

PRODUCT ENGINEERING

AN INTRODUCTION
SECOND EDITION
BY
TOM HALPIN

A tale from the Pet Clinic multi-verse

Foreword by Dr. Padma Roy

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Preface

Humans have an innate love for stories; the urge to tell them is embedded in our DNA.

This book is the novelization of an online interactive **Product Engineering Dojo**, which utilized a role-based storytelling approach to facilitate large-scale, hands-on learning.

Product Engineering An Introduction is set in the **Pet Clinic** multiverse. Its goal is to immerse readers and learners in realistic scenarios where they engage with a virtual cast of characters, experiencing the team's challenges and sharing in the team's aspirations as they delve into the world of Product Engineering.

About the Author

Tom Halpin works in a DevOps enablement role, helping teams transition to a DevOps model to support product-aligned value streams. His goal is to facilitate the scaled adoption of the associated culture, practices, and tools. Tom brings a wealth of experience across various sectors, including factory automation, supply chain & logistics, lecturing, eLearning & training, and finance. He has held a wide range of roles from software development to technical management.

Tom believes that product engineering can help teams achieve greater speed by recognizing the importance of occasionally slowing down. Teams need to understand this balance and invest in the right mix of product features and work practices. By doing so, they can optimize their value stream, reduce technical and operational debt, and ultimately achieve greater success.

Foreword

The progression of information technology (IT) over the past three decades has underscored the fundamental reality that organizations must effectively leverage the advantages of technology's evolution. However, this still depends upon Human Resources, Processes, and Technology.

However, human resources and processes must evolve in harmony. While the influence of teamwork and adopting agile methodologies in software development are well-documented and widely acknowledged, extending these principles across the broader IT landscape has proven to be a complex challenge. The transition to a Product Engineering operating model represents a journey requiring deliberate and strategic steps.

A notable obstacle to this transition is the misinterpretation of team roles. Merely designating an individual as a scrum master or a product owner is insufficient. While these roles are pivotal, a more comprehensive understanding of their interactions and functions is often required. Enter "Product Engineering" and its innovative approach to delineating these roles and functions through a unique, multi-verse (Pet Clinic) experience. This method renders corporate roles relatable and applies a straightforward yet potent set of proven techniques, thereby elucidating the complexities of product engineering and informing the audience.

This publication is designed to cater to all levels within a corporate hierarchy, from product owners, managers, and executives seeking to deepen their understanding to development team members aiming to refine their practices. Its simple yet creative approach imparts invaluable knowledge and insights into modern techniques that have the potential to revolutionize one's approach to product development. Each role is recognized for its unique contribution, making this a truly inclusive resource.

As you delve into the second edition of this publication, get ready for a transformative journey. The wisdom encapsulated within these pages is not just theoretical, but practical, poised to redefine how product development is approached. It equips individuals with the tools and comprehension required to thrive in the ever-evolving landscape of IT. This prospect should inspire and invigorate individuals, sparking excitement about the potential changes it can bring to their approach.

Dr Padma Roy

Distinguished Technologist

Dedication

For my family, those who have come before, those that are here now and those that are yet to arrive.

June, 2024

Dojos

This book's roots lie in a number of interactive enablement dojos which were developed and open sourced to share with the wider community.

DevOps Dojos

DevOps Dojos gained popularity after Target, a major U.S. retail company, introduced the practice to support its DevOps transformation. Since then, numerous conference talks, white papers, and books have explored DevOps Dojos.

The dojo experience resonates with many, consistently delivering impressive results through on-site sessions. However, scalability remains a challenge, as it's often impractical to accommodate everyone in face-to-face dojos. To overcome this, interactive browser-based DevOps Dojos have been developed. Additionally, the Dojo model has been extended to other domains, including Product Engineering.

Product Engineering An Introduction

A business's customer-centric approach to software development can be better facilitated by the judicious application of Product Engineering, underpinned by Agile and DevOps principles. As a result many companies are investing in helping customer-facing teams adopt new approaches like Product Engineering to increase their agility, collaboration and responsiveness to customer needs.

Product Engineering embraces concepts of design thinking, which aims to create better products and services by understanding how users interact with them and the conditions under which they are to operate. It emphasizes bidirectional communication, feedback loops, learning from mistakes and experiential approaches.

However, training is essential to facilitate the cultural shift from a project mindset to a product mindset. This book aims to address that training need, with the objective of helping individuals ensure that the software applications and integrations they develop, along with the managed services they provide, are "productized" and thus better aligned with business needs and market demands.

"Productization" being the process of transforming a service, solution, or internal tool into a standardized product that can be consistently replicated, marketed, and sold. This typically involves defining clear features, creating a user-friendly interface, establishing support systems, and setting pricing models, thereby making the offering accessible to a broader market. The goal of "productization" is to create a scalable and repeatable product that meets specific customer needs and can be offered to multiple clients without extensive customization for each one.

Open Sourcing

This open-sourced eBook, **Product Engineering An Introduction**, is designed to:

- Raise awareness of Product Engineering.
- Prepare individuals for face-to-face or virtual Product Engineering Dojos and Design Thinking Workshops by teaching associated techniques in advance.
- Offer a Product Engineering curriculum in a flexible format, allowing students to access and consume the material as needed.
- Share best practices for addressing inquiries related to Product Engineering and Design Thinking patterns.

Universal Imports - A Story

One of our ongoing challenges as coaches is to make the learning experience engaging. There is nothing better than a good story to engage people, so we created one to support our training.

Product Engineering An Introduction tells the story of a fictitious group of companies, the "Universal Imports Group" and its employees as they embark on their Product Engineering journey. You will meet those employees shortly, share their journey and hopefully gain some insights that will help you in your own Product Engineering journey.

Ready to Begin?

Ready to begin? If so go grab a cup of your favorite ☕ or ☕. Resist the temptation to multi-task, turn off all electronic devices 📱 other than the device you are reading this book on of course.

Let's get started on Product Engineering!



This is the way!

Chapter 1 - Welcome

Thank you for making time to peruse this book. We hope the investment of your time is rewarded with Product Engineering learnings and insights. We further hope that you can apply these learnings in your work and in your team's work.

This book includes **5** chapters and an assessment:

- Welcome
- Introduction to Product Engineering
- Design Thinking
- Getting Started
- Afterword
- Assessment

Overview

In this Welcome chapter, we will get you started by introducing you to the scenario and the cast of characters. Once you are all set, you can complete the other chapters at your own pace.

This book is set in the **Pet Clinic** 🐱🐶🐼🐹🐰🐹🐙🐹 - **Multiverse** 💥.

We will begin by introducing the Universal Imports group, the group of companies led by the Charlie the CEO and and by introducing our troupe of characters.

Product Engineering the final frontier: these are the 🚀 voyages of the Universal Imports Group as they work to introduce Product Engineering ...



The Challenge



Charlie is keen to ensure that the teams working in his group of companies apply the discipline of Product Engineering when designing and developing solutions.

The introduction of Product Engineering comes hot on the heels of his initiative to pilot DevOps improvements in the Pet Clinic company.

The group of companies which are collectively known as the **Universal Imports Group** include the following

- **Daily Mentioner** - a national newspaper.
- **InGen** - a space exploration company.
- **Pet Clinic** - one of a number of online retailing businesses in the group.

All of the companies in the Universal Imports Group rely on software to run their business. Some of this software is purchased, some of it is open source and some of it is developed in-house.

The objective of introducing Product Engineering practices in the group is to:

Ensure that any software applications and integrations developed, and any managed services provided are more suited to the needs of the business and to the demands of the market.

Our Cast

This book has several characters which play a role throughout the story. Before we proceed lets take a few minutes to meet some of the Pet Clinic crew and some people from the other companies in the Universal Imports Group.

We will share in their challenges, opportunities and achievements as our story unfolds.

Charlie has gathered the following key individuals together from across the group to lead the adoption of Product Engineering in the Universal Imports Group under a program called **Overlook**.

Charlie (CEO)



Charlie is a technology entrepreneur, investor and philanthropist.

Charlie is a serial disruptor, he understands the importance of adaptability and speed.

Being an entrepreneur he has had successes and failures in the past, he expects to have more successes and indeed more failures in the future.

He views the discipline of Product Engineering as being essential to tilting the scales in favour of future successes.

His motto is to "*Better to fail fast if you are likely to fail at all*" hence he is keen to see more work done in the design and prototyping phases of projects.

Miyagi (Product Engineering Mentor)



Miyagi Product Engineering Coach and Mentor hired by Charlie to help increase the use of Product Engineering within the Universal Imports Group.

Miyagi's coaching philosophy is to engage, coach, empower and support the teams he works with, and in doing so enable those teams to solve problems for themselves.

He finds coaching to be a rewarding experience but on the rare occasions it is not, he de-stresses by doing a little DIY including painting fences, sanding floors and waxing cars.

Miyagi has worked in a number of industry and sectors. He has coached clients in how to design and develop better products at scale.

Miyagi is keen to apply those learnings in the Universal Imports Group and to also learn from the good work in the space already underway across the group.

Adriana (Architect) - InGen - Space Exploration Company



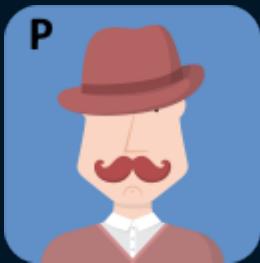
Adriana the **Architect** working on the R237 control software for Redrum, InGen's revolutionary rocket designed for suborbital flights.

She caught the space bug as a child watching the lunar landings on a grainy old TV set and is busy pursuing her passion for all things Space with InGen.

Adriana has an interest in all phases of the Product Engineering Lifecycle, but has a particular interest in architecture for testability.

She wants to ensure the rockets InGen plan to send to infinity (figuratively speaking) and beyond return safely.

Pennyworth (Project Manager) - The Daily Mentioner - National Newspaper



Pennyworth a **P**roject Manager from the Daily Mentioner national newspaper is a servant leader, he facilitates the work of the teams on the projects he manages.

A loyal and longstanding confidant of Charlie, Pennyworth often acts as Charlie's weather *wayne* pardon the pun on new programs.

Pennyworth works to ensure that new programs become shining examples of best practices and is thus ideally suited to helping on the Overlook program.

Paulo (Product Owner) - Pet Clinic Application



Paulo is an Agile **P**roduct Owner for the Pet Clinic company.

Paulo works with the Pet Clinic business to understand what functionality is needed, why it is needed and when it is needed. He then manages the back log, working with the development team to groom the backlog in response to the evolving business priorities.

Paulo perhaps inspired by his pet cat, John Connor, regularly comments "The backlog has not been written. There is not fate but for what we make for ourselves" much to the bemusement of the team.

Paulo is excited by the increasing focus on Product Engineering.

He is particularly keen to understand more about approaches to ideation, conceptualization and prototyping in the hope of making improvements in the Pet Clinic application development process.

Brenda (Business) - Pet Clinic Application



Brenda works in the Pet Clinic Business. One of her goals is to help grow the company, to that end she works with Paulo and the Pet Clinic development team to introduce new features which will leave Pet Clinic's competitors far behind.

A recent foray by the Pet Clinic into Fair Trade pet products was very successful. To leverage that opportunity to its full potential a number of new business applications/modules will be needed in support of the associated product launches.

Brenda is keen to understand how Product Engineering principles can be applied to those developments to help ensure the right product are developed for the intended users in the most efficient manner possible.

Dan (Developer) - Pet Clinic Application



Dan, one of the Pet Clinic development team. During the Pet Clinics' DevOps transformation Dan focused on test-driven development, continuous integration and continuous delivery pipelines.

Dan has been asked to participate in the Product Engineering Chapter to give a developer's perspective and to help tailor the Product Engineering practices for software development.

Conclusion

In this chapter we introduced the scenario and the cast of characters that will be used in this book.

Hopefully upon completing the rest of the chapters in **Product Engineering An Introduction**, the next time you or your team have a need for a bigger 🚢 it will be Product Engineered accordingly.

Buckle up we are going on an adventure, where we are going we don't need roads 🚶 but first an optional challenge ...

👉👉👉 Call👉👉👉 for curious students 👩👩👩👩👩👩👩👩.

The challenge is to take some time to consider and make some notes as to your current understanding of and on the use of Product Engineering in your team.

The ask is that you review and reflect on those notes upon completion of **Product Engineering An Introduction**. Good luck with the challenge.

Chapter 2 - Introduction to Product Engineering

Purpose

The primary objective of this chapter is to give you an introduction to Product Engineering concepts and practices.

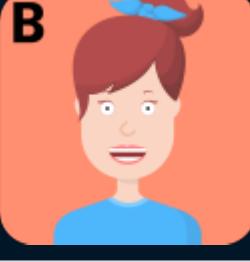
Learning Outcomes

This chapter will give you an introduction to Product Engineering including

- Definition of Product Engineering
- Role of Product Engineer
- Product Engineer - Skill Set
- Product Engineering - Lifecycle
- Product Engineering - Manifesto

Opening Scroll

Charlie has formed a small team to increase the use of Product Engineering across the companies in the Universal Imports Group.

	Miyagi Product Engineering coach and mentor tasked with increasing the use of Product Engineering within the Universal Imports Group.
	Pennyworth Project Manager from The Daily Mentioner National Newspaper tasked with chairing the effort.
	Adriana Architect from the InGen Space Exploration Company lending her expertise to the Product Engineering effort.
	Paulo Product Owner for the Pet Clinic Application.
	Brenda Business representative from the Pet Clinic. The main Business champion of the DevOps transformation in that business.

The remainder of this chapter gives an introduction to Product Engineering in the context of

software development.

It includes a series of conversational snippets taken at various points in the timeline of the introduction of Product Engineering in the Universal Imports Group.

Product Engineering

The team meet to start work on program Overlook, the program created to increase the adoption of Product Engineering in the Universal Imports Group.

Pennyworth kicks off the session by explaining the ask from **Charlie** the CEO.

He then asks **Miyagi** to give an overview of Product Engineering to the team. This is to help ensure they start work on the program with a shared understanding of the discipline of Product Engineering.



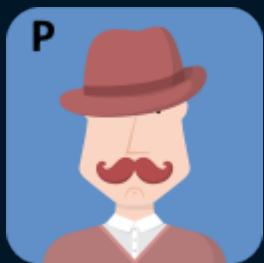
shares the following definition of Product Engineering with the team.

Product engineering is an engineering discipline that deals with both design and manufacturing aspects of a product. - Wikipedia

The team, following a detailed discussion agree that

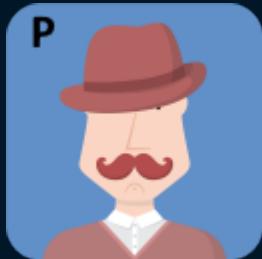
- Their objective is to help their respective companies to be more successful in taking products from ideas to production.
- They want teams to move from a project to a product mindset.
- They need to leverage the domain expertise and industry experience that exists in the Universal Imports Group.
- The companies in the group have to work to ensure Product Engineering becomes part of their DNA.
- They want to ensure that any in-house developed software is designed, built, tested, released, deployed and operated in manner that ensures it delivers the expected value to the business at the required cadence and with required quality.

- They recognize that the development teams mostly practice iterative development models, with a mix of 'Kanban' and 'Scrum' based styles in operation.
- They acknowledge that whilst the teams are at various stages in their DevOps journeys, they are committed to their respective journeys.
- They are confident that the group has versatile development teams which are capable of adjusting to new ways of doing things.
- They want to encourage teams to test ideas, to validate solutions, and to market opportunities through early prototypes and MVPs.



thanks the team for their ideas and asks them to focus the conversation on the need to move from a project to a product mindset.

Moving from a Project to a Product Mindset



I am happy with what we have agreed to focus on as a team.

In my opinion, this is not primarily a re-tooling exercise, this is about the need to make a cultural pivot. Of course that pivot may in time need to be supported by tooling.



We found that culture rather than tooling was key to the success of the Pet Clinic's DevOps transformation.



I agree that establishing a Product Engineering culture is important. I think that encouraging teams to move from a project to a product mindset is key to the delivery of incremental value to the business via continuous product innovation. We need to ensure we factor what such a move might entail into our considerations.

To facilitate those considerations I offer the following definitions of a project and a product.

Project

A project is designed to achieve a specific goal. Projects typically have a set lifespan with a defined beginning and a defined end. They may involve the formation of a dedicated project

team to deliver the project.

Product

A product is a solution created to address the needs of a particular set of customers, the aim is to create one solution to address the needs of many customers. Software Products come in many forms including applications, APIs, managed services, platforms etc. Products are typically developed, deployed and operated by dedicated product teams and / or product squads.

Cultural Impacts



I would like to note for the record before the "Project Managers" guild, with **Pennyworth** leading them, turn up at my door with torches and pitchforks ala Shrek that the following cultural impacts are not intended as sweeping generalized statements as to the ills of a Project Management approach.

These impacts are intended to convey how the cultural challenges that exist in **many** organizations and that exist in **many** projects can be addressed by a pivot to a product mindset.

Impact	Project	Product
Purpose	Meet the IT needs of the business	Meet the needs of internal and external customers
Lifecycle	Defined start and end dates	Iterative
Structure	Typically organized by individual, often siloed functions	Multi-disciplinary product teams
People	Individual contributors engaged for duration of project	Members of empowered persistent teams
Risk Management	Analysis done before project starts, mitigations factored into project plan	Managed in parallel to development lifecycle using DevOps, Lean & Agile practices

Impact	Project	Product
Leadership	Hierarchical, PMO, PM	Servant leaders, Empowered self-organizing teams
Scheduling	Due Date, Left to right scheduling	Capacity based incremental delivery
Requirements	Dedicated phase(s) to capture customer requirements	On-going backlog management supported by Agile ceremonies
Deliverables	Systems focus	Customer focus
Unit of Work	% Complete	Value Added
Ownership	Gates, Hand offs, KTs, Functional Teams	Team builds it, team deploys it, team runs it
Technical Debt	Responsibility for and accountability for technical debt may be a different team or even a different organization	Product team owns technical debt for their product and are accountable for it
Funding	IT Projects	Business Outcomes

Role of Product Engineer

The team spend time discussing the role of the Product Engineer in a product development squad.



