軟體工程
(Software Engineering)

功能、場景和故事
(Features, Scenarios, and Stories)

1101SE04
MBA, IM, NTPU (M6131) (Fall 2021)
Thu 11, 12, 13 (19:25-22:10) (209)

Min-Yuh Day
戴敏育
Associate Professor
副教授
Institute of Information Management, National Taipei University
國立臺北大學 資訊管理研究所
https://web.ntpu.edu.tw/~myday

2021-10-14

課程大綱 (Syllabus)

國立臺北大學 National Taipei University

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2021/09/23	軟體工程概論 (Introduction to Software Engineering)
2	2021/09/30	軟體產品與專案管理：軟體產品管理，原型設計 (Software Products and Project Management: Software product management and prototyping)
3	2021/10/07	敏捷軟體工程：敏捷方法、Scrum、極限程式設計 (Agile Software Engineering: Agile methods, Scrum, and Extreme Programming)
4	2021/10/14	功能、場景和故事 (Features, Scenarios, and Stories)
5	2021/10/21	軟體工程個案研究 I (Case Study on Software Engineering I)
6	2021/10/28	軟體架構：架構設計、系統分解、分散式架構 (Software Architecture: Architectural design, System decomposition, and Distribution architecture)

課程大綱 (Syllabus)

國立臺北大學 National Taipei University

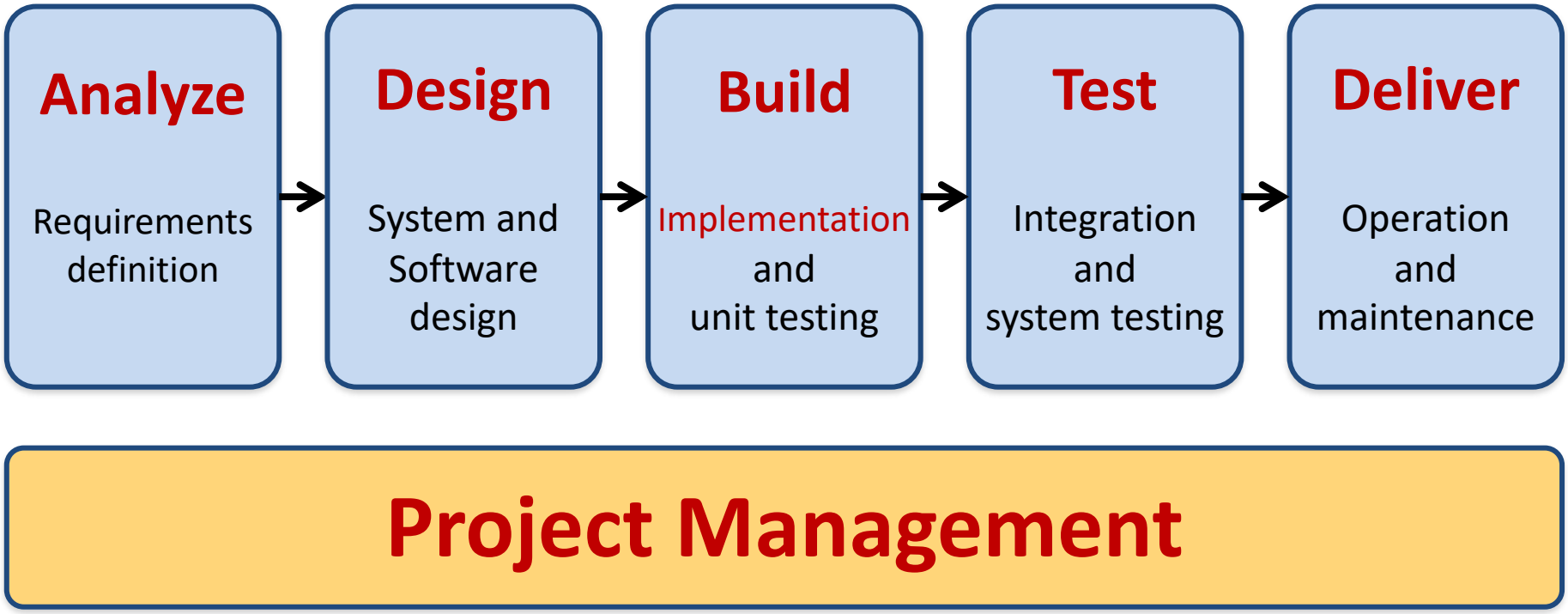
週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2021/11/04	基於雲的軟體：虛擬化和容器、軟體即服務 (Cloud-Based Software: Virtualization and containers, Everything as a service, Software as a service)
8	2021/11/11	期中報告 (Midterm Project Report)
9	2021/11/18	雲端運算與雲軟體架構 (Cloud Computing and Cloud Software Architecture)
10	2021/11/25	微服務架構：RESTful服務、服務部署 (Microservices Architecture, RESTful services, Service deployment)
11	2021/12/02	軟體工程產業實務 (Industry Practices of Software Engineering)
12	2021/12/09	軟體工程個案研究 II (Case Study on Software Engineering II)

課程大綱 (Syllabus)

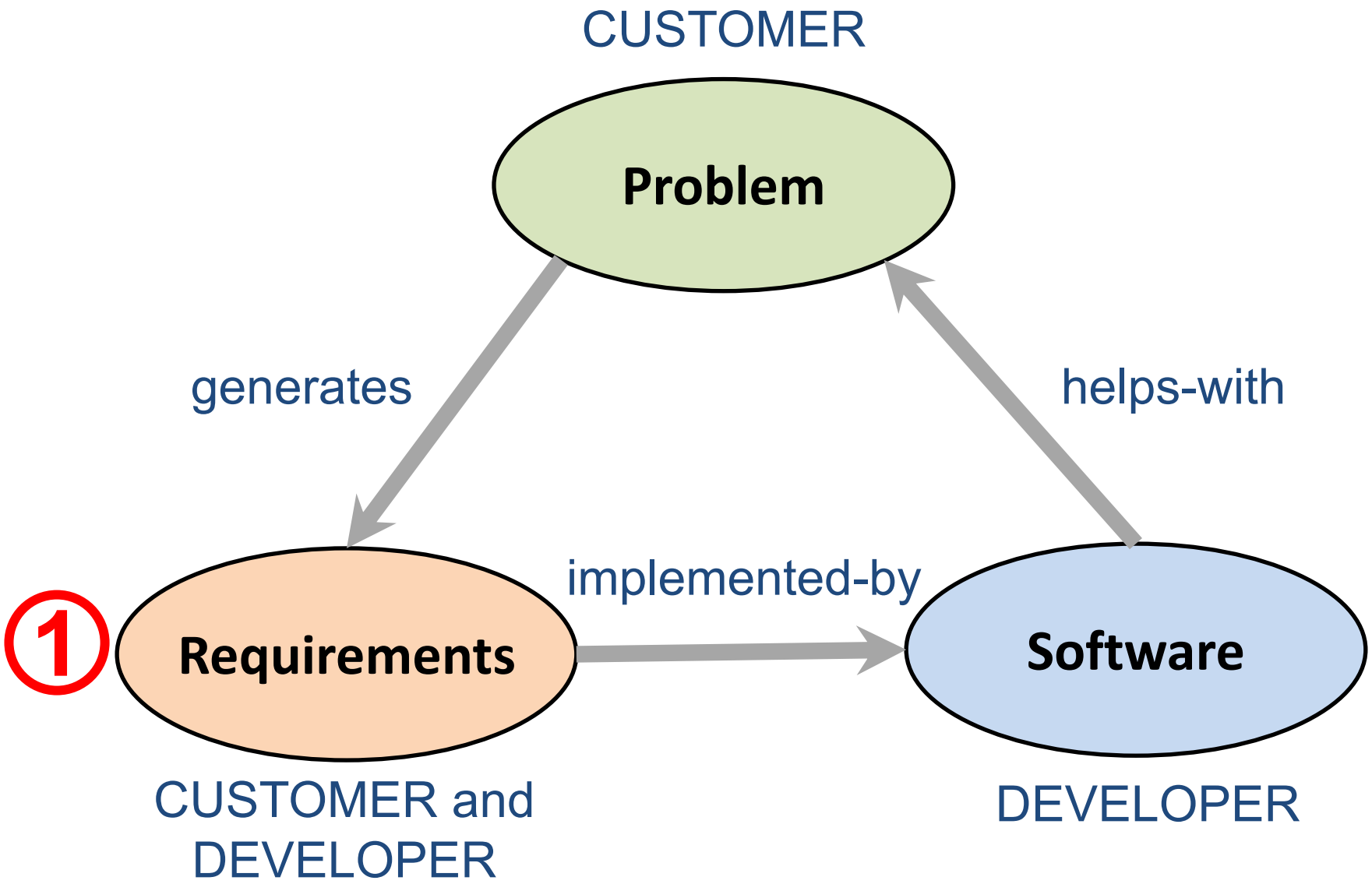
國立臺北大學 National Taipei University

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2021/12/16	安全和隱私 (Security and Privacy); 可靠的程式設計 (Reliable Programming)
14	2021/12/23	測試：功能測試、測試自動化、 測試驅動的開發、程式碼審查 (Testing: Functional testing, Test automation, Test-driven development, and Code reviews); DevOps和程式碼管理：程式碼管理和DevOps自動化 (DevOps and Code Management: Code management and DevOps automation)
15	2021/12/30	期末報告 I (Final Project Report I)
16	2022/01/06	期末報告 II (Final Project Report II)
17	2022/01/13	學生自主學習 (Self-learning)
18	2022/01/20	學生自主學習 (Self-learning)

Software Engineering and Project Management

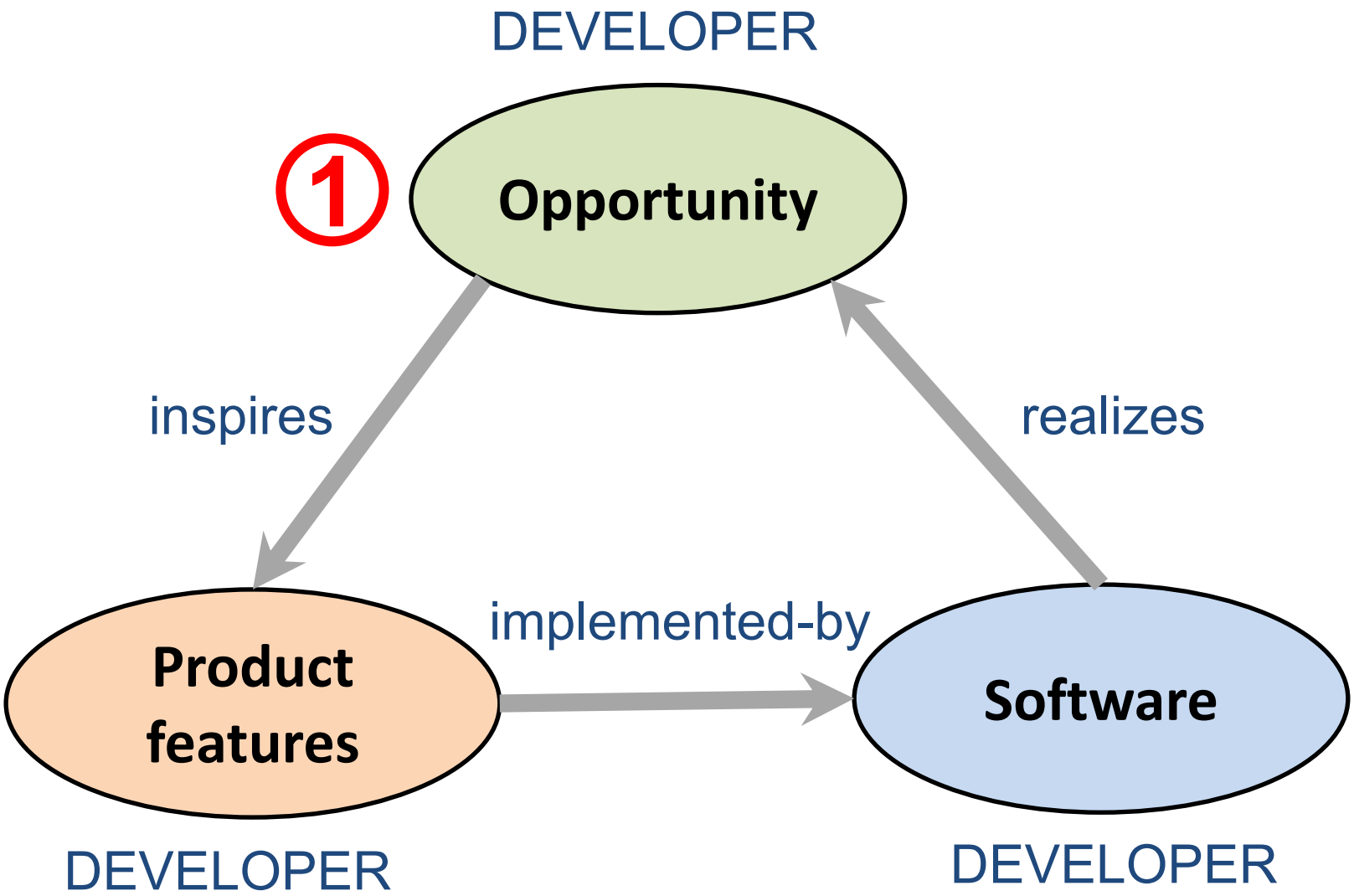


Project-based software engineering



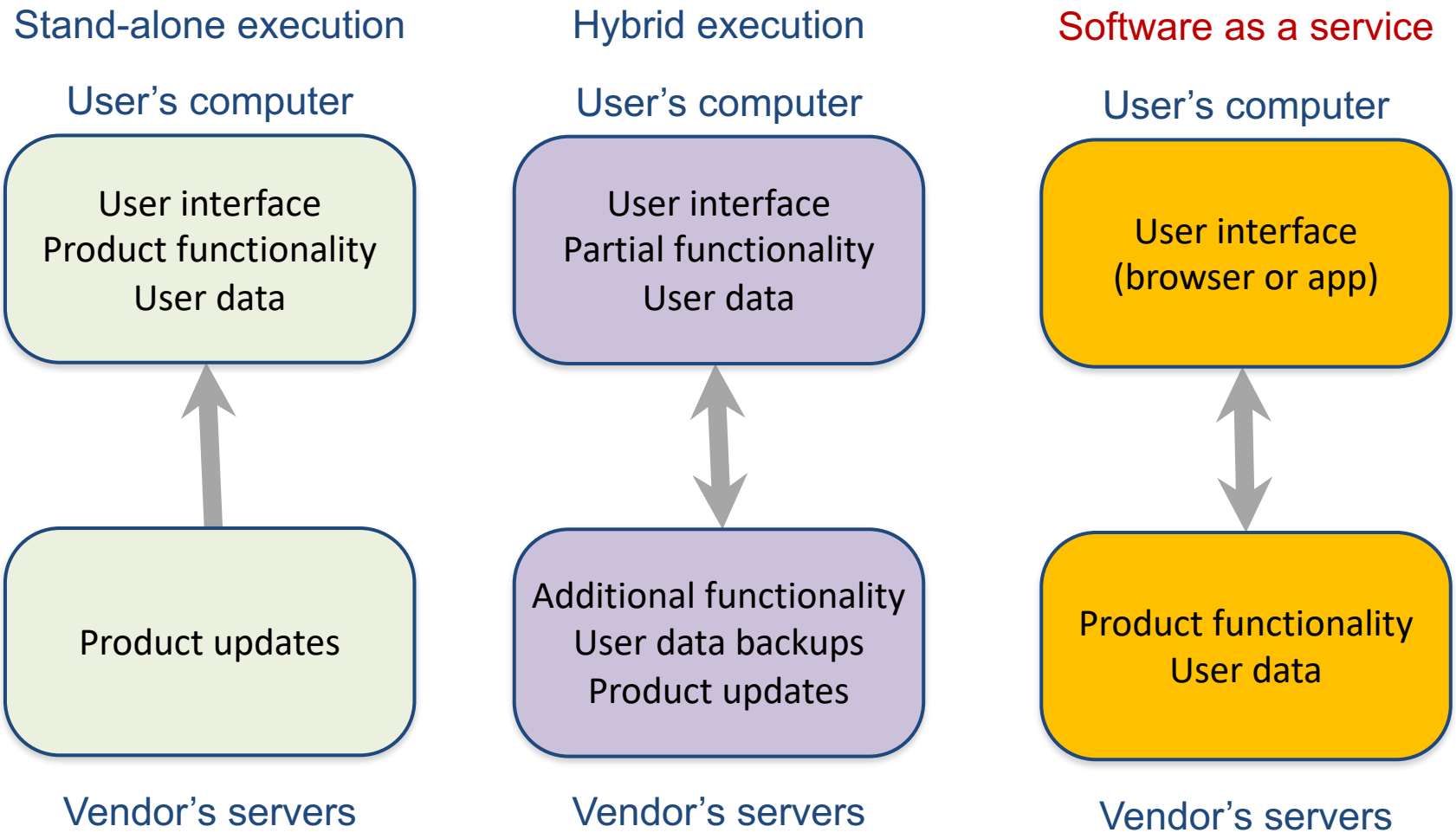
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Product software engineering



