CompTIA Project+ (PK0-005) Study Notes

Introduction

- **Introduction**
  - Project+ gives IT professionals the basic concepts to successfully manage small to medium sized projects
  - This certification will verify the successful candidate has the knowledge and skills required to the following
    - Manage the project life cycle
    - Coordinate small-to-medium sized projects
    - Communication plan
    - Resources and stakeholders
    - Project documentation
    - Completion of larger projects
  - The certification will also cover both waterfall and agile project management methodologies
  - Project Management
    - The practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time
  - The exam you will take to become certified has a maximum of **90 questions** over the course of **90 minutes**
    - Multiple-choice questions
    - 3 to 5 performance-based questions
  - The exam covers four domains
    - Project Management Concepts (33%)
    - Project Life Cycle Phases (30%)
    - Tools and Documentation (19%)
    - Basics of IT and Governance (18%)
  - 4 tips for success in this course
    - Turn on closed captioning
      - If you want to enable closed captions, simply click on the CC button in the bottom of your video player

- You can control the playback speed
    - Faster or slower, the choice is yours
- Join our student support group
    - **www.facebook.com/groups/diontraining**
    - In this group, we answer your questions, we put out additional free content, and we help support each other throughout our IT careers
- Download and print the study guide
    - We do recommend you download it, print it out, highlight on it, circle on it, take notes directly on it, whatever you need to do so you have it ready to reference during your offline studies before taking the exam

- **Exam Tips**
    - There will be no trick questions
        - Always be on the lookout for distractors or red herrings
        - At least one of the four listed possible answer choices that are written to try and distract you from the correct answer
    - Pay close attention to words in bold, italics, or all uppercase
    - Answer the questions based on CompTIA Project+ knowledge
        - In the world of project management, there is often not a 100% correct answer to every question you face in your daily work
        - When in doubt, choose the answer that is correct for the highest number of situations
    - Understand the key concepts of the test questions
    - Do not memorize the terms word for word, try to understand them instead
    - During the exam, the answers will be from multiple-choice style questions

- **100% Pass Guarantee**
    - All the risk is on us, as it should be
        - You have nothing to lose here, but you do have to do your part and put in some effort
    - When you take those quizzes, you have to score at least an 80% for it to be considered a pass in our system
    - At the end of the course, you will find our practice exams
        - Understand why the answers are right or wrong
        - Explanations are provided for every single question

- o Please don't try to simply memorize the questions, but instead take the time to understand the why behind them
- o Make sure that you watched the videos, took the quizzes, did the labs, and finished the practice exams
  - ▪ If you've done all and don't see the progress part at the top going from 0 to 100, that means something's wrong
  - ▪ If you think you've done everything and it still doesn't show 100%, please email us at **support@diontraining.com**
- o Once you have the course completion letter, you are eligible for our 60-Day 100% Pass Guarantee

- ● **Project Lifecycle**
  - o Project Management
    - ▪ Practice of initiating, planning, executing, controlling, and closing a team's work to achieve specific goals and meet specific success criteria within a specified timeframe
  - o Having a good framework and methodology for project management helps everyone
  - o Project management lets the team save time, spend less money, and minimize the overall risk of a project
  - o Project
    - ▪ Temporary organization created for the purpose of delivering one or more business products according to an agreed-upon business case
    - ▪ Projects are temporary in nature
      - ● It must have a defined beginning and end
  - o Business as Usual
    - ▪ Standard and typical business operations
  - o A project follows a life cycle that starts with a business case and ideally ends with a successfully delivered project
  - o All projects move through five general phases of work
    - ▪ Discovery Phase
      - ● This occurs before the project starts
      - ● Leaders and analysts brainstorm ideas for potential projects and determine whether they are practical for their organizations
    - ▪ Initiation Phase
      - ● You will learn about the project's goals, what the project needs to deliver, and what the final product or outputs may look like

- This phase also builds the project team, where each member's role is identified
- In the initiation phase, the project team is built, and roles are identified
- Planning Phase
    - A high-level summary of the project's goals is fully detailed and fleshed out
- Execution Phase
    - This work varies by project and by the team
    - By the end of the execution phase, the team has completed the plan, and as a result, all goals set in the initiation stage should be completed
- Closing Phase
    - The project winds down and then end
    - Products are delivered, billing accounts are closed to prevent accidental charges, feedback is provided, and lessons are recorded

Project Management Basics

- **Project Management Basics**
  - Projects are temporary in nature and are undertaken to produce a specific outcome within a specified amount of time
  - Project management helps companies to meet their goals and objectives
  - A project should be providing new value and not simply performing normal operations in a business
  - Projects can last from a single day in duration to several years
  - Project management turns an idea into a tangible goal and implements it
    - It also controls costs while producing high-quality outcomes
  - As a discipline, project management wants to deliver work in an orderly and efficient manner
  - Templates make work easier and simplify the creation of project artifacts

- **Project Management Skills**
  - Project management requires a mindset where **adaptability**, **discipline**, and **personal relationships** hold the same value
  - A project manager needs to know the myriad of moving parts within a project
  - Project teams have to stay flexible and adapt to the challenges that they face
  - Project management also needs a fair amount of **critical thinking**, **analysis**, and **problem-solving**
  - Project teams often work in areas where they do not own the systems or manage the people
  - Project team members have—or develop—excellent **collaboration**, **leadership**, and **influence** skills
  - Project management is a mosaic of different talents, and you will learn many valuable skills

- **Benefits of Project Management**
  - Project Management
    - It is designed to deliver work in an efficient, orderly manner
  - Conducting good project management can save money and optimize the results for an organization
  - Project management and project managers help bring order to complex work
  - When managing a project, plans can change

- o Contingency Reserve
  - ▪ Calculated buffer of time and money that covers documented risks
- o Management Reserve
  - ▪ Additional sum of time or money that covers "unknown unknowns" - the setbacks we haven't forecasted
- o Benefits of properly conducting project management includes **saving money**, **optimizing results**, and **preventing costly errors** for organizations

- **Types of Work**
  - o The work environment surrounding an individual project influences the approach of the project and responsibilities of a project manager
  - o The **roles**, **types of work**, and **organizational structure** have an effect on communication, team dynamics, and reporting relationships
  - o 2 Main Categories of Project Work
    - ▪ Operational Work
      - ● A routine, predictable, and repetitive work
    - ▪ Project Work
      - ● Accomplishes something new
      - ● A project must meet three criteria
        - • It is unique
          - ▪ It has a brand-new objective
        - • It has a specific purpose
          - ▪ It has a reason to exist
        - • It is temporary
          - ▪ It has a defined beginning and end
  - o Projects are a temporary endeavor

- **Organizational Structures**
  - o The organizational structure affects the project management process, how work moves, how people form teams, and the project manager's role
  - o 3 Main Organizational Structure
    - ▪ Functional
      - ● Divides the organization into areas of specialization and expertise
      - ● An organizational chart for this type of structure is pretty intuitive
      - ● The functional manager is responsible for maintaining the budget and managing personnel
      - ● The project manager coordinates the project

- Functional teams have less awareness of others in the organization, operating in information silos
  - Projectized
    - The organization pools resources around projects as its main focus
    - Projectized organizations benefit companies that spend most of their resources on project work
    - The project managers have more control in a projectized organization
    - The project manager also owns the budget and typical line manager's responsibilities
  - Matrix
    - Includes both functional leaders and specialized roles
    - In a matrix organization, the team members from the functional areas work on the project teams, either part-time or full-time
    - 2 Categories of Matrix Organization
      - Weak Matrix Organization
        - The functional manager retains budget and staff management responsibilities
        - The project manager has a bit less control authority over the project
      - Strong Matrix Organization
        - The project manager has substantial control over the project
        - They have both management responsibility for the staff and budget
    - Businesses in nearly every industry can operate as a matrix organization
    - The primary disadvantage of this type of structure is that employees often divide their time between operational work and one or more projects

- **Roles and Responsibilities**
  - Project Manager
    - Responsible for planning, organizing, leading, and keeping your teams on track and within budget
    - Project managers are there to deliver projects on time, within budget, and within scope

- o Program Manager
  - ▪ Individuals that lead programs or related groups of projects
  - ▪ A program manager operates at a more strategic level and oversees multiple projects in a program
  - ▪ As a project manager, it is important to maintain communication with the program manager
- o Project Management Office (PMO)
  - ▪ Functional department for all project managers in a company
  - ▪ Manages the flow of projects and provides administrative support, such as maintaining archives, best practices, and project management tools
  - ▪ Oversees project performance management and tracks metrics for projects throughout the organization
  - ▪ Provides valuable coaching and training for personnel
  - ▪ 3 Project Management Office Types
    - ● Supportive Project Management Office
      - • Provides support when it is requested
    - ● Controlling Project Management Office
      - • Monitors project performance and coordinates resource selection while allocating project managers to projects
      - • The controlling PMO coordinates communications and sets some project standards
    - ● Directive Project Management Office
      - • Has full authority over projects, standards, and procedures
      - • It focuses on organizational strategy and will start, cancel, or adjust projects to ensure strategic alignment
  - ▪ The PMO is motivated to ensure projects perform well, and every project lists the PMO as a stakeholder
- o Some project influencer roles
  - ▪ Stakeholder
    - ● Anyone with a vested interest in the project
    - ● Stakeholders are not built-in supporters
  - ▪ Senior Management
    - ● Highest level of leadership in an organization
  - ▪ Sponsor
    - ● A single senior management member that reviews and validates initial business case
    - ● Secure funding and remove barriers, making them valuable assets for a project manager

- Customers
  - Parties who receive the benefits from the projects
  - Internal Customers
    - Inside the organization
    - They are more accessible to provide feedback during and after the project
  - External Customers
    - Outside the organization
    - They may fund the project's results
- End-User
  - Person who will interact with the project's final output
- The sponsor, customer, and end-user could be the same person in some instances

- **Programs and Portfolios**
  - Each project has a single objective that explains what it intends to accomplish
  - When a project is in a program, it increases the responsibilities of the project manager
  - A project manager needs to be aware of other projects in the program and assess how any program changes affect the project's schedule and scope
  - Program stakeholders and program staff are stakeholders you will need to consider when assessing impacts
  - There are budget constraints and other resource limits that must be accounted for
    - To avoid this, use portfolios and portfolio management
      - Program
        - Group of related projects
      - Portfolio
        - Group of all projects and programs
        - Projects in a program are related to the same objective, but projects in a portfolio do not need to be related
      - Enterprise Portfolio
        - Contains all programs and projects in an organization and is broken down into sub-portfolios at the division or branch level

- Portfolio Management
  - Offers strategic context and perspective that helps an organization to maintain a maximum number of projects and prioritize them into objectives or priorities
  - A successful portfolio management process limits the total number of projects
- Projects can be a part of larger programs and portfolios
- A program groups together related projects to achieve a larger objective
- Portfolio helps organizations prioritize and execute multiple projects and programs efficiently

