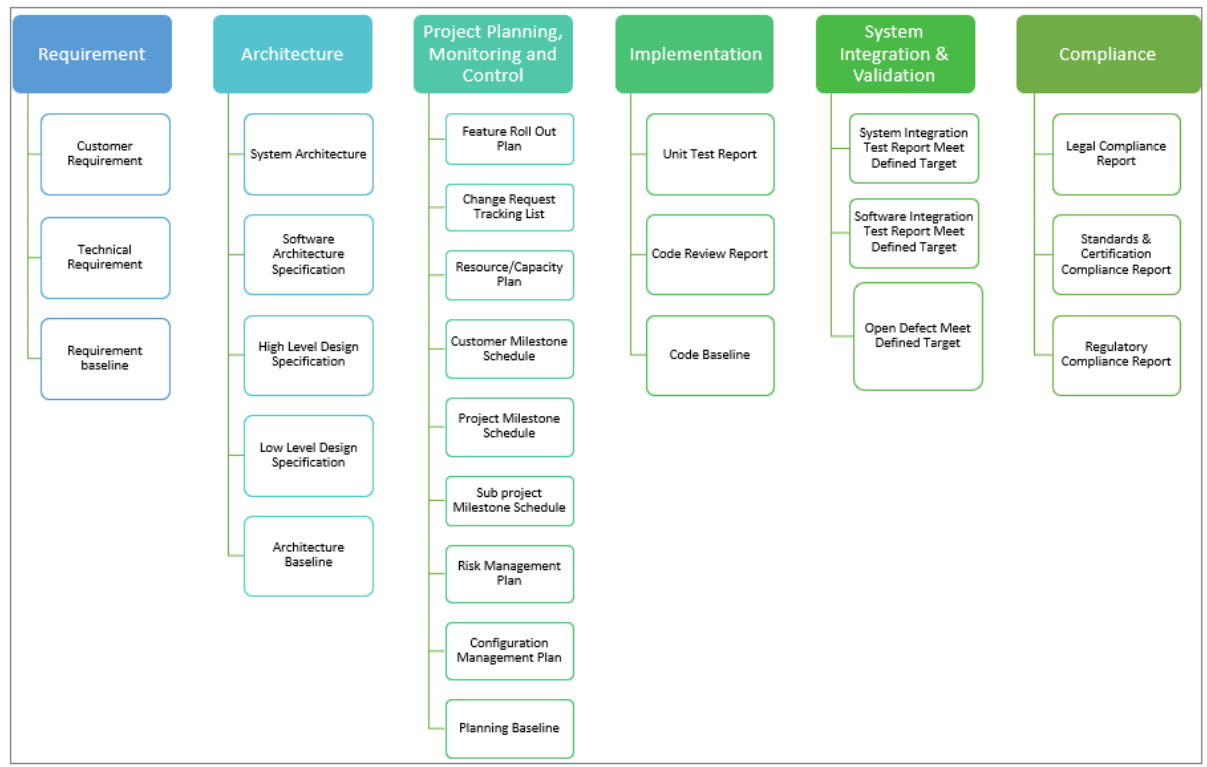
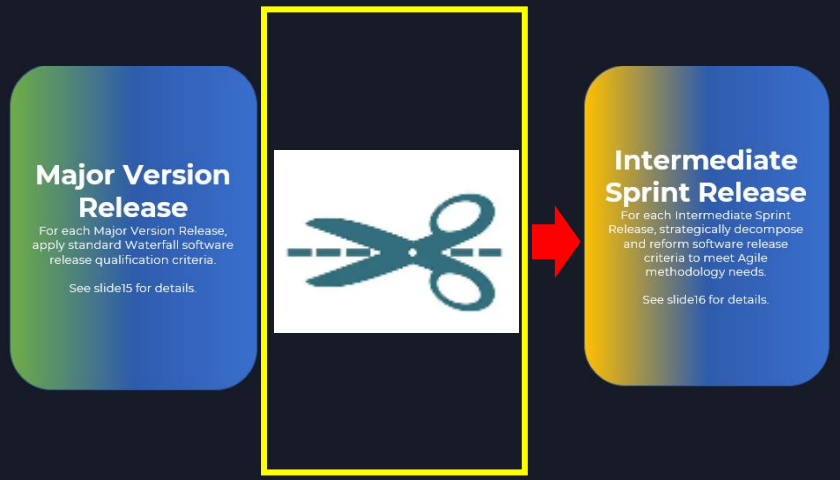