They agree on the importance of the role in establishing a Product Engineering mindset across the Universal Imports Group.

They specify the following as being the requirements for the Product Engineering role

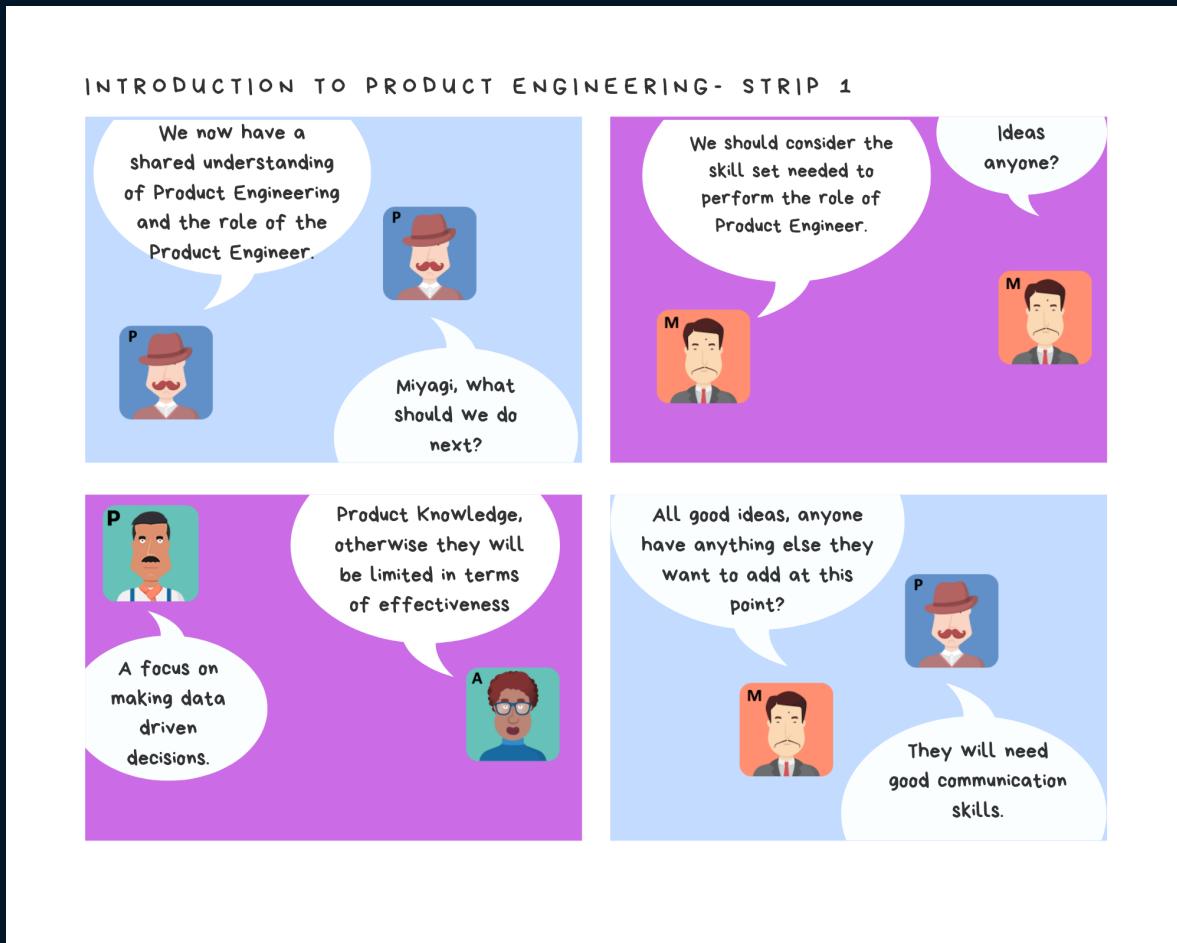
- Help shape the product.
- Participate in product development process.
- Understand technical constraints, resources and opportunities.
- Work to achieve practical product/technical tradeoffs.
- Ability to directly interact with customers.
- Focus on Return on Investment (ROI).
- Deliver a mix of products across the Universal Imports including but not limited to
 - Proof of Concepts (POCs): Preliminary versions of products released to a limited audience for testing and feedback.
 - Full-Scale Production Versions: Complete, fully functional versions of products ready for release to the mass-market.
 - Custom Solutions: Tailored products designed to meet specific customer requirements.
 - Data-Driven Systems: Products that leverage analytics and big data to provide

insights and drive decision-making.

- Cloud-Based Services: Products offering software as a service (SaaS) over the internet, leveraging the cloud for scalability and flexibility.
- Microservices Architectures: Products designed as a suite of modular services which are independently deployable.
- IoT (Internet of Things) Devices: Connected devices that collect and exchange data with other systems and devices.
- AI and Machine Learning Models: Intelligent systems that continually learn and adapt to provide advanced capabilities and insights.

Product Engineer - Skill Set

Having agreed on the importance of the role to the **Overlook** program, the team discuss the skill set required by Product Engineers



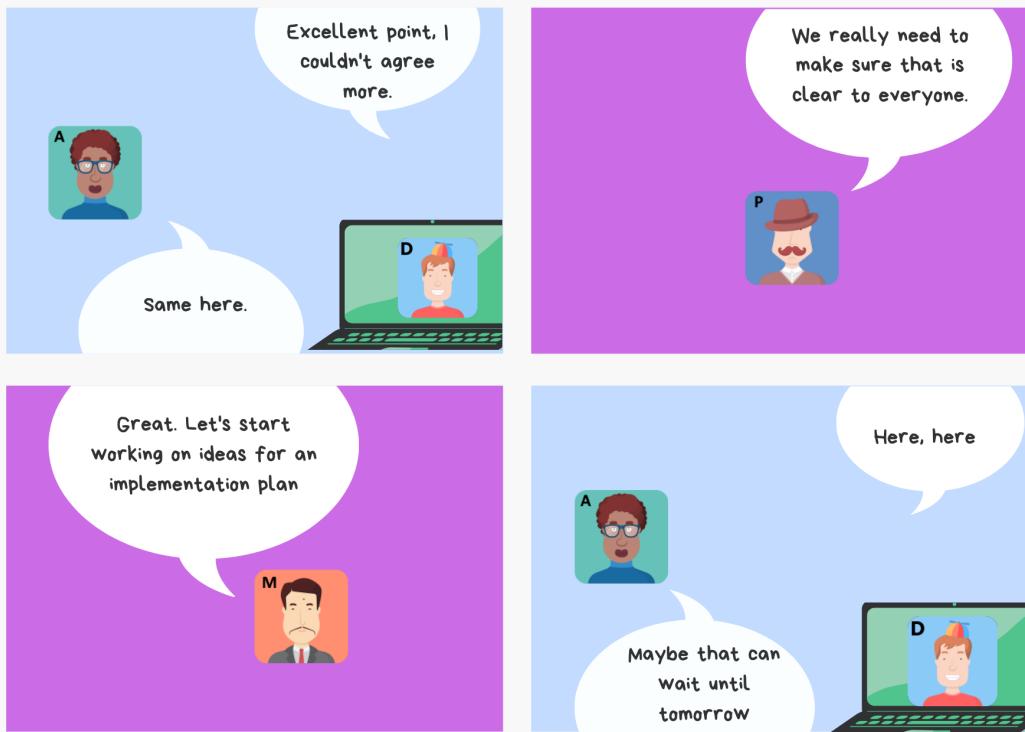
INTRODUCTION TO PRODUCT ENGINEERING- STRIP 1



INTRODUCTION TO PRODUCT ENGINEERING- STRIP 1



INTRODUCTION TO PRODUCT ENGINEERING- STRIP 1



Pop Quiz 1

Question 1

Which of the following are the responsibilities of a Product Engineer?

- [] Help shape the product
- []Participate in product development process
- []Understand technical constraints, resources and opportunities
- []Work to achieve practical product/technical tradeoffs
- []Focus on ROI
- []Deliver a mix of products
- []All of the above

Question 2

Which of the following are included in the Skill Set of a Product Engineer?

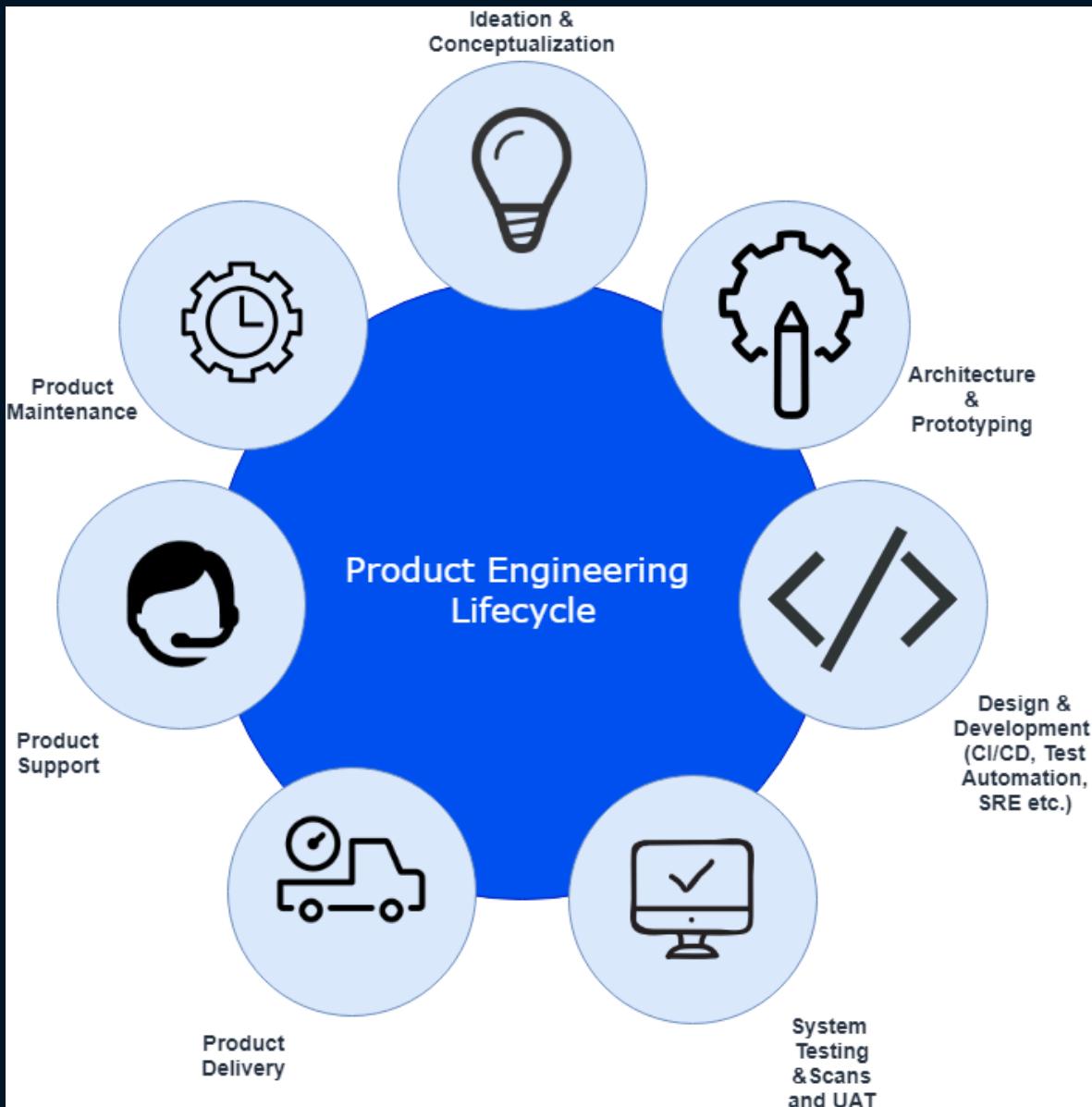
- []Strong focus on and deep understanding of the Product
- []Make data driven decisions
- []Effective communicator
- []Prioritization and estimation
- []Engineering execution
- []All of the above

Product Engineering - Stages

The team have discussed and agreed on the

- Definition of Product Engineering
- Role of Product Engineer
- Skill set required by Product Engineer

Following a series of workshops the team agree to recommend and to start implementing the following Product Engineering Cycle in the Universal Imports Group.

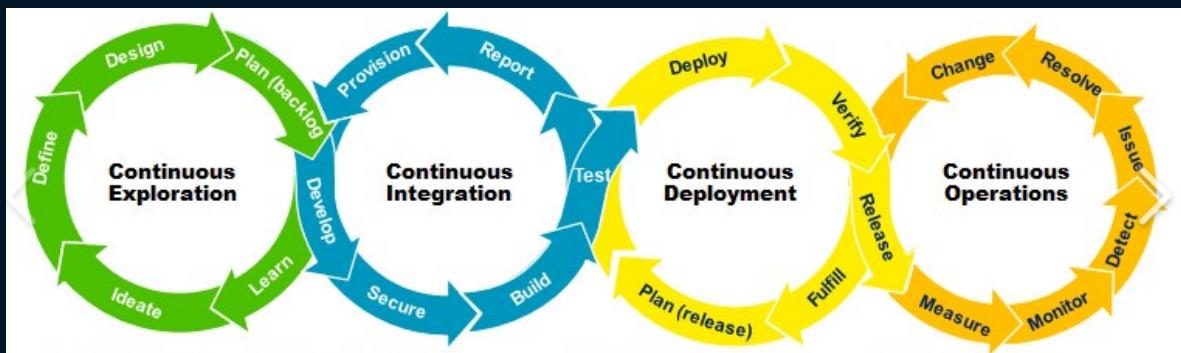


Phase	Description	Comments
Ideation and Conceptualization	Conceive the idea. Document it. Idea worth pursuing or not?	UI/UX prototyping tools
Architecture and Prototyping	Create engineering designs. Bring finalized concept to life.	Look to design companies
Design & Development	Develop both product features and all supporting requirements including CI/CD pipelines, Test Automation & SRE needs. Manage implementation costs.	<input checked="" type="checkbox"/>

Phase	Description	Comments
System Testing, Scans, and UAT	System testing, scans and UAT. Validate developed product meets the intended use and is fault free. Identify & fix any issues.	<input checked="" type="checkbox"/>
Product Delivery	Release to market.	<input checked="" type="checkbox"/>
Product Support	Periodic updates and enhancements. Maintenance. Support.	<input checked="" type="checkbox"/>

Note: Review the **Getting Started** chapter in this book to learn how the workshops were conducted and for more details as to the outcomes from the workshops.

The team aim to ensure the recommended Product Engineering lifecycle is seamlessly integrated with existing Agile, Lean and DevOps practices across the group:



They believe Design Thinking to have the potential to become a key enabler of the **Ideation and Conceptualization** and **Architecture and Prototyping** phases of the Product Engineering lifecycle in particular.

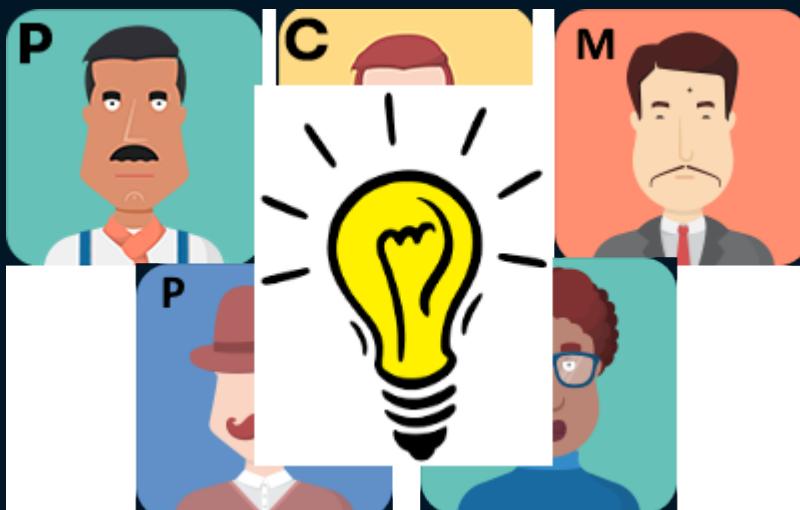
Note: See the **Design Thinking** chapter in this book for how Design Thinking can be applied to solve complex problems, and to provide solutions for customers.

Product Engineering - Brainstorming Ideas



Pennyworth is pleased with the progress the team are making, he is keen to keep the momentum going.

He arranges a brainstorming session to generate as many ideas or solutions as possible to support the **Overlook** program: the Introduction of Product Engineering into the Universal Imports Group.



The session is facilitated by Miyagi. Before starting the session Miyagi reminds the team that:

- Everyone should feel free to contribute any and all ideas to the session.
- There is no such thing as a bad or a silly idea.
- Everyone is free to build upon the ideas of others.
- People are encouraged to challenge the expected norms.

- Everyone has an equal voice.
- Initial aim is for quantity over quality. as soon as an idea occurs to them they are to add it to the board.

The brainstorming session results in the following ideas.