The Business Case

- **The Business Case**
  - o Business case is the most important part of why projects are undertaken
    - ▪ It should be **concise**, **visually appealing**, and **easy to read**
    - ▪ It is also called a "business justification" or "business objective"
    - ▪ It summarizes information about the project and serves as the first project proposal
  - o A business case presents an objective analysis of a **business problem**, **potential solutions**, and **financial impact**
  - o Business case can contain any relevant data such as
    - ▪ Executive Summary
      - ● A brief synopsis of what the remaining portions of the business case will cover
      - ● This is an overview of the most important relevant information, usually only a few sentences in length, that includes
        - • Problem Statement
        - • Solution
        - • Expected Result
    - ▪ Problem Statement
      - ● Shares more details about the problem
      - ● The problem is then broken down in the problem analysis section
      - ● It provides more context about why the project should be prioritized and may include evidence to support the following
        - • Business Case
        - • Environmental Assessment
        - • Historical Data
    - ▪ Options
      - ● Compare the solutions against each other with pros and cons
      - ● Alternative identification adds more depth to the business case
    - ▪ Financial Overview
      - ● Contains a cost-benefit or return on investment analysis and provides relevant risks and assumptions

- Project Definition
  - Additional relevant information about the proposed project
    - Project Scope
    - Resources
    - Milestones
    - Implementation Timeline
- Project Recommendation
  - Provides an analysis of which option would likely be the best solution for the project
  - It should reflect the **Financial Overview**, **Return on Investment**, and **Project Definition**
- Writing value-focused problem statements
  - One of the primary goals of a project manager is to create a business case that resonates with stakeholders and concentrates on the value of the project instead of the technology
  - Technology is simply a tool or vector that solves a problem for the business
- A good business case presents a problem and an expected outcome with multiple options
- Write the case using clear and simple language
- ESG (Environmental, Social, and Governance) Factors
  - Refer to a company's actions and programs beyond maximizing profits

- **Current State and Future State**
  - A business case needs an element of storytelling
  - Current State
    - What is going on with the organization right now?
  - Future State
    - What the business is going to look like after implementing your project?
  - A great comparison shows a clear difference between the current and future states of the organization
  - Side-by-side comparisons can be visual, descriptive, or both and it will help hammer the points home
  - A descriptive summary could slightly expand this information with qualitative improvements or unique investments
    - A visual summary can also be included
    - Visual summaries use diagrams or charts to show the differences between states

- o Process Flowchart
  - ▪ Shows the steps, sequence, and possible outcomes using a standard set of shapes
- o To create a compelling visual comparison, you could create a current state, then cross out the steps that will be eliminated
- o The future state would show a streamlined process flowchart, with fewer steps and less looping
- o Be good storytellers when writing our business case
- o Your current and future states should share the same metrics, and side-by-side comparisons can be used

- **Financial Impact**
  - o Financial Analysis
    - ▪ Also called financial benefit, cost-benefit analysis, or an economic return
  - o Return on Investment (ROI)
    - ▪ Compares the financial benefit of the project to the cost, and it is written as a percentage
    - ▪ **Positive** number represents a profitable project
    - ▪ **Negative** number means the project lost money
    - ▪ ROI is often presented in the following three formulas which will all generate the same result
      - ● ROI = (Net Profit / Cost) x 100
      - ● ROI = ((Revenue – Cost) / Cost) x 100
      - ● ROI = ((Financial Value – Project Cost) / Project Cost) x 100
    - ▪ The three main values are the **benefit**, the **cost**, and the **net profit**
      - ● Benefit
        - • The money generated or explicitly saved due to undertaking the project
        - • Benefit is often referred to as "financial value" or "revenue"
        - • This variable is the money flowing into the company
          - ▪ Revenues
          - ▪ Cost Reduction
          - ▪ Cost Avoidance
          - ▪ Other measurable returns
      - ● Cost
        - • Usually called "project cost" or "project expense", this variable is the money flowing out of the company

- Expenses will include direct and indirect expenses
  - Labor
  - Equipment
  - Contracts
- Net Profit
  - The difference between the benefit and the cost
- Business context, regulations, and environmental requirements are among many factors influencing project approvals
- Financial analysis involves assigning hard numbers to future events
- The further out we are trying to plan or assign numbers to something, the worse our accuracy is going to be
- It's helpful to include a summary of your assumptions and risks in the financial plan section of the business case
  - Assumptions
    - Factors that you state as true in the calculations to present a simplified financial plan
  - Risks are events that you think could happen
  - Including risks with a higher likelihood of occurrence balances the optimism of business case assumptions

- **ESG Factors**
  - Environmental, Social, and Governance (ESG) Factors
    - Refer to a company's actions and programs with intentions beyond simply making money and maximizing their profits
  - Environmental Factors
    - How the organization impacts the natural world
    - Environmental considerations may include
      - Landfill Consumption
      - Waste Generation and Disposal Methods
      - Pollution
      - Habitat Protection or Destruction
      - Resource Consumption
  - Social Factors
    - How the company develops relationships and treats people
      - Employees
      - People in the community
      - Groups impacted by the company's products and services

- o Governance Factors
  - ▪ How the company operates
    - ● Policies
    - ● Transparency
    - ● Structure
- o A company must apply environmental, social, and governance factors when conducting their business as usual operations and their temporary projects
- o Form relationships with the organization's internal legal team
- o Corporate Identity
  - ▪ Includes the **vision**, **mission statement**, **values**, and **brand** of the company
  - ▪ The vision, mission, and values are the identity the company shares via published statements that should reflect the company's spirit
  - ▪ A company's brand describes how people actually perceive the company
    - ● It might include **tangible** items
      - Symbols
      - Color Schemes
      - Memorable Slogan or Spokesperson
    - ● It might also include **intangible** items
      - General sense of how they feel about the company
      - General characteristics or traits
      - Company's societal influence
  - ▪ The brand is influenced by the company's consumers, employees, community members, and business partners, and not just the PR department
- o Incorporate ESG factors into the project design and decision-making throughout the life of the project

# Methodologies and Frameworks

- **Methodologies and Frameworks**
  - There are many different kinds of methodologies and frameworks to manage projects
  - The proper framework can simplify the project management process and amplify the project's results
  - Framework
    - The processes, tasks, roles, and guiding principles that form the structure of completing work
    - The framework significantly influences how a project moves from start to finish
  - DevOps promotes continuous integration, continuous delivery, and continuous deployment (CI/CD)
  - DevSecOps takes it a step further by incorporating security measures throughout the development process
  - Scaled Agile Framework (SAFe)
    - Methodology used to expand Agile practices across multiple teams in an organization
    - SAFe is best suited for companies with projects involving multiple teams that need to communicate and collaborate effectively
  - Software Development Life Cycle (SDLC)
    - Flexible framework designed to produce high-quality, low-cost, and thoroughly tested software through continual improvement
    - SDLC also relies heavily on thorough advance planning, which may not suit agile-focused teams

- **Waterfall**
  - Waterfall Methodology
    - A sequential development process that flows like a waterfall through all phases of a project
    - Initially used in manufacturing, and eventually made its way to software development because it was in common use by that time, serving as an early starting point
    - It follows a linear sequence
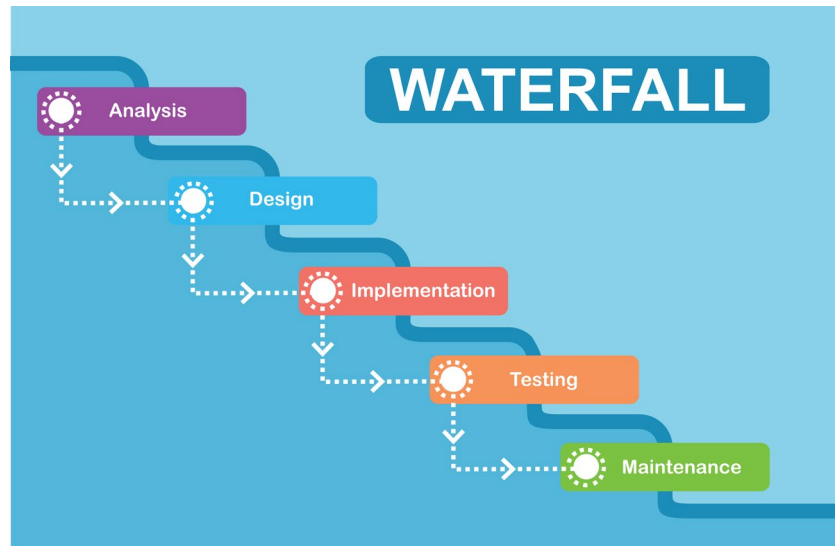
- o 6 Phases of Waterfall Methodology
  - ▪ Requirements
    - ● Define the requirements of the project
  - ▪ Design
    - ● Converts the requirements into actionable specifications
  - ▪ Implementation
    - ● Completes the work like writing code
  - ▪ Testing
    - ● Verifies that the work meets the requirements and quality specifications
  - ▪ Delivery
    - ● Also known as deployment, moves the product into production
  - ▪ Maintenance
    - ● Solves any issues that may arise
- o Waterfall phases are displayed uniquely and differently since they cascade from the first stage to second to the third, and so on, until you reach the last phase
- o Advantages of Waterfall
  - ▪ Waterfall framework is the simplest framework that you will be tested on and is easy to understand and deploy
  - ▪ The documentation required for these projects is very thorough
- o Disadvantages of Waterfall
  - ▪ Waterfall methodology is not very flexible
  - ▪ The plan is designed up front and changes or revisions down the line are often costly in time, money, or other resources

▪ Makes change management very expensive to conduct in a waterfall-based project
- o When would we use waterfall?
  - ▪ Fixed requirements with no unknowns
  - ▪ Change costs are very high
  - ▪ Short and simple
- o Waterfall project management is a linear methodology
  - ▪ Advantages
    - ● Simplicity
    - ● Ease of understanding
    - ● Thorough documentation
  - ▪ Disadvantages
    - ● Inflexibility
    - ● High change management costs

- **Agile**
  - o Agile Methodology
    - ▪ A project management approach that involves breaking the project into phases and emphasizes continuous collaboration and improvement

  - o Differences between Waterfall and Agile
    - ▪ Waterfall
      - ● Structured and delivers value at the end
      - ● Big design upfront approach
      - ● Best with no unknowns
    - ▪ Agile
      - ● Flexible and delivers value early and often
      - ● Iterative and incremental
   - ● Adaptable to change

- Iterative Development
  - A software development approach that emphasizes the continuous refinement and improvement of a system or product
  - The main goal of each iteration is to identify issues, make improvements, and incorporate feedback from users or stakeholders
  - Key Benefits
    - Ability to respond quickly to changing requirements or emerging user needs
    - Opportunity for early and frequent user feedback
- Incremental Development
  - A software development approach that focuses on delivering small, functional parts of a system or product in a step-by-step manner
  - Key Benefits
    - Reduced risk and predictable project outcomes
    - Developers manage complexity, minimize errors, and maintain a higher level of control over the development process
    - Allows for faster delivery of new features
- When a team used iterative and incremental development, they would build one feature at a time
- Agile is adaptable with shorter release cycles, and waterfall will require more information and requirements
  - Its flexibility can lead to scope creep and missed deadlines
  - It can lead to less documentation
- ERP system may not be a good agile candidate
- Advantages of Agile
  - Adaptability
  - Shorter release cycles
  - Higher quality results
- Disadvantages of Agile
  - Potential scope creep
  - Missed deadlines
  - Less documentation