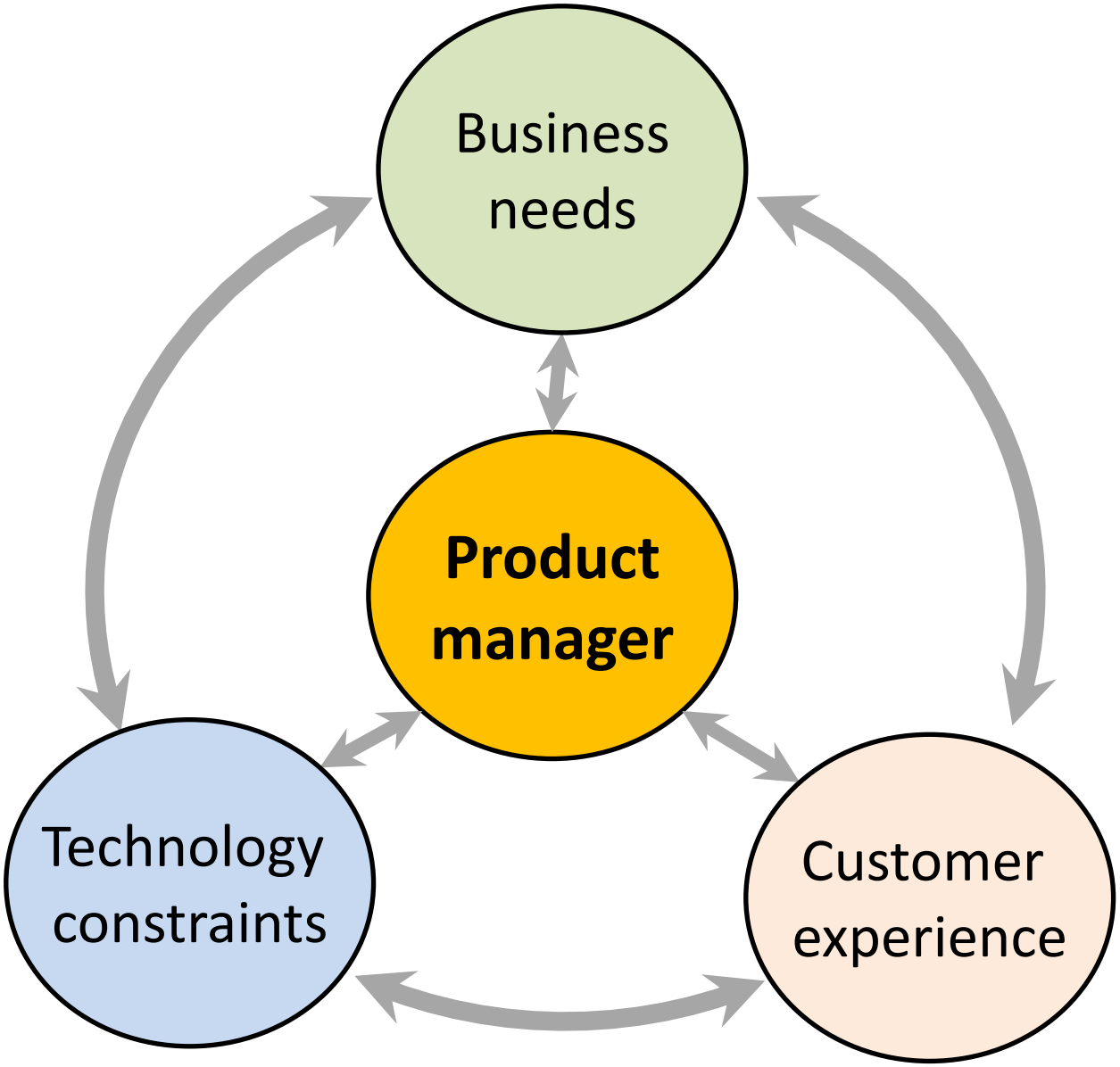
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Software execution models



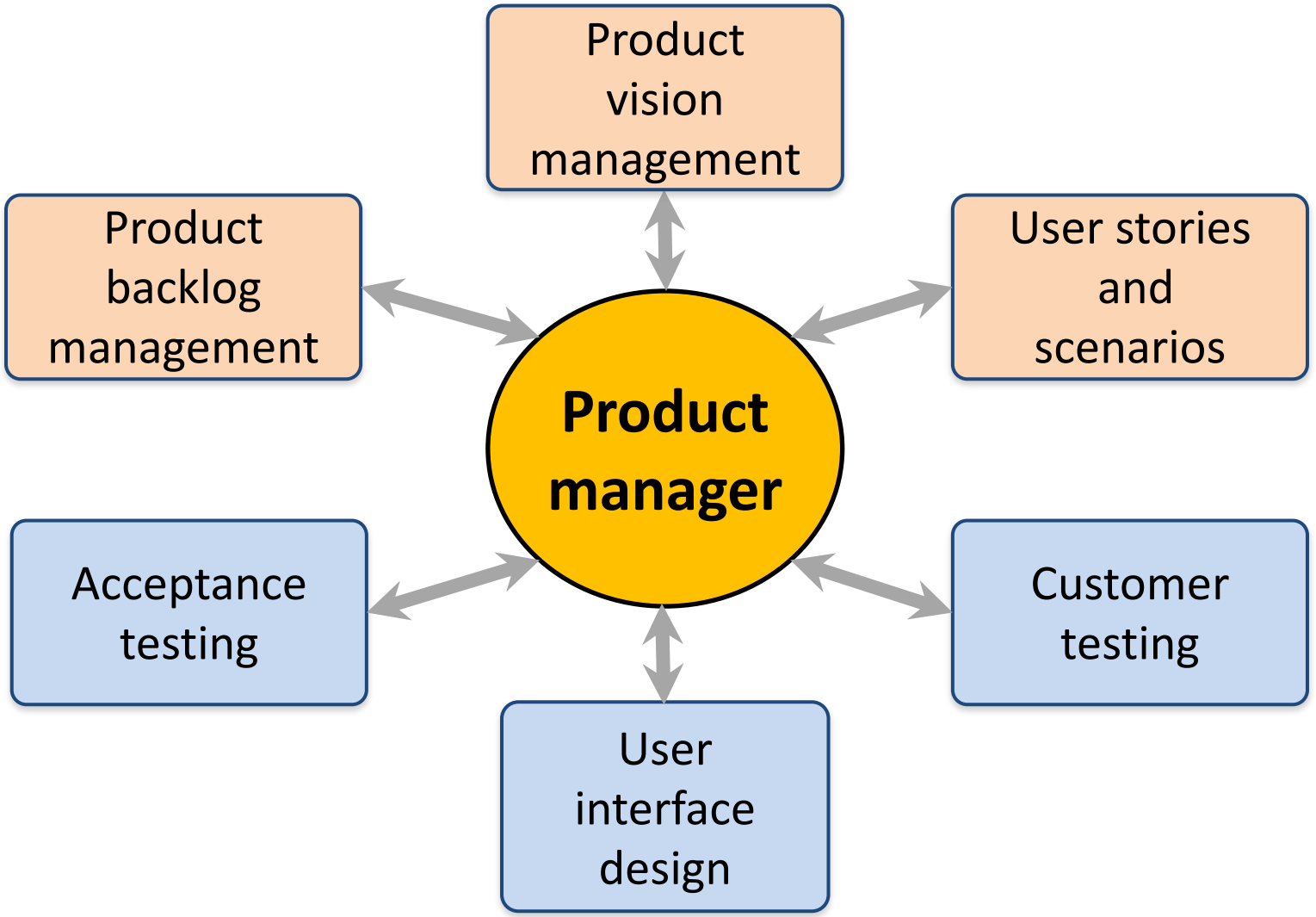
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Product management concerns



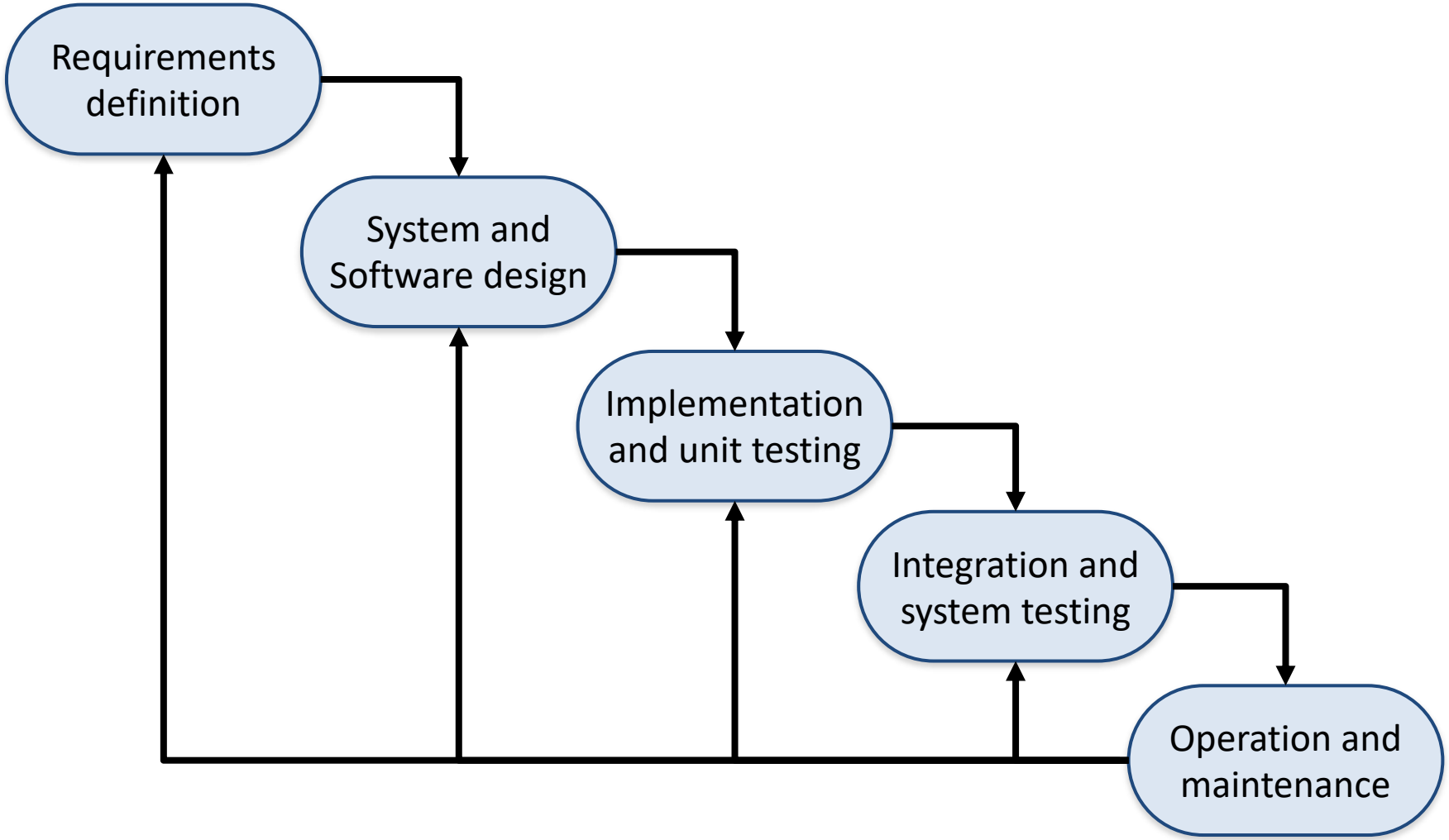
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Technical interactions of product managers



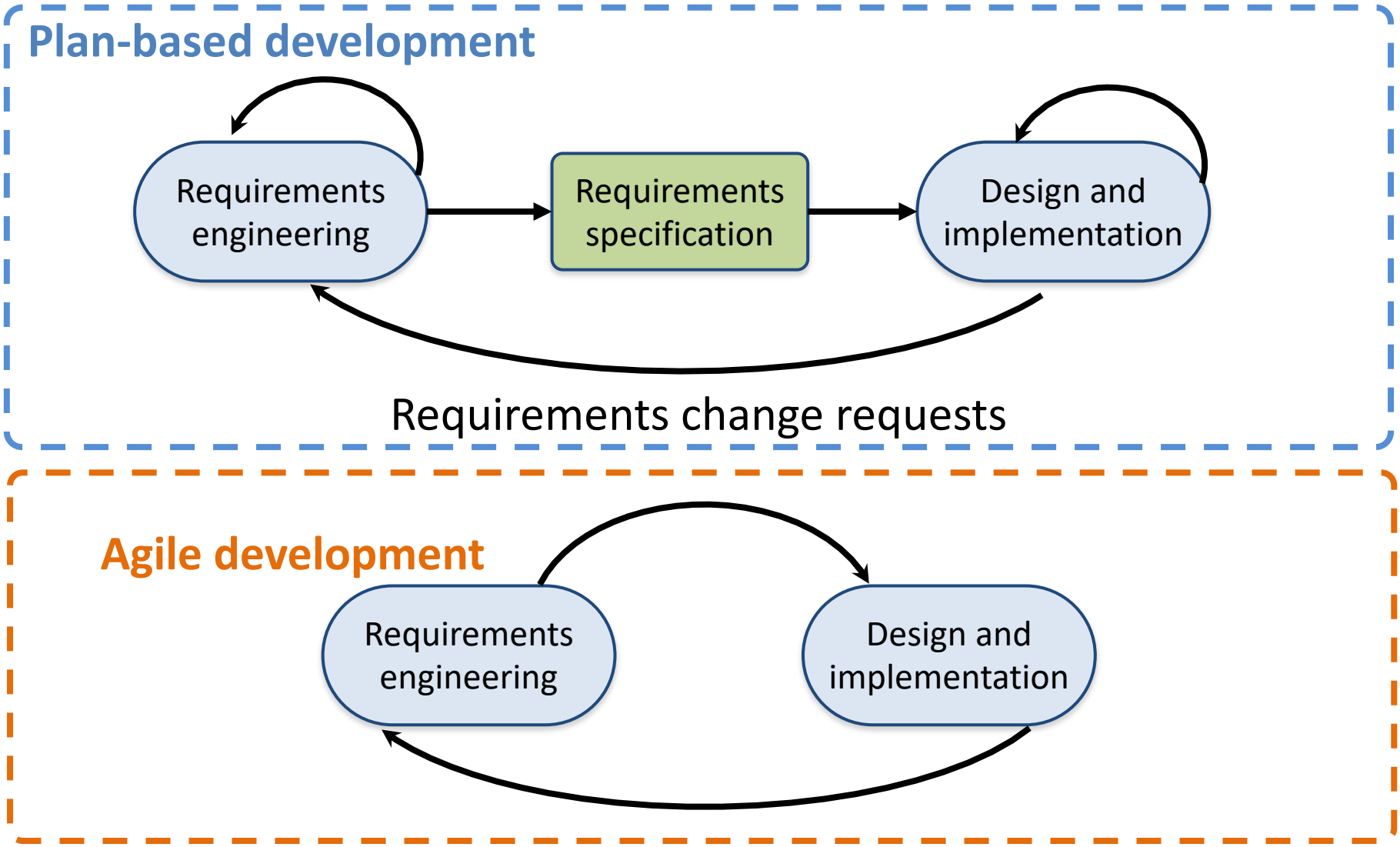
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Software Development Life Cycle (SDLC)
The waterfall model



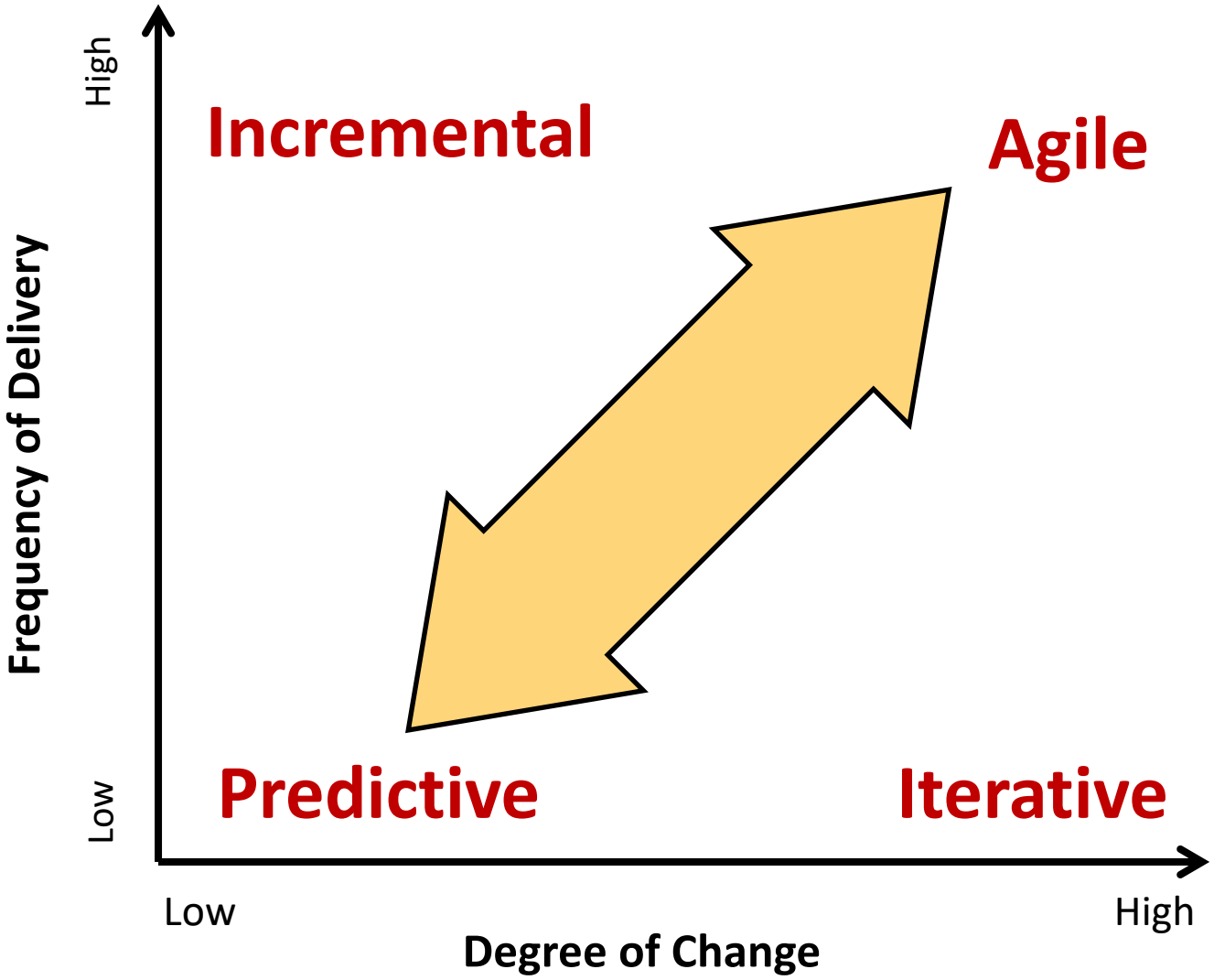
Source: Ian Sommerville (2015), Software Engineering, 10th Edition, Pearson.

