

# Projektowanie oprogramowania systemów

## System software design

**Politechnika Gdańska**

Katedra systemów multimedialnych

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# PLAN OF THE COURSE AND ASSESSMENT

- Lecture:
  - first half of semester
  - finished by exam
- Project
  - second half of semester
- Assessment:
  - exam – 50%
  - project – 50%

# Agenda

- System Development Life Cycle (SDLC)
- Business Analysis
- Analysis – methods
- Solutions Architecture
  - What is IT architecture
  - Architecture development method
  - Architecture governance
  - Reference models
  - Content metamodel
- Specific dedicated solutions
  - Mobile
  - Cloud
- DevOPS
- Developers tools
- Project management
- Design patterns, tests

# What is DevOps & DevOps Tools

1. The word DevOps is a combination of two words that is development and operations. This is a culture that promotes the collaboration between development team and the operations team. With the help of DevOps, The applications can be delivered faster and serve their customer needs nicely.



# Why DevOps is Needed?

- Before DevOps, the development and operation team worked in complete isolation.
- Testing and Deployment were isolated activities done after design-build. Hence they consumed more time than actual build cycles.
- Without using DevOps, team members are spending a large amount of their time in testing, deploying, and designing instead of building the project.
- Manual code deployment leads to human errors in production
- Coding & operation teams have their separate timelines and are not in synch causing further delays.

# How is DevOps different from traditional IT

Old Process	DevOps
After placing an order for new servers, the Development team works on testing. The Operations team works on extensive paperwork as required in enterprises to deploy the infrastructure.	After placing an order for new servers Development and Operations team work together on the paperwork to set-up the new servers. This results in better visibility of infrastructure requirement.
Projection about failover, redundancy, data center locations, and storage requirements are skewed as no inputs are available from developers who have deep knowledge of the application.	Projection about failover, redundancy, disaster recovery, data center locations, and storage requirements are pretty accurate due to the inputs from the developers.
Operations team has no clue on the progress of the Development team. Operations team develop a monitoring plan as per their understanding.	In DevOps, the Operations team is completely aware of the progress the developers are making. Operations team interact with developers and jointly develop a monitoring plan that caters to the IT and business needs. They also use advance Application Performance Monitoring (APM) Tools
Before go-live, the load testing crashes the application. The release is delayed.	Before go-live, the load testing makes the application a bit slow. The development team quickly fixes the bottlenecks. The application is released on time.

# Why is DevOps used?

DevOps allows Agile Development Teams to implement Continuous Integration and Continuous Delivery. This helps them to launch products faster into the market.

Other Important reasons are:

- 1. Predictability:** DevOps offers significantly lower failure rate of new releases
- 2. Reproducibility:** Version everything so that earlier version can be restored anytime.
- 3. Maintainability:** Effortless process of recovery in the event of a new release crashing or disabling the current system.
- 4. Time to market:** DevOps reduces the time to market up to 50% through streamlined software delivery. This is particularly the case for digital and mobile applications.
- 5. Greater Quality:** DevOps helps the team to provide improved quality of application development as it incorporates infrastructure issues.
- 6. Reduced Risk:** DevOps incorporates security aspects in the software delivery lifecycle. It helps in reduction of defects across the lifecycle.
- 7. Resiliency:** The Operational state of the software system is more stable, secure, and changes are auditable.
- 8. Cost Efficiency:** DevOps offers cost efficiency in the software development process which is always an aspiration of IT companies' management.
- 9. Breaks larger code base into small pieces:** DevOps is based on the agile programming method. Therefore, it allows breaking larger code bases into smaller and manageable chunks.

# DevOps Lifecycle

DevOps is deep integration between development and operations. Understanding DevOps is not possible without knowing DevOps lifecycle.

## 1. Development

In this DevOps stage the development of software takes place constantly. In this phase, the entire development process is separated into small development cycles. This benefits DevOps team to speed up software development and delivery process.

## 2. Testing

QA team use tools like Selenium to identify and fix bugs in the new piece of code.