Figure-8 Hybrid Waterfall and Agile Development (HWAD) Major Version Software Release Criteria

HWAM - SW Release Acceptance Criteria



Requirement	Shifting the idea of requirement complete at the entire project base to sprint base.
Architecture	Low-level design specification is required as Intermediate Sprint Releases focus more on software component release.
Project Planning, Monitoring and Control	Feature roll-out plan should be mapped to sprint backlog. Resource/Capacity should be mapped to sprint capacity.
Implementation	Same as Waterfall.
System Integration & Validation	Same as Waterfall but uses pre-production targets like Alpha or Beta. Project team could determine based on business needs.
Compliance	Still check it but will not be gating to mitigate big gap found in Major Version Release.

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HWAM - SW Release Acceptance Criteria

Intermediate Sprint Release

Recommended software release qualification checkpoints covered in Intermediate Sprint Release:

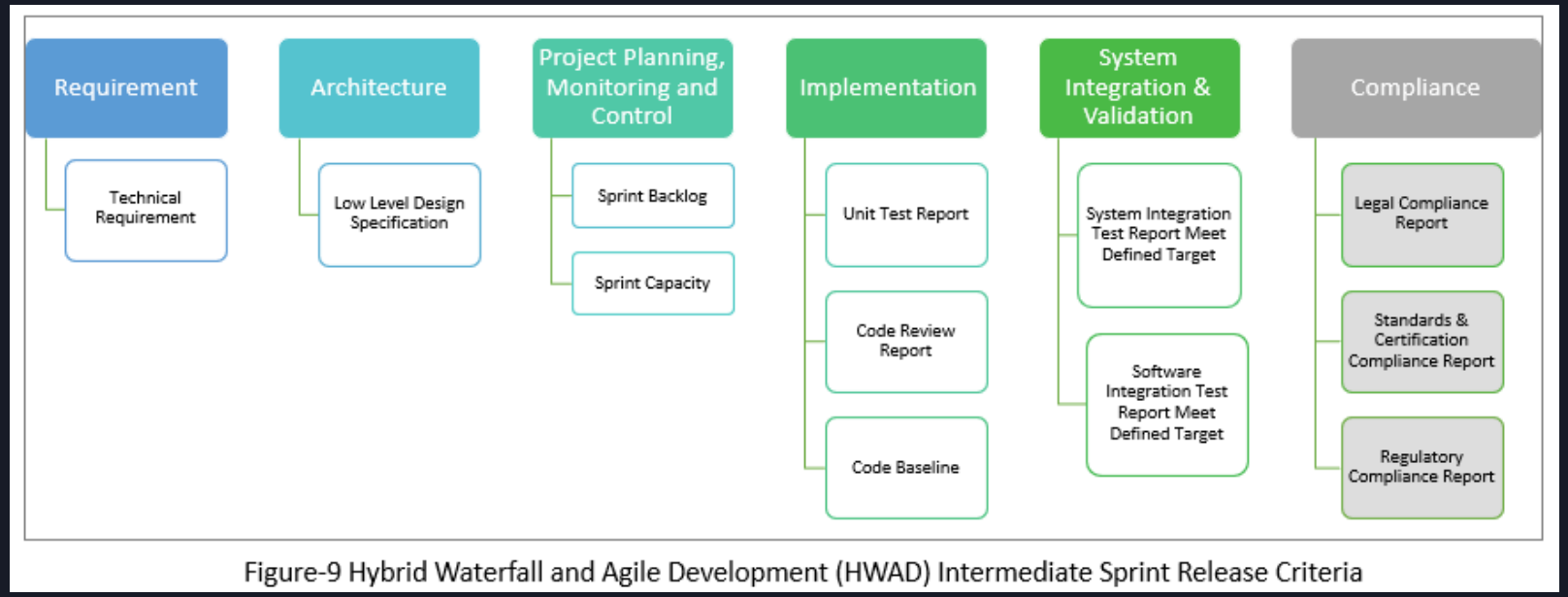
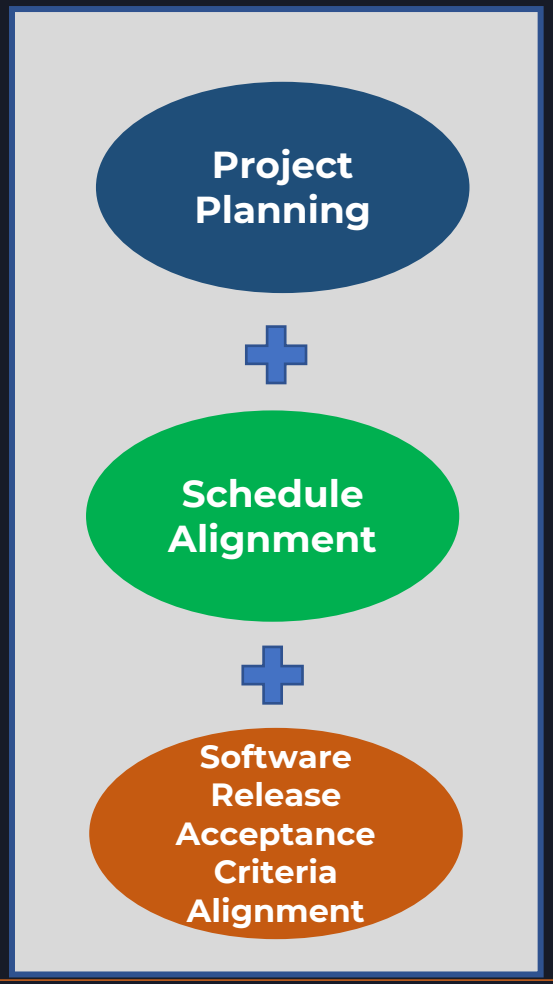