Plan-based and Agile development



Source: Ian Sommerville (2015), Software Engineering, 10th Edition, Pearson.

The Continuum of Life Cycles

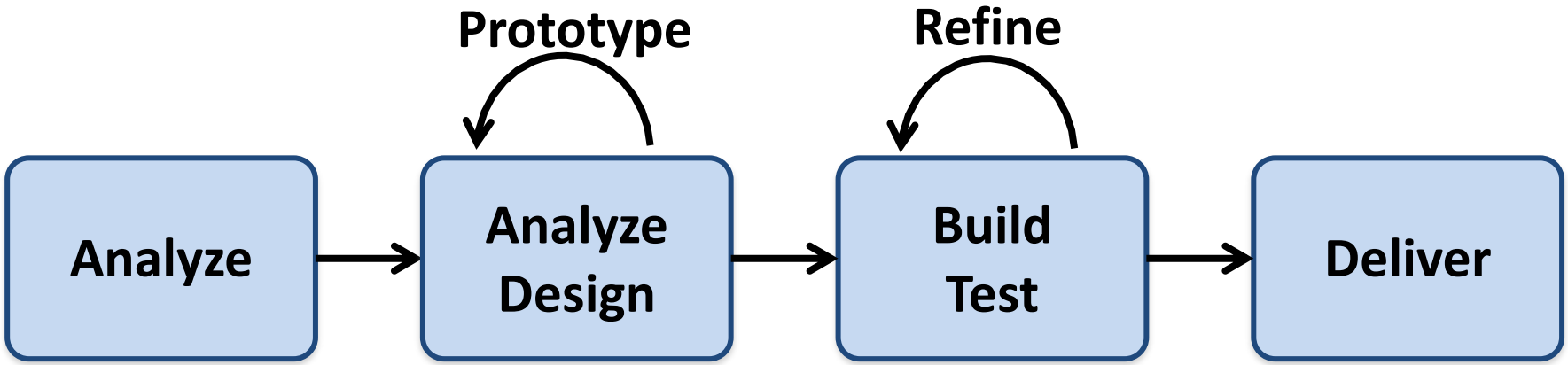


Source: Project Management Institute (2017), Agile Practice Guide, Project Management Institute

Predictive Life Cycle

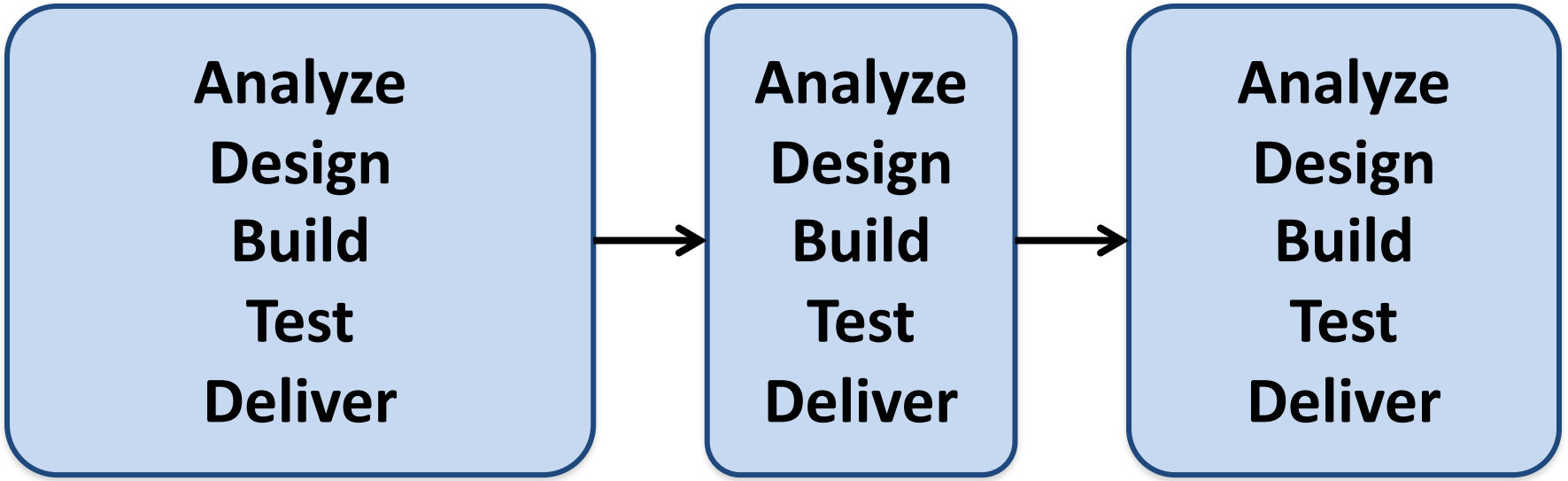
Source: Project Management Institute (2017), Agile Practice Guide, Project Management Institute

Iterative Life Cycle



Source: Project Management Institute (2017), Agile Practice Guide, Project Management Institute

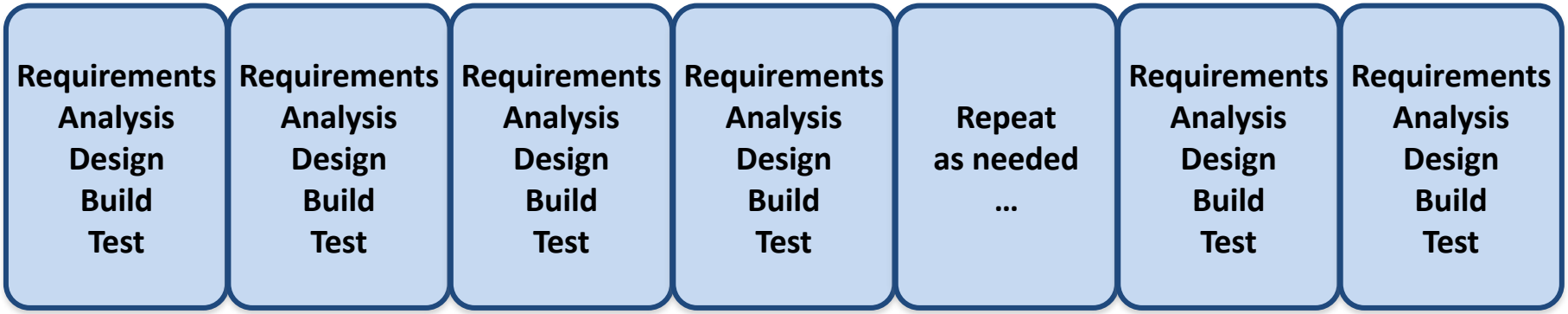
A Life Cycle of Varying-Sized Increments



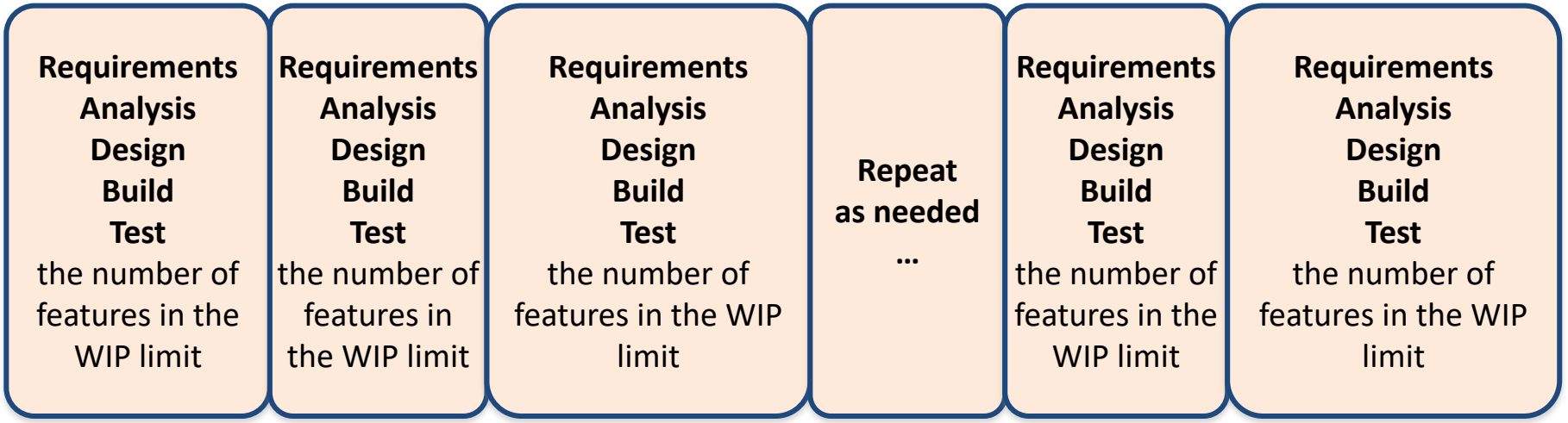
Source: Project Management Institute (2017), Agile Practice Guide, Project Management Institute

Iteration-Based and Flow-Based Agile Life Cycles

Iteration-Based Agile

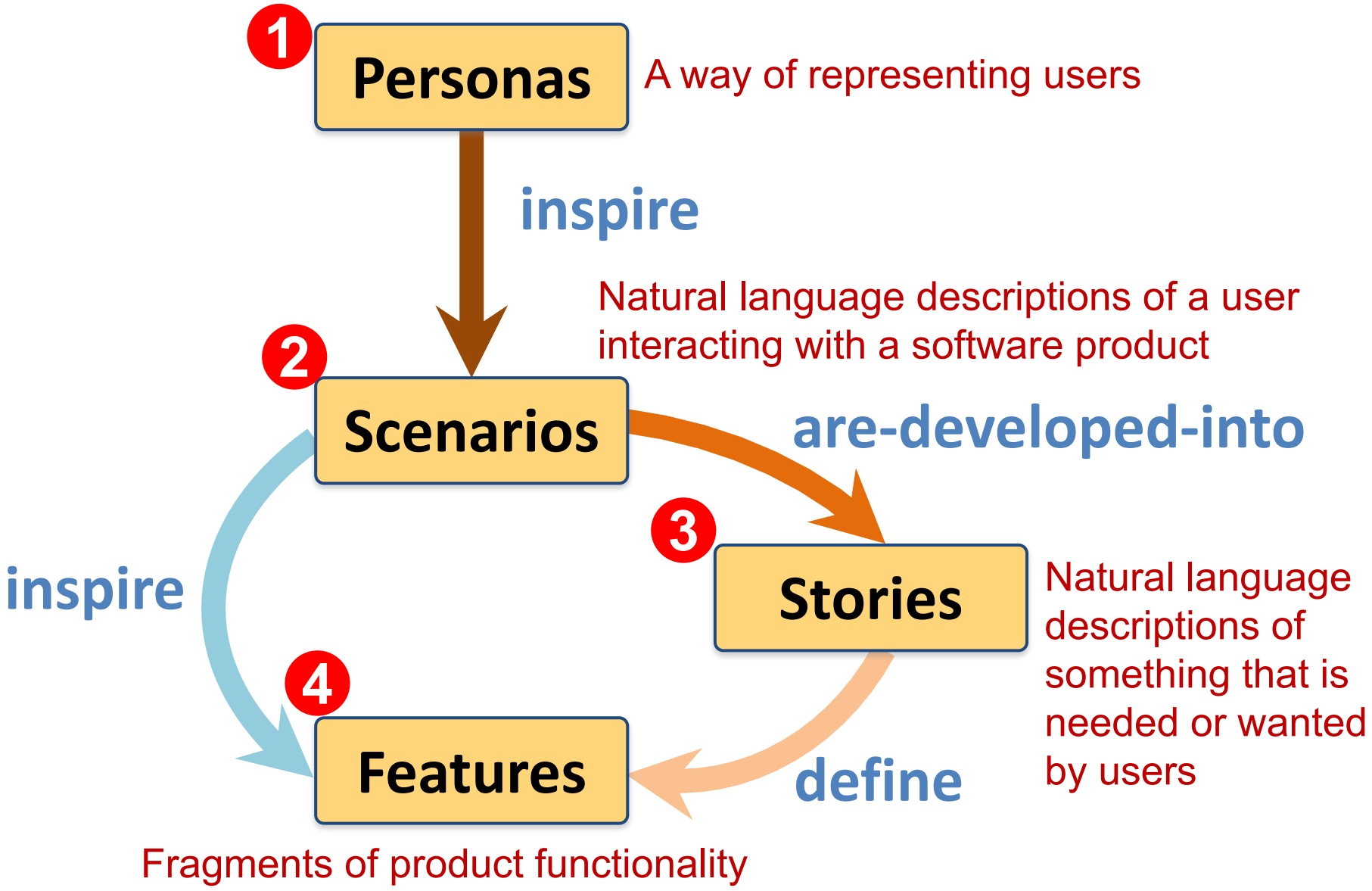


Flow-Based Agile



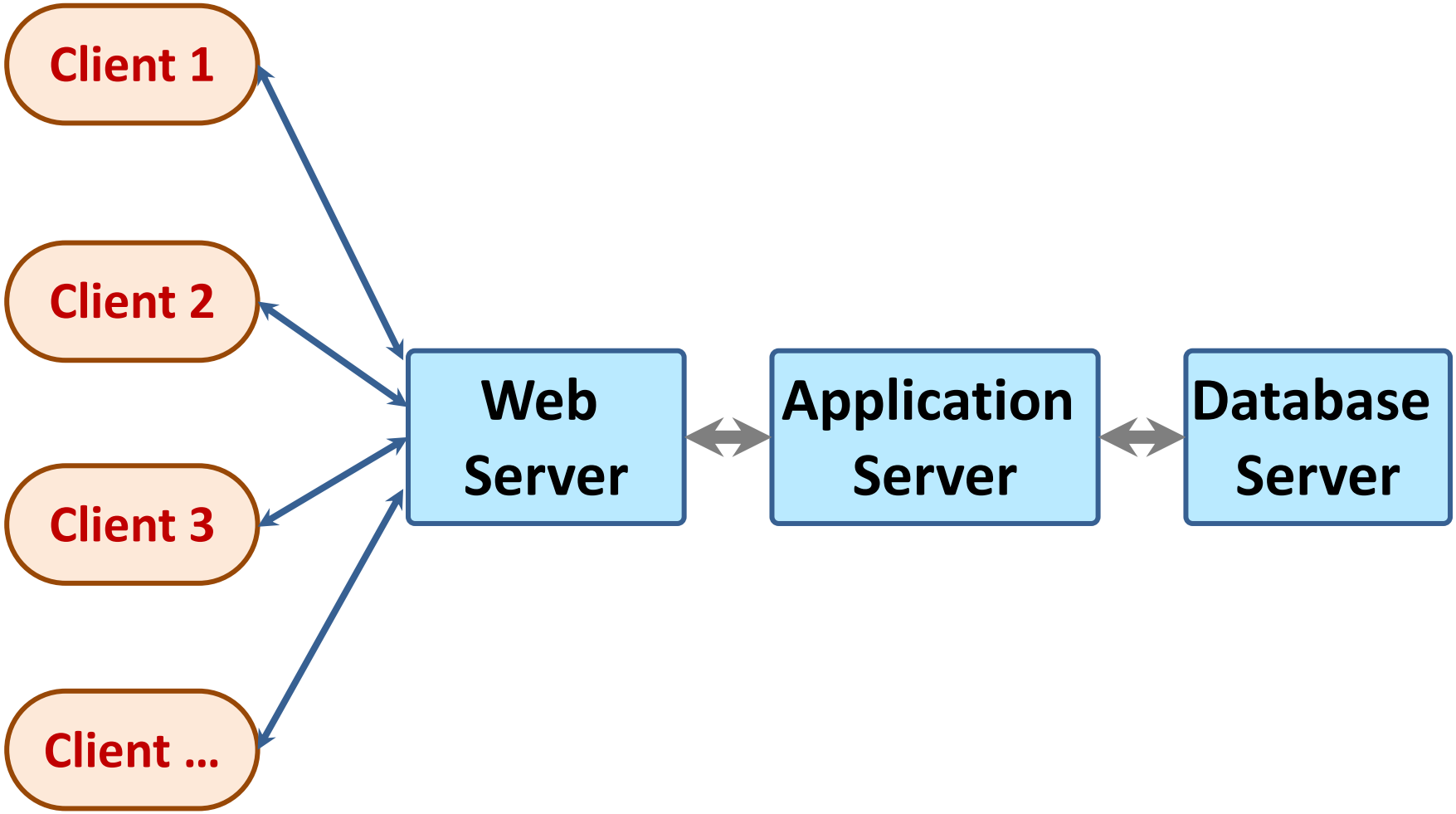
Source: Project Management Institute (2017), Agile Practice Guide, Project Management Institute