## 3. Integration

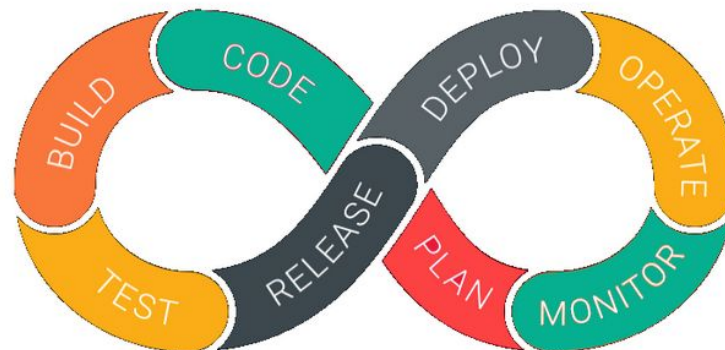
In this stage, new functionality is integrated with the prevailing code, and testing takes place. Continuous development is only possible due to continuous integration and testing.

## 4. Deployment

In this phase, the deployment process takes place continuously. It is performed in such a manner that any changes made any time in the code, should not affect the functioning of high traffic website.

## 5. Monitoring

In this phase, operation team will take care of the inappropriate system behavior or bugs which are found in production.





# DevOps vs Agile



- Agile approach address the gap between customer and developer communities.
- DevOps approach address the gap between developer and IT operations communications

Agile	DevOps
Emphasize breaking down barriers between developers and management.	DevOps is about software deployment and operation teams.
Addresses gap between customer requirements and development teams.	Addresses the gap between development and Operation team
Focuses more on functional and non-functional readiness	It focuses operational and business readiness.
Agile development pertains mainly to the way development is thought out by the company.	DevOps emphasizes on deploying software in the most reliable and safest ways which aren't necessarily always the fastest.
Agile development puts a huge emphasis on training all team members to have varieties of similar and equal skills. So that, when something goes wrong, any team member can get assistance from any member in the absence of the team leader.	DevOps, likes to divide and conquer, spreading the skill set between the development and operation teams. It also maintains consistent communication.
Agile development manages on "sprints. It means that the time table is much shorter (less than a month) and several features are to be produced and released in that period.	DevOps strives for consolidated deadlines and benchmarks with major releases, rather than smaller and more frequent ones.

# DevOps Principles

- **Customer-Centric Action:** DevOps team must take customer-centric action for that they should constantly invest in products and services.
- **End-To-End Responsibility:** The DevOps team need to provide performance support until they become end-of-life. This enhances the level of responsibility and the quality of the products engineered.
- **Continuous Improvement:** DevOps culture focuses on continuous improvement to minimize waste. It continuously speeds up the improvement of product or services offered.
- **Automate everything:** Automation is a vital principle of DevOps process. This is not only for the software development but also for the entire infrastructure landscape.
- **Work as one team:** In the DevOps culture role of the designer, developer, and tester are already defined. All they needed to do is work as one team with complete collaboration.
- **Monitor and test everything:** It is very important for DevOps team to have a robust monitoring a

## DevOps Automation Tools

Automation tools are vital to automate the test scripts and to achieve speed and the agility. The process is known as the DevOps Automation.

The difficulties faced by the IT team when managing large IT infrastructure are divided into six major categories.

1. Infrastructure Automation
2. Configuration Management
3. Deployment Automation
4. Performance Management
5. Log Management
6. Monitoring

# DevOps - summary

- DevOps is a culture which promotes collaboration between Development and Operations Team to deploy code to production faster in an automated & repeatable way
- Before DevOps operation and Development team working in completed isolation.
- Manual code deployment leads to human errors in production
- In the Old process, Operations team has no clue on the progress of the Development team. So, operations team developed a IT infrastructure purchase and monitoring plan as per their understanding.
- In the DevOps process operation team fully aware of the progress of developer. The purchase and monitoring planning is accurate.
- DevOps offers Maintainability, Predictability, Greater quality cost efficiency and time to market.
- Agile process focuses on functional and non-functional readiness while DevOps focuses on that IT infrastructure aspects.
- DevOps life cycle includes Development, Testing, Integration, Deployment, and Monitoring.
- DevOps engineer will work with development team staff to tackle the coding and scripting needs.
- DevOps engineer should have the soft skill of a problem-solver and be a quick-learner
- DevOps Certifications are available from Amazon web services, Red Hat, Microsoft Academy, DevOps Institute
- DevOps helps organizations in shifting their code deployment cycles to weeks and months instead of years.

# Project Management

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# Project Management

## What is a Project?

“Unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including constraints of time, cost, quality and resources”

- A Project is a planned set of activities
- A Project has a scope
- A Project has time, cost, quality and resource constraints

# What is Project Management?

**The art of organising, leading, reporting and completing a project through people**

- A project is a planned undertaking
- A project manager is a person who causes things to happen
- Therefore, project management is causing a planned undertaking to happen.