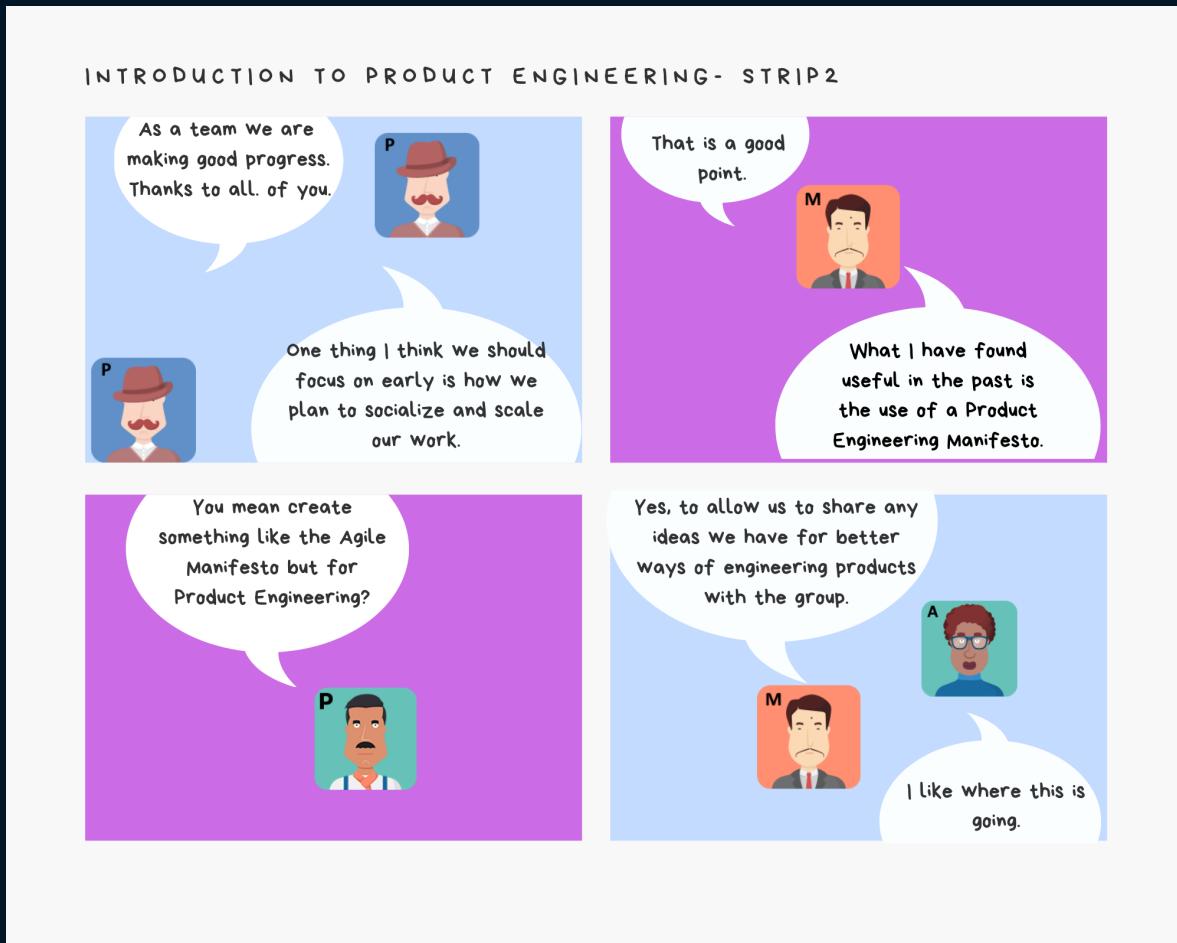
Pennyworth thanks the team for the ideas and explains the next step is to get the planning process started.

In the planning session the team will select the best ideas and put a plan in place to action them.

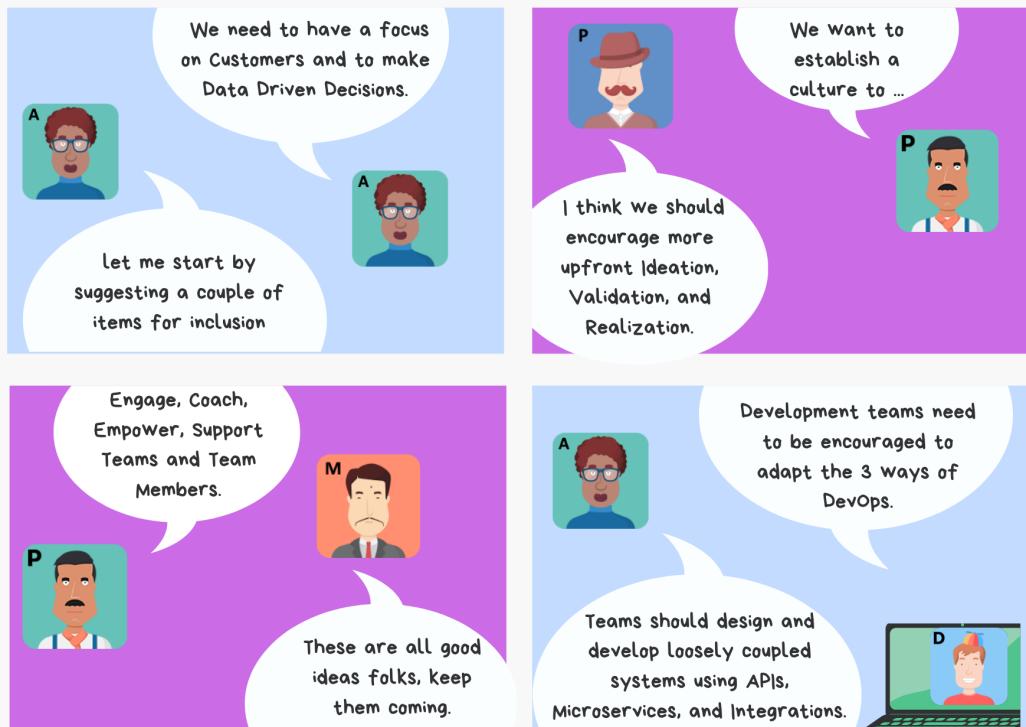
Product Engineering - Need for a Manifesto

The team decides to create a Product Engineering Manifesto as a declaration of values and principles.

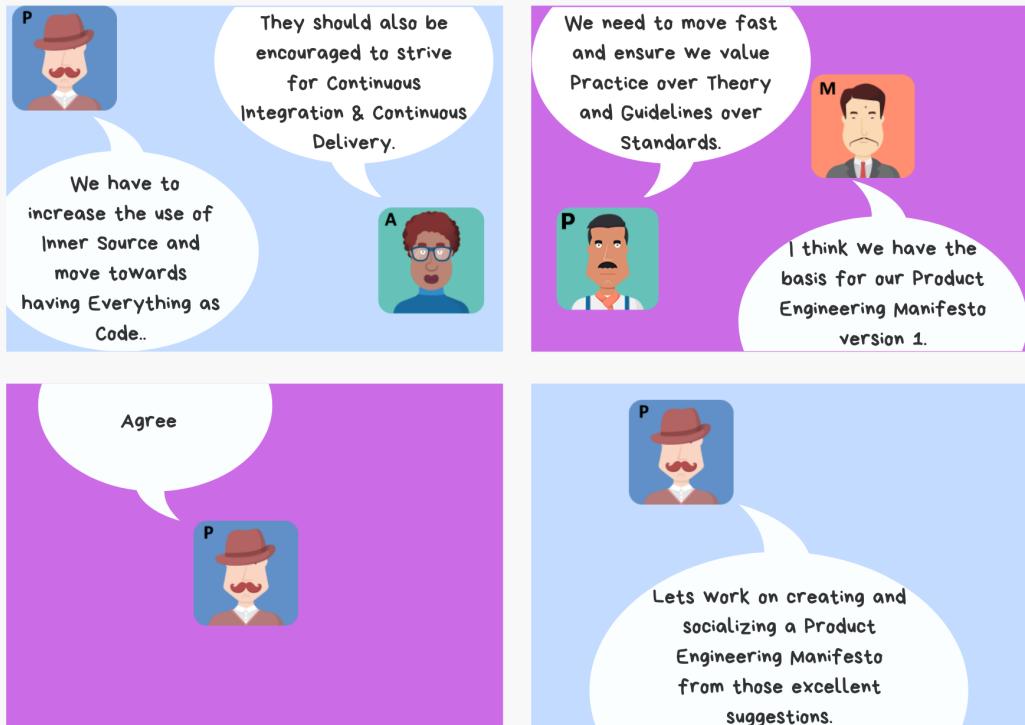
The team plan to use the Product Engineering Manifesto to share its views, and intentions in relation to the use of Product Engineering within the Universal Imports Group.



INTRODUCTION TO PRODUCT ENGINEERING- STRIP2



INTRODUCTION TO PRODUCT ENGINEERING- STRIP 2



Product Engineering Manifesto

Inspired by the [Agile Manifesto](#) the team settle on the following draft **Product Engineering Manifesto** for the Universal Imports Group.

We are uncovering better ways of engineering products by doing it and helping others do it.

Through this work we have come to value these 12 principles:

- *Focus on Customers underpinned by a deep empathy for their needs.*
- *Make Data Driven Decisions at all stages of the product lifecycle.*
- *Foster a Culture of Experimentation via Ideation, Validation, Realization, Feedback and Iteration.*
- *Engage, Coach, Empower, Support Teams and Team Members.*
- *Value on Practice over Theory, Guidelines over Standards & Culture over Tooling.*
- *Create loosely coupled components supported by APIs, Microservices & Integrations.*
- *Actively work to optimize flow across the entire value stream.*
- *Aim for optimal DevOps - Continuous Integration & Continuous Delivery - per product.*
- *Apply Inner Source Principles supported by an Everything as Code first approach.*
- *Celebrate Success / Learn from Failures.*
- *Everybody's free to Automate Testing.*
- *Encourage teams to have fun, as if they don't enjoy making a product chances are consumers won't enjoy using it.*

Pop Quiz 2

Question 1

In which phase of the Product Engineering Cycle should teams ideally focus on determining if a proposed product or feature is worth pursuing or not ?

- []Ideation and Conceptualization
- []Architecture and Prototyping
- []Design and Development
- []System Testing, Scans and UAT
- []Product Delivery
- []Product Support
- []Product Maintenance

Question 2

What should a team create as a declaration of their Product Engineering values and principles, a Product Engineering ... ?

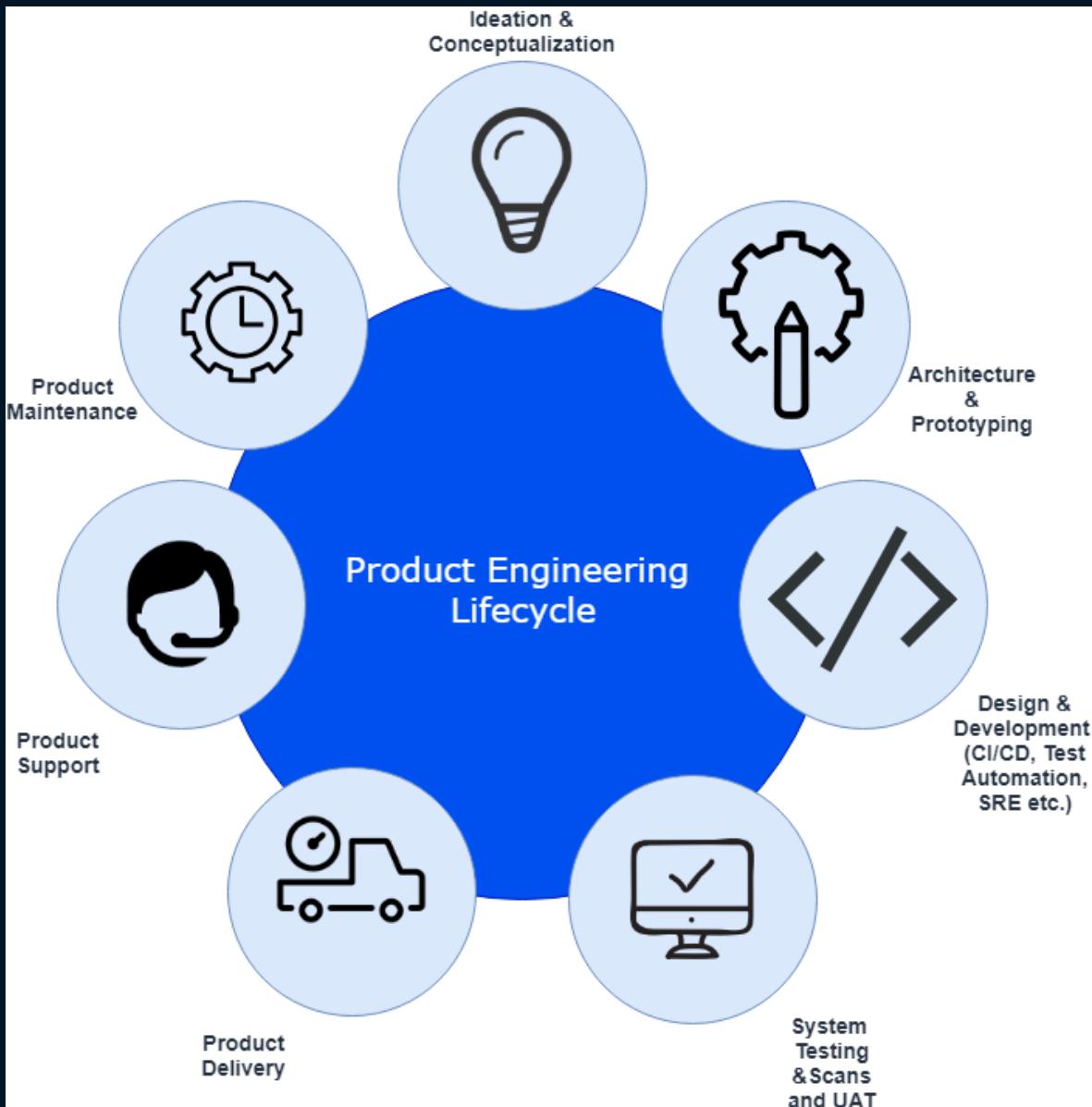
Conclusion

Our hope is that following this chapter you have a better understanding of the

- Definition of Product Engineering
- Role of Product Engineer
- Product Engineer - Skill Set
- Product Engineering - Lifecycle
- Product Engineering - Manifesto

If so there is an optional challenge awaiting you.

The challenge is to review the Universal Imports groups' Product Engineering lifecycle



and the Universal Imports groups' Product Engineering Manifesto with your team with a view to agreeing and documenting your teams'

- Product Engineering Cycle
- Product Engineering Manifesto

Good luck with the challenge.

We hope it leads to some interesting insights and actionable items to improve your teams' Product Engineering practices.

Chapter 3 - Design Thinking

Purpose

The primary objective of the **Design Thinking** chapter is to introduce you to Design Thinking concepts and practices.

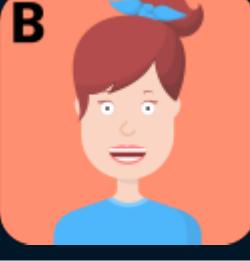
Learning Outcomes

This chapter will give you an introduction to Design Thinking it includes

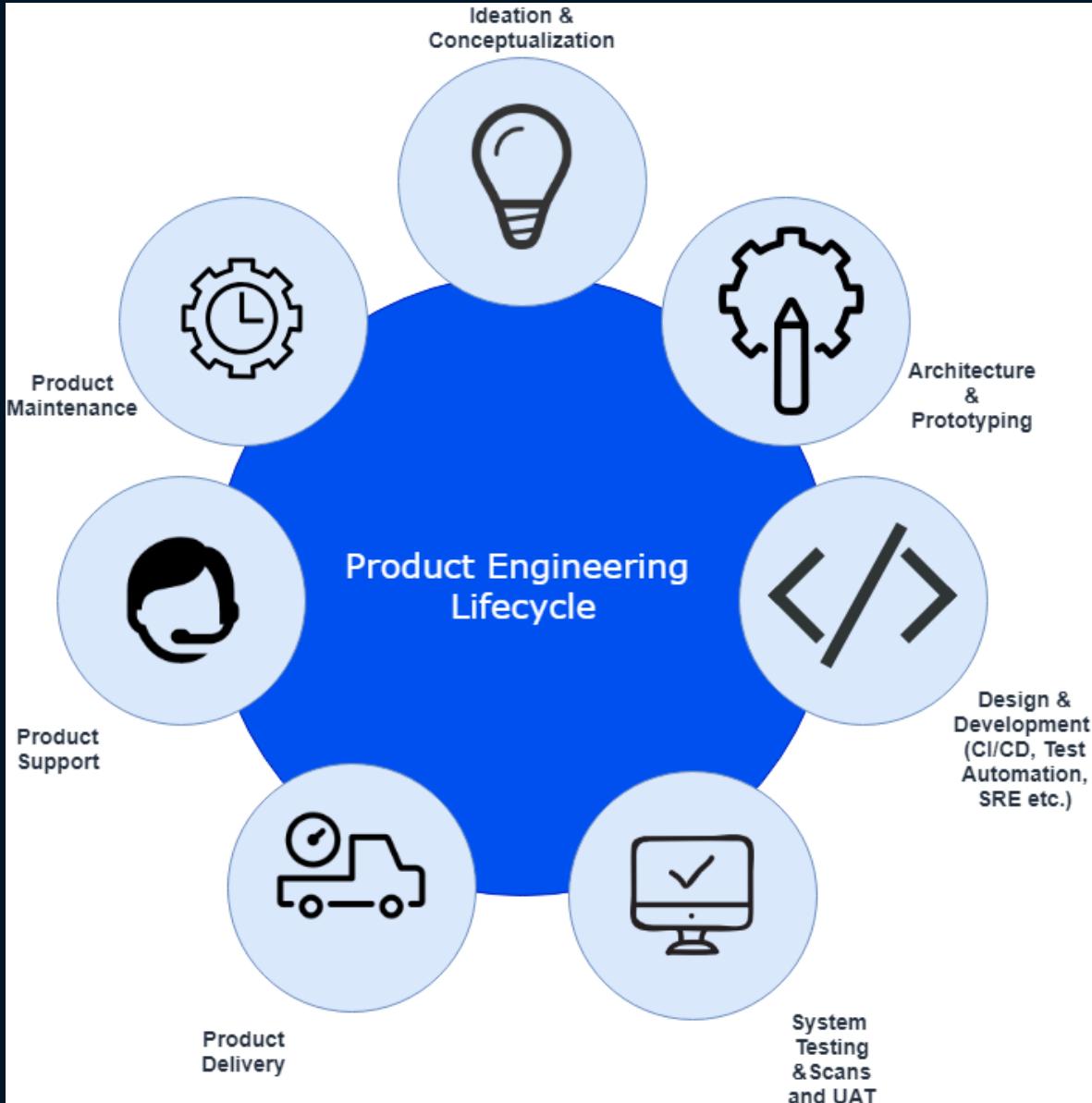
- An overview of Design Thinking.
- Reasons to use Design Thinking.
- Differences between what might be termed Traditional Thinking and Design Thinking.
- Key Elements of Design Thinking.
- Challenges with Design Thinking.
- Process of Design Thinking.
- Getting Started with Design Thinking.