- **Scrum**
  - **Scrum** is the most common agile framework; it delivers iterative and adaptive value while intentionally covering only the barest requirements
    - It uses empiricism and lean thinking to continuously improve results

- Empiricism encourages teams to make decisions based on what they see and know
  - It is the practice of relying on observation and experimentation
  - In other words, look at what happened instead of trying to predict what might happen
- Lean Thinking
  - It is focused on driving improved efficiency by reducing waste, redundancy, and other unnecessary work within a given project
- o 5 Key Values of Scrum
  - Commitment
  - Focus
  - Openness
  - Respect
  - Courage
- o 3 Fundamental Pillars of Scrum
  - Transparency
    - Ensures that all team members have a clear understanding of the project's progress, goals, and any challenges faced
  - Inspection
    - Involves regularly reviewing and assessing the work being done, as well as the processes used by the team
  - Adaptation
    - The process of making necessary adjustments in response to the findings from the inspection
- o 4 Basic Steps of Scrum Process
  - Product owner prioritizes work into a product backlog
  - Scrum team selects the top items in that backlog
  - Scrum team and stakeholders review the sprint results
  - Steps repeat as long as the product backlog exists
- o 4 Roles in Scrum
  - Scrum Team
    - Group of people who work together to deliver increments of value
  - Product Owner
    - Creates, maintains, and owns the product backlog
  - Scrum Master
    - The team's coach which helps the team, product owner, and organization improve the implementation of scrum

- Developer
  - Describes the remaining team members and isn't exclusive to software engineers
- The scrum master and project manager are not the same role
- Key Artifacts and Terms of Scrum
  - Product Backlog
    - An ordered list of product changes or enhancements
  - Product Goal
    - Describes the product's longer-term target, and the product backlog should deliver the product goal
  - Sprint Backlog
    - Includes what the team will do, why they think it is important, and how they will get it done

  - Sprint Goal
    - Summarizes the value of the sprint
  - Increment
    - A complete body of work that meets the definition of done and moves toward the product goal
- A sprint can have one or many increments
  - Every increment needs a definition of done to create a shared understanding of what it takes to move forward
- Different Scrum Events
  - Sprint
    - Scrum iteration and the container for all other Scrum events
  - Sprint Planning
    - Lasts no more than eight hours for one-month sprints, and even less for shorter sprints
  - Daily Scrum
    - Where the developers meet to review progress toward the sprint goal and then plan the next 24 hours of work
  - Sprint Review
    - Uncovers issues early when they are small and easy to fix, reveals previously unknown development ideas, or confirms that the team is on track
  - Sprint Retrospective
    - Occurs when the team inspects how they worked in the past sprint and identifies improvement opportunities

- Retrospective focuses on the Scrum team and how they can improve how they work together
  - o Advantage of Scrum
    - ▪ Scrum is flexible and can be used across any industry, and its short cycles allow for responsive learning and complex problem solving
  - o Disadvantages of Scrum
    - ▪ Scrum relies on the organization to respect the product owner's decisions about the backlog and priorities
    - ▪ Scrum's framework is designed for a single, high-performing and cross functional team, which means that less-experienced teams may struggle and scaling up to larger groups might be difficult
  - o Scrum is best suited for highly cohesive, cross-functional teams that are focused on continual improvement
  - o Scrum methodology is a lightweight, customer-centric Agile framework that focuses on iterative and adaptive value

- **Kanban**
  - o **Kanban** is used to control work in progress levels, known as WIP levels, and manage workflows in software and business processes
  - o 6 Core Practices of Kanban
    - ▪ Visualizing work
      - ● Create a Kanban board that shows the specific phases that work moves through on your team
    - ▪ Limit work in progress
      - ● Prevents team members from getting overwhelmed and helps increase productivity and degradation of product quality
    - ▪ Make policies explicit
      - ● Clearly define how work gets completed and moves from one phase to another
    - ▪ Manage flow
      - ● This embraces the roots of lean manufacturing and reduces waste in the system
    - ▪ Implement feedback loops
      - ● You bake feedback directly into the system and stay informed about performance
    - ▪ Improve collaboratively while evolving experimentally
      - ● This means that we need to use the scientific method to test ideas and measure the results in the Kanban signals

- o Kanban's goal is to start now and keep improving
  - ▪ Its most recognizable feature is the Kanban board
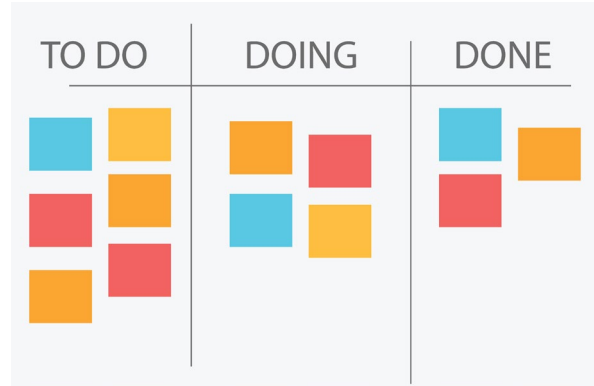
  - ▪ Work moves through three basic phases: **To Do**, **In Progress**, and **Done**
- o Four-Part Workflow of Kanban
  - ▪ The product owner prioritizes and orders the backlog
  - ▪ A team member selects the top-ordered item in the backlog and pulls it into progress
  - ▪ The team moves the work item through the workflow, keeping within the work in progress limits
  - ▪ When the team is ready to start new work, they select the next item in the backlog
- o Differences of Scrum and Kanban
  - ▪ Scrum
    - ● Helps teams solve complicated issues
    - ● Better for unpredictable work
  - ▪ Kanban
    - ● Helps teams focus on a reasonable amount of work
    - ● Excels at most routine tasks
- o Scrum teams often use Kanban boards to visualize their work
- o Kanban teams use demonstrations and retrospectives to gather feedback and improve their processes
- o Agile teams are even classified as **Scrum**, **Kanban**, or **Scrumban**
- o Advantages of Kanban
  - ▪ Kanban is the simplest agile framework to learn and can be applied to any industry
  - ▪ It's lightweight and focuses on routine work over iteration planning
- o Disadvantages of Kanban
  - ▪ Kanban can be less effective if teams are oversized or have high turnover

- Inaccuracies or changes between work items can disrupt the team's focus, and cycle times may stretch out in the absence of set iterations, if performance is not properly managed
    - o Kanban is most effective for teams that have a backlog which changes often
    - o Kanban is an agile methodology that originated in lean manufacturing and is now applied to software development and other business processes
    - o Kanban and Scrum solve different problems and can be combined in some project into what is referred to as "**Scrumban**"

- **Extreme Programming**
    - o Extreme Programming (or XP) is another type of agile framework designed specifically for software development
        - ▪ It aims to create a higher quality of life for the developer and better software for the customer
        - ▪ It believes in the 40-hour workweek alongside frequent releases and customer centricity
    - o 5 Values in the Extreme Programming Framework
        - ▪ Communication
        - ▪ Simplicity
        - ▪ Feedback
        - ▪ Respect
        - ▪ Courage
    - o Extreme Programming methodology is also known for its unique principles and practices, like its **emphasis on simplicity**, promoting the solution that requires the least amount of coding or work
    - o 3 Roles in Extreme Programming
        - ▪ Customer
            - ● Decides which features are needed and which are needed next
        - ▪ Tracker
            - ● Captures metrics, measures progress, and looks for improvement opportunities
        - ▪ Coach
            - ● Mentors team members on how to use Extreme Programming practices
    - o Most Common Practices in Extreme Programming
        - ▪ Paired Programming
            - ● Two software engineers work side by side to create code at once

- Ten-minute Building
  - States that it should take less than 10 minutes to build, test, and deploy an entire system
- Continuous Integration
  - Merges local code into the main repository at least a few times each day
- Test-First Programming
  - A practice where developers write tests and then write code to pass the tests
- Extreme Programming adopts incremental design
- User stories are also implemented for communicating requirements
  - The user's needs are written in a short, descriptive format that conveys what the user wants and how it would help them
- Extreme Programming utilizes the concept of slack in its teams' work schedules
- Advantages of Extreme Programming
  - Very efficient
  - Continuous integration, automation, and high rate of adaptability
  - Team-focused practices and less project failures
- Disadvantages of Extreme Programming
  - Has limited scope
  - Code-centric practices can result in less optimal design
  - Rapid pace of the work can cause stress
  - Minimal documentation can hinder new team members' understanding
  - Relies on face-to-face interaction between team members and customers
- Extreme Programming is best employed by small, collocated teams who can manage unknown requirements with tight deadlines and who have test automation capabilities

- **DevOps & DevSecOps**
  - DevOps
    - A set of practices and tools that integrates and automates the work of software development and IT operations as a means for improving and shortening the systems development life cycle
  - 2 Categories of Software Delivery Process
    - Software Development
      - The development team designs and creates software across four workflow phases: **plan**, **code**, **build**, and **test**

- ▪ IT Operations
  - ● The operations team would then deploy and support software across the four workflow phases of **release**, **deploy**, **operate**, and **monitor**
- o DevOps eliminates the barrier between development and operations
  - ▪ It includes the **practices**, **tools**, and **culture** of integrating development and operations and delivering work as often as needed
- o DevOps increases throughput with automation and decreases bugs through early detection
- o Continuous Integration (CI)
  - ▪ Individual developers check their code into the main branch frequently, and automated tests run against the new code
- o Continuous Delivery (CD)
  - ▪ Prepares the code for release to production
- o Continuous Deployment (CD)
  - ▪ After integration, the continuous deployment process prepares the code for production release and deploys it to production
- o Strengths of DevOps
  - ▪ Great for teams that want to release code often
  - ▪ Companies that want to limit friction
  - ▪ Organizations with the resource to staff cross-functional teams
- o Weaknesses of DevOps
  - ▪ Require significant expertise and groups may struggle to find enough team members with the necessary skills
  - ▪ Large or legacy systems with minimal automation will find it difficult to quickly switch over to DevOps
- o DevOps is not a project management methodology, but it does control the software engineering process
- o DevSecOps
  - ▪ A development practice where security processes, such as security audits and testing, are automated and built in throughout the development process
  - ▪ DevSecOps creates a shared responsibility where everybody on the team considers and owns the product's security
  - ▪ This decentralized security model requires a significant culture change
  - ▪ We all need to understand security risks and utilize good operational security

- o DevOps and DevSecOps are two approaches that integrate software development and IT operations to improve the systems development life cycle
  - **DevOps** promotes **continuous integration**, **continuous delivery**, and **continuous deployment (CI/CD)**, which enables faster delivery of high-quality code
  - **DevSecOps** takes it a step further by **incorporating security measures** throughout the development process, creating a shared responsibility for security across the team