From personas to features



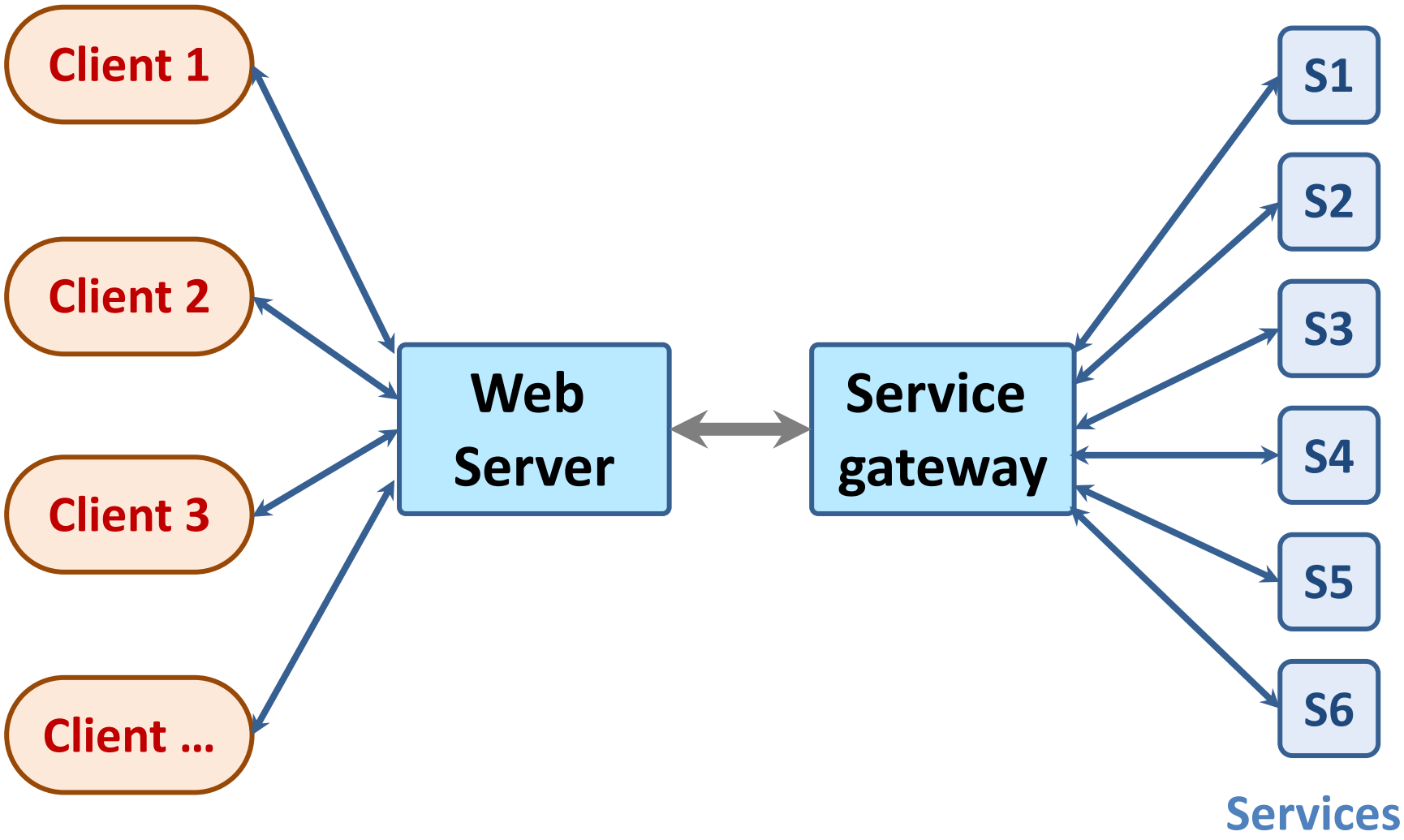
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Multi-tier client-server architecture

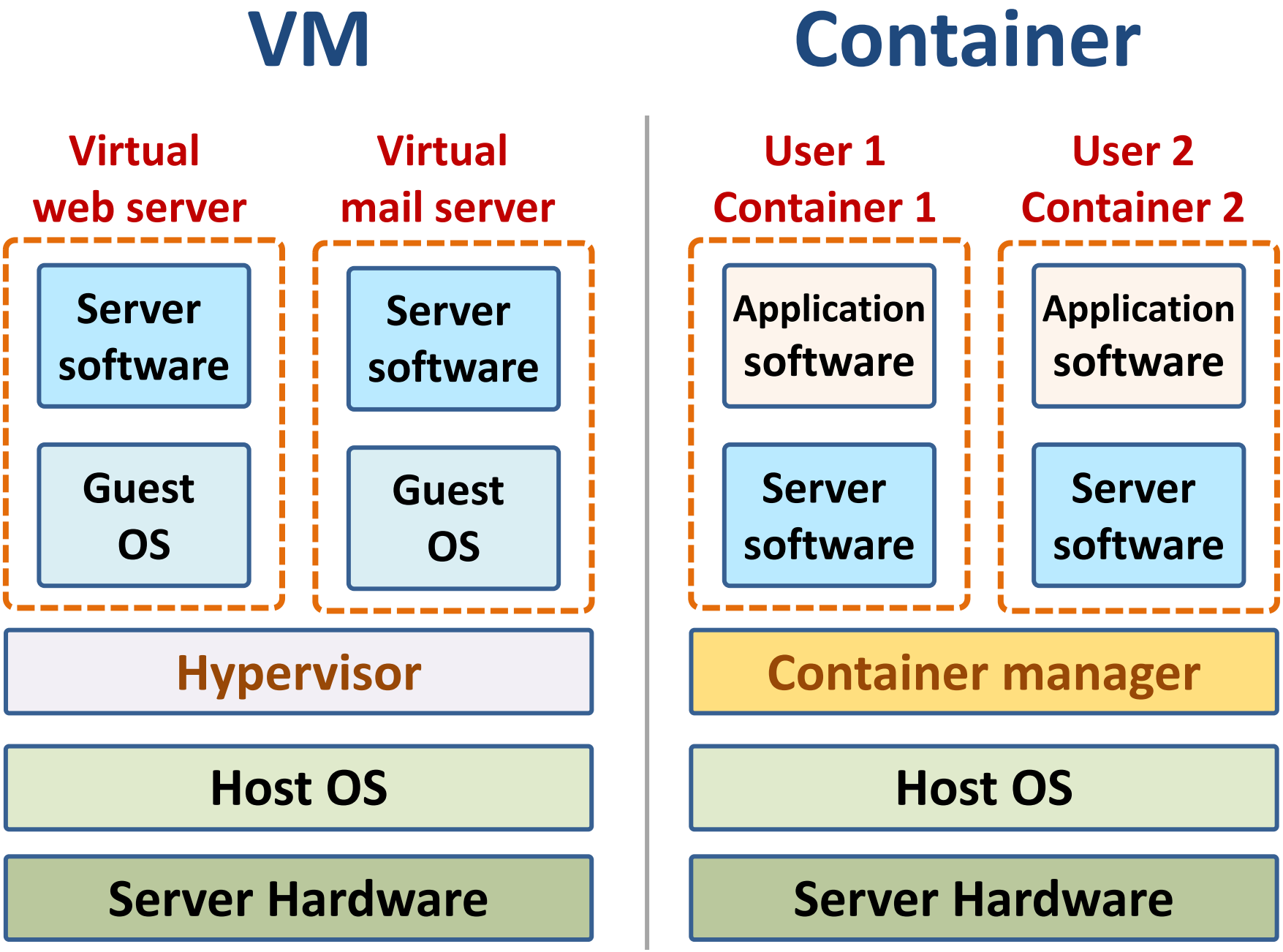


Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Service-oriented Architecture

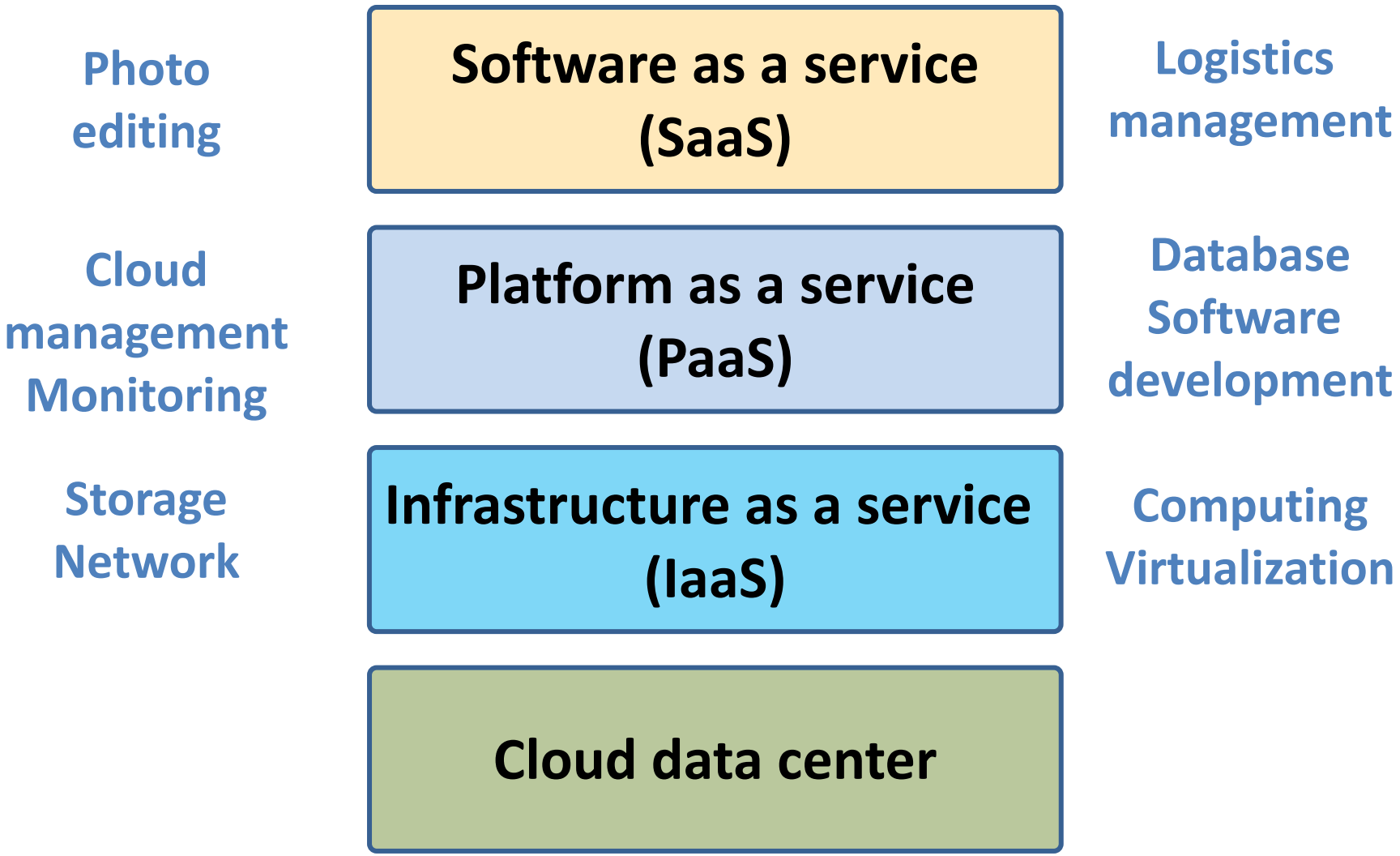


Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.



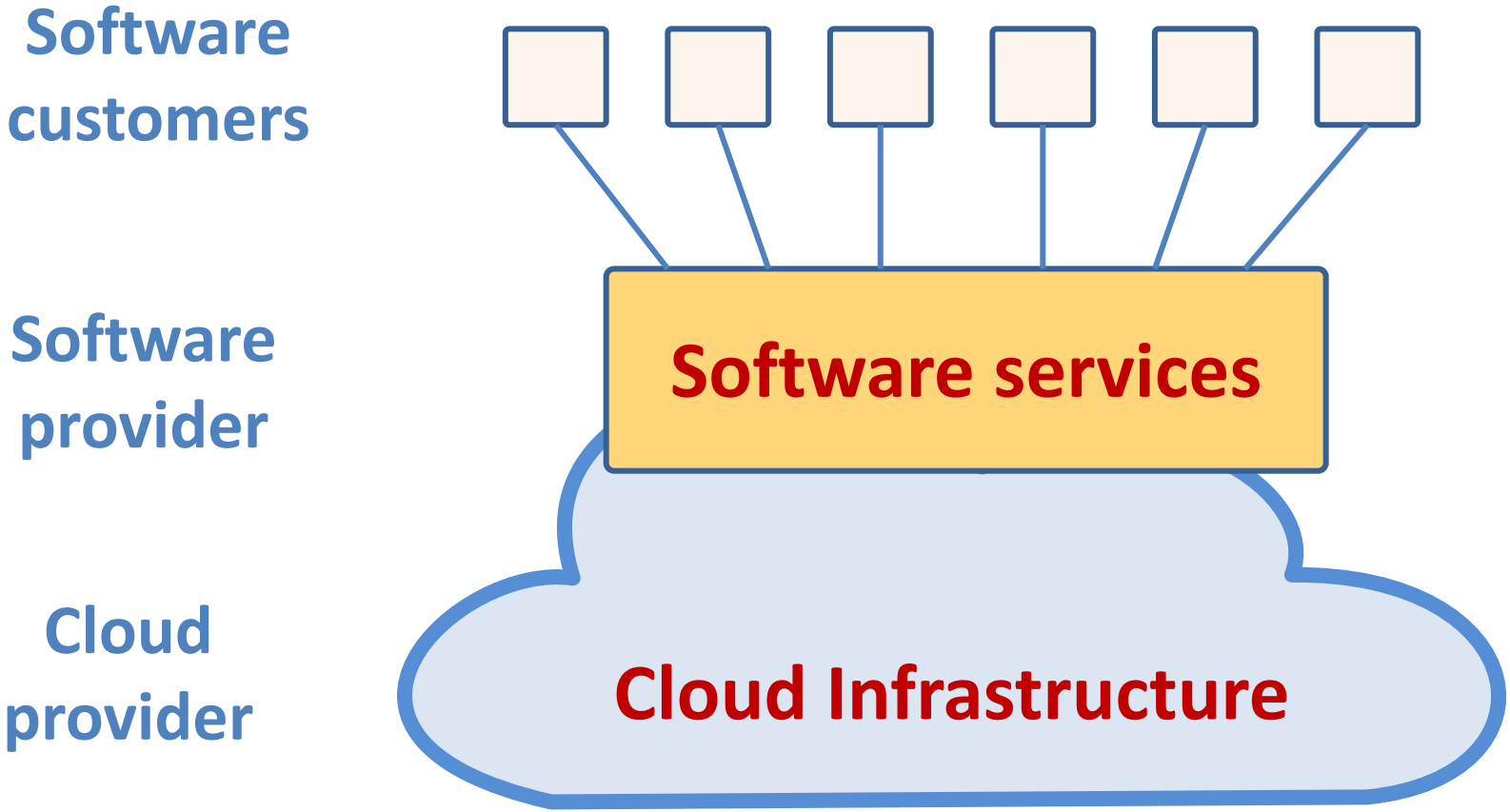
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Everything as a service



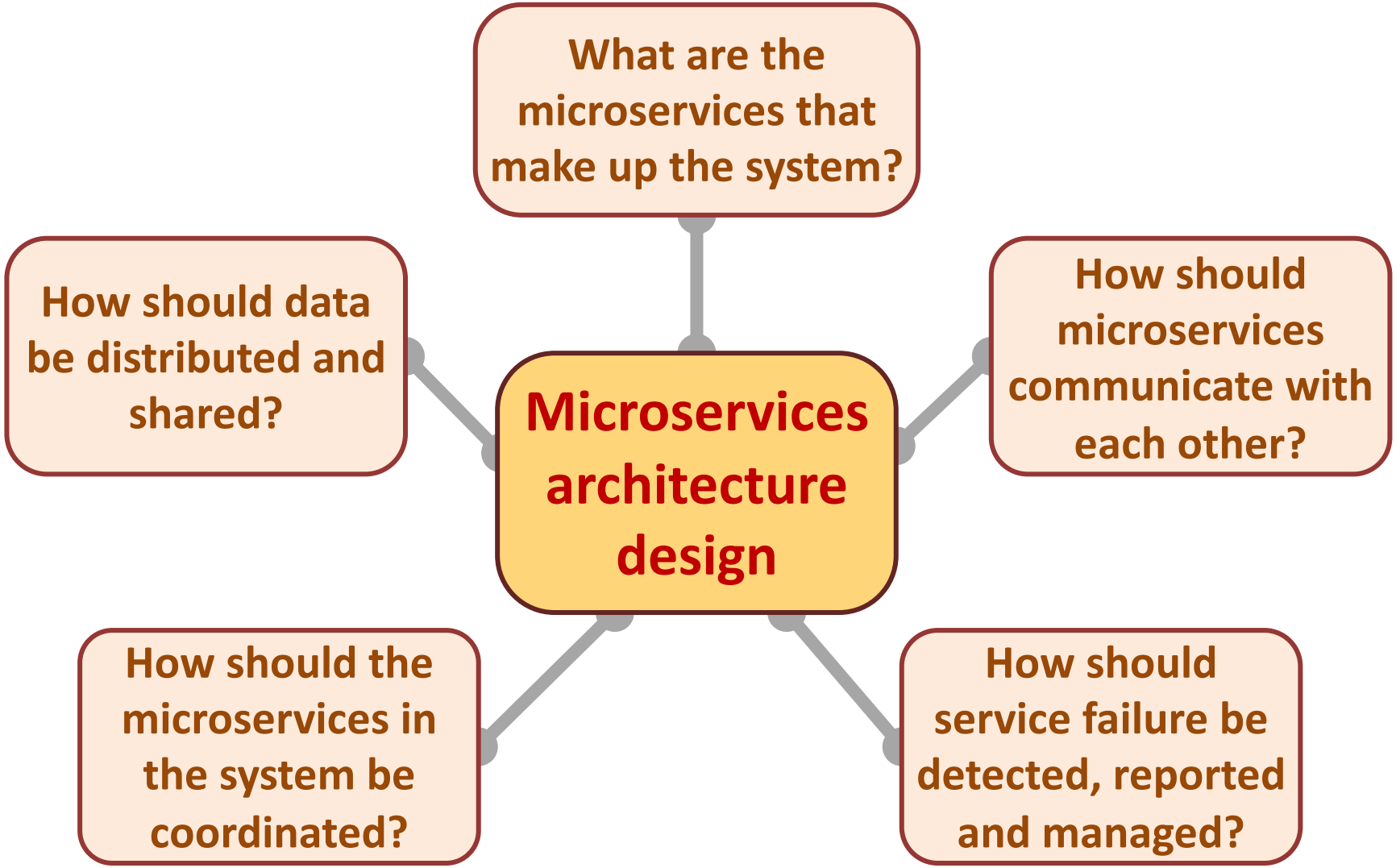
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Software as a service