Opening Scroll

The team working to improve Product Engineering practices across the companies in the Universal Imports Group include

	Miyagi Product Engineering Coach and Mentor tasked with increasing the use of Product Engineering within the Universal Imports Group.
	Pennyworth Project Manager from The Daily Mentioner National Newspaper tasked with chairing the effort.
	Adriana Architect from the InGen Space Exploration Company lending her expertise to the Product Engineering effort.
	Paulo Product Owner for the Pet Clinic Application.
	Brenda Business representative from the Pet Clinic who was the main Business champion of the DevOps transformation.

They have recommended the following Product Engineering lifecycle



In parallel to this effort, the DevOps transformation recently piloted in the **Pet Clinic** is about to be rolled out across the wider group.

The team expects that the DevOps transformation will support and improve the following Product Engineering lifecycle phases

- Design & Development
- QA & Testing
- Product Delivery

- Product Support
- Product Maintenance

However the team has identified a gap which needs to be addressed in the early Product Engineering lifecycle phases

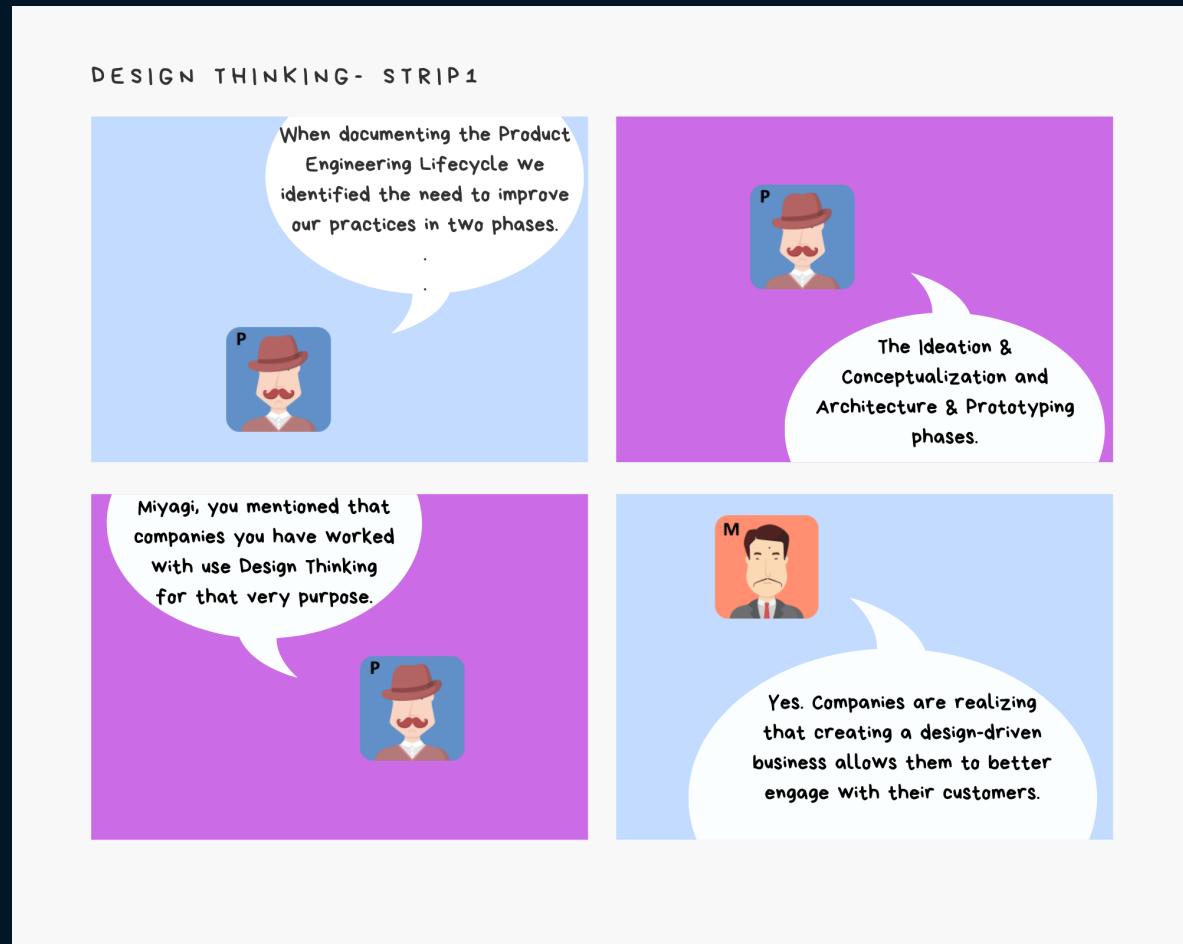
- Ideation and Conceptualization
- Architecture and Prototyping

The team wants these critical phases to be seamlessly integrated with the subsequent phases. They believe that having teams adapt Design Thinking will ensure a strong interlock is established between the Architecture & Prototyping phase and the Design & Development phase.

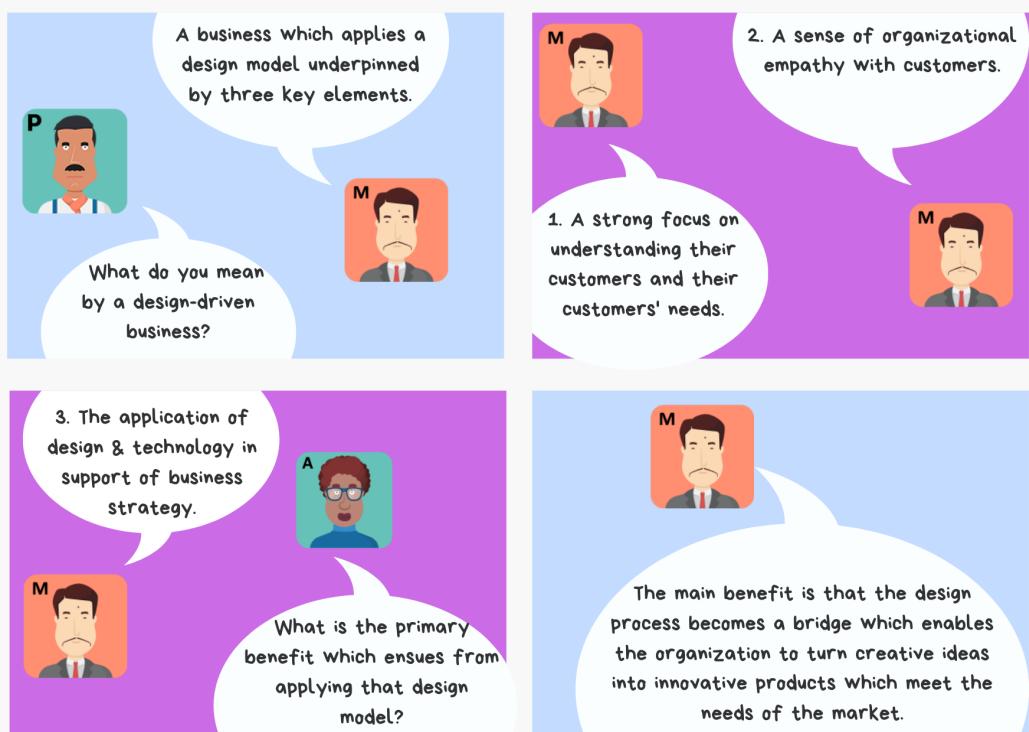
The remainder of this chapter gives an overview of Design Thinking. It includes a series of conversational snippets taken at various points in the timeline of the evaluation and introduction of Design Thinking in support of the Product Engineering lifecycle in the Universal Imports Group.

Role of Design Thinking

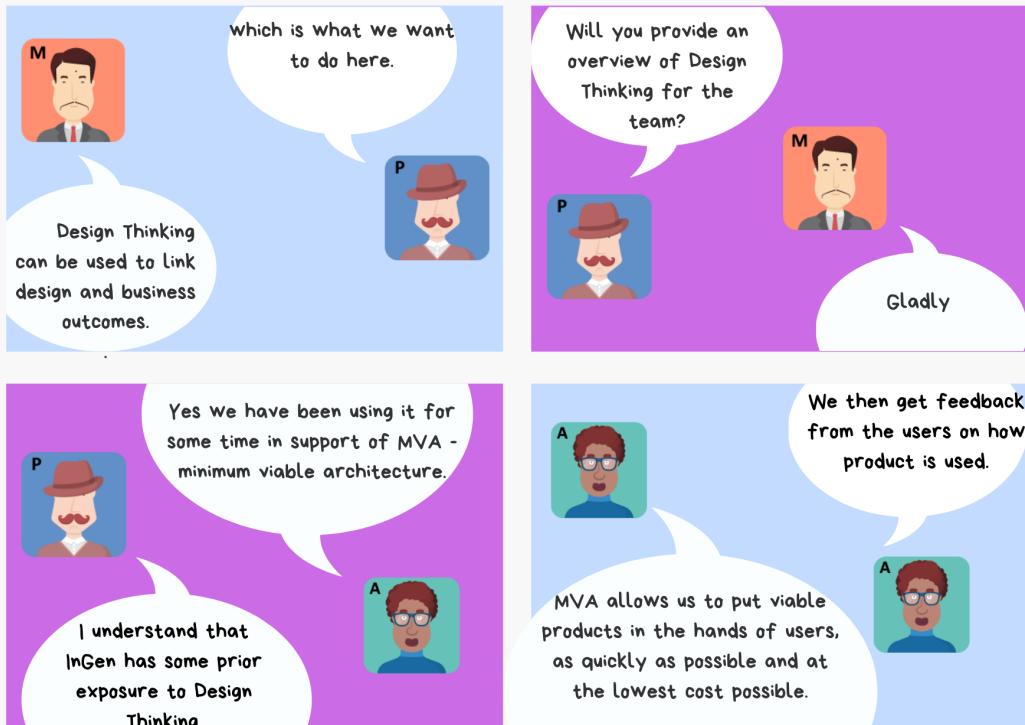
The team discusses the need to ensure a strong interlock is established between the Architecture & Prototyping phase and the Design & Development phase of the Product Engineering lifecycle, and how Design Thinking could be used establish that interlock.



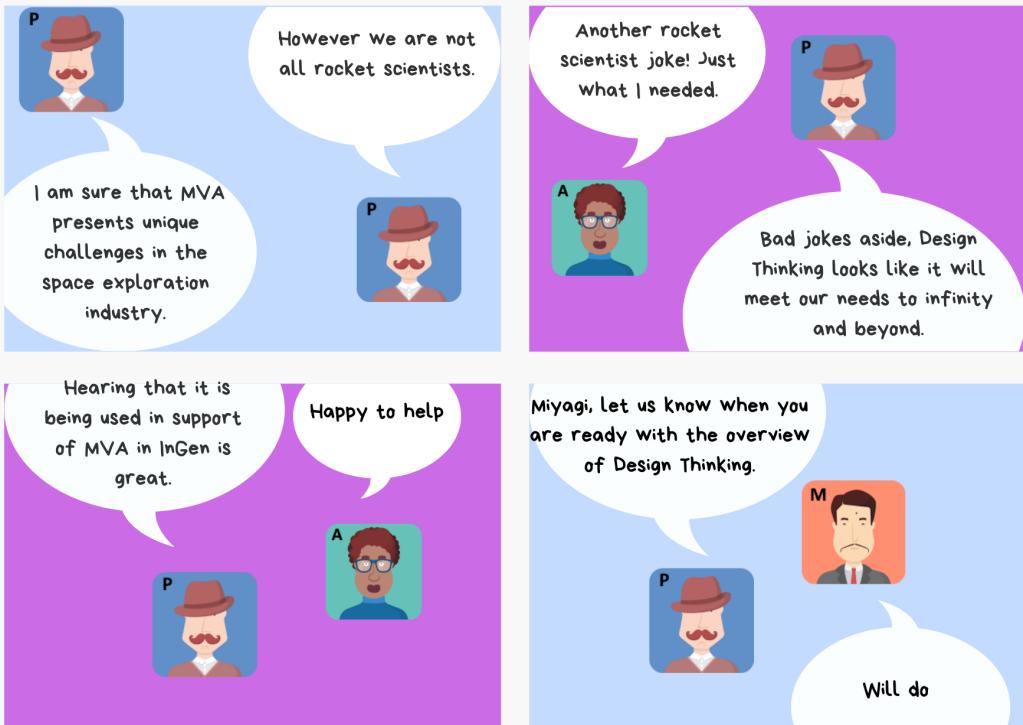
DESIGN THINKING- STRIP 1



DESIGN THINKING- STRIP 1



DESIGN THINKING- STRIP 1



Design Thinking in Product Engineering



Introduction

The aim of Design Thinking is to

- Create superior products and services.
- Lower the costs and risks associated with development of products and services.
- Get user and employee buy-in for the Design Process, and to the resulting products and services.

Design Thinking is a creative-problem solving process. Design Thinking is performed to create better products and services by understanding how users are to interact with them and the conditions under which they are to operate.

Design Thinking

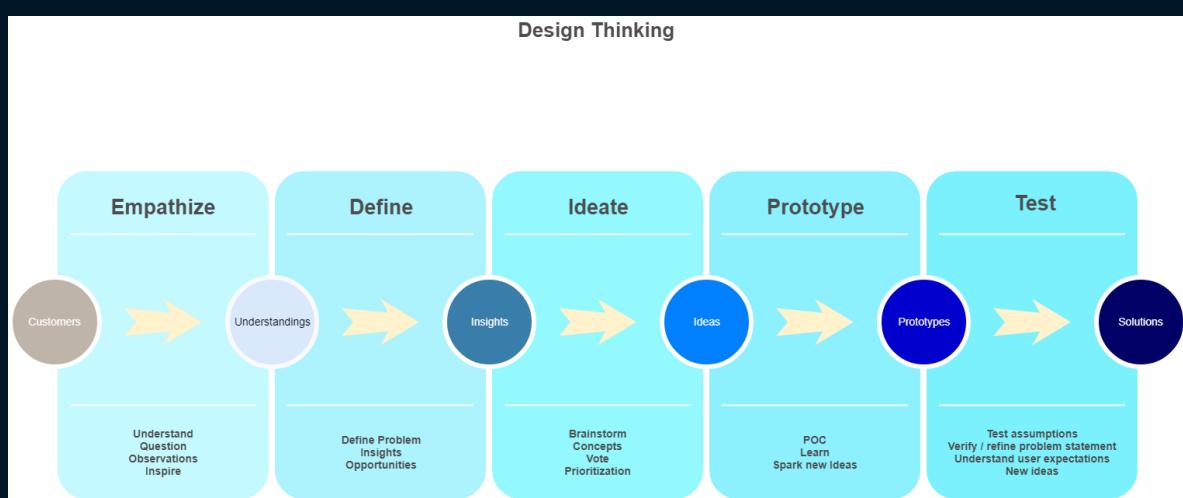
- Is for everyone.
- Is a user-centered approach to problem solving.
- Provides a means of exploring new ideas, new solutions & new alternatives.
- Allows designers and teams to apply their collective skills to large challenging problems.
- Is an iterative step-by-step process with amplified feedback loops.

- Represents a fundamental change, with ensuing challenges and opportunities for organizations.
- When practiced correctly leads to innovation.

Design Thinking - Five Phase Model

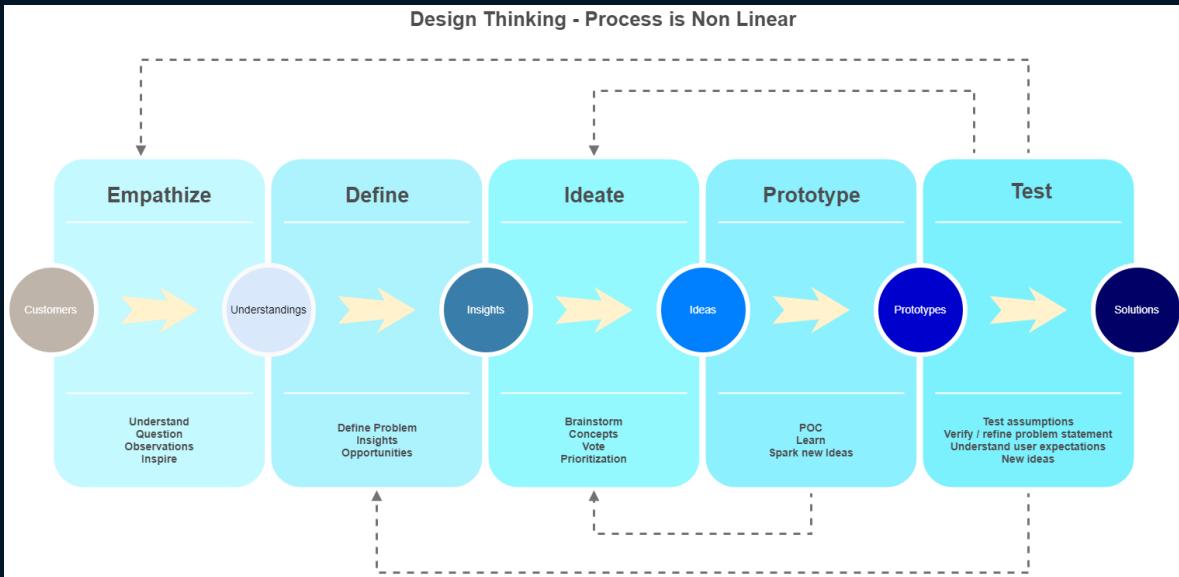
There are a number variants of Design Thinking all of which embody broadly similar principles.