- **Scaled Agile Framework**
  - o Scaled Agile Framework (SAFe)
    - A methodology used to expand Agile practices across multiple teams in an organization
    - Strikes a balance between keeping teams aligned and preserving the team's autonomy
  - o Scaled Agile
    - Term used to describe any methodology that expands agile tools to more than one team
  - o SAFe stands out as a comprehensive business agility framework and is free to use
  - o SAFe visualizes the prominent roles, practices, events, and artifacts on its interactive big picture
  - o Some key terms about SAFe
    - Agile Team
      - Teams are made of three to ten cross-functional people working together to deliver increments of value
    - Agile Release Train (ART)
      - Groups the related teams to simplify communication, planning, and schedules
    - Iteration
      - Agile methodology iteratively develops a product in fixed time increments
    - Program Increment
      - Similar to a quarterly cycle in extreme programming, and it serves as a longer-term planning cycle
      - A program increment is a fixed-length increment that lasts 8-12 weeks instead of three months
   - It is a shared timebox for all the teams on an ART

- Program Increment Planning
  - Serves as the ART's planning event and is similar to sprint planning for a single Scrum team
- o Strength of SAFe
  - SAFe is great for bringing the benefits of agile to a larger organization and meets the scaling needs of scaling
- o Weakness of SAFe
  - Needs to add layers of terms, overhead, organization, and staff, which can grind the gears of Agile's ground-up approach

- **Software Development Life Cycle**
  - o Software Development Life Cycle (SDLC)
    - A flexible software development framework that aims to produce high-quality, low-cost, and thoroughly tested software
    - SLDC users incorporate best practices and lessons learned into the framework to be more efficient every subsequent cycle
  - o According to the CompTIA Project+ official textbook, there are 7 phases in the SDLC Framework
    - Planning
      - Where we outline the project and define the software's scope and purpose
    - Requirements
      - We define the resources needed for the project and determine what the software needs to do
    - Design & Prototyping
      - Defines how the software needs to work, such as which programming language to use, which security protocols to use, and how the user interface behaves
    - Development
      - When the software is actually created
    - Testing
      - When tests are carried out to ensure the software performs as expected
    - Deployment
      - When the software enters production
    - Operations and Maintenance
      - When the software is supported as long as it remains in production

- o   The software development life cycle can be linear and sequential, iterative and incremental, or a combination both
- o   SDLC can be applied to multiple types of development models
    - ▪   Waterfall
        - ●   The original SDLC model that was created to replicate existing waterfall methodologies
        - ●   Waterfall SDLC is suitable for predetermined technology stacks and short projects
    - ▪   Iterative
        - ●   A hybrid approach of iterative and sequential models
    - ▪   Spiral
        - ●   A risk-centric iterative model
        - ●   Spiral is the most complex and resource-intensive model, and the projects need to manage cost and scope aggressively
    - ▪   Agile
        - ●   An iterative, customer-centric model
        - ●   Agile SDLC includes more customer feedback
        - ●   Companies seeking a fast time-to-market also use agile
- o   Strength of SDLC
    - ▪   SDLC is a comprehensive framework and includes every necessary task
- o   Weakness of SDLC
    - ▪   SDLC framework depends on time spent on thorough advance planning

- ●   **PRINCE2**
    - o   **PRINCE2** is a process-based methodology that is most common in the UK, EU, Canada, and Australia
        - ▪   It aims to control project management processes by creating clear project phases, clearly defining roles and responsibilities, and predefining tasks to manage the project life cycle
    - o   PRINCE2 requires several roles
        - ▪   Team Manager
            - ●   A member of the project management team who is focused on helping the project manager by supervising the teams and managing the quality of outputs
        - ▪   Project Board
            - ●   Authorizes resources and funding, supports the project manager, and is ultimately responsible for the project

- The project board includes three roles: **executive**, **senior user**, and **senior supplier**
  - Executive
    - A member of upper management, represents the business perspective, the deciding member of the project board, and owns the project's business case
  - Senior User
    - Represents the customer's perspective
  - Senior Supplier
    - Represents the supplier or implementation partner's perspective
- PRINCE2 started as a waterfall methodology and has since adopted a complementary agile model
- The key here lies in the best practices that it enforces which are the **7 principles**, **7 themes**, and **7 processes** of the method
- PRINCE2 is highly flexible and one of its strengths is customization
- The 7 principles represent the philosophy of PRINCE2 and help guide decision making
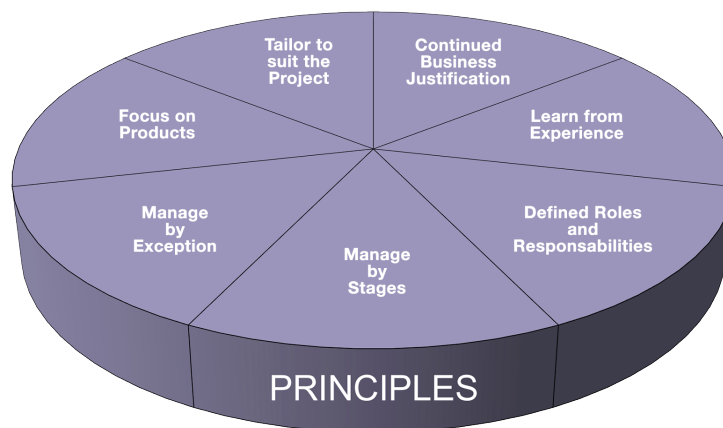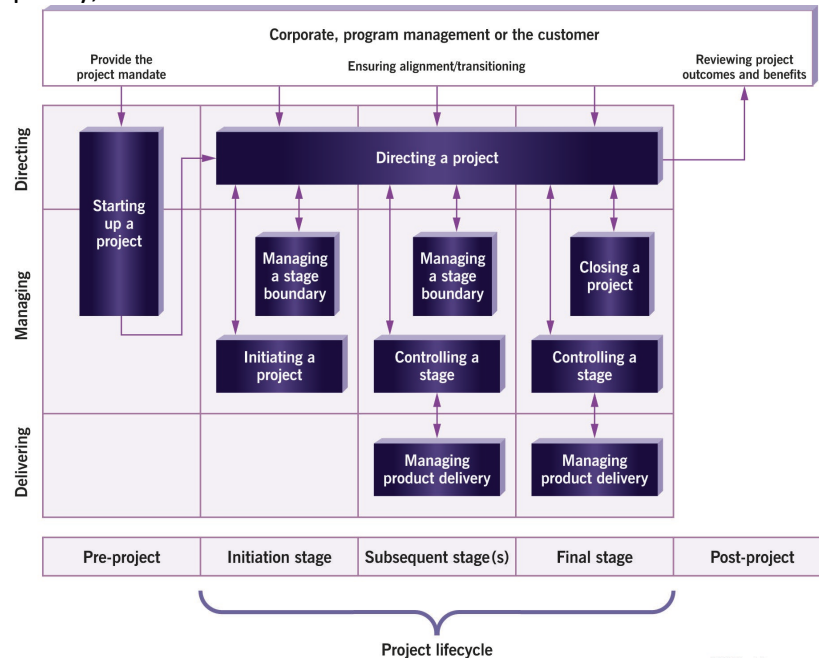
- The themes represent the project manager's knowledge areas
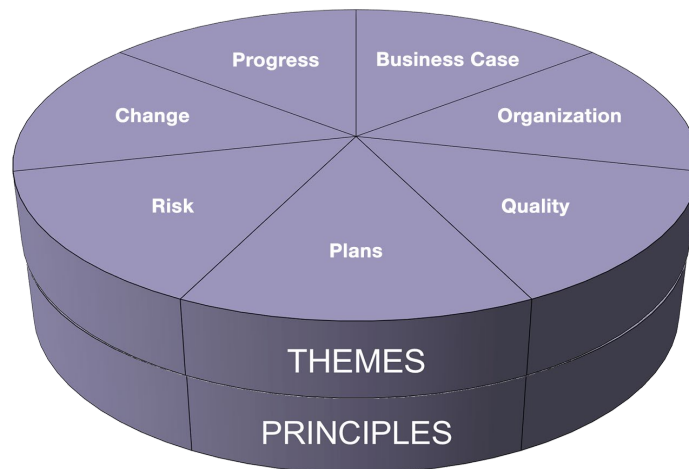
- The 7 processes represent the activities that must happen throughout a project's life cycle
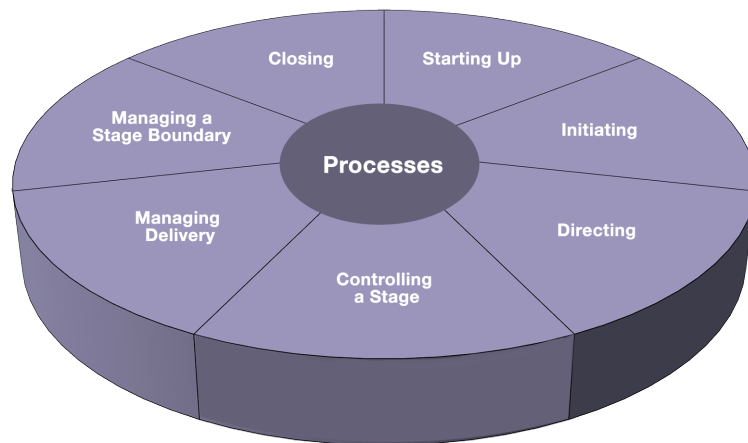
- o Starting up investigates the business case and determines a project's viability
  - ▪ Initiating defines the project's aspects such as the scope, costs, time, risk, quality, and benefits

- o PRINCE2 is very flexible and can be applied to pretty much any project
  - ▪ It has constant communication between the project board, project manager, and project teams
  - ▪ It is not a good fit for companies that do not emphasize documentation
- o PRINCE2 is process-based project management methodology that is very popular in the United Kingdom, and is rapidly gaining acceptance in the United States
  - ▪ It involves greater upper management involvement than other methodologies, fostering better resource management and reduced risk

Comparing Waterfall and Agile

- **Comparing Waterfall and Agile**
  - The starkest difference between waterfall and agile is flexibility
  - **Waterfall** practitioners might refer to this flexibility as ambiguity, and **agile** supporters describe it as adaptability

- **Product Ownership**
  - The project framework you select can affect how roles and responsibilities are assigned during a project
  - Product Owners
    - Work within agile teams and identify how to improve a product while being accountable for creating the most valuable product possible
    - Responsibilities of Product Owner
      - Creation of a valuable product
      - Working within a fixed time, fixed cost and flexible scope
      - Providing product direction and visions
  - Project Managers
    - Lead projects in any framework and do so as long as the project is active
    - Responsibilities of Project Manager
      - Managing project plans
      - Schedule
      - Initiation and closing documents
      - Measuring the project's progress
      - Managing project risks
      - Working within a fixed time, fixed cost, and fixed scope
  - Product Managers
    - Define the product strategy and create roadmaps to show how it will improve and change over time
  - Both the project manager and product owner have overlapping responsibilities and unique shared interests
    - They're both responsible for communicating directly with stakeholders, leading their team, and maintaining work lists
  - When leading a team
    - Product owner shares guidance about the product's purpose and vision
    - Project manager builds support for the project and project approach