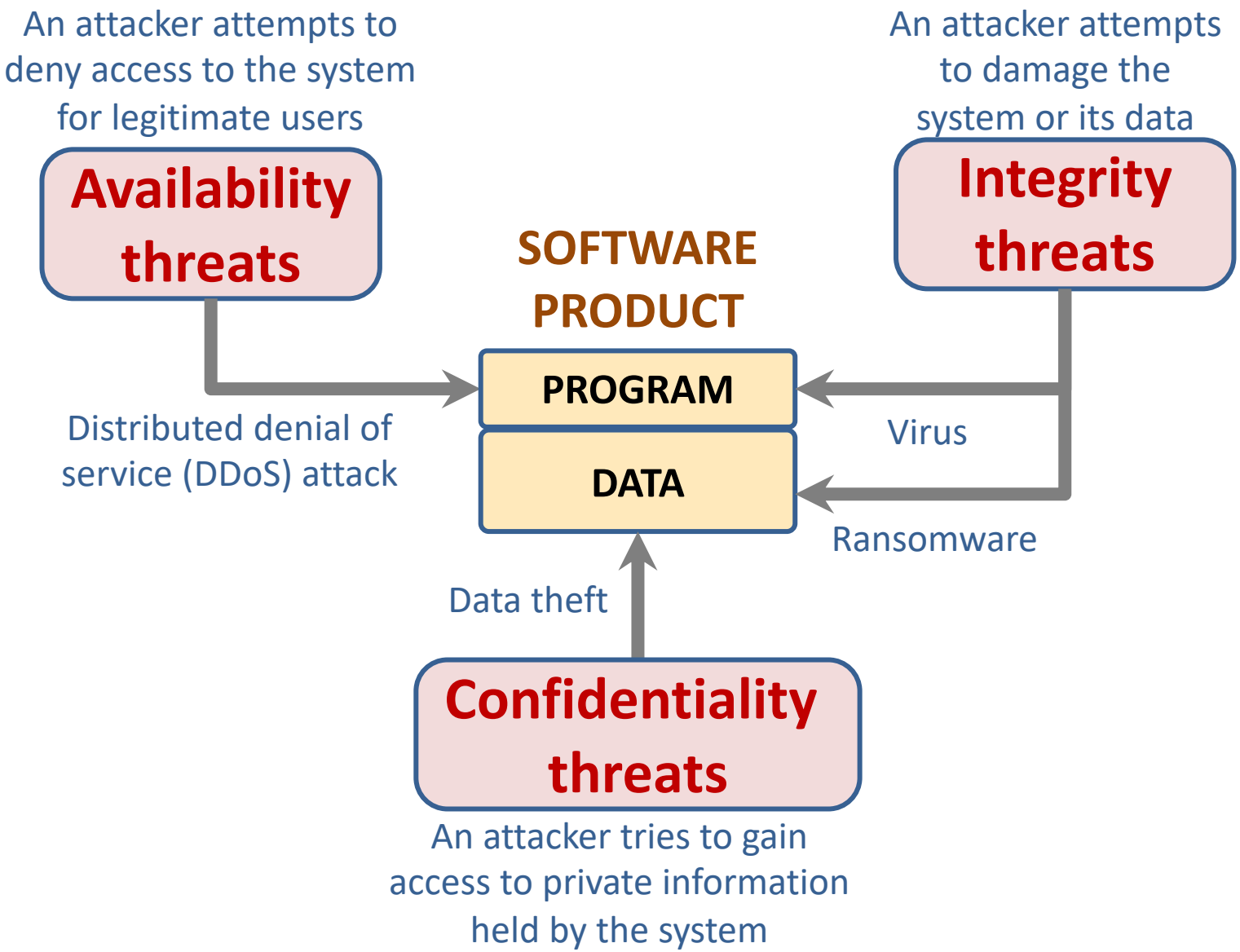
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Microservices architecture – key design questions



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Types of security threat

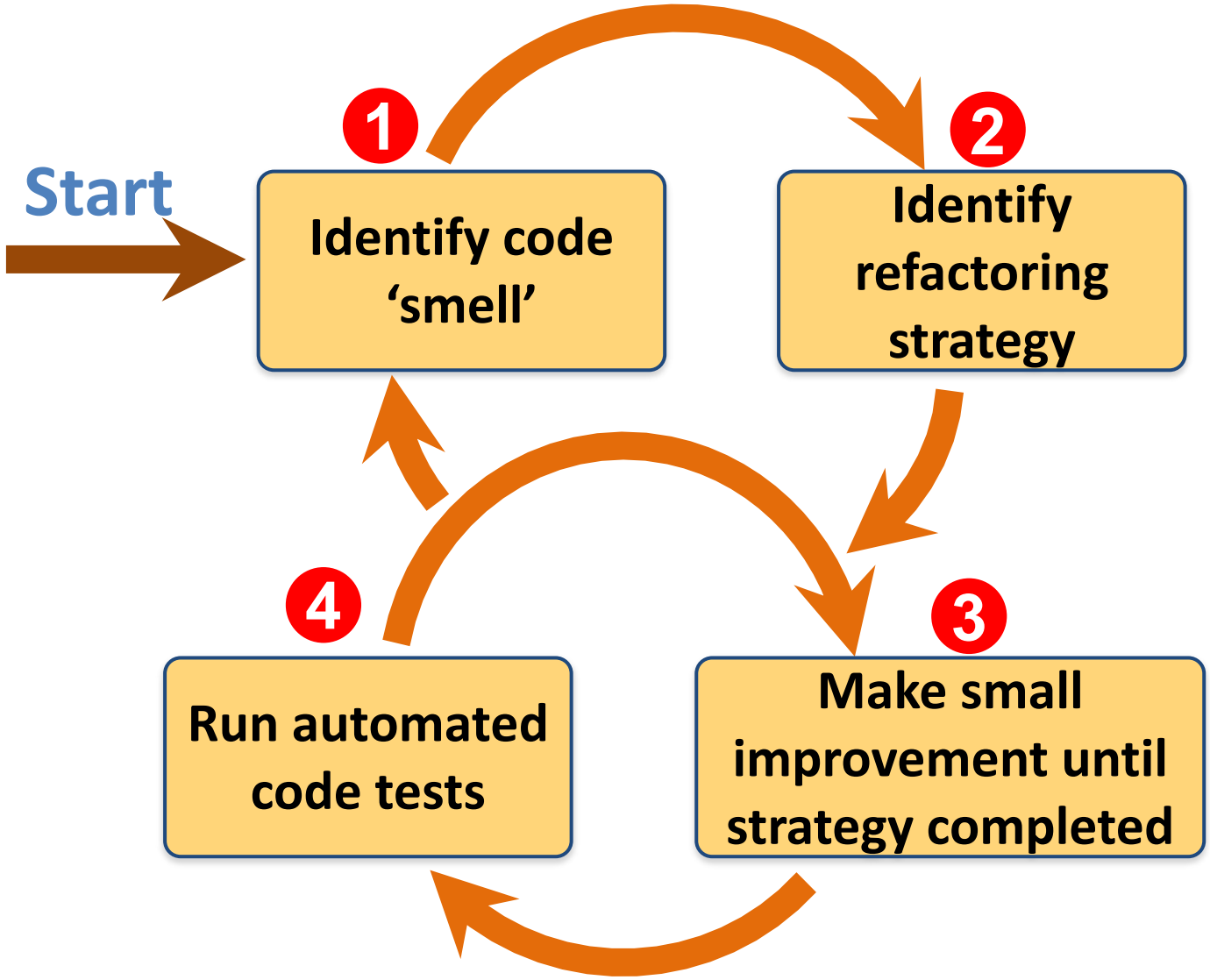


Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Software product quality attributes

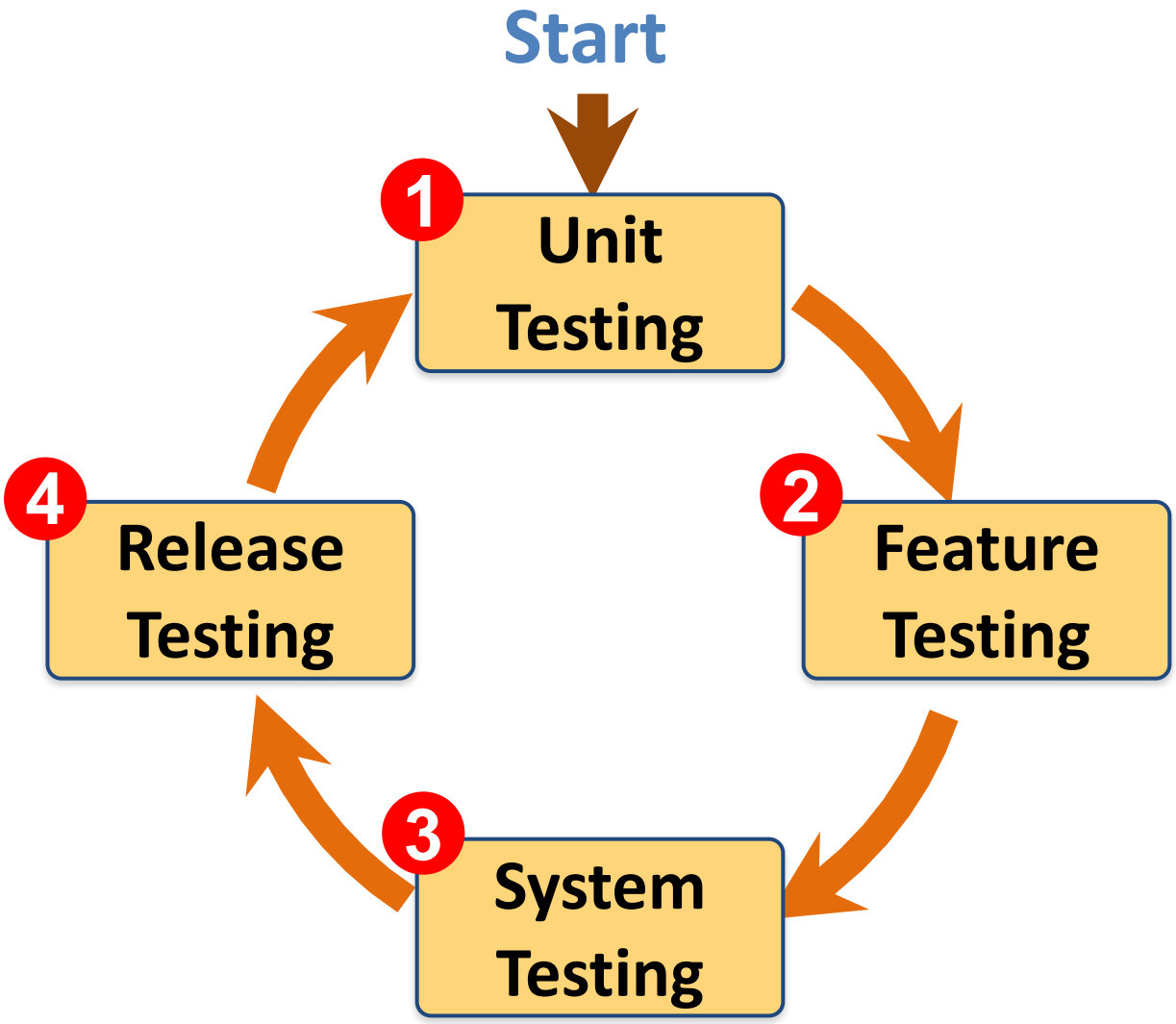
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

A refactoring process



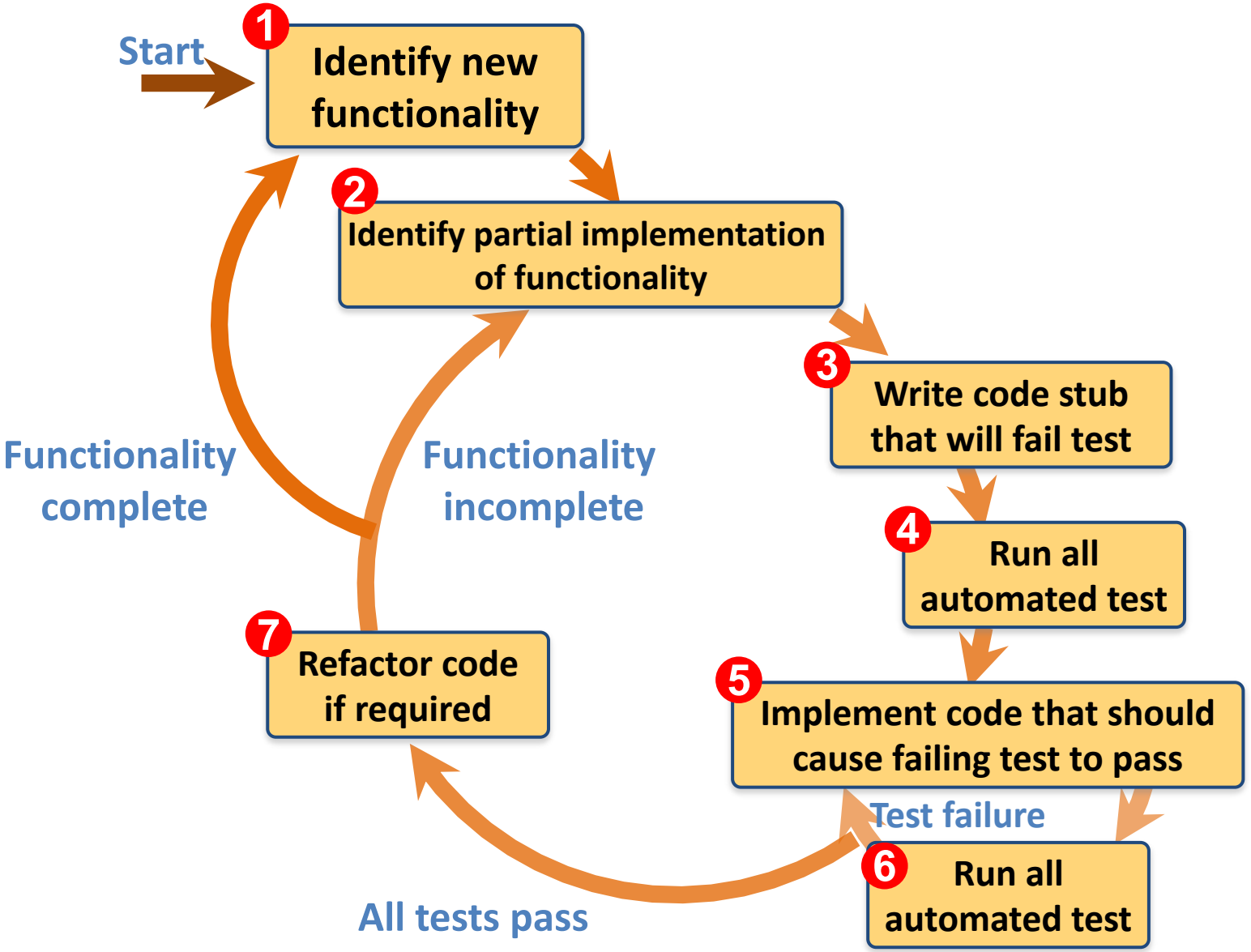
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Functional testing



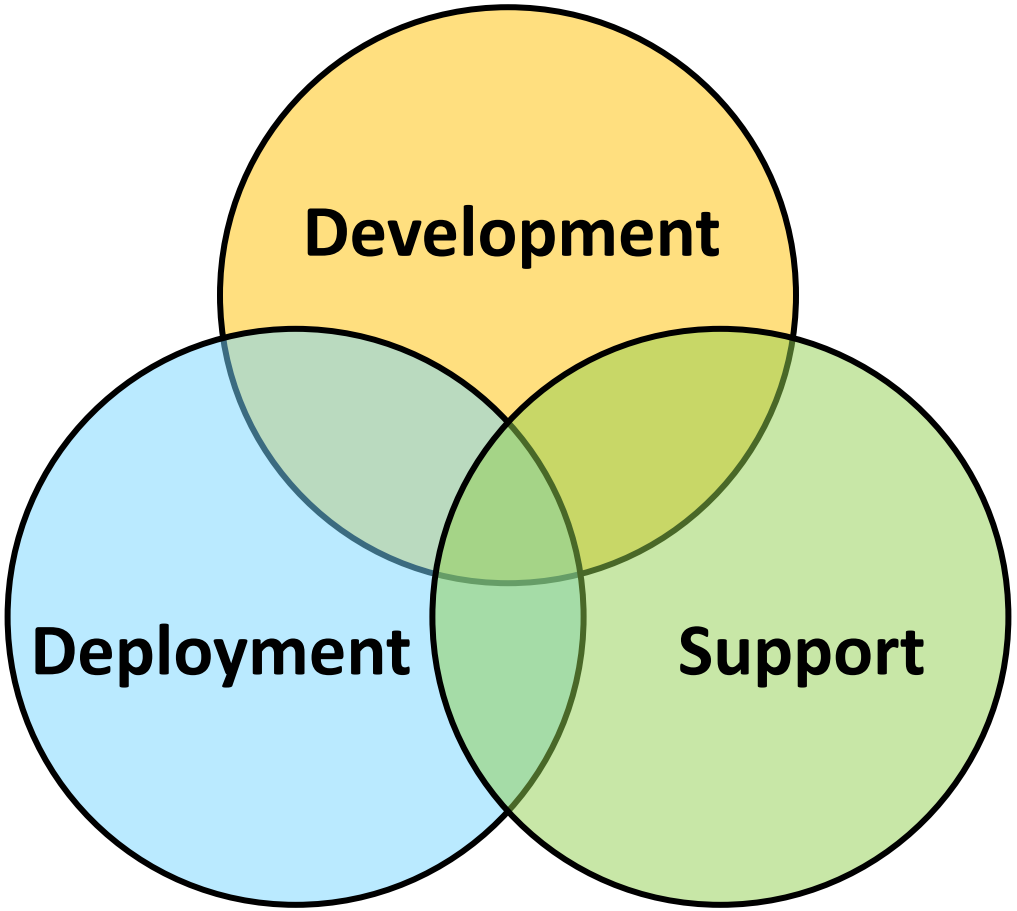
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Test-driven development (TDD)