One of the most popular variants is the five-phase model proposed by researchers at Stanford this can be represented as



Note: The Design Thinking process is non linear. Typically the process is iterative and includes feedback loops between the five phases:

- Empathize – with your users to better understand and thus define the problem.
- Define – your users' problems in the form of use cases and customer journeys which include the teams' insights.
- Ideate – create ideas for innovative solutions which challenge assumptions.
- Prototype – to start creating viable solutions and spark new ideas.
- Test – solutions to better understand user expectations and to spark new ideas.



In this model, our understanding of the users' expectations are constantly being questioned and knowledge is constantly being acquired. This allows us to iteratively redefine a problem and identify alternative solutions. These alternative solutions might not have been apparent with our initial understanding of the problem domain.

Pop Quiz 1

Question 1

During the Design Thinking Test stage the team conclude there is a need to 'revisit the defined problem' why might that be?

- []Prototype will create problems for companies' other product lines.
- []Prototype may result in competition for your partners' products.
- []Team built the wrong prototype.
- []Prototype identified a problem which the design did not address.

Question 2

What is the purpose of a prototype in the context of Design Thinking?

- []A model that describes the problem to be solved.
- []Brainstorming session to come up with ideas.
- []A model of the proposed solution which end users can test and provide feedback on.
- []Fully functional product that includes all functionality required to address the problem to be solved.

Design Thinking vs Traditional Thinking



The adoption of Design Thinking may require a significant cultural shift on the part of an organization, a shift from what may be termed as "Traditional Thinking" to Design Thinking.

For the purposes of this discussion, "Traditional Thinking" can be considered as taking a methodical and scientific approach to problem solving. In this approach, a problem is defined, the process and tools to generate a solution are identified, then a plan is created and followed in the expectation of arriving at the desired outcomes.

Design Thinking takes a different approach, an approach which can be described as follows

- Focuses on user expectations
- Expectations, once defined, result in ideas
- The most promising ideas are embodied in the form of prototypes
- Prototypes, once tested, are turned into products and services to improve user experiences.

Traditional Thinking	Design Thinking
Top Down Communication	Bi-directional Communication
Focus on avoiding mistakes	Learn from mistakes
Reports, documentation & gates	Show, don't tell
Maintaining order	Encouraging reasonable risk taking
Decisions based on Logic underpinned by Numerical models	Decisions based on Emotional Insights underpinned by Experimental models

Traditional Thinking	Design Thinking
Focus on arriving at the one answer to rule them all, the best answer	Experimental approach intended to hone in on the best answer in an iterative manner
Upfront Planning	Incremental Delivery
Business Requirements Definition	Customer Journeys and Use Cases

Key Elements and Challenges



Key Elements

There are a number of elements key to the successful adaption of Design Thinking:

- *People-centered* - Empathy is key - Focus on what people, users, customers, consumers, etc. need or want to do.
- *Highly Creative* - Look at problems differently - Problems are opportunities to add value & to come up with new solutions.
- *Show, Don't Tell* - Use visuals to communicate what you are thinking.
- *Hands-on* - Less talking, more making - Use prototypes and have users validate them - Realize that failure is a (necessary) part of the process - The trick is to fail fast and to incorporate any learnings from those failures in the eventual solutions.
- *Iterative Process* - Process depends on having lots of ideas - Prototyping, testing, analyzing, and refining one or more of those ideas in to a solution.
- *Transparent Collaboration* - Bring together designers, innovators and stakeholders with different backgrounds, skills and viewpoints.

Challenges

There are also challenges in successfully adapting Design Thinking. There is a need to:

- *Accept more ambiguity* - Better experiences are difficult to quantify in terms of value delivered.
- *Embrace risk* - Iterative innovation is inherently risky, it requires trust and a culture which allows people to take risks sometimes when only having a partial understanding of the problem domain.
- *Set realistic expectations* - Design is not a cure for all ills, stakeholder expectations need to be managed appropriately and aligned to a realistic delivery timeline.



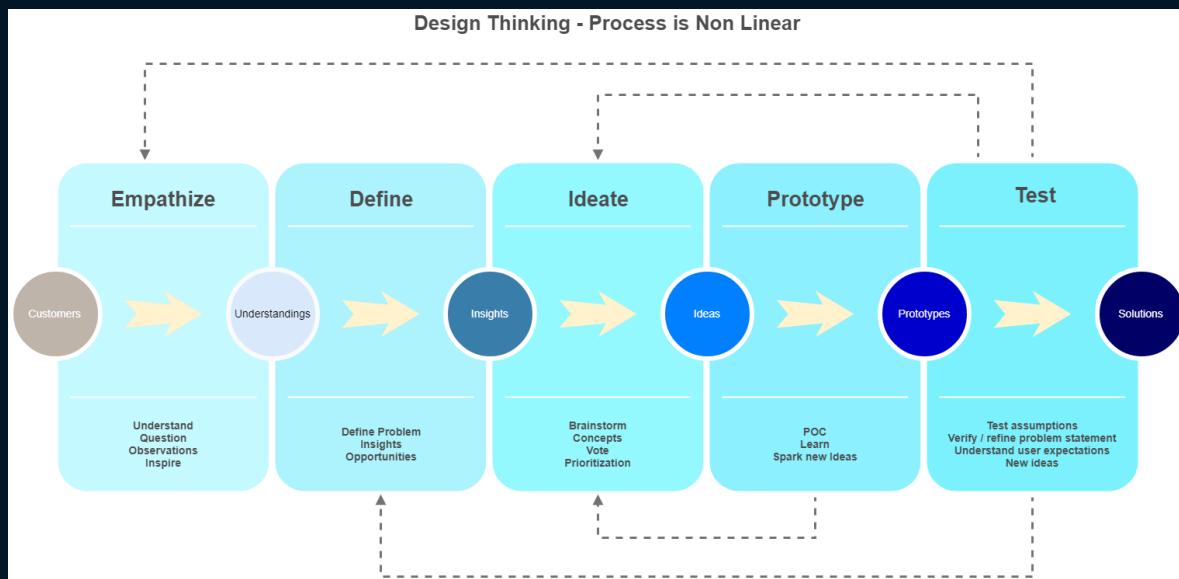
Thank you **Miyagi**. I think we all now have a better understanding of how companies which commit to the cultural pivot can achieve strong interlocks between design and development.

IDEO Design Thinking Process

Design Thinking provides a structure for the innovation process.

Design Thinking as we have learnt per the Stanford model is a five stage process:

Empathize -> Define -> Ideate -> Prototype -> Test



IDEO, a design and consultancy firm, recommend a similar process for innovation:

Understand -> Observe -> Visualize / Realize -> Evaluate -> Implement

The phases in the IDEO model are closely aligned with the *phases* in the Stanford model.

Understand => *Empathize*

- Client
- Market
- Technology

Observe => *Define*

- Sources of Confusion?

- What is disliked?
- What needs are not being met?

Visualize / Realize => *Ideate*

- Role Play
- Create story boards
- Build early stage Prototype

Evaluate / Refine => *Prototype*

- Expect to have to create several prototypes
- Concurrent engineering

Implement => *Test*

- Verify the final product works
- Commercialize
- Go to market

Pop Quiz 2

Question 1

How can Universal Imports continue to innovate after introducing Design Thinking?

- []By extending the Ideate phase
- []By implementing a process of continuous improvement
- []By creating new Design Thinking stages
- []All of the above

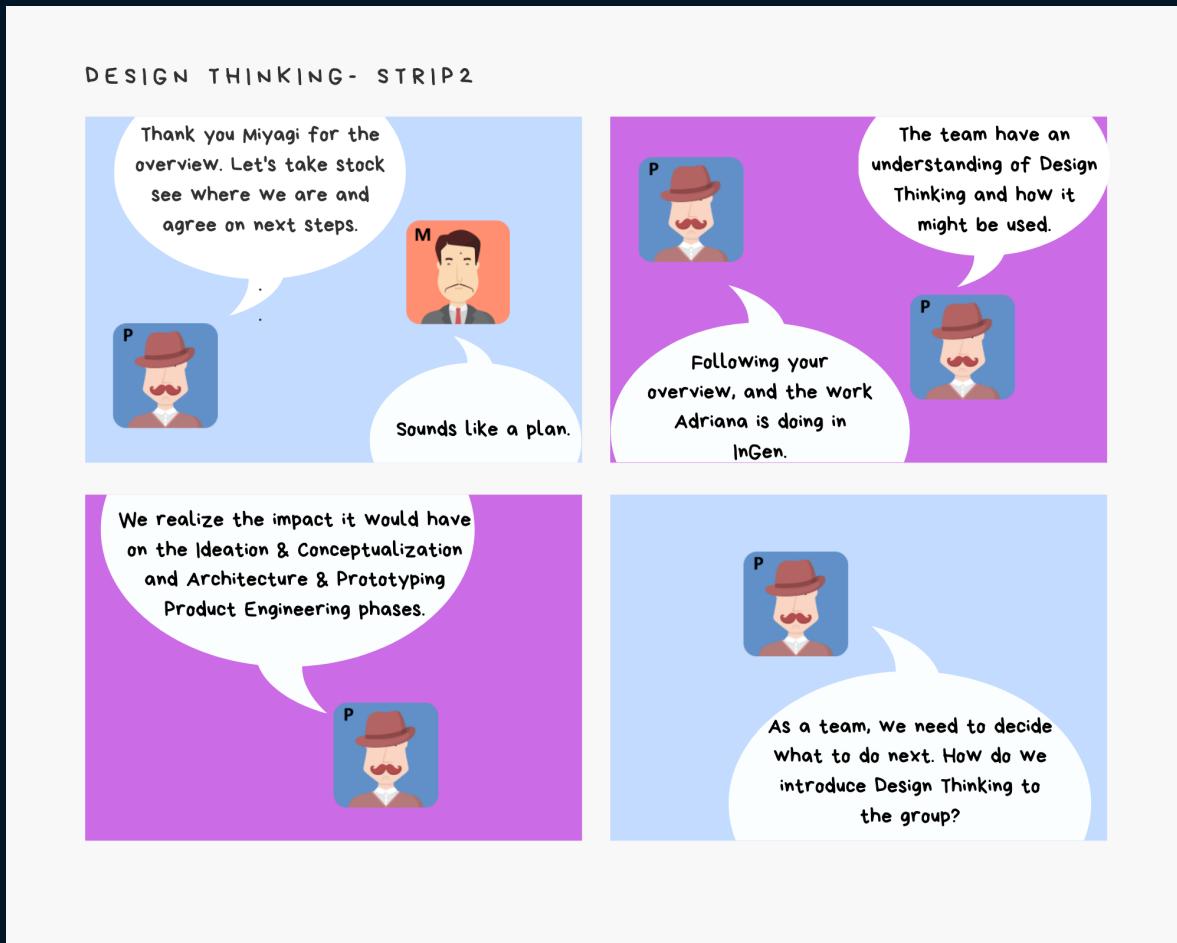
Question 2

Having brainstormed a number of ideas to solve a problem, what should a team do to test those ideas?

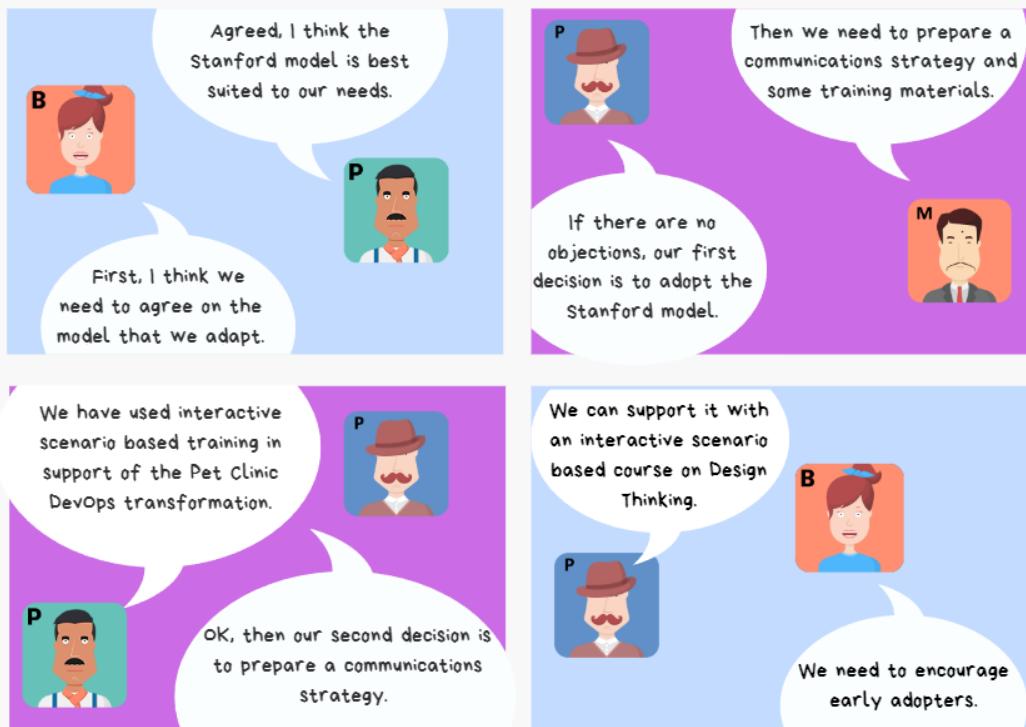
- []Develop prototypes for all of the brainstormed ideas
- []Create a reference architecture
- []Write a business requirements document
- []Select the most promising ideas and create viable prototypes

Getting Started With Design Thinking

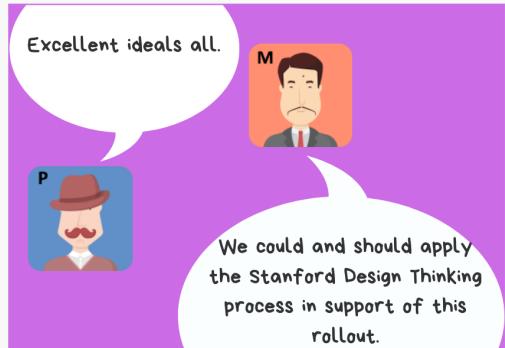
The team, now armed with an understanding of Design Thinking, discuss how they can introduce it to the Universal Imports Group.



DESIGN THINKING- STRIP2



DESIGN THINKING- STRIP2



Conclusion

Hopefully this overview of Design Thinking has given you an insight into how simple and yet how revolutionary an approach it is.

The chapter included

- An overview of Design Thinking.
- Reasons to use Design Thinking.
- Differences between what might be termed Traditional Thinking and Design Thinking.
- Key Elements of Design Thinking.
- Challenges with Design Thinking.
- Process of Design Thinking.
- Getting Started with Design Thinking

We trust that after this introduction to Design Thinking you are ready to:

- Empathize
- Define
- Ideate
- Prototype
- Test

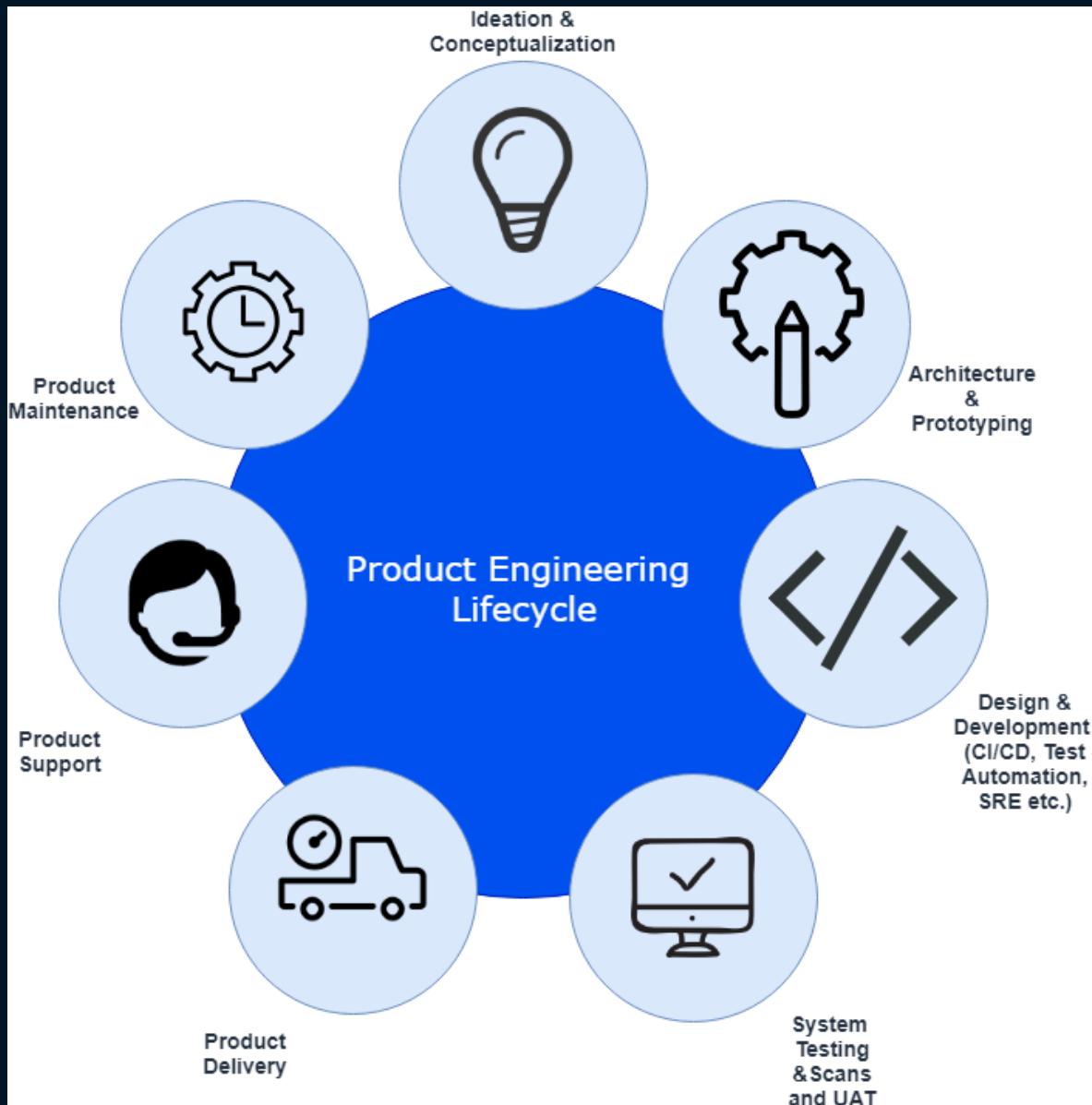
and that you realize that Design Thinking:

- Is for everyone.
- Is a user-centered approach to problem solving.
- Allows designers and teams to apply their collective skills to large challenging problems.
- Is a step-by-step process with amplified feedback loops repeated over multiple iterations.
- Represents a fundamental change, with ensuing challenges and opportunities for organizations.