# Project Manager Role

## A Good Project Manager

- Takes ownership of the whole project
- Is proactive not reactive
- Adequately plans the project
- Is Authoritative (NOT Authoritarian)
- Is Decisive
- Is a Good Communicator
- Manages by data and facts not uniformed optimism
- Leads by example
- Has sound Judgement
- Is a Motivator
- Is Diplomatic
- Can Delegate



## Stakeholder

**“A person or group of people who have a vested interest in the success of an organization and the environment in which the organization operates”**

- Sponsor
- Funding Body
- Customer
- Suppliers
- End User
- HSE/Environmental Agency
- Maintenance Team
- Neighbours/Community/Shareholders
- Fusion Community
- Interfaces

## Stakeholder Engagement process

- Identify Stakeholders
- Assess needs
- Define actions
- Establish communication channels
- Gather feedback
- Monitor and review

## Project Set-up and Definition

- Create Project Management Plan (PMP)
- Be clear of scope and objectives
- Establish clear statement of what is to be done (WBS)
- Establish Risks to be Managed
- Establish Costs and Durations
- Establish Resources Required

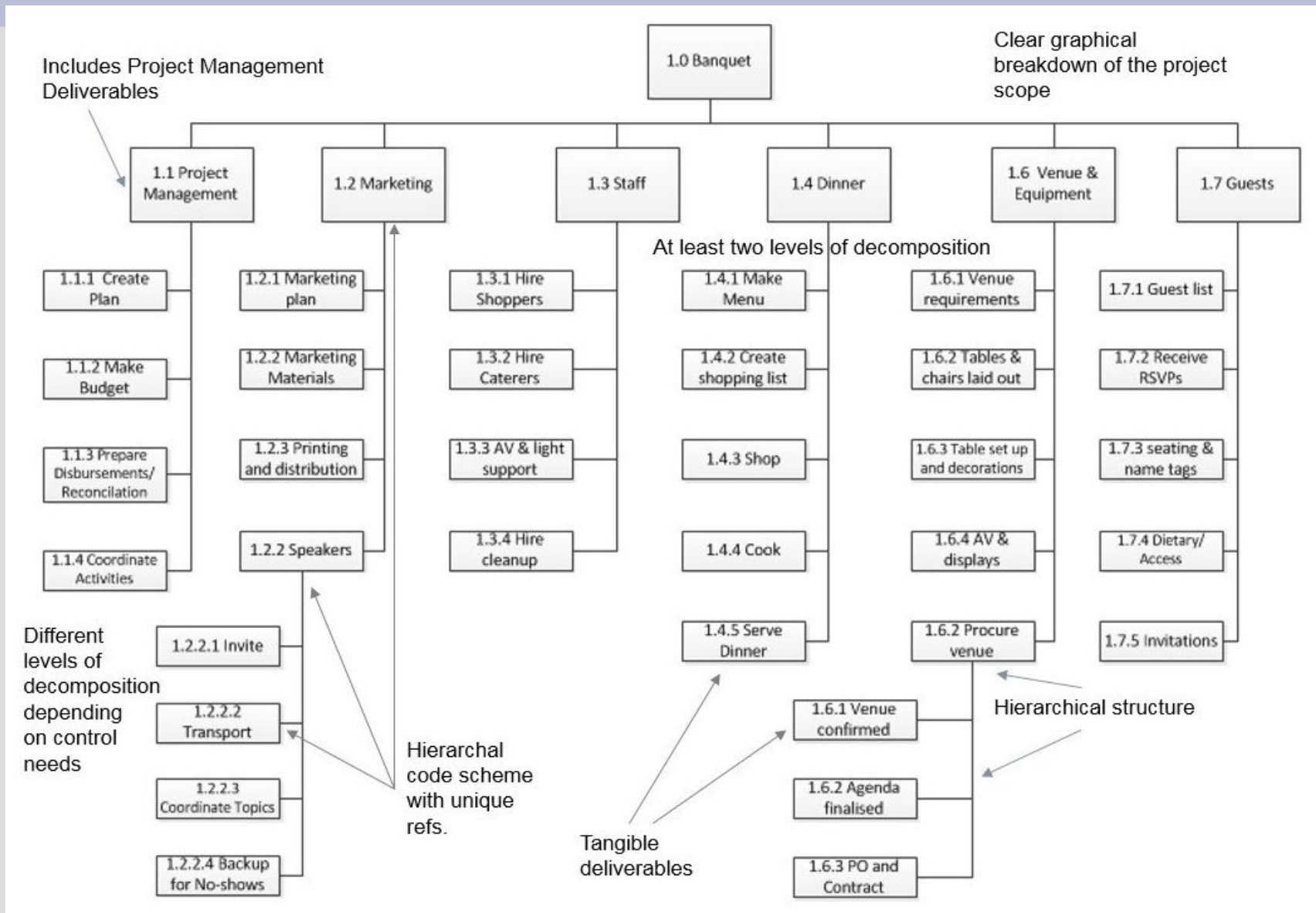
# Project management Plan - PMP

- Master Document for Project
- Defines the following:
  - Project Objectives, Scope, Deliverables
  - Stakeholders (Internal & External)
  - Work to be done (WBS)
  - Project Organisation and Resources (OBS)
  - Project Costings (CBS)
  - Project Schedule
  - Procurement/Contract Strategy
  - Risk Management
  - Quality management
  - Change Management

# WBS

- **“A Work Breakdown Structure (WBS) is a hierarchical (from general to specific) tree structure of deliverables and tasks that need to be performed to complete a project.”**