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

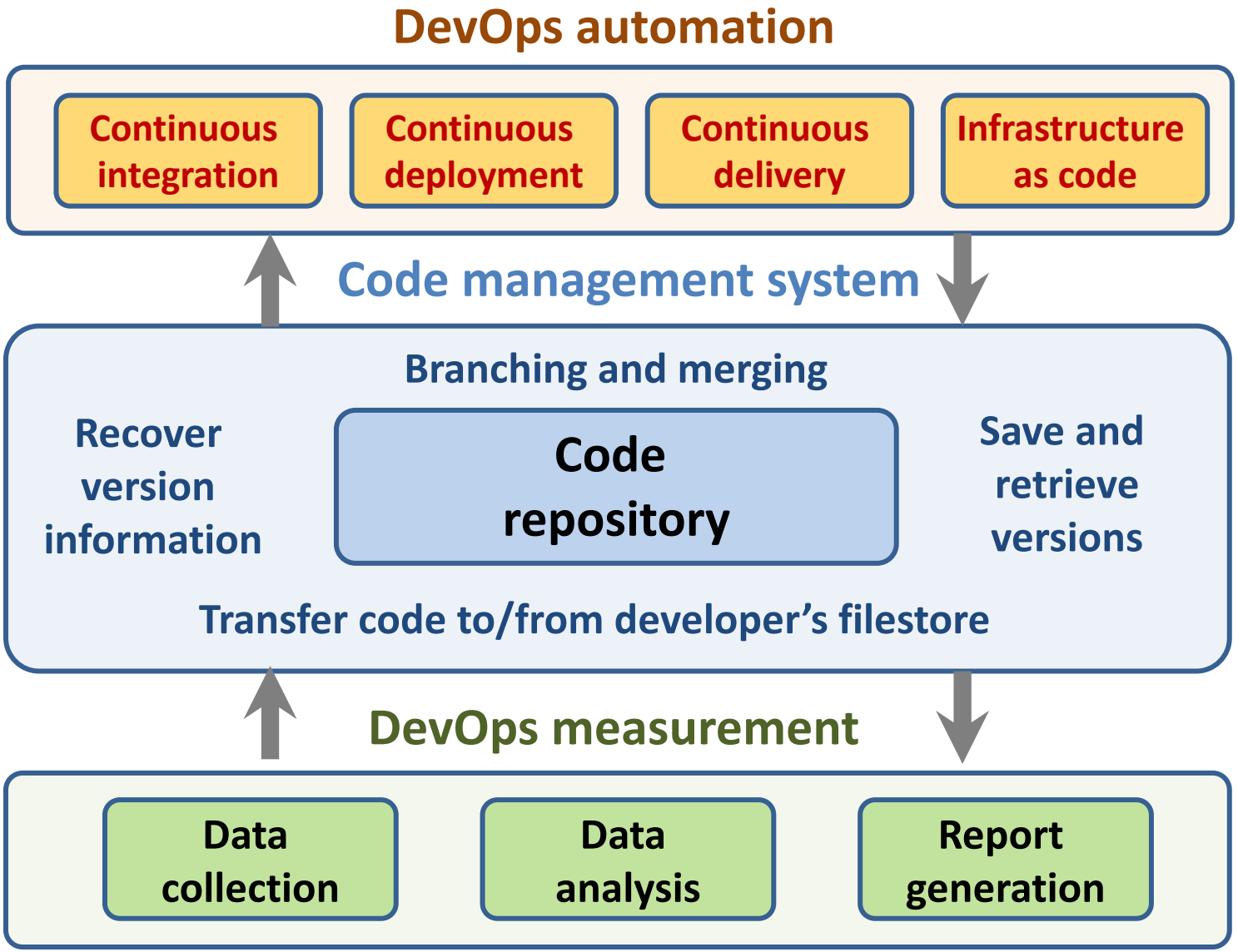
DevOps



Multi-skilled DevOps team

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

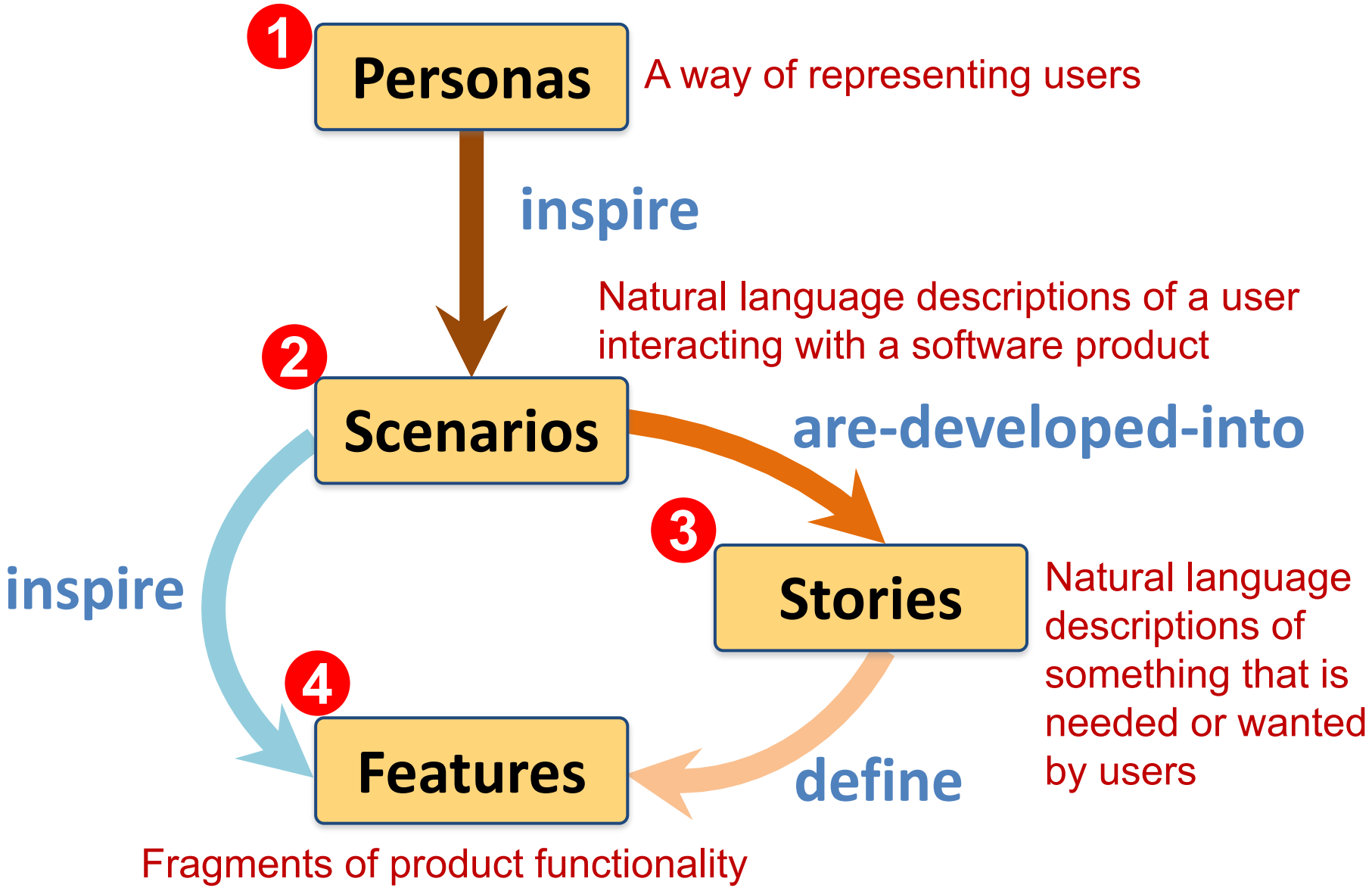
Code management and DevOps



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Personas, Features, scenarios and stories

From personas to features



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Software products

- Three factors that drive the design of software products
  - Business and consumer needs that are not met by current products
  - Dissatisfaction with existing business or consumer software products
  - Changes in technology that make completely new types of product possible
- In the early stage of product development, you are trying to understand, what product features would be useful to users, and what they like and dislike about the products that they use.

Software features

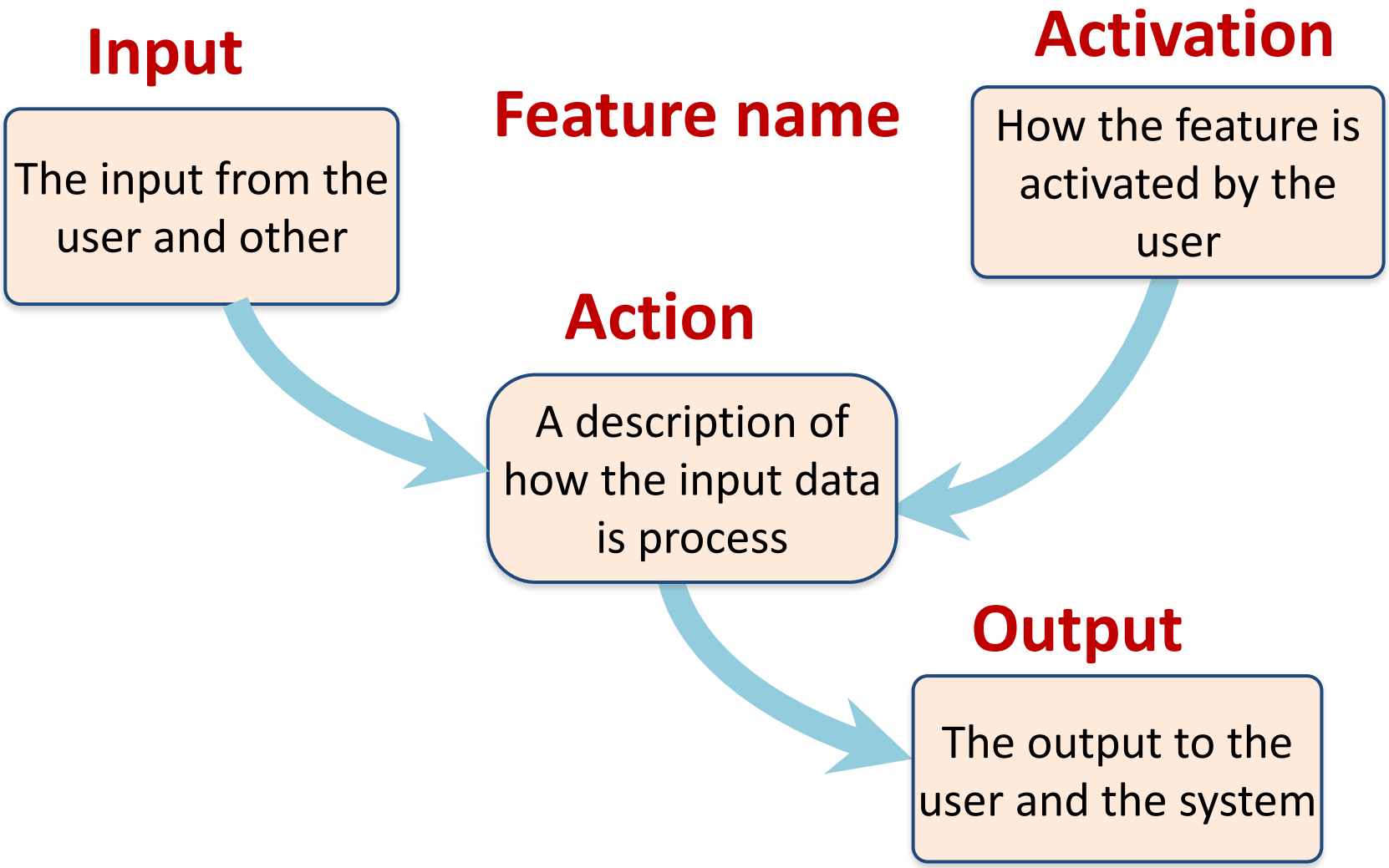
- A feature is a fragment of functionality such as a ‘print’ feature, a ‘change background feature’, a ‘new document’ feature and so on.
- Before you start programming a product, you should aim to create a list of features to be included in your product.
- The feature list should be your starting point for product design and development.

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

User understanding

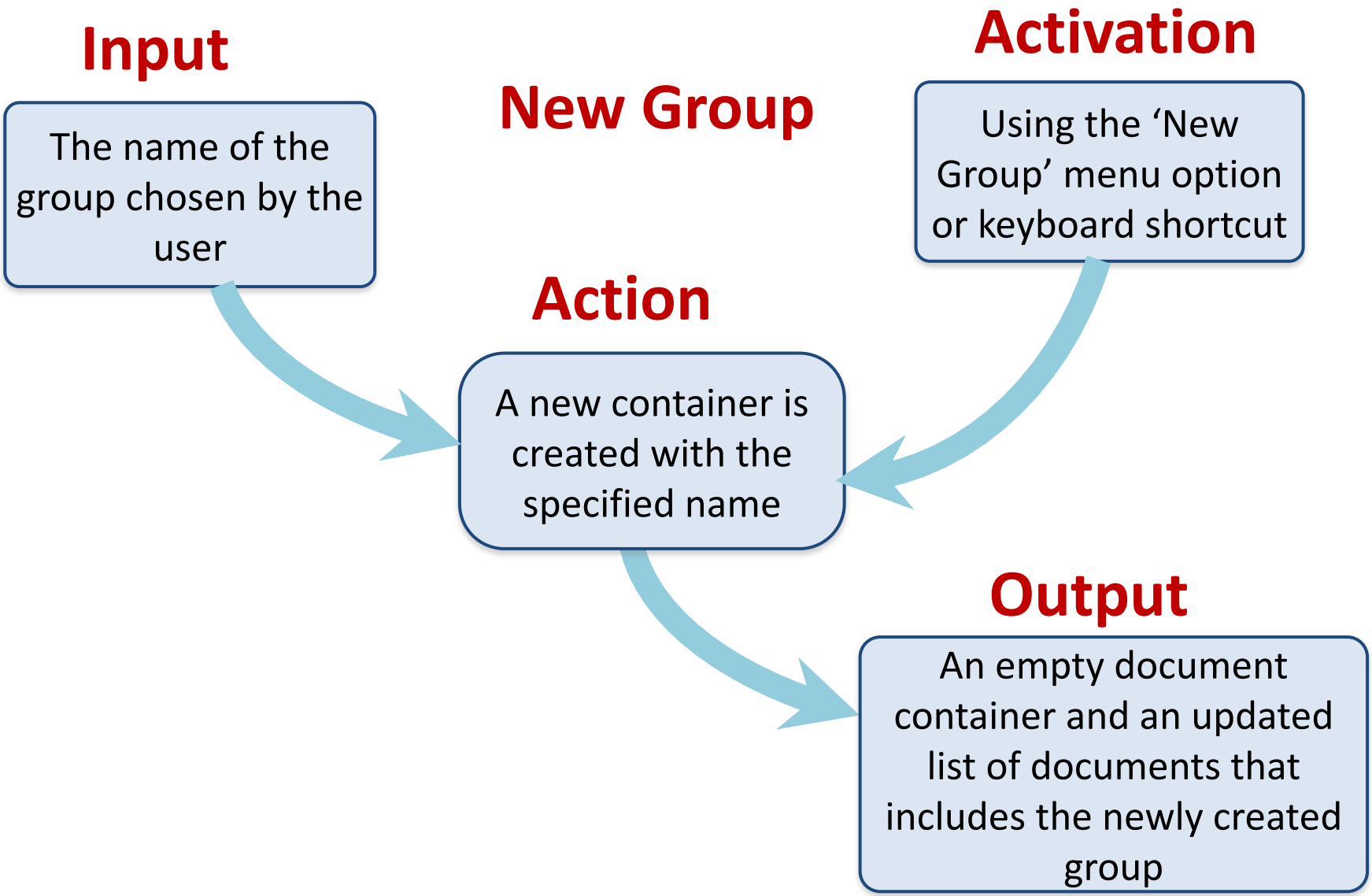
- It makes sense in any product development to spend time trying to understand the potential users and customers of your product.
- A range of techniques have been developed for understanding the ways that people work and use software.
  - These include user interviews, surveys, ethnography and task analysis.
  - Some of these techniques are expensive and unrealistic for small companies.
- Informal user analysis and discussions, which simply involve asking users about their work, the software that they use, and its strengths and weaknesses are inexpensive and very valuable.