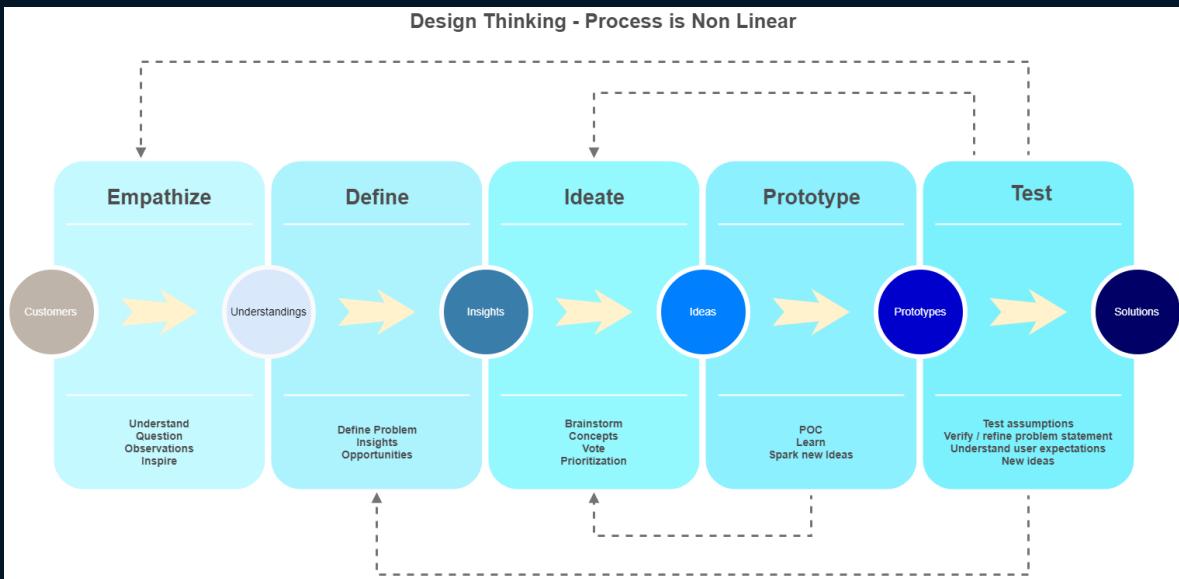
If that is the case, then you are in luck as there is an optional challenge awaiting you.

 Call  for curious readers .

The challenge is to review the Universal Imports groups' Product Engineering lifecycle, shown below, with your team:



Also discuss where and how you might apply Design Thinking:



in support of **all** phases of your teams' Product Engineering lifecycle.

We wish you well with the challenge.

Chapter 4 - Getting Started

Purpose

The primary objective of the **Getting Started** chapter is to help you to start assessing, understanding and improving your development team's Product Engineering practices.

Building and fostering product-oriented engineering teams isn't easy, as the saying goes "*if it was everyone would be doing it*".

Product-oriented engineering teams should not be considered as feature factories. They are capable of and ultimately responsible for so much more than just cutting code.

They need to be

- Empowered stakeholders and custodians of all facets of the product experience.
- Aware of the value proposition of and the impact of the product they are building.
- In constant contact with and thus more in tune with the needs of the customers.
- Focused on continuous improvement and the elimination of waste in all phases of the product development and product lifecycle.
- Plugged into the ideation and design process.
- Committed to the cultural pivot needed to move an organization from a project to a product mindset.

Learning Outcomes

By the end of the chapter you will be able to

- Access your current Product Engineering practices.
- Understand "*Universal Imports Group's*" recommended Product Engineering practices.
- Introduce or improve your Product Engineering practices.
- Create an environment which enables your team to better influence the products they are responsible for.

Opening Scroll

Charlie, the CEO of the Universal Imports Group of companies, sponsored a DevOps Transformation in the Pet Clinic.

The Pet Clinic's DevOps Transformation is starting to deliver results including:

- Improvements in the development team's culture, process and tooling.
 - Requested features being made available sooner to the business.
 - Increases in quality and operability of the business features deployed.
 - Stronger links between business and IT teams.
 - Improved experiences for customers with a resulting increase in customer satisfaction.

A recent workshop was held to facilitate the group leaderships' desire to see the learnings from the Pet Clinic's DevOps Transformation applied to the other companies in the Universal Imports Group.

Amongst the attendees were

- Paulo and Brenda from the Pet Clinic transformation team 🐕🐩🐩🐩🐩🐴🐹🐙🐙🐶🐶
 - Adriana from InGen, the group's Space Exploration Company 💥💥💥🚀🚀🚀💥💥💥🚀🚀
 - Pennyworth from The Daily Mentioner, the group's national newspaper 📰📰📰📰📰📰📰

The purpose of the meeting was to brief the representatives from the other companies in the Universal Imports Group on the Pet Clinic's DevOps Transformation, with a view to having them champion similar transformation efforts in their respective companies.

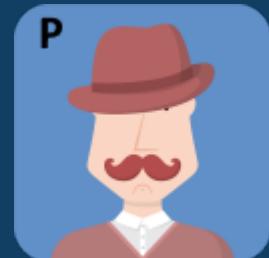
One of the main outcomes from the meeting was the general recognition how Lean principles were applied to a relatively complex development environment. This enabled the Pet Clinic team to document, analyze, and improve the processes involved in the delivery of the Pet Clinic application to their customers in the business.

The resulting process improvements helped the Pet Clinic team to identify and eliminate waste in their processes.

The team, now faced with the challenge of improving Product Engineering practices within the Universal Imports Group, are considering applying the techniques learnt during the workshop to help scale Product Engineering practices across the Universal Imports Group.

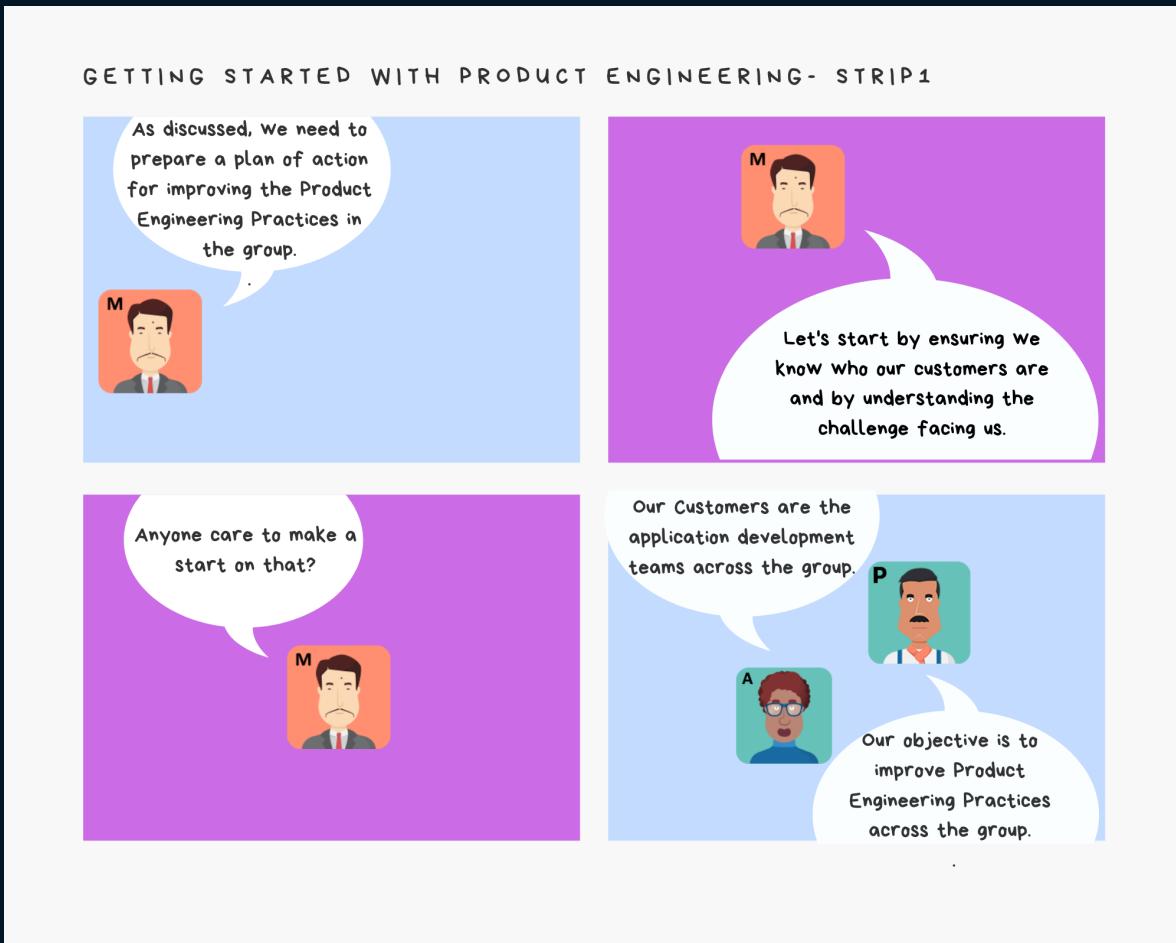
This chapter covers the ensuing discussions and the actions arising from those discussions.

The team involved in the discussions are

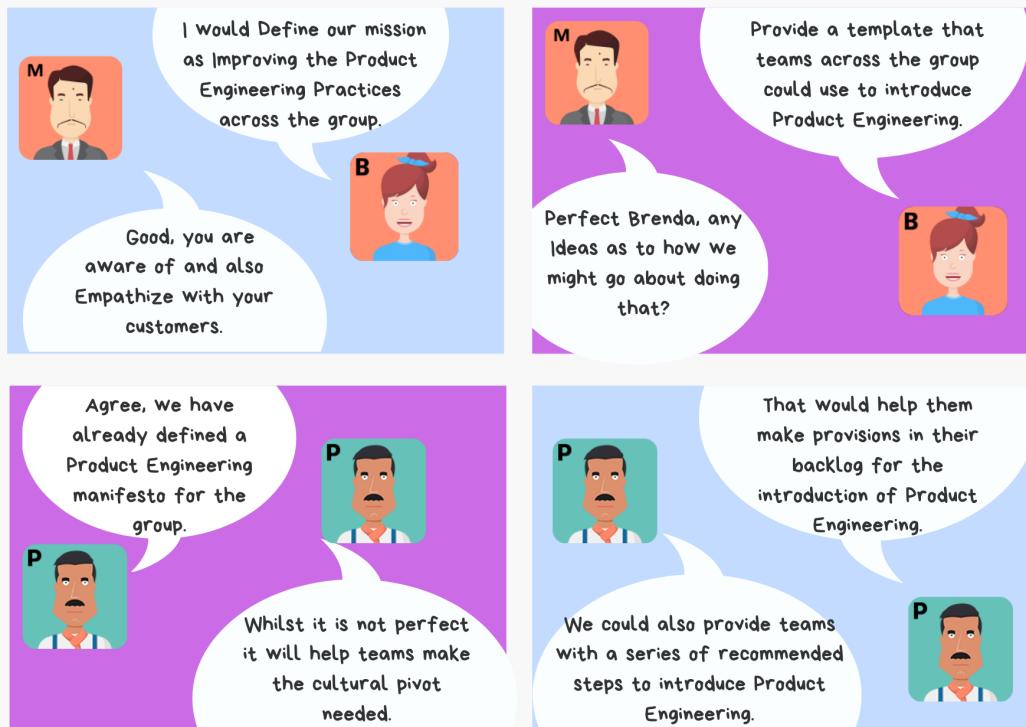
 M	Miyagi Product Engineering Coach and Mentor, tasked with increasing the use of Product Engineering within the Universal Imports Group.
 P	Pennyworth Project Manager from The Daily Mentioner National Newspaper tasked with chairing the effort.
 A	Adriana Architect from the InGen Space Exploration Company lending her expertise to the Product Engineering effort.
 P	Paulo Product Owner for the Pet Clinic Application.
 B	Brenda Business representative from the Pet Clinic, who was the main Business champion of the DevOps transformation.

Improving Product Engineering Practices at Scale

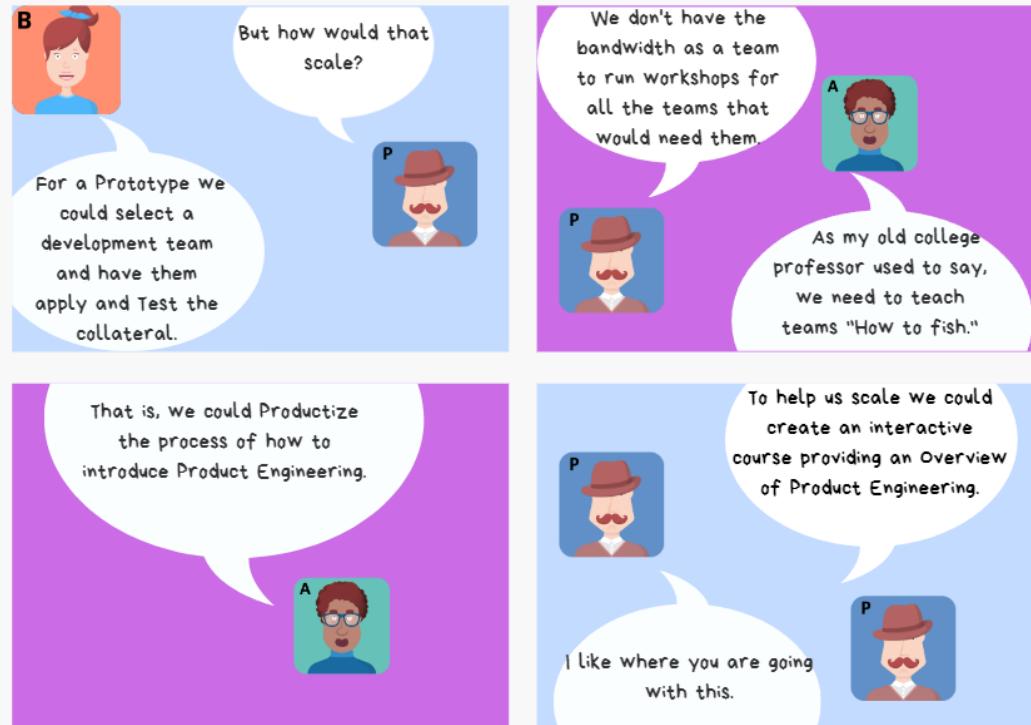
The team discusses how to scale the improvement of Product Engineering practices in the Universal Imports Group.



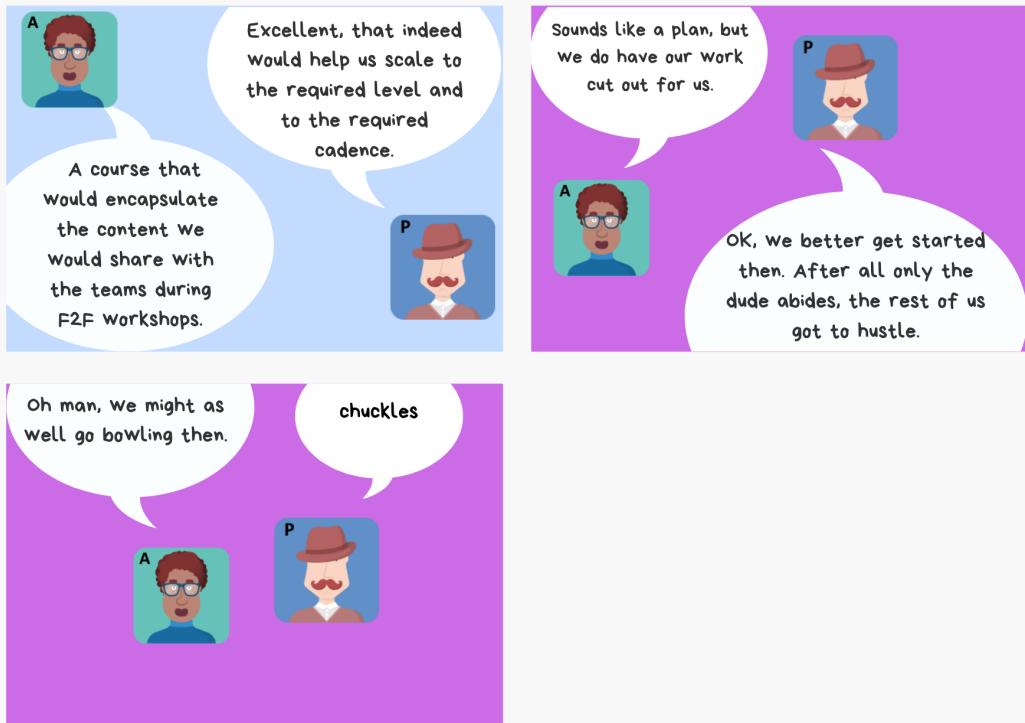
GETTING STARTED WITH PRODUCT ENGINEERING- STRIP 1



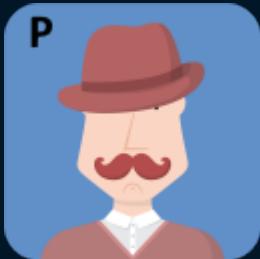
GETTING STARTED WITH PRODUCT ENGINEERING- STRIP1



GETTING STARTED WITH PRODUCT ENGINEERING- STRIP1



Build Product Squads



We in the Universal Imports Group want to build the best possible products.