- Lowest Level of WBS is the Work Package (WP)
- WP can be clearly defined allowing package to be costed, scheduled and resourced
- WP contains a list of Tasks to be Performed that form the basis for the Schedule
- WP allows assignment of responsibilities (Work Package Manager, WPM)
- WBS allows hierarchical build-up of costs and schedule
- Cost and Schedule can be reported at any level of the WBS
- WBS facilitates strong management during project execution (Cost and Schedule control)
- WBS can be used for many other things - Document Management, Risk Management etc.

# WBS



# Project Planning

## Scheduling

- Schedules (task durations) can have a wide variation
- There is no unique answer. Rather, there is a statistical variation depending on assumptions
- Need to understand the basis of scheduling (Most challenging; Most likely; Absolute certainty - bet your life on it!)
- Most people are very optimistic/naive

# Project Planning

- Recognise that adequate project planning is essential
- Produce a sound WBS
- Use the framework provided by the Project Management Plan (PMP) template
- Involve the right people
- Allow enough time
- Be systematic



# Project Risk

**“Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective”**

“A combination of the probability of a defined threat or opportunity (Likelihood) and the magnitude of the consequences of the occurrence (Impact) defines a Risk Index”

- Identify Risks
- Assess likelihood and impact
- Rank risks and prioritise
- Define risk management approach & actions
- Implement actions
- Monitor & review