Feature description



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

The ‘New Group’ feature description



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

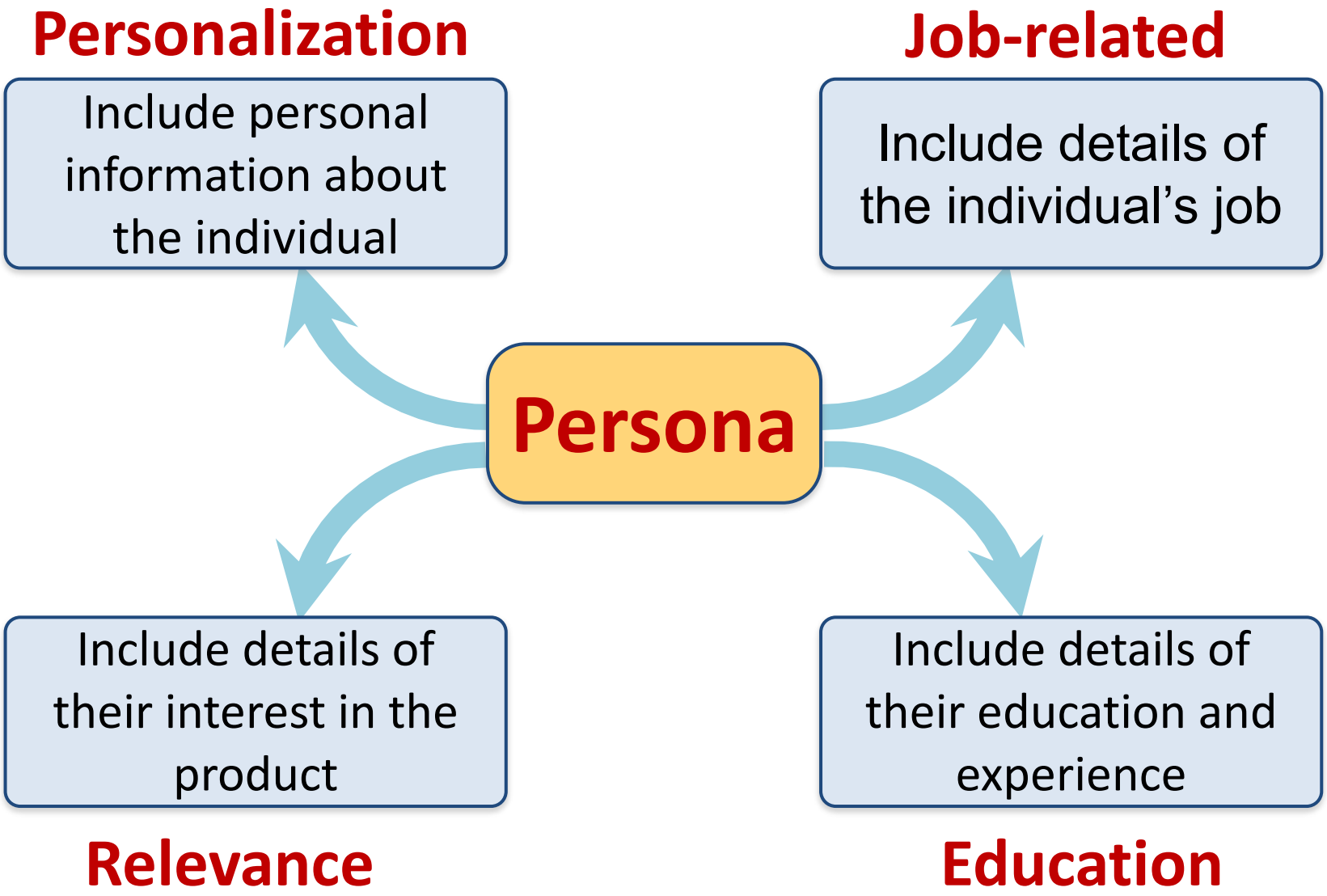
Personas

- You need to have an understanding of your potential users to design features that they are likely to find useful and to design a user interface that is suited to them.
- Personas are 'imagined users' where you create a character portrait of a type of user that you think might use your product.
  - For example, if your product is aimed at managing appointments for dentists, you might create a dentist persona, a receptionist persona and a patient persona.
- Personas of different types of user help you imagine what these users may want to do with your software and how it might be used. They help you envisage difficulties that they might have in understanding and using product features.

Persona descriptions

- A persona should 'paint a picture' of a type of product user. They should be relatively short and easy-to-read.
- Describe their background and why they might want to use your product.
- Say something about their educational background and technical skills.
- These help you assess whether or not a software feature is likely to be useful, understandable and usable by typical product users.

Persona descriptions



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Persona benefits

- Personas help you and other development team members empathize with potential users of the software.
- Personas help because they are a tool that allows developers to 'step into the user's shoes'.
  - Instead of thinking about what you would do in a particular situation, you can imagine how a persona would behave and react.
- Personas can help you check your ideas to make sure that you are not including product features that aren't really needed.
- They help you to avoid making unwarranted assumptions, based on your own knowledge, and designing an over-complicated or irrelevant product.

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

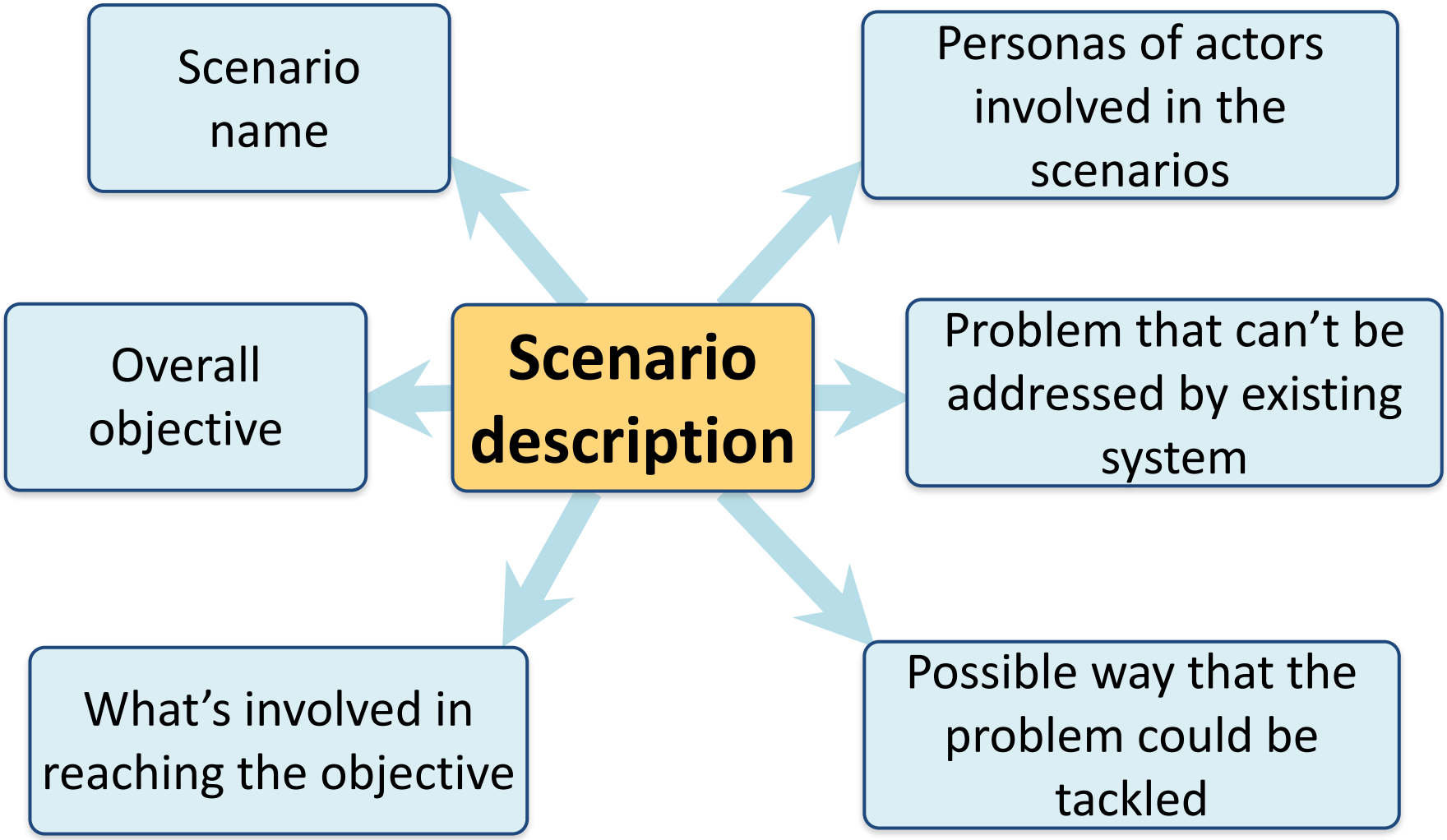
Deriving personas

- Personas should be based on an understanding of the potential product users, their jobs, their background and their aspirations.
- You should study and survey potential users to understand what they want and how they might use the product.
- From this data, you can then abstract the essential information about the different types of product user and use this as a basis for creating personas.
- Personas that are developed on the basis of limited user information are called proto-personas.
- Proto-personas may be created as a collective team exercise using whatever information is available about potential product users. They can never be as accurate as personas developed from detailed user studies, but they are better than nothing.

Scenarios

- A scenario is a narrative that describes how a user, or a group of users, might use your system.
- There is no need to include everything in a scenario – the scenario isn't a system specification.
- It is simply a description of a situation where a user is using your product's features to do something that they want to do.
- Scenario descriptions may vary in length from two to three paragraphs up to a page of text.

Elements of a scenario description



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Writing scenarios

- Scenarios should always be written from the user's perspective and based on identified personas or real users.
- Your starting point for scenario writing should be the personas that you have created. You should normally try to imagine several scenarios from each persona.
- Ideally, scenarios should be general and should not include implementation information.
- However, describing an implementation is often the easiest way to explain how a task is done.
- It is important to ensure that you have coverage of all of the potential user roles when describing a system.

User involvement

- It is easy for anyone to read and understand scenarios, so it is possible to get users involved in their development.
- The best approach is to develop an imaginary scenario based on our understanding of how the system might be used then ask users to explain what you have got wrong.
- They might ask about things they did not understand and suggest how the scenario could be extended and made more realistic.
- Our experience was that users are not good at writing scenarios.
- The scenarios that they created were based on how they worked at the moment. They were far too detailed and the users couldn't easily generalize their experience.

User stories

1	**WHO**	**As a** <role>
2	**WHAT**	**I** <want | need> **to** <do something>
3	**WHY**	**so that** <reason>

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

User stories

- **As a** <role>,
  I <want | need> **to** <do something>
  - **As** a teacher,
    I want to tell all members of my group when new information is available
- **As a** <role>
  I <want | need> **to** <do something>
  so that <reason>
  - **As** a teacher,
    I need to be able to report who is attending a class trip **so that** the school maintains the required health and safety records.

User stories

- Scenarios are high-level stories of system use. They should describe a sequence of interactions with the system but should not include details of these interactions.
- User stories are finer-grain narratives that set out in a more detailed and structured way a single thing that a user wants from a software system.
  - As an author, I need a way to organize the book that I'm writing into chapters and sections.

User stories

- This story reflects what has become the standard format of a user story:
- As a <role>, I <want | need> to <do something>
  - As a teacher, I want to tell all members of my group when new information is available
- A variant of this standard format adds a justification for the action:
  - As a <role> I <want | need> to <do something> so that <reason>
    - As a teacher, I need to be able to report who is attending a class trip so that the school maintains the required health and safety records.

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

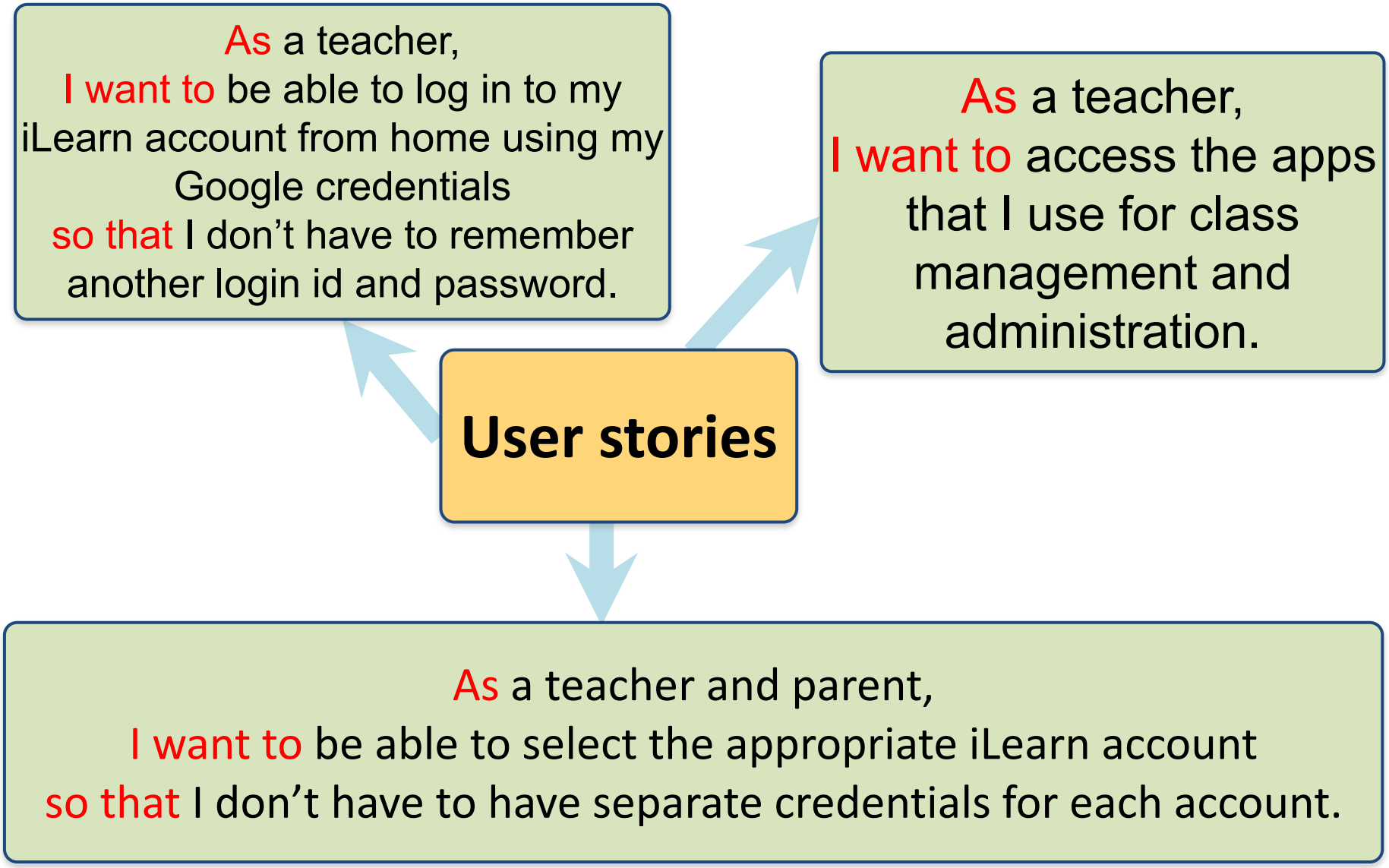
User stories in planning

- An important use of user stories is in planning.
  - Many users of the Scrum method represent the product backlog as a set of user stories.
- User stories should focus on a clearly defined system feature or aspect of a feature that can be implemented within a single sprint.

User stories in planning

- If the story is about a **more complex feature** that might **take several sprints** to implement, then it is called an **epic**.
  - As a system manager, I need a way to backup the system and restore either individual applications, files, directories or the whole system.
  - There is a lot of functionality associated with this user story. For implementation, it should be broken down into simpler stories with each story focusing on a single aspect of the backup system.

User stories from Emma's scenario



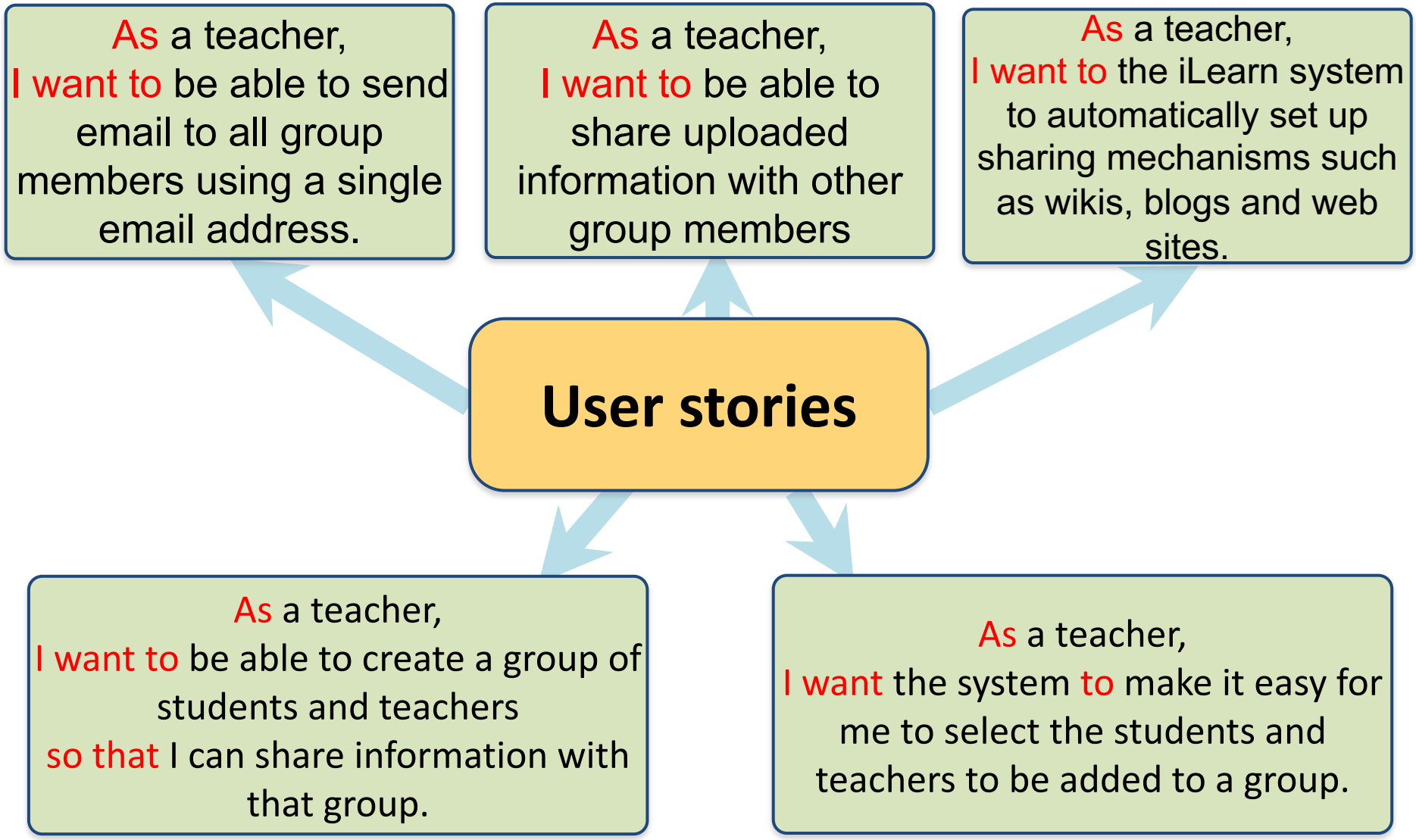
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature description using user stories

- Stories can be used to describe features in your product that should be implemented.