- o When maintaining worklists
  - ▪ Product owner maintains a product backlog
  - ▪ Project manager uses a work breakdown structure (also called the WBS) or project backlog
- o The product owner is **not** a manager
- o Project managers need to manage teams and their work
- o The product owner doesn't get involved in the details of the work
- o Agile teams are self-organizing and will take more of a leading role in breaking down work, regardless of if the work is for a product or project
- o Collaboration with a product owner can make life easier for a project manager
- o Preferably work with the product owner to build a consolidated product backlog that incorporates the project work
- o If a team already has a product owner, they probably use an agile project management methodology
- o Teams without a product owner could also use an agile project management approach

- **Team Composition**
  - o Agile
    - ▪ Teams are small by design, with 3-10 members
  - o Waterfall
    - ▪ Teams are large and can be any size
  - o Scaled Agile
    - ▪ Creates a large team by grouping multiple small agile teams together
  - o Agile teams form a cross-functional group that stays with the project for the entire life cycle
  - o Members have to fill multiple roles and have broad experience
  - o A waterfall team assembles specialists to complete the work
  - o If keeping all team members for the entire project, select an agile framework
  - o When needing highly specialized individuals, consider using a Waterfall

- **Communication**
  - o Stakeholder Communication
    - ▪ Stakeholder communication changes under different frameworks
      - ● For example, in waterfall projects, the stakeholder provides comprehensive requirements at the start of the project

- Ensure customer's requirements, quality expectations, and needs are understood before moving on to the development of the project
  - Agile projects engage the stakeholder throughout the entire project
    - They require stakeholders with time and motivation to collaborate and receive a product that meets their needs
  - o Communication Channels
    - In waterfall, the customer does not communicate directly with the developers
    - In agile, the development team communicates directly with the customer to clarify requirements and share progress
  - o Communicating updates and changes
    - Change frequency affects communication requirements as well
    - **Waterfall** projects **introduce few changes**, whereas **agile** projects **embrace change**
    - Agile reduces the chance of miscommunication
    - The speed and volume of change require efficient communication
    - Agile teams create a schedule every 1-4 weeks for sprint intervals and can incorporate changes at every planning session

- **Requirements**
  - o Requirements direct the project
    - They dictate how the project's result looks, behaves, and is used
  - o The main differences between methodologies are **when** requirements are created
    - In a waterfall project
      - Collection of Requirements -> Product Creation -> Customer Review -> Maintenance Phase
    - In an agile project
      - Collection of Requirements -> Product Creation -> Customer Review

- **Budget and Schedule**
  - o Waterfall budgets are more rigid and predictable
  - o Agile budgets incorporate change and flexibility
  - o Projects with a strict budget would do well with a waterfall

- o A project manager may need to communicate with customers to ensure they understand how costs accrue against the project's deliverables
  - ▪ It might also work with a team to ensure that their estimates accurately reflect their actual costs
- o Agile projects can arrange budgets around high-level deliverables to create a hybrid approach
- o Customers with a **limited budget** may prefer a **waterfall project**
- o Customers who would rather **spend more money on a tailored product** would favor an **agile approach**
- o Agile schedule is more flexible than waterfall schedule
  - ▪ The schedule is loose and flexible
  - ▪ The team plans one iteration at a time
- o Waterfall schedule is more predictable than agile schedule
  - ▪ The team plans the entire project schedule, including the timeline and the time needed for each phase and task of the project

- ● **Environmental Factors**
  - o Different Environmental Factors Between Waterfall and Agile
    - ▪ Culture
      - ● An agile team requires strong commitment, trust, and collaboration to achieve its ultimate value
      - ● In waterfall, customers receive nearly finished products
    - ▪ Developmental Processes
      - ● When considering agile development maybe a customer can't review increments
      - ● Maybe manual testing and integrations make frequent builds expensive
    - ▪ Industry Standards
      - ● Highly regulated industries that require more documentation need a project management structure that will provide adequate traceability
      - ● Companies that lean on documentation often choose waterfall

Initiating the Project

- **Initiating the Project**
  - A project moves through four overarching phases, known as initiation, planning, execution, and closing
  - Teamwork is essential for project success, as it involves collaborating with diverse individuals who possess different backgrounds, perspectives, skills, and talents
  - Customizing the team structure to fit the project's needs is crucial
  - Responsibility Assignment Matrix (RAM)
    - Clarifies roles and responsibilities in a project, ensuring efficient task completion and effective communication
    - It outlines the **responsible**, **accountable**, **consulted**, and **informed** individuals for each task
  - Stakeholder engagement in project management involves building and managing relationships with stakeholders throughout the project's duration
  - Performance measurement in projects involves clear, observable, and measurable objectives listed in the project charter
    - Key Performance Indicators (KPIs)
    - SMART Objectives
    - Objective and Key Results (OKRs)
  - The project charter outlines the project's parameters, purpose, expectations, and vision
  - The scope statement provides detailed descriptions of project elements
  - A records management plan is crucial during the initiation stage of a project to handle the generation of documentation effectively
  - Project Kickoff
    - Live meeting where the team comes together for the first time to create a shared understanding of the project's purpose, goals, and plan

- **Team Roles and Responsibilities**
  - Teamwork is an absolute necessity to make a project successful
  - Identify the people who will deliver the work
  - Choose members who have the right skills for the job
  - Project Manager (PM)
   - Runs the day-to-day management of the project

- Project sponsor holds ultimate responsibility for the success or failure of the project, delegating operations to the PM
- Responsibilities of PM
  - Building the project team and securing resources
  - Building the project charter and defining the project's scope
  - Creating required project logs and processes, including the issue log, change log, and risk register
  - Ensuring project deliverables are met which includes making sure team members have the right skills and resources for activity completion on the activity list
  - Preparing and delivering project status updates
  - Tracking the project's progress and status when compared to the schedule and budget
  - Managing vendor relationships
- o Business Analyst (BA)
  - Improves the final product and operates between the business and IT department like a translator
  - Responsibilities of BA
    - Helping to define the project
    - Gathering business and technical requirements
    - Ensuring requirements stay aligned to needs
    - Interpreting business requirements
    - Verifying deliverables against requirements
    - Assisting with testing and validation of products
- o Architect (Enterprise, Software, or Cloud)
  - Design solutions by looking across organizations to identify how different systems interoperate and ensure that projects meet solution requirements
  - Responsibilities of Architects
    - Solution design
    - System blueprints
    - Evaluating systems against organizational standards
- o Developer or Engineer
  - Possesses specialized expertise in their field, like front-end or back-end development, writing code, etc.
  - Responsibilities of Developer
    - Writing code to standards
    - Building products according to the project plan or sprint backlog

- Reporting development progress to the project manager or product owner
  - o Tester or Quality Assurance
    - Work closely with developers to build quality software, and help prevent errors from escaping into production, which could be a costly and time-consuming mistake
  - o Customer or End-User
    - Some project teams will also include a customer or end-user on the team
    - They can offer valuable insight and often lend perspective on the product's usability and functionality
  - o Vendor
    - Any third party you work with to procure resources is a vendor, and you may work with none or many vendors on a single project
    - Responsibilities of Vendor
      - Provide work outlined in contracts
      - Maintain service level agreements
      - Keep clear lines of communication open for business relationships
  - o Stakeholder
    - They are the people or groups affected by projects, but they carry responsibilities for the project too
    - Responsibilities of Stakeholder
      - Must understand the project's purpose and how it will affect them
      - Be transparent about their support or lack of support
      - Provide timely feedback on the project's progress
  - o Subject Matter Expert (SME)
    - The person you consult when you need somebody to explain a complex topic simply or solve advanced issues
  - o Project Team Member
    - Any team member, regardless of their job title or role, is considered a project team member
  - o Core Team Members
    - Also called "operational" team members because they work on day-to-day project operations
  - o Extended Team Members
    - They work on the project part time and might split their time between multiple projects and their functional job
  - o Each member will need to be identified as either a core or extended member

- Extended team members will have varying levels of availability, business needs, staffing availability, and organizational structure affect each individual's availability
- Functional member can be fully committed to project execution
- Members can be further categorized by percentage of time available, availability by phase, or availability on request

- **Building the Project Team**
  - Identify your project team members based on **skillsets**, **availability**, and **roles**
  - Choose the right people for the job
  - Building the project team is often a continual process
    - Define the project scope
    - Select potential team members
  - When the team is being assembled, the PM usually selects the team members
    - Sponsors may also assign some key members early in the project
  - You also want to capture additional information about the project team
    - Job Position
    - Availability
    - Sub team or Grouping
    - Responsibilities
    - Preferred Contact Methods
    - Manager
    - Organization

- o This leads us to the development of our project organizational chart
  - ▪ This chart will look like a regular org chart, but will show project interfaces for the team
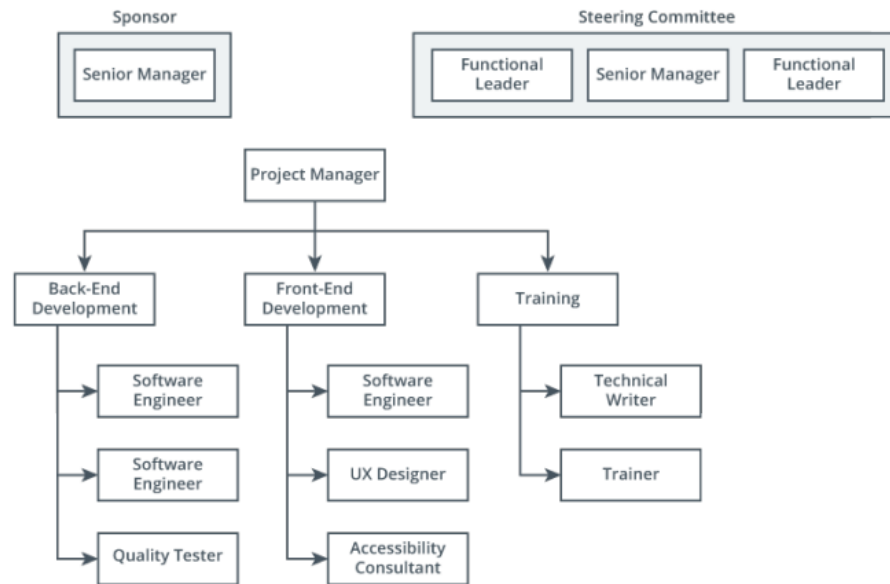
Project organizational chart in a projectized organization.