To do that I suggest we should first invest time, energy and budget in to building the best engineering teams that we can. Then we need to make additional investments to support those teams ensuring we foster accountability, creativity and also encourage experimentation.

Simply put stronger engineering teams will build better products.

Miyagi any suggestions as to how we might go about doing this?



The structure and culture I recommend for Product Engineering teams is known as the "Product Squad" a concept popularized by Spotify.

Product squads are cross-functional teams comprised of a small number of developers and a product owner. Product squads own a complete product or a specific functional area of a product line, they are also responsible for developing domain expertise in support of an organizations product portfolio.



I am sure you are thinking that sounds remarkably similar to Agile scrum teams.

It is, the key differentiator being in the squad model is that the squad are fully empowered. They release their work to the business when they deem their work to be ready. More often than not there are no other approvals required.

However with great power comes great responsibility as the squad are on point for

- Writing code.
- Testing the code.
- Testing the functionality.
- Deploying the "live" product.
- Monitoring and supporting the product.
- Managing technical debt.



Makes sense to me. The essence of what you are saying is that we need to empower our teams for success and to trust them to use that power wisely. I think the teams will welcome such an approach.



To do that, we will need to provide our teams some guidance on how to move to a product squad model.

Product Squad Enablement



I think any help we provide has to be guided by the Universal Import Groups' **Product Engineering Manifesto** we just created.

We are uncovering better ways of engineering products by doing it and helping others do it.

Through this work we have come to value these 12 principles:

- *Focus on Customers underpinned by a deep empathy for their needs.*
- *Make Data Driven Decisions at all stages of the product lifecycle.*
- *Foster a Culture of Experimentation via Ideation, Validation, Realization, Feedback and Iteration.*
- *Engage, Coach, Empower, Support Teams and Team Members.*
- *Value on Practice over Theory, Guidelines over Standards & Culture over Tooling.*
- *Create loosely coupled components supported by APIs, Microservices & Integrations.*
- *Actively work to optimize flow across the entire value stream.*
- *Aim for optimal DevOps - Continuous Integration & Continuous Delivery - per product.*
- *Apply Inner Source Principles supported by an Everything as Code first approach.*
- *Celebrate Success / Learn from Failures.*

- *Everybody's free to Automate Testing.*
- *Encourage teams to have fun, if they don't enjoy making a product, chances are consumers won't enjoy using it.*



We can't expect teams to hit all those marks out of the gate, but we need to ensure that teams are able to commit time to both Product (building new features) and Engineering (documentation, addressing technical debt, monitoring etc) activities.

Our Product Owners have a key role in ensuring that balance between Product and Engineering work is maintained.



Agreed, we can do that by creating appropriate Feature and Enabler epics in the respective product backlogs and ensuring the squads are given sufficient time to work on both types of epics.

Pop Quiz 1

Question 1

Which of the following are responsibilities of a Product Squad?

- []Writing Code.
- []Testing the code and the functionality implemented.
- []Deploying the "live" product.
- []Supporting the product

Question 2

Which of the following are principles in the Universal Imports Group's Product Engineering Manifesto?

- []Focus on Customers underpinned by a deep empathy for their needs.
- []Foster a Culture of Experimentation via Ideation, Validation, Realization, Feedback and Iteration.
- []Value on Theory over Practice, Standards over Guidelines & Tooling over Culture.
- []Create tightly coupled components supported by APIs, Microservices & Integrations.

Getting Started

The team have agreed to follow a Product Engineering approach using Design Thinking - Empathize, Define, Ideate, Prototype & Test - to Introduce Product Engineering across the Universal Imports Group



Miyagi reminds everyone of the teams' Defined mission statement:

Improve the Product Engineering Practices across the Universal Imports Group

and of their agreed Product:

A set of best practices representing the recommended Product Engineering Practices for the Universal Imports Group and collateral to help teams implement those practices

The team meet. Ideas ebb and flow. Serious amounts of 🍕🍕🍕🍕 and ☕☕☕☕ are consumed.

Deliberations are intense, engaging and heated at times but ultimately rewarding.

The results of those discussions is the following Getting Started with Product Engineering steps for teams across the Universal Imports Group.

- **Teams are to adapt the groups' Product Engineering Manifesto.**
- **Teams are to appoint a champion to spearhead the introduction of Product Engineering.**

A champion is a squad member empowered and willing to lead the introduction of Production Engineering in a squad. They are authorized to facilitate the 'pull' of Product Engineering into the squad whilst ensuring the squad is aligned with both the pivot in the organization's culture and the company's goals.

- **Champions will participate in a bi-weekly Product Engineering Guild.**

A Guild, another concept introduced by Spotify, is basically a community of interest. Guilds are where people from different squads can help each other and exchange information on a topic.

- **Communication facilitates flow squads need to work to improve communication pathways.**

Product squads need to continually optimize flow, one of the best ways of doing that is communication with both upstream and downstream stakeholders.

- **Iteration provides a pathway to rapid value creation.**

Product squads focus on delivering a solution that will address the problem at hand as quickly as possible. That solution may not be perfect initially but as the customer and the squad learn more about the problem domain the solution is improved in subsequent iterations.

- **Cherish and encourage direct customer interactions.**

Product squads need to have a clear understanding of customer expectations, wishes and problems, to better influence product direction. The best way to get this understanding is direct customer interactions at all stages of the product lifecycle.

- **Establishing a culture of experimentation is essential.**

Experimentation often drives innovation, high performing squads realize this simple truth and foster a culture of experimentation in the squad. This can be experimenting with new ways of doing things, new tools, new technologies etc. all done with the aim of engineering a better product.

- **Allocate time for both Product and Feature work.**

Squads need to commit time to both Product (building new features) and Engineering (documentation, addressing technical debt, monitoring etc) work. That can often mean going slower when developing features, in order to have the robust engineering and automations in place to enable the squad to go faster in the long run.

- **Celebrate successes, learn from failures and have fun.**

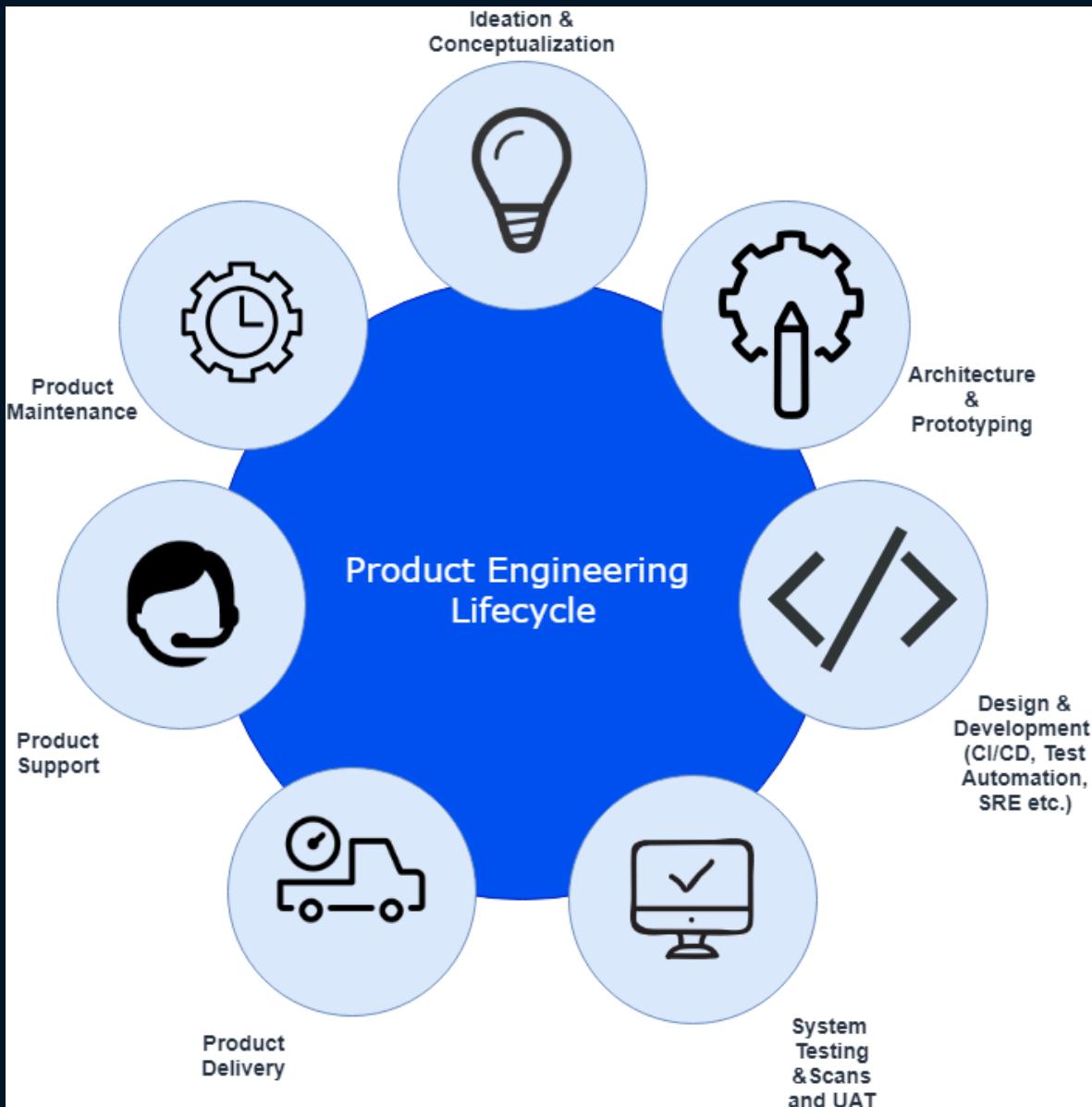
Happy and engaged teams build better products, successes should be celebrated and lessons should be viewed as learning opportunities.

Lifecycle

The team brainstorm Ideas to create a Prototype or "example of good" for Product Engineering Lifecycle which will:

- Enable the companies in the group to create new revenue-generating business models.
- Cover the end-to-end product value chain from ideation through the development process to deployment and after-market product support.
- Use Agile, Lean and DevOps principles to facilitate highly efficient development processes.
- Facilitate value creation at a lower cost base and with a lower total cost of ownership.

The team agrees to recommend the following Product Engineering Lifecycle to teams in the group working to improve their Product Engineering practices:



Pop Quiz 2

Question 1

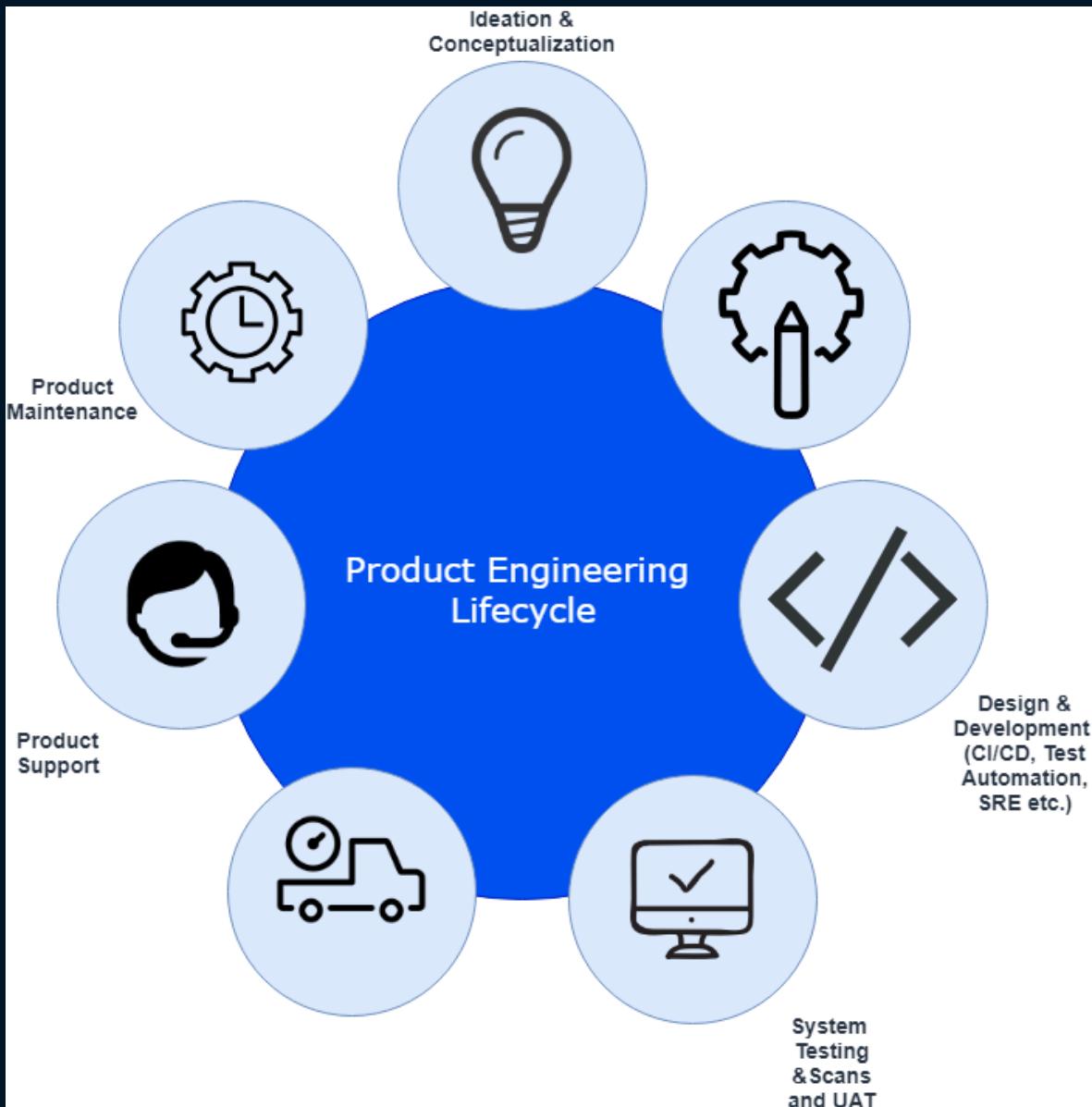
Which of the following should good Product Engineering practices support?

- []Help shape the product
- []Participate in product development process
- []Understand technical constraints, resources and opportunities
- []Work to achieve practical product/technical tradeoffs
- []Focus on ROI
- []Deliver a mix of products
- []All of the above

Question 2

Which two phases are missing from the Product Engineering Lifecycle diagram?

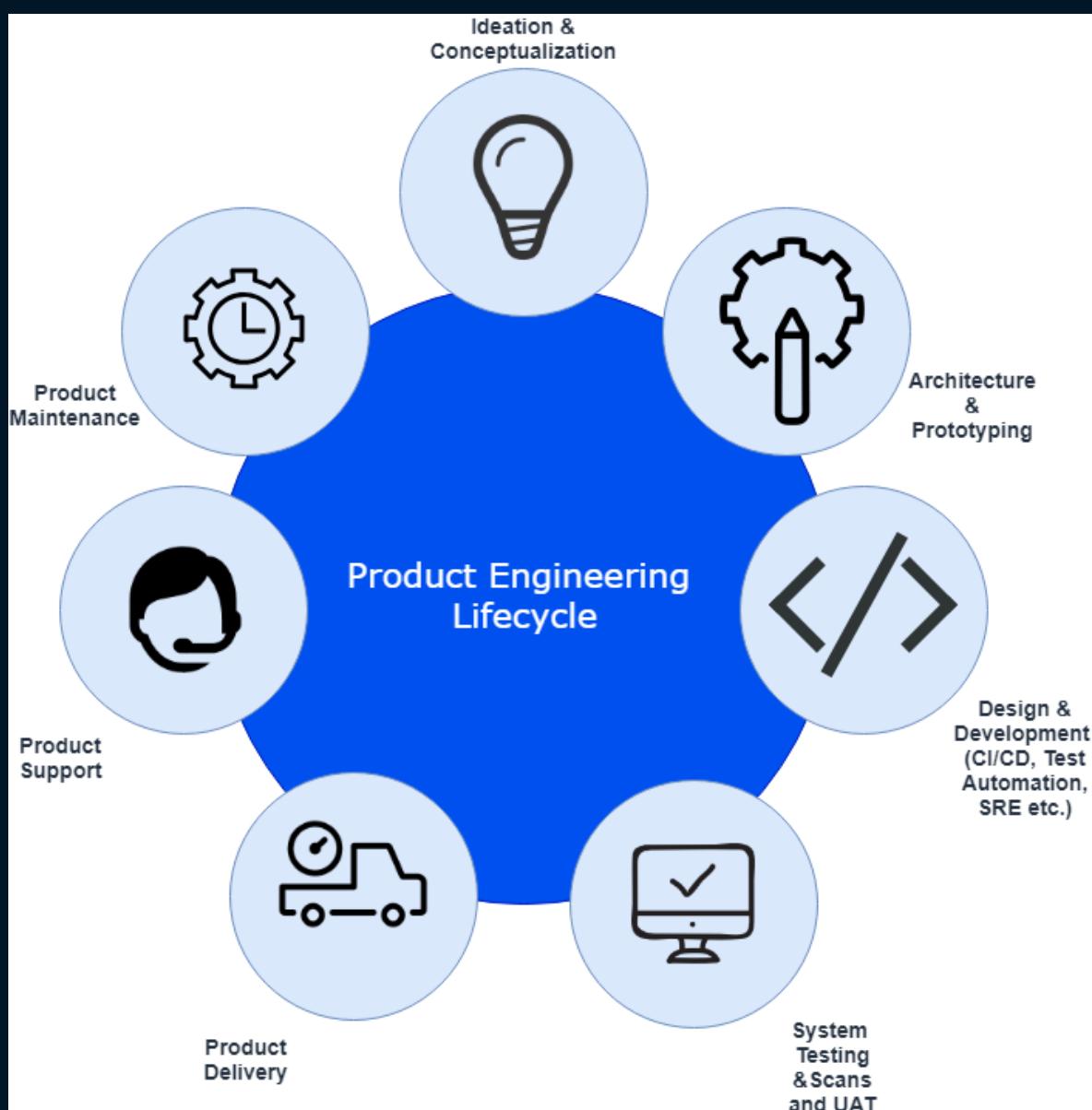
- []Architecture and Prototyping.
- []Product Delivery.
- []Program Increment.
- []Business Requirements Definition.