- Each feature can have a set of associated stories that describe how that feature is used.

User stories describing the Groups feature



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Stories and scenarios

- As you can express all of the functionality described in a scenario as user stories, do you really need scenarios?'
- Scenarios are more natural and are helpful for the following reasons:
  - Scenarios read more naturally because they describe what a user of a system is actually doing with that system. People often find it easier to relate to this specific information rather than the statement of wants or needs set out in a set of user stories.
  - If you are interviewing real users or are checking a scenario with real users, they don't talk in the stylized way that is used in user stories. People relate better to the more natural narrative in scenarios.
  - Scenarios often provide more context - information about what the user is trying to do and their normal ways of working. You can do this in user stories, but it means that they are no longer simple statements about the use of a system feature.

Feature identification

- Your aim in the initial stage of product design should be to create a list of features that define your product.
- A feature is a way of allowing users to access and use your product's functionality so the feature list defines the overall functionality of the system.
- Features should be independent, coherent and relevant.

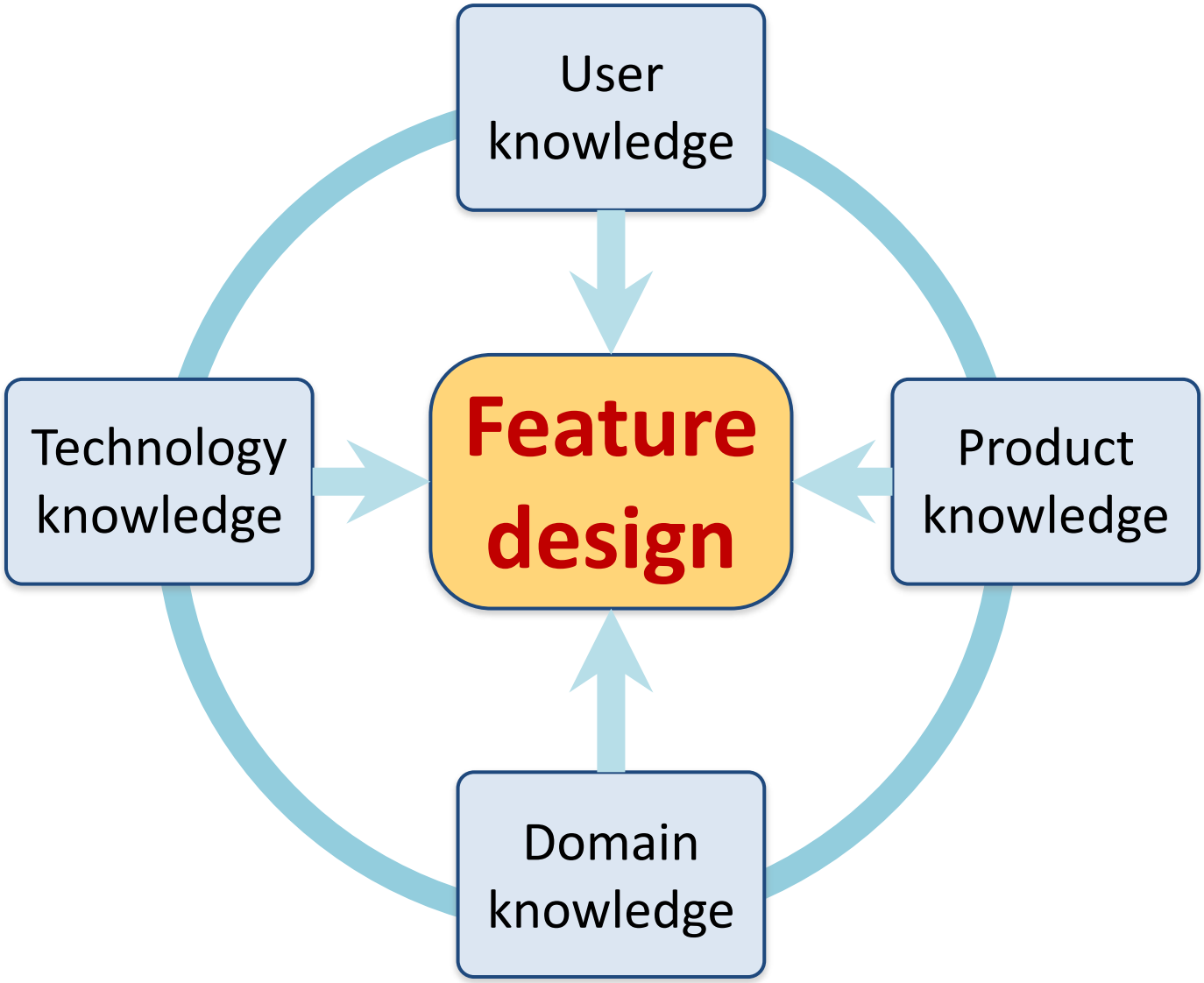
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature identification

- Features should be independent, coherent and relevant:
  - **Independence**
    Features should not depend on how other system features are implemented and should not be affected by the order of activation of other features.
  - **Coherence**
    Features should be linked to a single item of functionality. They should not do more than one thing and they should never have side-effects.
  - **Relevance**
    Features should reflect the way that users normally carry out some task. They should not provide obscure functionality that is hardly ever required.

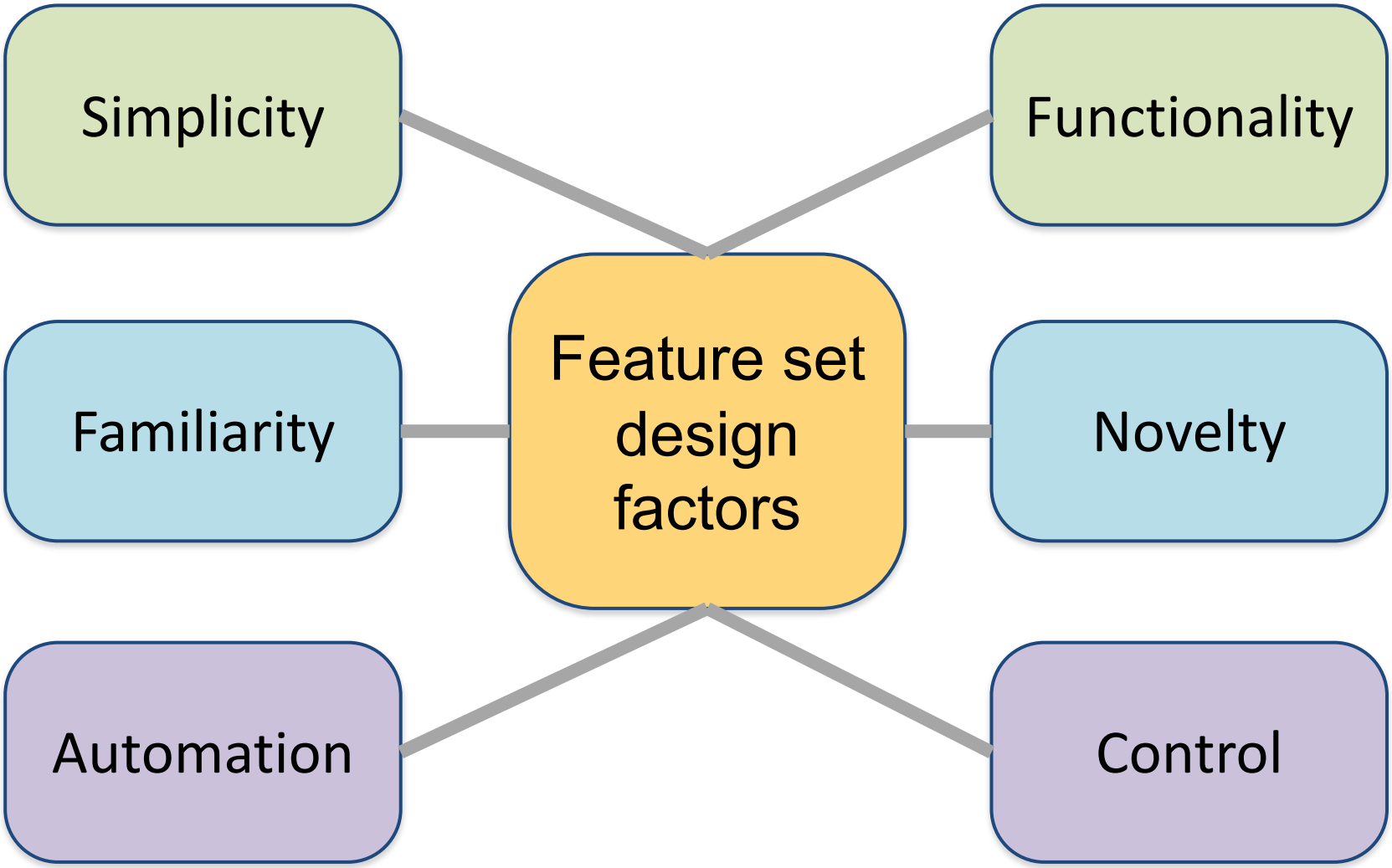
Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature design



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Factors in feature set design



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature trade-offs

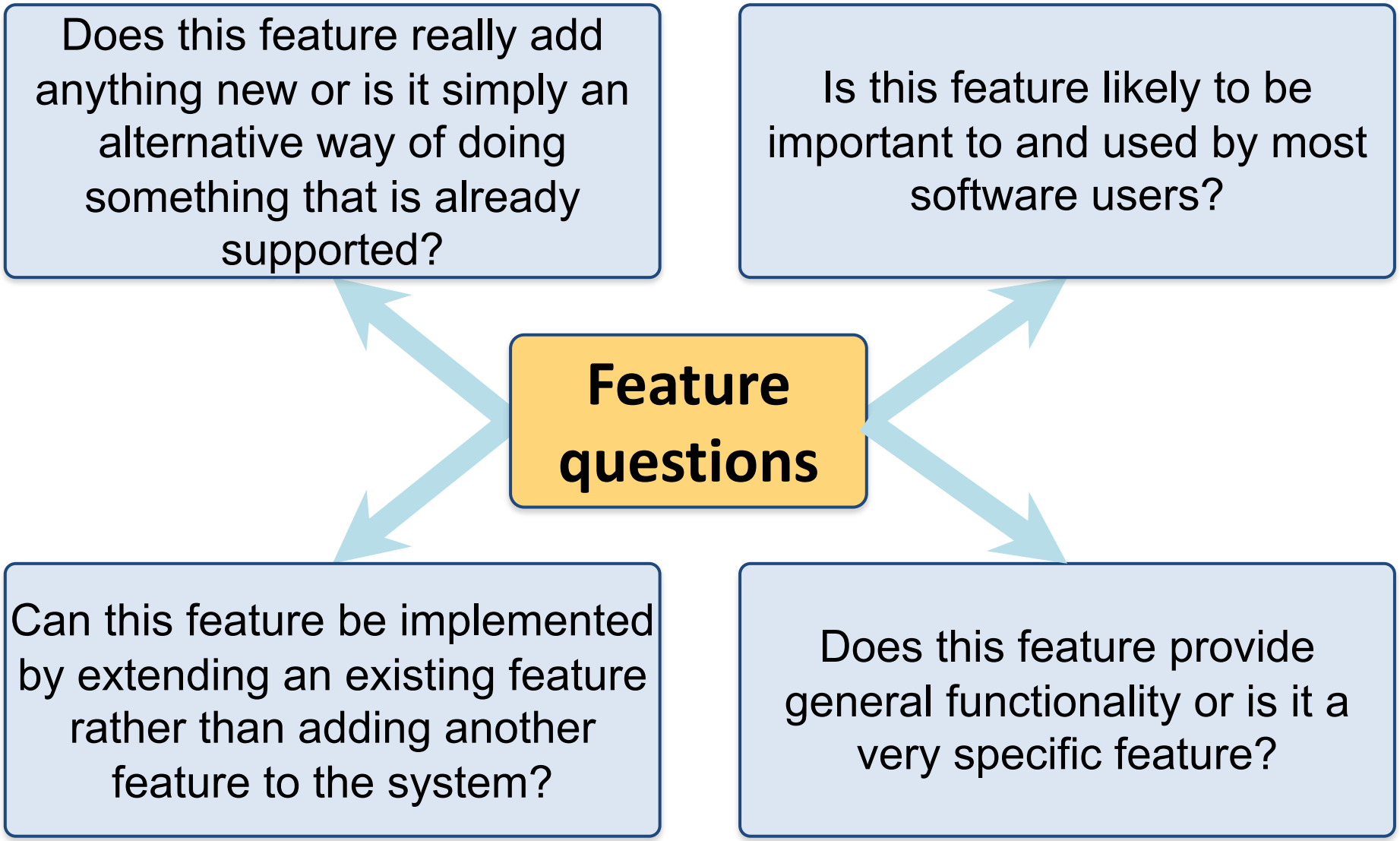
- Simplicity and functionality
  - You need to find a balance between providing a simple, easy-to-use system and including enough functionality to attract users with a variety of needs.
- Familiarity and novelty
  - Users prefer that new software should support the familiar everyday tasks that are part of their work or life. To encourage them to adopt your system, you need to find a balance between familiar features and new features that convince users that your product can do more than its competitors.
- Automation and control
  - Some users like automation, where the software does things for them. Others prefer to have control. You have to think carefully about what can be automated, how it is automated and how users can configure the automation so that the system can be tailored to their preferences.

Feature creep

- Feature creep occurs when new features are added in response to user requests without considering whether or not these features are generally useful or whether they can be implemented in some other way.
- Too many features make products hard to use and understand
- There are three reasons why feature creep occurs:
  - Product managers are reluctant to say 'no' when users ask for specific features.
  - Developers try to match features in competing products.
  - The product includes features to support both inexperienced and experienced users.

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Avoiding feature creep



Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature derivation

- Features can be identified directly from the product vision or from scenarios.
- You can highlight phrases in narrative description to identify features to be included in the software.
  - You should think about the features needed to support user actions, identified by active verbs, such as use and choose.

The iLearn system vision

- FOR teachers and educators WHO need a way to help students use web-based learning resources and applications, THE iLearn system is an open learning environment THAT allows the set of resources used by classes and students to be easily configured for these students and classes by teachers themselves.
- UNLIKE Virtual Learning Environments, such as Moodle, the focus of iLearn is the learning process itself, rather than the administration and management of materials, assessments and coursework. OUR product enables teachers to create subject and age-specific environments for their students using any web-based resources, such as videos, simulations and written materials that are appropriate

Features from the product vision

- A feature that allows users to access and use existing web-based resources;
- A feature that allows the system to exist in multiple different instantiations;
- A feature that allows user configuration of the system to create a specific instantiation.

Source: Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.

Feature description using user stories

- Description
  - As a system manager, I want to create and configure an iLearn environment by adding and removing services to/from that environment so that I can create environments for specific purposes.
  - As a system manager, I want to set up sub-environments that include a subset of services that are included in another environment.
  - As a system manager, I want to assign administrators to created environments.
  - As a system manager, I want to limit the rights of environment administrators so that they cannot accidentally or deliberately disrupt the operation of key services.
  - As a teacher, I want to be able to add services that are not integrated with the iLearn authentication system.
- Constraints
  - The use of some tools may be limited for license reasons so there may be a need to access license management tools during configuration.
- Comments
  - Based on Elena's and Jack's scenarios

Innovation and feature identification

- Scenarios and user stories should always be your starting point for identifying product features.
- Scenarios tell you how users work at the moment. They don't show how they might change their way of working if they had the right software to support them.
- Stories and scenarios are 'tools for thinking' and they help you gain an understanding of how your software might be used. You can identify a feature set from stories and scenarios.
- User research, on its own, rarely helps you innovate and invent new ways of working.
- You should also think creatively about alternative or additional features that help users to work more efficiently or to do things differently.

Summary

- A software product feature is a fragment of functionality that implements something that a user may need or want when using the product.
- The first stage of product development is to identify the list of product features in which you identify each feature and give a brief description of its functionality.
- Personas are 'imagined users' where you create a character portrait of a type of user that you think might use your product.

Summary

- A persona description should 'paint a picture' of a typical product user. It should describe their educational background, technology experience and why they might want to use your product.
- A scenario is a narrative that describes a situation where a user is accessing product features to do something that they want to do.

Summary

- Scenarios should always be written from the user's perspective and should be based on identified personas or real users.
- User stories are finer-grain narratives that set out, in a structured way, something that a user wants from a software system.

Summary

- User stories may be used as a way of extending and adding detail to a scenario or as part of the description of system features.
- The key influences in feature identification and design are user research, domain knowledge, product knowledge, and technology knowledge.
- You can identify features from scenarios and stories by highlighting user actions in these narratives and thinking about the features that you need to support these actions.

References

- Ian Sommerville (2019), Engineering Software Products: An Introduction to Modern Software Engineering, Pearson.
- Ian Sommerville (2015), Software Engineering, 10th Edition, Pearson.
- Titus Winters, Tom Manshreck, and Hyrum Wright (2020), Software Engineering at Google: Lessons Learned from Programming Over Time, O'Reilly Media.
- Project Management Institute (2021), A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Seventh Edition and The Standard for Project Management, PMI
- Project Management Institute (2017), A Guide to the Project Management Body of Knowledge (PMBOK Guide), Sixth Edition, Project Management Institute
- Project Management Institute (2017), Agile Practice Guide, Project Management Institute