- ● **Responsibility Assignment Matrix**
  - o Responsibility Assignment Matrix (RAM)
    - ▪ Clarifies who is responsible for completing and managing the activities in a project
  - o Team members will need to know what to do and whom to work with
  - o The RAM helps create a sense of project ownership and describes how team members and stakeholders work with project deliverables
  - o The roles fall into the following four categories: **responsible**, **accountable**, **consulted**, and **informed**
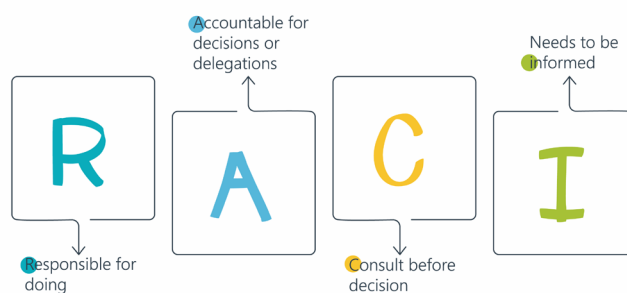
- RAM is first created in the project initiation phase
- Steps to Create a RAM
  - List the activities for the project which will be placed within the first column of the matrix
  - List the project team members, stakeholders, and other parties across the top of the available columns
  - Identify those responsible for doing the work
    - Mark an **R** for people that are responsible for the activities
    - Mark an **A** for those accountable for the activities
    - Mark a **C** for those responsible for consultation
    - Mark an **I** for people that needs to be informed
  - Optional Step: If it helps you and the team, use color-coding and grouping to make the chart easier to read

Name And Role / Task	Bailey Lead Software Engineer	Robin Software Engineer	Casey Technical Writer	Ryan UX Designer	Taylor Web Accessibility Consultant
Activity 1	A	R			
Activity 2	A	R	I	C	C
Activity 3	I	R	A/R		C
Activity 4	R		I	A	C
Activity 5	A	I		R	R
Activity 6			A/C		R

Key	R – Responsible	A – Accountable	C – Consulted	I – Informed

Color-coded responsibility assignment matrix (RAM).

- **Stakeholder Engagement**
  - Relationships between people really matter
  - A firm handshake, eye contact, being polite, and timely correspondence goes very far when you're building relationships and engaging with stakeholders
  - Stakeholder engagement is how a PM builds and manages relationships with stakeholders throughout the life of the project
  - Stakeholders will ask probing questions and challenge assumptions
  - Soft skills are extremely important and should be on the imaginary tool belt of every project manager
  - 4 Steps to Stakeholder Engagement
    - Identify key stakeholders

- ▪ Prioritize stakeholders
- ▪ Understand stakeholders
- ▪ Develop an engagement plan
- o The highest-priority stakeholders need frequent and active engagement, and the lowest-priority stakeholders require minimal attention
- o Impact Grid
  - ▪ A matrix chart that sets high-low values for two stakeholder variables
  - ▪ It measures how much stakeholders can influence a project's trajectory and how much it will impact them
  - ▪ The grid has four quadrants in order of priority
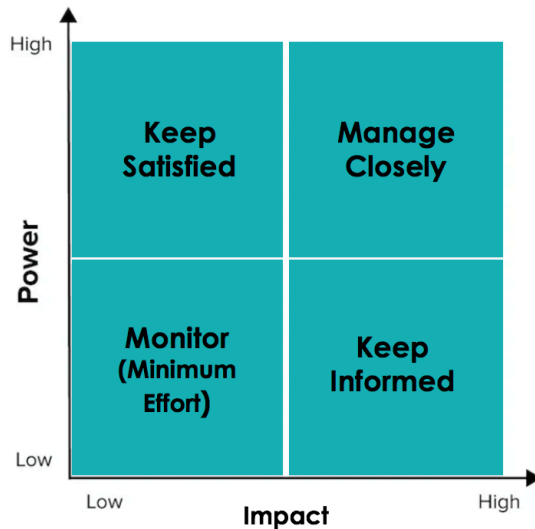
- ● High Power/High Impact
  - • Stakeholders have the most to gain and the most power
  - • It's important to work with them to build support and ensure they are satisfied with the project's progress.
- ● High Power/Low Impact
  - • Stakeholders have enough influence that they could derail a project if they wanted
  - • The project has little impact on them, so they might have lower interest
- ● Low Power/High Impact
  - • Stakeholders have little power to change a project, so they are less likely to disrupt it
  - • Their work will change significantly because of the project

- Low Power/Low Impact
  - Stakeholders have little power or impact on the project
  - You are likely to find the lowest level of interest in this quadrant, but the situation could change
- The stakeholder engagement plan includes the following sections
  - Stakeholder
    - List the person or group
  - Point of Contact
    - If the stakeholder is not a person, list the person who represents the stakeholder
  - Power
    - List the power level from the Power/Impact Grid
  - Influence
    - List their impact level from the Power/Impact Grid
  - Project Phase
    - List the project phases that you will need to engage with them
  - Engagement Needs
    - Describe what they need or why they are a key stakeholder
  - Engagement Approach
    - List the type of engagement you will conduct from the Power/Impact Grid
  - Methods
    - Capture how you will communicate with them
  - Frequency
    - List a descriptive term of how often you will engage with the stakeholder
- The stakeholder engagement plan is not the same as the communication management plan

- **Project Initiation Documents**
  - A strong launch for our project and a strong launch helps us create a shared understanding with all team members and stakeholders working on a project
    - A shared, mutual understanding of the project creates an environment where everyone has the same perception of the **project's scope**, **timeline**, **team structure**, and **purpose**
  - A solid foundation helps prevent miscommunication, lost documentation, and scope creep throughout the project

- Artifacts can give great insight into how similar projects have already been executed
- Observe the lessons learned from past experiences and steer clear of obstacles
- Preparing for a project often begins with research
- Project Artifact
  - Tangible item that was generated and used by people throughout the project
  - Other examples of project artifacts
    - Videos
    - Audio Recordings
    - Work Items
    - Data Diagrams
- Studying the current artifacts helps you orient yourself to the project quickly

- **Performance Measures & Timeline Charts**
  - When we talk about performance, it refers to **clear**, **observable**, and **measurable** project objectives which are listed in the project charter
  - PMs use structured goal-oriented approaches to measure performance
    - Key Performance Indicators (KPIs)
      - It measures only the most crucial measures
      - KPIs are measured regularly in an ongoing manner
      - KPIs include targets and actuals
      - Target
        - A value or set of values that describe an acceptable range of performance
      - KPIs measure both leading and lagging indicators
      - Lagging Indicators
        - These are reflective measures that can only be captured after the work is done and describe the realized success of a project or process
      - Leading Indicators
        - These are predictive measures that if perform well, the truly desired outcomes will improve
    - SMART Objectives
      - A simple way to create a goal
      - An acronym that stands for
        - **S**PECIFIC
          - Explain exactly what we want to achieve

- **M**EASURABLE
  - ▪ Have a quantifiable metric for success

- **A**CHIEVABLE
  - ▪ Need to be realistic about the goal
- **R**ELEVANT
  - ▪ Helps you get a promotion or move positions
- **T**IME-BOUND
  - ▪ Have a target end date
        - Evaluate it against each SMART criterion and refine it
    - ▪ Objective and Key Results (OKRs)
        - Organizations apply OKRs to achieve results quickly
        - They are meant to be aspirational and slightly out of reach
        - They drive teams to deliver value that they didn't think was possible
        - OKRs create a two-part goal statement composed of objectives and key results
        - These objectives take a "less is more" approach
  - o KPIs help you stabilize and protect systems
  - o SMART is a method for writing solid goals
  - o OKRs are used to create short term goals and generate change
  - o Project Roadmap
    - ▪ High-level documents that share major progress points, such as new feature rollouts
    - ▪ Highly visual and resembles the format and level of detail that you might read in a press release
  - o Milestone Chart
    - ▪ Describes the milestone events, which are project checkpoints
    - ▪ They look like a timeline and plot deadlines, check-ins, and critical dates over the course of the project
  - o Gantt Chart
    - ▪ Shows relationships and dependencies between tasks
    - ▪ Use the Gantt chart during the planning, execution, and closing phases

- **Project Charter & Scope Statement**
  - o Project Charter
    - ▪ A concise, formal document that outlines the project's parameters

- Created in the initiation phase and helps the team, stakeholders, sponsor, and PM achieve consensus on the importance of the project and how it will be executed
- Several Benefits of Project Charter
  - Clarifies the project's purpose and expectations for stakeholders
  - Clarifies the PM's role and authority level
- Simplified Creation Process of Project Charter
  - **Using a template** will help tremendously because you'll repeatedly use the same fields of information
  - The document should be **short and simple**
  - Use **clear and concise language**
  - **Collaborate with your team** to hammer out the timeline and risk assessment
- 4 General Categories of Information
  - General Project Information
    - A header with standard information used for administrative purposes
      - Project Name
      - Description
      - Version Number and Date
      - Project Manager
      - Project Sponsor
  - Project Vision
    - Includes fields that build a business justification and set expectations for the project's outcomes
      - Objectives
      - Purpose
      - Preliminary Scope
      - Success Criteria
      - Expected Benefits
  - Organization (People)
    - The people and groups affected by the project
      - Stakeholders
      - Customers
      - Project Roles
      - Team Members
      - Project Organization
  - Implementation Overview

- Factors that will affect the project during implementation
    - Budget
    - Risks
    - Constraints
    - Timelines
    - Milestones
    - Resource Requirements
  - **Project Charter** is a summarized scope and boundaries & deliverables
  - **Scope Statement** is a detailed description of multiple elements
    - Scope statement is a living document
    - In the preliminary scope statement, you will have the following
      - Project Scope Description
        - Summarizes the project's intent and purpose
      - Project Acceptance Criteria
        - Details what the measurable outcomes of success looks like
      - Project Deliverables
        - Sets the project boundaries and identifies what the team will deliver for the scope
      - Project Exclusions
        - Sets the project boundaries for what is out of scope and what the project won't deliver
      - Assumptions and Constraints
        - Assumptions section lists the project team's collective assumptions and the constraints section lists the known constraints throughout the life of the project

- **Records Management**
  - A document is a tangible artifact
    - It contains data, which are facts, figures, and information
  - Record
    - An artifact that's needed to run the project or the business
    - Not every document is not a record

- o Your records management plan should cover which records to keep and how to classify and protect the data
    - ▪ Common types of artifacts into this plan
        - ● Project Management Artifact
            - • Artifact used to manage the project, such as the project budget and stakeholder engagement plan
        - ● Project Artifact
            - • Document created to move the project along, such as the required documentation and blueprints
        - ● Legal Document
            - • Generates project contracts and other legally binding agreements
        - ● Communication
            - • Includes meeting notes, status reports, and written communications
- o Project Information
    - ▪ Company asset and some of the information provides a competitive advantage against competitors
- o 4 Types of Data
    - ▪ Public Data
        - ● Information found on the company website and in public records
    - ▪ Internal Data
        - ● Available to anybody within the company
    - ▪ Confidential Data
        - ● Information is only available to authorized users either on a role or a case-by-case basis
    - ▪ Restricted Data
        - ● A top-secret data which access is severely restricted
- o Classification of a document is dependent on the data it contains
- o Requirements of a Records Management Plan
    - ▪ The plan complies with organizational policy
    - ▪ The records need to be organized and easy to find
    - ▪ The plan is accessible to authorized users
    - ▪ The plan needs to establish accepted communication channels
- o Elements of a Records Management Plan
    - ▪ Creation
        - ● Defines naming conventions, file owners, and who can create files