# Project Monitoring

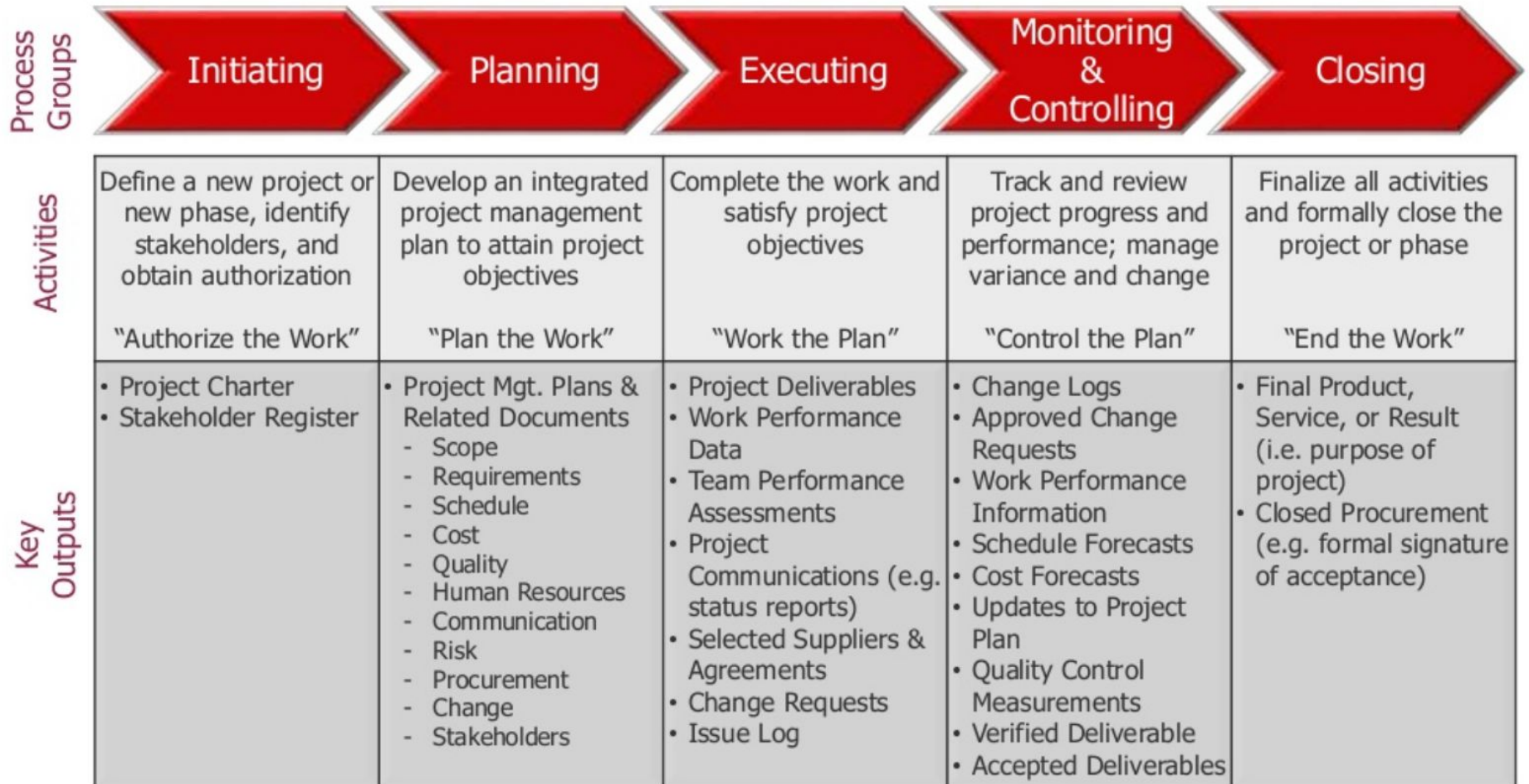
## Typical Monitoring Activities

- regular reviews of progress against schedule using WBS as basis (Plan against Baseline)
- regular review of actual costs (O/P from SAP) against budgeted costs and Earned Value at WBS level
- regular review of resource loading
- regular progress meetings with project team
- regular meetings with contractors
- production of periodic progress reports
- risk reviews
- inspections/ audits

# Project Management - PMI

- The Project Management Institute (PMI) is the world's largest membership association for the advocacy of Project and Program management.
  - Over 400,000 current members across 180 countries
  - Over 600,000 PMI certification holders
  - Their most widely recognized certification is the PMP (Project Management Professional). The PMP credential recognizes your:
    - Experience, ○ Education, and ○ Competency to lead and manage projects
- Earning the PMP credential requires:
  - A bachelor's degree and 4,500 hours of documented project management experience, or a secondary degree and 7,500 hours of documented project management experience
  - 35 hours of certified project management training
  - Passing the certification exam
- Regardless of your inclination to pursue PMP certification, PMI project management principles apply to your role as a project leader or stakeholder

# Project Management - PMI



# Project Management - PRINCE2

- PRINCE2 is an acronym for Projects IN Controlled Environments. It's a process-based method for managing a project. As noted, it's been mostly used by the government in the United Kingdom, but it's also prevalent in the private sector in the United Kingdom and other places around the world.
- The key features of PRINCE2 focus on business justification, defining the structure of an organization for the project management team and using a product-based approach. There's an emphasis on dividing the project into manageable and controllable stages, with flexibility. PRINCE2 provides great control over project resources and excels at managing business and project risk more effectively.



# Project Management - Agile

**Agile project management** is an **iterative** approach to delivering a project throughout its **life cycle**.

Iterative or agile life cycles are composed of several **iterations** or **incremental** steps towards the completion of a project. Iterative approaches are frequently used in **software development** projects to promote velocity and adaptability since the benefit of iteration is that you can adjust as you go along rather than following a linear path. One of the aims of an agile or iterative approach is to release benefits throughout the process rather than only at the end. At the core, agile projects should exhibit central values and behaviours of trust, flexibility, empowerment and collaboration.