Integrating With Current Practices

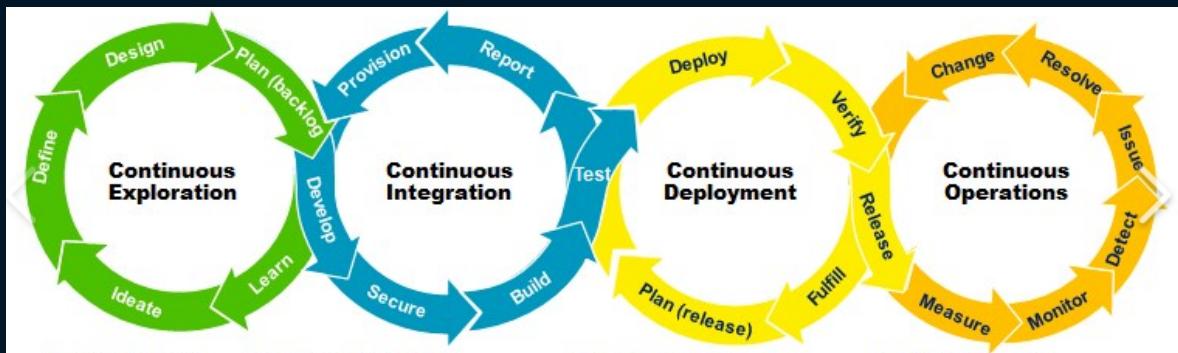


How would the recommended Product Engineering lifecycle fit with our current DevOps practices?





I was wondering about the same thing, and put together the following diagram to help illustrate that point.



I see the recommended Product Engineering lifecycle seamlessly integrating with our current lifecycle, thus helping to accelerate the deployment of best Agile, Lean, and DevOps practices.



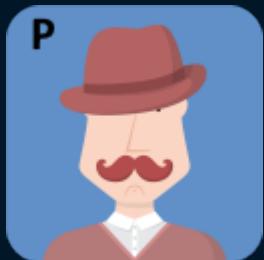
Thanks the team and explains that having created Product Engineering

- Manifesto
- Getting Started Guidelines
- Lifecycle
- Training Content

and formed a

- Product Engineering Guild

The next steps are to work with the teams to help them introduce Product Engineering across the Universal Imports Group.



I love it when a plan comes together. I can't wait to see this start to get rolled out across the group.

Thanks to all, for all your contributions.

Conclusion

Thank you for reading the **Getting Started** chapter.

You now should be able to:

- Access your current Product Engineering practices.
- Understand "*Universal Imports Group's*" recommended Product Engineering practices.
- Introduce or improve your teams' Product Engineering practices.
- Create an environment which enables your team to better influence the products they are responsible for.

📚 Call for curious readers 📚 for curious students 🧑🧑🧑🧑🧑🧑🧑🧑🧑🧑.

We trust having completed this chapter that you have a better understanding of the importance of the need to improve your teams' Product Engineering practices and how you can start to improve your teams' Product Engineering practices.

If that is the case then there is an optional challenge awaiting you.

The challenge is to set some time aside on your teams' calendar to review your approach to Product Engineering, to document that approach and to compare it with the Universal Imports Group's recommended Product Engineering practices.

We wish you well with the challenge, should you decide to accept it. Hopefully it will help you identify and in time make significant improvements to the Product Engineering practices applied in your teams' applications and services.

Afterword

The **Product Engineering: An Introduction** eBook is intended to enhance the understanding and application of product engineering practices to software development; through the use of storytelling and real-world scenarios involving a fictional team. The hope being to make learning process engaging and practical.

In closing, this collection of chapter summaries and key takeaways revisits the core insights and lessons presented throughout the book.

Chapter Summaries and Key Takeaways

Chapter 1: Welcome

Synopsis:

The welcome chapter sets the stage for the eBook by introducing its purpose, structure, and the fictional team that will be used to illustrate key concepts. It outlines the main objectives of the book and what readers can expect to learn.

Key Takeaways:

- Understanding the scope and goals of the eBook.
- Identifying the intended audience.
- Setting expectations for the learning journey.
- Overview of the structure and content.
- Introduction to the concept of Product Engineering.

Chapter 2: Introduction to Product Engineering

Synopsis:

This chapter introduces the fundamental concepts of product engineering, emphasizing its importance in modern software development. It covers the lifecycle of product engineering from ideation, design, development, testing, deployment and maintenance.

Key Takeaways:

- Understanding the holistic nature of product engineering.
- Key principles and practices involved.

- Benefits over traditional engineering methods.
- The role of culture in successful implementation.

Chapter 3: Design Thinking

Synopsis:

Focusing on design thinking, this chapter explains how to adopt a user-centric approach to product development to drive innovation and user-centric solutions. It details the Design Thinking phases of empathize, define, ideate, prototype, and test.

Key Takeaways:

- Steps and stages in the Design Thinking process.
- How Design Thinking enhances product development.
- The importance of empathizing with users to identify their needs.
- Iterative prototyping and testing to refine products.
- Techniques for fostering creativity and innovation.
- Integration of Design Thinking in Product Engineering.

Chapter 4: Getting Started with Product Engineering

Synopsis:

This chapter provides practical steps to introduce product engineering in an organization. It includes guidance on setting up teams, defining roles, and establishing processes.

Key Takeaways:

- Initial steps to start with Product Engineering.

- Strategies for assembling a cross-functional product engineering team.
- Key roles and responsibilities within a product engineering team.
- Steps to implement product engineering practices effectively.
- Overcoming common challenges.
- Tips for continuous improvement and scaling.

Conclusion

You have now finished the **Product Engineering: An Introduction** book. Thank you for making the time to read it.

If this book has been your introduction to Product Engineering we hope that it is just the start of your foray into Product Engineering.

We trust you have enjoyed the book and as promised in the Welcome chapter the next time you have need for that bigger  you are better positioned to Product Engineer it accordingly.

We further hope that you will apply your learnings from this book in the teams you work with and on the products you work on.

This is the way!

However before you turn off the electronic device you used to read this book.

There now follows an assessment; which you can take to validate your learnings from the time you invested in reading **Production Engineering: An Introduction** if you are so inclined.

Appendix 1 - Assessment

Purpose

The primary objective of the **Assessment** is to help you verify the knowledge gained from reading this tome on **Product Engineering**.

The answers are out there  ...

Questions

Question 1

Who was appointed as the coach and mentor for the adaption of Product Engineering in the Universal Imports Group?

- []Charlie
- []Paulo
- []Miyagi
- []Adriana
- []Brenda

Question 2

In the Product Engineering Manifesto, which of the following is valued?

- []Theory over Practice
- []Standards over Guidelines
- []Culture over Tooling

Question 3

What is the name given to a squad member empowered and willing to lead the Introduction of Production Engineering in their squad?

- []Champion
- []Mentor
- []Product Owner

Question 4

What is the first phase of the Product Engineering Lifecycle being adapted by the Universal Imports Group?

- []Architecture and Prototyping
- []Product Delivery
- []Ideation and Conceptualization

Question 5

What is the first phase in the Stanford Design Thinking model?

- []Empathize
- []Ideate
- []Define
- []Test
- []Prototype

Question 6

Design Thinking is seen as a means of addressing which identified gap in Universal Imports Groups' recommended Product Engineering Lifecycle?

- []Product Delivery
- []Product Support
- []Ideation and Conceptualization

Question 7

Which of these is the correct sequence of the phases in the Stanford Design Thinking model?

- []Empathize -> Define -> Ideate -> Prototype -> Test
- []Ideate -> Empathize -> Define -> Prototype -> Test
- []Define -> Empathize -> Ideate -> Prototype -> Test

Question 8

Product Engineering is a discipline that deals with which aspects of a product?

- []Design
- []Testing
- []Delivery
- []Support
- []Development
- []All of the above

Question 9

The cultural pivot required for a successful adaption of Product Engineering requires a shift to which type of mindset?

- []Project
- []Product

Question 10

In which phase of the Product Engineering Lifecycle being adapted by the Universal Imports Group is the product released to the market?

- []Product Support
- []Product Maintenance
- []Product Delivery

Appendix 2 - Answers

Introduction to Product Engineering

Pop Quiz 1

Question 1

Which of the following are the responsibilities of a Product Engineer?

The correct answer is **All of the above**

The following are some of the responsibilities of a Product Engineer

- Help shape the product
- Participate in product development process
- Understand technical constraints, resources and opportunities
- Work to achieve practical product/technical tradeoffs
- Focus on ROI
- Deliver a mix of products

Question 2

Which of the following are included in the Skill Set of a Product Engineer?

The correct answer is **All of the above**

The following are skills needed by a Product Engineer

- Strong focus on and deep understanding of the Product
- Make data driven decisions
- Effective communicator
- Prioritization and estimation
- Engineering execution

Pop Quiz 2

Question 1

In which phase of the Product Engineering Cycle should teams ideally focus on determining if a proposed product or feature is worth pursuing or not ?

The correct answer is **Ideation and Conceptualization**

The **Ideation and Conceptualization** stage of the Product Engineering Cycle is where

teams

- Conceive the idea.
- Document it.
- Decide if idea is worth pursuing or not.

Question 2

What should a team create as a declaration of their Product Engineering values and principles, a Product Engineering ... ?

The correct answer is **manifesto**, a team should create a Product Engineering manifesto as a declaration of their Product Engineering values and principles.

Design Thinking

Pop Quiz 1

Question 1

During the Design Thinking Test stage the team conclude there is a need to 'revisit the defined problem' why might that be?

The correct answer is **Prototype identified a problem which the design did not address**

Design Thinking is not a linear process, prototypes are created to both validate and identify issues in designs and proposed solutions.

Question 2

What is the purpose of a prototype in the context of Design Thinking?

The correct answer is **A model of the proposed solution which end users can test and provide feedback on**

In Design Thinking prototypes are used to produce an early stage scaled down version of a product. Prototypes allow a group of end users evaluate a potential solution, thus enable teams to gather feedback and identify potential problems with the design.

Pop Quiz 2

Question 1

How can Universal Imports continue to innovate after introducing Design Thinking?

The correct answer is **By implementing a process of continuous improvement**

Continuous Improvement or Kaizen events should be run to identify and implement innovation opportunities.

Question 2

Having brainstormed a number of ideas to solve a problem, what should a team do to test those ideas?

The correct answer is **Select the most promising ideas and create viable prototypes**

Having brainstormed a number of ideas to solve a problem a team should select the most promising ideas and create viable prototypes to test those ideas.

Getting Started

Pop Quiz 1

Question 1

Which of the following are responsibilities of a Product Squad?

The correct answer is **all of them** as these are all responsibilities of a Product Squad

- Writing Code.
- Testing the code and the functionality implemented.
- Deploying the "live" product.
- Supporting the product.

Question 2

Which of the following are principles in the Universal Imports Group's Product Engineering Manifesto?

The correct answer is **Focus on Customers underpinned by a deep empathy for their needs** and **Foster a Culture of Experimentation via Ideation, Validation, Realization, Feedback and Iteration** are principles in the Universal Imports Group's Product Engineering Manifesto.

Pop Quiz 2

Question 1

Which of the following should good Product Engineering practices support?

The correct answer is Good Product Engineering practices should support **all of them**

- Creation of new revenue-generating business models.

- End-to-end product value chain from ideation through the development process, to deployment and after-market product support.
- Application of Agile, Lean and DevOps principles to facilitate highly efficient development processes.
- Value creation at a lower cost base and with a lower cost of ownership.

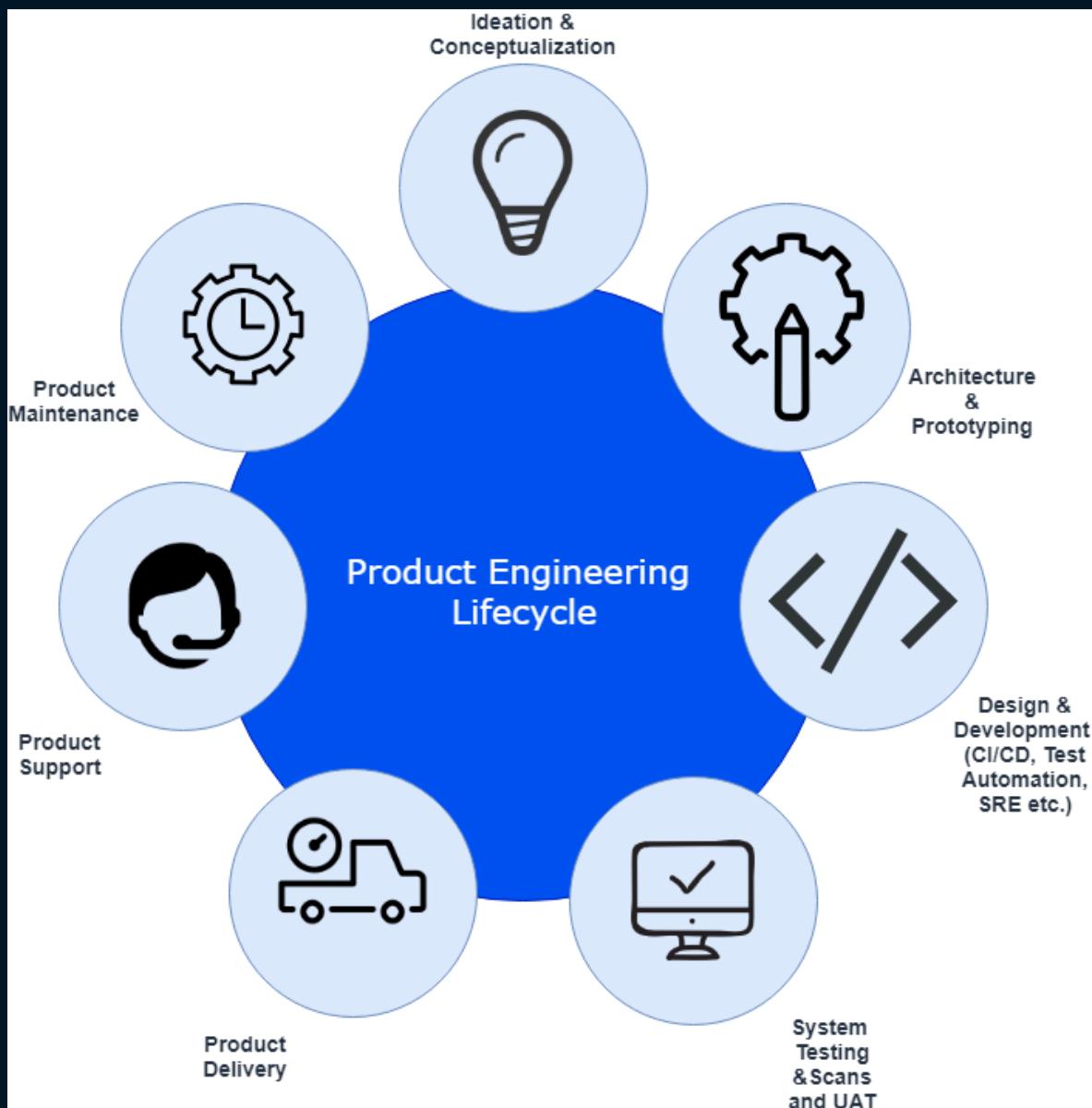
Question 2

Which two phases are missing from the Product Engineering Lifecycle diagram?

The two phases of the Product Engineering Lifecycle missing from the Product Engineering Lifecycle are

Architecture and Prototyping and **Product Delivery**.

The recommended Product Engineering Lifecycle is



Assessment

Answers

Question 1

Who was appointed as the coach and mentor for the adaption of Product Engineering in the Universal Imports Group?

The correct answer is **Paulo**. Refer to Chapter 1 - Welcome for more details

Question 2

In the Product Engineering Manifesto, which of the following is valued?

The correct answer is **Culture over Tooling**. Refer to Chapter 4 - Getting Started for more details

Question 3

What is the name given to a squad member empowered and willing to lead the Introduction of Production Engineering in their squad?

The correct answer is **Champion**. Refer to Chapter 4 - Getting Started for more details

Question 4

What is the first phase of the Product Engineering Lifecycle being adapted by the Universal Imports Group?

The correct answer is **Ideation and Conceptualization**. Refer to Chapter 4 - Getting Started for more details

Question 5

What is the first phase in the Stanford Design Thinking model?

The correct answer is **Empathize**. Refer to Chapter 3 - Design Thinking for more details

Question 6

Design Thinking is seen as a means of addressing which identified gap in Universal Imports Group recommended Product Engineering Lifecycle?

The correct answer is **Ideation and Conceptualization**. Refer to Chapter 3 - Design

Thinking for more details

Question 7

Which of these is the correct sequence of the phases in the Stanford Design Thinking model?

The correct answer is **Empathize -> Define -> Ideate -> Prototype -> Test**. Refer to Chapter 3 - Design Thinking for more details

Question 8

Product Engineering is a discipline that deals with which aspects of a product?

The correct answer is **All of the above**. Refer to Chapter 2 - Introduction to Product Engineering for more details

Question 9

The cultural pivot required for a successful adaption of Product Engineering requires a shift to which type of mindset?

The correct answer is **Product**. Refer to Chapter 2 - Introduction to Product Engineering for more details

Question 10

In which phase of the Product Engineering Lifecycle being adapted by the Universal Imports Group is the product released to the market?

The correct answer is **Product Delivery**. Refer to Chapter 2 - Introduction to Product Engineering for more details