Figure-9 Hybrid Waterfall and Agile Development (HWAD) Intermediate Sprint Release Criteria

HWAM - Process Flow



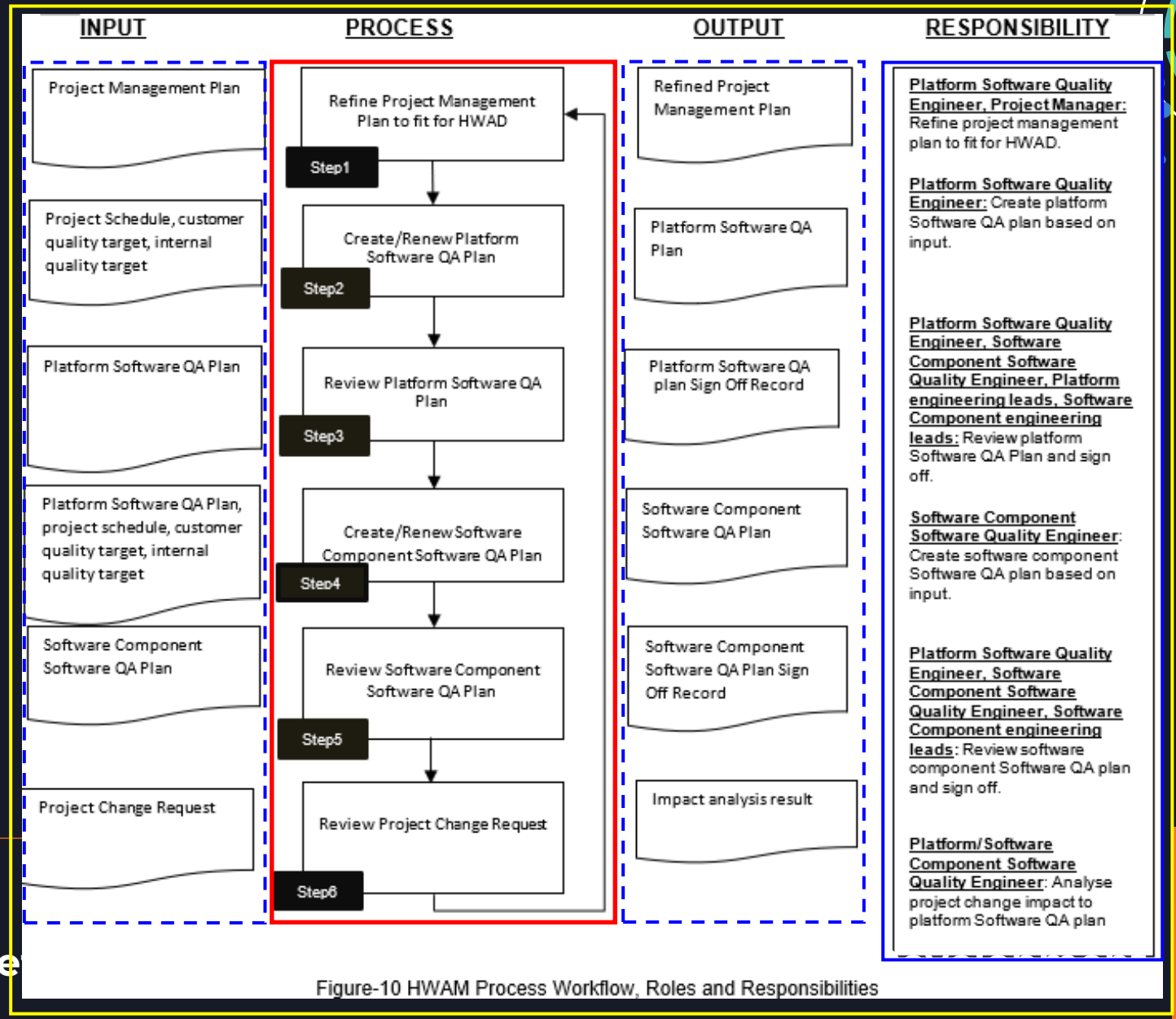


Figure-10 HWAM Process Workflow, Roles and Responsibilities

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HWAM - Key Action

Activity	**Refine Project Management Plan to fit for HWAD**
Purpose	The purpose of this activity is to refine the Project Management Plan to fit for HWAD.
Start criteria	Project Management Plan in place
Input work products	• Project Management Plan
Responsible	• Platform Software Quality Engineer, Project Manager
Action list	• Add a formal evaluation task in Microsoft Project Planning (MPP) at the beginning of a project to see if the Agile development methodology was fit for the current project. (CH3) • Add Agile development methodology (E.g., Scrum Master, Product Owner, etc.) training to the project training plan. (CH3) • Add big feature evaluation and planning training to the project training plan. (CH4) • Create software component and platform dependence matrix to align software release schedule. (CH1) • Create hardware and software dependence matrix to align hardware and software release schedules. (CH1) • Create a formal communication channel to synchronize hardware and software on schedule, scope, and resources. (CH1) • Perform risk analysis and mitigation plans to narrow down the impact of hardware. (CH1) • Add retrospective meetings for each major milestone in MPP (CH2).
Output work products	Refined Project Management Plan; Refined Microsoft Project Planning
Exit criteria	Refined Project Management Plan; Refined Microsoft Project Planning in place
Work Instruction	Hybrid Waterfall and Agile Execution Checklist