- ▪ Storage and Retrieval
  - ● Identifies where the team will store files and the file organizational structure
- ▪ Archival and Disposition
  - ● Defines how to handle duplicate files and outdated files and how long the records will be archived after the project closes

- **Kickoff**
  - o **Kickoff** is the last step of the initiation phase in which the team has an approved project charter and a preliminary scope statement to boot
  - o The kickoff meeting is partly ceremonial but practical
  - o Kickoff's purpose is to create a shared understanding with everybody
  - o Team members and stakeholders should have clear and aligned expectations for the project
  - o The kickoff meetings will vary in formality and structure

Facilitating Effective Meetings

- **Facilitating Effective Meetings**
  - Bad communication can sink a project very quickly
  - Synchronous Communication
    - Enables immediate information exchange and in-depth conversations but requires everyone to be available simultaneously
  - Asynchronous Communication
    - Offers flexibility but introduces delays and the possibility of messages going unread
  - Formal communication follows official channels, while informal communication occurs casually within the organization
  - Communication challenges can arise due to **language barriers**, **geography**, **technology**, and **culture**
  - Meetings involve three key roles
    - Target Audience
    - Facilitator
    - Scribe
  - Informative meetings aim to disseminate information to the audience
  - Decisive meetings, also known as decision-making meetings, involve one or more attendees making a choice regarding a project
  - 4 Main Types of Collaborative Meetings
    - Focus Groups
    - Workshops
    - Application Reviews
    - Brainstorming Sessions
  - Staying organized as a project manager is crucial due to the multitude of meetings, emails, and interactions involved
  - Conflict is an inevitable part of both personal and professional life, and it must be resolved responsibly

- **Communication Methods**
  - Communication methods or modalities describe how information is shared/received
  - 4 Key Factors of Communication Methods
    - Timing
    - Format

- ▪ Formality
- ▪ Audience
- o 2 Types of Communication
    - ▪ Synchronous Communication
        - ● Also known as real-time communication, this could be a phone call, teleconference, or in-person meeting
        - ● Synchronous communication is beneficial because you get all the information you need fast and can resolve confusion immediately
        - ● The downside is that everybody needs to be available at the same time
    - ▪ Asynchronous Communication
        - ● Occurs when information exchanges include a delay, such as email and comments in a shared document
        - ● Asynchronous communication offers flexibility; you can communicate with many people at once
        - ● Delays may be unacceptable for urgent issues, and they can make simple questions drag on
- o Format Considerations
    - ▪ Written Communication
        - ● Anything where exchanges occur through handwritten or typed messages
        - ● Examples include letters through instant messages, emails, and Braille
    - ▪ Verbal Communication
        - ● Done orally, such as through face-to-face interactions, phone calls, teleconferencing, etc.
    - ▪ Nonverbal Communication
        - ● Refers to the other signals sent during verbal communication, such as the body language and appearance
- o Formal Communication
    - ▪ Represents official communication channels which are the intentional, procedural channels where information flows and decisions are documented
        - ● Project Phase Gate Reviews
        - ● Help Desk Systems
        - ● Company Memos
    - ▪ Formal communication channels tend to be specific and rigid

- Informal Communication
  - Describes all the unofficial information flows in an organization
  - It includes a casual conversation between coworkers, group chatter before a meeting starts, and nonverbal communication during a meeting
- Know the audience and the level of formality in your language
- Internal Communication
  - Includes recipients who work inside the organization
  - The audience could consist of members from different projects, teams, or divisions, but everybody works at the same company
- External Communication
  - Includes recipients who work outside the organization
  - It tends to be formal, polished, and filtered
  - Generally, need to be incredibly cautious when communicating with them

- **Communication Challenges**
  - Language barriers, geography, technology, and culture can all pose challenges for communication
  - Select appropriate communication formats or incorporate additional accommodations, such as including interpreters in live meetings and enabling closed captioning
  - People who need more time to understand content might prefer asynchronous, written, or recorded communication
  - Geographically distributed teams are more common than ever
  - Be aware and respectful of time zone differences
  - If the team is broadly spread, better opt for asynchronous communication
  - Hold multiple meetings, use email and chat, or record meetings
  - Technological barriers include any communication challenge related to technology
  - Some team members might have slower internet or older hardware
  - Anything you invest in removing technology barriers will make your teammates happier, efficient, and more productive
  - Culture includes shared social customs, behavior, habits, and beliefs
    - It can refer to any observable group, including age, gender, employer, profession, and hobby
  - Companies often aim to create a strong workplace culture, which would unite everybody working for the company

- o PMs need to be aware of the cultures within their project team and their implications

- **Meeting Roles**
  - o Meetings are a group effort, and several roles keep meetings on track
  - o 3 Roles in a Meeting
    - ▪ Attendees/Target Audience
      - Group of people who need to be at the meeting
      - The attendees on the list should be intentionally selected to keep the group small and productive
        - Identify the meeting's purpose and expected outcomes
        - Select people who can make that happen
    - ▪ Facilitator
      - Guides the meeting's progress
      - The facilitator monitors the flow of the meeting and redirects the conversation
    - ▪ Scribe
      - Records notes for the meeting including the meeting minutes, action items, and follow ups
      - All participants help the scribe in any meeting by answering questions, offering context, or sharing information via chat or email
      - Following guidelines are helpful if you choose to implement the role
        - Meetings that generate an official record (Board Meetings)
        - Need for a written record and facilitation is expected to be taxing
        - A session where the conversation will move quickly

- **Informative Meetings**
  - o Informative Meetings
    - ▪ Disseminate information, informing the group of the information that needs to be spread
  - o Informative meetings are educational or persuasive in nature
  - o Use informational meetings when necessary, and make them as interactive as possible
  - o 3 Subcategories of Informative Meetings
    - ▪ Demonstrations and Presentations

- The presenter shares product features or offers training
- Demonstrations help a team's outcome align with the stakeholder's expectations
  - Status Updates
    - Gives updates on project progress at a specific point in time and varies in frequency and agenda
    - Status meetings help the audience stay updated on the project without investing too much time in the minutiae too
  - Stand-up
    - Scrum uses daily stand-up meetings to keep every team member on the same page
    - Stand-up meetings are short and usually last 15 minutes or less
    - The intent is for team members to exchange information quickly, solve problems, and return to work

- **Decisive Meetings**
  - **Decisive Meeting** is also called decision-making meetings where one or more attendees can make a decision
    - Need to allow team members to exchange information, so aim for a smaller, interactive group; eight members or fewer works well
  - People don't recognize when they need to make decisions
  - Examples of Decisive Meeting
    - Task Setting
      - Assigns work to individuals on a team
    - Project Steering
      - Includes the project manager and executive stakeholders
      - The steering committee represents the voice of the customer and act as the governing body of the project without managing it
        - They monitor the project's progress and deliverables
      - PM can use this type of meeting to secure decisions on funding and priorities
    - Refinement Meeting
      - Also known as product refinement or backlog refine meeting, which is the process of prioritizing the most valuable idea into a plan

- **Collaborative Meetings**
    - Collaborative meetings are very interactive
        - Need enough attendees to generate diverse ideas but not so many attendees that people can't participate
    - 4 Main Kinds of Collaborative Meetings
        - Focus Groups
            - Research technique where a project manager gathers a group of customers or potential customers so that attendees can share their experiences, perceptions, needs, and problems related to a project or product
            - They usually contain 6-12 participants and are held either in-person or online and have a structured agenda, like a prepared list of questions
            - The PM facilitates and moderates the session, but the real value comes from the participants' interaction
            - Reduce bias by remaining neutral throughout the process or recruiting an objective party to moderate the session
            - Several ways to facilitate a focus group
                - Single-moderator
                - Dual-moderator
                - Dueling-moderator
            - Two-way Focus Groups
                - Allow one group to observe another focus group's session
            - Respondent-Moderator Focus Groups
                - Allow one group to observe another focus group's session
            - Stakeholders can gain invaluable perspective from focus groups
        - Workshop
            - Working session where a group with shared interests gathers to exchange information and conduct research
            - When creating a workshop agenda, include clear objectives that describe what people need to do or prepare for the meeting
            - The diverse attendee list can create scheduling issues and challenge team dynamics
        - Joint Application Review
            - Specific type of workshop where customers take part in the design process of a product
            - The development team can adjust their approach quickly and at a much lower cost

- ▪ Brainstorming
  - ● Allows a group to generate many ideas rapidly
  - ● Brainstorming sessions are usually fast-paced events where everybody can participate and they're usually pretty fun, in terms of business meetings of course
  - ● 4 Subcategories of Brainstorming
    - Rapid
      - ▪ Gives participants 3-5 minutes to write down ideas
    - Reverse
      - ▪ Looks at the problem from different angles
    - Stop-and-Go
      - ▪ Fights the quantity over quality issue
    - Round-Robin
      - ▪ Gives everyone an equal voice

- ● **Meeting Artifacts**
  - ○ It's important to stay organized as a project manager
  - ○ Meeting Agenda
    - ▪ Includes the meeting's purpose and schedule of activities or topics for the meeting
    - ▪ POWER Start Agenda Technique is a great way to create meeting agendas
      - ● **P**urpose
      - ● **O**utcomes
      - ● **W**hat's In It For Me (WIIFM)
      - ● **E**ngagement
      - ● **R**oles and Responsibilities

Purpose - Officially kick off our new certification.

Outcomes - At the end of this meeting, we will all understand what deliverables we need to create for our certification, like exam objectives.

WIIFM - Meet your team mates and learn more about the project plan and timeline.

Engagement - Review the project charter and scope statement. Share any concerns and ask any questions related to the scope.

Roles and Responsibilities - Facilitator, Reed Bidgood. Scribe, Joe Schmo. Questions, all attendees.