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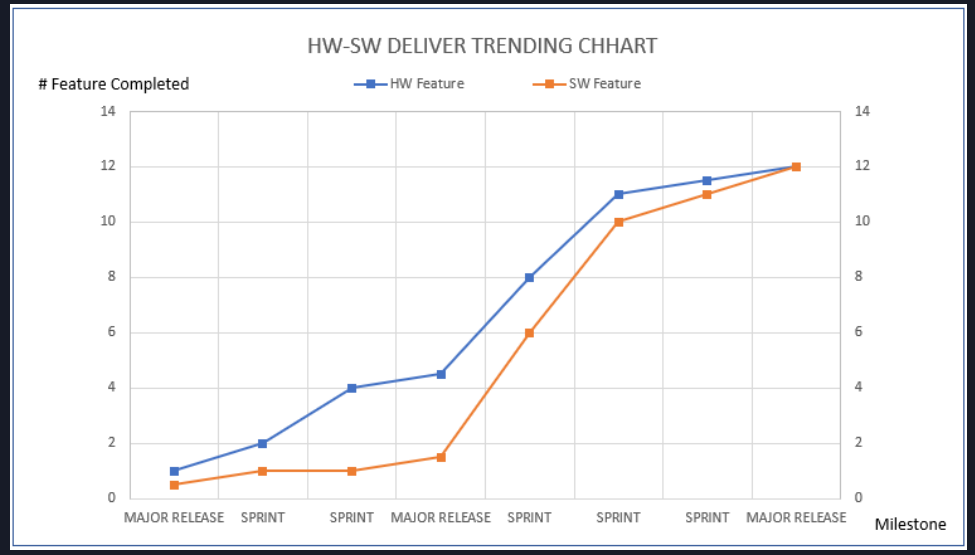
HWAM – Implementation Result



- Hardware and software delivery **schedule trend** converged by the 8th sprint.

Implementation	Result (Before)	Result (After)	Improvement
Release cycle and Human resource	SW 26 platform releases within 1 year HW 6 releases within 1 year	12 platform releases with both working HW and SW within 1 year	The release cycle and and human resource usage are decreased by 62% respectively
Customer evaluation	On average, customer validation feedback was received twice and feedback is collected late in the delivery lifecycle.	Customer validation feedback was collected ⩾ 6 times throughout the product lifecycle (because of the aligned HW and SW schedule), including early, mid, and end of the delivery period.	Customer feedback received improved ⩾300%

- **Release cycle and human resource usage** decreased by ~62%.
- **Customer feedback** received improved 300%.

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Continuous Improvement

- **HWAM Gap Analysis and Continuous Improvement:**

Gap Analysis	Continuous Improvement
Sometimes it is hard to map HW and SW features to get a good schedule alignment.	Use a unified tool to track both HW and SW features in the same location. E.g., Using Jira which has the burndown chart report embedded.
Sometimes HW schedule cannot fit for SW schedule.	Plan additional SW releases to fit for HW release schedule. E.g., the HW B0 release has aligned the SW Alpha release, but the next HW B1 release does not have a corresponding SW release with it.
Process KPIs (key performance indicators, KPI) are not formally defined and measured.	Define formal process KPIs to monitor and control efficiency and quality, identify process gaps, and improve the process. E.g., considering execution velocity, feature completion, customer evaluation, effective communication…etc.

*HW: Hardware
* SW: Software

Summary and Key Takeaway

Software Quality Assurance

- Definition
- Independence, Plan, Criteria, Checklist
- Process Compliance and Product Compliance

HWAD

- Traditional SDLC* Waterfall and Agile
- Definition
- Team Structure

HWAD Challenges

Major Challenges:

- Schedule alignment
- Release criteria alignment
- Resist to change
- Big feature evaluation

HWAM

- Definition
- Address problem from 3 aspects: Plan, Criteria, Process
- Key Action

*SDLC: Software Development Life Cycle

Thanks to My Team

Felix Eu

Mei Chen Ooi

Peh Wei Wooi

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QUESTIONS?

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