- o Timeboxes
    - ▪ Define how long the team will spend on each topic in a meeting
- o Action Items
    - ▪ Tasks that somebody will complete after the meeting
- o Meeting Minutes
    - ▪ Create a written record of key points
- o Follow-Up
    - ▪ Email for sharing the meeting minutes and additional information

- **Conflict Management**
    - o Conflict is inevitable it both our personal and professional lives
    - o A team needs time to stabilize and normalize
    - o Tuckman's Team and Group Development Model
        - ▪ Forming
            - ● Members come together for the first time and are meeting each other and sizing up the other members
        - ▪ Storming
            - ● Every problem in the process, large or small, gets amplified and questioned in this stage
        - ▪ Norming
            - ● Members work through their differences and respect each other
        - ▪ Performing
            - ● Members know how to work together and what to do
        - ▪ Adjourning
            - ● Team breaks apart, and the members move on to new projects
    - o 2 Types of Conflict
        - ▪ Substantive
        - ▪ Emotional
    - o Both positive and negative conflicts need to be monitored and managed
    - o Common Causes of Conflict
        - ▪ Personality differences are a big contributing factor
        - ▪ Personal issues and external factors could play into this as well
        - ▪ Competition over project resources stemming from budget constraints or perhaps there are conflicting priorities or proposals'
        - ▪ Differences in writing styles can lead to miscommunication and conflict
            - ● Formality
            - ● Tone
            - ● Presentation

- Cultural differences
    - Tone
    - Subtlety
    - Word Choice
- Differences in typical expressiveness, body language, and personal space
- How do we resolve conflict?
    - Effectively managing conflict requires a lifetime of practice
    - You can manage and resolve conflict by applying five strategies:

        - Smoothing
            - Also called "accommodating", this attempts to redirect conflicted parties away from the conflict
        - Forcing
            - Also called "dominating", this manages conflict by deciding what needs to happen to fix the issue, like an authoritarian
        - Compromising
            - People in the conflict share their insights and concede to change something but keep some part of their idea
        - Collaborating
        - Avoiding
            - Ignoring the conflict; choose this option if the problem is too small to address and isn't affecting the team's performance
- Recognizing conflict early is key to successful conflict management
- 9 Stages of Conflict Escalation
    - Stages 1-3
        - Parties still want to agree with each other and find a "win-win" solution
    - Stages 4-6
        - Conflict escalates into a win-lose scenario and parties vie for control
    - Stages 7-9
        - A fully lose-lose situation, people involved in the conflict are incapable of resolving it themselves

Project Management Tools

- **Project Management Tools**
  - Good software can reduce your overhead and create better lines of communication
  - Project managers need to facilitate meetings and interactions, and using various media and meeting tools
    - Calendaring Tools
    - Conferencing Platforms
    - Survey and Polling Tools
    - Print Media
  - People have different learning styles, with some being auditory learners, others tactile learners, and some visual learners
  - Project managers often use diagrams
    - Gantt Charts
    - Flow Charts
    - Decision Trees
    - Data Flow Diagrams
    - Mind Maps
    - Quadrant Diagrams
  - Collaboration tools are essential for project managers to communicate and work with their teams
    - Multi-authoring editing software
    - File sharing platforms
    - Workflow and e-signature platforms
    - Knowledge bases
    - Whiteboards
  - Communication tools, such as email, chat messaging, SMS, face-to-face communication, phone calls, video conferencing, and social media, are crucial for project managers to connect with their team members
  - Communication Plan
    - Outlines how stakeholders and team members will receive project updates and establishes recurring communication loops for critical information and feedback
    - The key elements of a communication plan include
      - Goals
      - Stakeholders

- Team members
- Artifacts
- Channels
- Communication Recipients
- Frequency
- Outcomes
    - o Escalation Plan
        - ▪ Helps resolve project issues by outlining problem scenarios, escalation levels, owners, and triggers

- **Installation Options**
    - o Installation options affect the total cost of ownership
        - ▪ Cloud-based
            - Give users access to applications through an Internet browser and usually called "online software" or "online installations"
            - Uses recurring fees
            - Operational expense
        - ▪ On-premise
            - Installed in the cloud or on premise
            - Initial investment
        - ▪ Local Installation
            - A variation of the on-premise solution and a common model for personal computers
            - Software is installed on existing equipment
    - o User access considerations for the installation options
        - ▪ Cloud software works across various devices via an Internet browser
        - ▪ On-premise solutions give users access through an application on the devices
        - ▪ In local installation, the user accesses the software from the device where it is installed
    - o How installation options affect pricing models
        - ▪ Cloud-based
            - Uses recurring fees
            - Operational expense
        - ▪ On-premise
            - Initial investment
        - ▪ Local Installation
            - Software is installed on existing equipment

- o Advantages of Installation Options
  - ▪ Cloud-based solutions are a low-maintenance option
  - ▪ On-premise installation allows companies to have total control over the installed software
  - ▪ Local installation option provides reliable access to software
- o Disadvantages of Installation Options
  - ▪ Cloud has lower short-term costs but higher long-term costs
  - ▪ Local and on-premise installations require a large upfront purchase of software licenses and hardware
  - ▪ On-premise software product needs to be maintained, monitored, and updated
  - ▪ The software in a local installation is only available on the computer that it is downloaded to
  - ▪ Local installations require additional storage space on each device

- **Meeting Tools**
  - o Project managers need to facilitate meetings, workshops, and other interactions
  - o Calendaring Tool
    - ▪ Simplifies the scheduling process by managing calendars and schedules
  - o Meetings with geographically distributed teams benefit from using conferencing platforms
  - o Survey and polling tools allow interaction among attendees without everybody speaking
    - ▪ Surveys and polls are an excellent way to increase interaction during videoconference meetings
  - o Print Media
    - ▪ Physical materials, such as posters, flip charts, brochures, and training manuals

- **Productivity Tools**
  - o Project tools help create records of project activities and their status and help automate many calculations and generate valuable reports and dashboards
  - o Help Desk System
    - ▪ Users submit requests in the system, and automated workflows route the request to a person or group who can resolve them
  - o Ticketing systems are incredibly important organizational tools that systematically break down and prioritize work that needs to be done

- Some features of a project management software
  - Task Planning
  - Workflow Automation
  - Resource Allocation
- Scheduling tools can automatically generate a Gantt chart, which is super helpful to stay organized
- Remember that your mileage will vary as you experiment with different software platforms
- Consider using a project management tool for your projects
- Different Productivity Tools
  - Text Editors
    - They allow to edit the text in a file, by adding, removing, or changing characters, but you cannot apply any formatting
    - Text editors are helpful for writing code, capturing information in a clean environment, and clearing the formatting from text
  - Word Processors
    - Format text, insert objects, and create a visually appealing document
  - Spreadsheets
    - Works with data in tables, organize and modify data, complete mathematical calculations, and create graphs
  - Presentation and Diagramming Software
    - Creates slide decks, which are a series of visual pages that combine to tell a story
    - List several topics that you'd like to discuss while presenting to the group

- **Common Diagrams**
  - Diagrams make it easy to describe and share situations visually and it's no surprise that every profession has a slew of diagram options
  - Modern diagramming software has built-in templates to make creating diagrams even more straightforward
  - Selection of Common Diagrams
    - Gantt Chart
      - A type of bar chart that shows time across the horizontal axis and a list of tasks or activities on the vertical axis with bars that represent the time each activity will occur
      - Gantt charts are used for advanced scheduling

- Flowchart
  - Flowcharts are also called "process flow" or "process diagrams"
  - Visualizes a process, and can compress complicated work instructions into few charts
  - Flowcharts are easy to read and understand; removing or changing steps is incredibly easy to demonstrate with a flowchart
- Decision Tree
  - Describes a process that can have many decisions and many outcomes
  - Use this type of chart when a single decision requires consideration of many factors
- Data Flow Diagram (DFD)
  - Shows how information flows through a process or system
  - This diagram type works particularly well for audiences that include people with technical and nontechnical expertise
- Mind Map
  - Visualizes categories of information around a single theme, excellent for facilitating brainstorming activities
  - Mind maps are excellent for facilitating brainstorming activities, thinking through problems, or consolidating information
- Quadrant
  - A four-quadrant grid, one factor is placed on each axis, and each quadrant represents a high-low combination of the two factors
  - Quadrant diagrams are an excellent tool for quickly assigning values or showing the relative priority of multiple options

- **Collaboration Tools**
  - Project managers help organize and lead groups of people
  - Collaboration tools allow people to work on documents at a place and time that will enable them to be most productive
  - As a project manager, you should be aware and know when to implement:
    - Multi-authoring Editing Software
      - Allows multiple users to update the same file simultaneously
      - The file also updates for all users as somebody updates it
      - Disadvantage
        - This format gives everyone the power to edit the final result, so you do have the risk of unauthorized changes and deletions

- File Sharing Platforms
  - Allow for posting of a file in a single location and grant access to one or more users
  - You can also manage permissions to control the files that people can access, edit, and download
  - Sharing the files with somebody external to the company exposes the company's assets to potential bad actors
  - Always ensure file sharing practices meet your organization's security requirements
- Workflow and e-Signature Platforms
  - Workflow management systems that allow for the signing of documents using an Internet connection and electronic devices, like smartphones, tablets, or laptops
  - Some users may be uncomfortable with electronic contracts
- Knowledge Bases
  - Wiki
    - Collaborative product where everybody with knowledge can contribute to its contents
  - Knowledge Base
    - More curated than a wiki and specific authors contribute to the knowledge base and cover particular topics
- Whiteboards
  - Creates a virtual creative space that looks a lot like a physical whiteboard, offering a blank canvas that anyone can use to accomplish any creative task
  - Virtual whiteboards allow more traffic and comfort for users and you can even save a copy of virtual whiteboards

- **Communication Tools**
  - Email
    - A common asynchronous communication technology
    - Email is used to interact with people outside and inside the organization in the same channel
    - Advantages
      - Messages reach the recipient quickly
      - Preserves historical records
      - Works for lower-priority messages, longer messages, and mass communications

- ▪ Email is not the appropriate tool for an immediate response
- o Chat/Instant Messaging
  - ▪ A type of messaging service where messages are exchanged between two or more parties via an Internet connection
  - ▪ Chat may not work with people inside and outside the organization at the same time
  - ▪ Advantages
    - ● Preserves historical records
    - ● Conversational and informal
    - ● Intends to be more real time
    - ● Used for short conversations
  - ▪ Do not use chat when capturing historical records or sharing long messages
- o Texting or Short Message Services (SMS)
  - ▪ A form of communication that generally transmits via cellular networks but can also be transmitted over the Internet
  - ▪ Businesses use SMS messages for short, one-way text messages
- o Talking Face-To-Face
  - ▪ Meetings where to or more people are in the same room at the same time, exchanging information and ideas
  - ▪ Meetings work when discussing sensitive topics and building relationships
- o Telephone
  - ▪ A form of synchronous communication that crosses geographical boundaries
    - ● Landline
      - • Phones that are hardwired into buildings

    - ● VoIP (Voice over Internet Protocol)
      - • Users receive a traditional phone number and use a handset to make phone calls
    - ● Cellular
      - • Users receive standard phone numbers and transmit voice through cellular towers
- o Video and Videoconference
  - ▪ Blends the visibility of face-to-face meetings and phone calls to create a fully online meeting
  - ▪ Videoconferencing uses specific software

- Users need access to reliable Internet, headsets, and cameras
  - o Enterprise Social Media
    - Internal communication networks that encourage P2P connections and conversational tones
    - Enterprise social media can be a tool for employees to network and communicate with each other
    - Do not use enterprise social media to interact with people outside the organization
    - Enterprise social media content tends to be shorter and shallow

- **Elements of a Communication Plan**
  - o Creating a formal plan reduces overhead and simplifies project management activities
  - o Communication Plan
    - Documented strategy that outlines how stakeholders and team members will receive project updates
    - Communication plans vary in depth and formality too, but every plan should be documented to provide clarity and manage expectations for those involved
    - 8 Common Elements of a Communication Plan
      - Communication Goal
        - Defines the purpose of the communication plan before it is created
      - Stakeholders
        - Identifies each stakeholder by name and records helpful information, like the person's title, relationship to the project, time zone, location, and preferred contact method
      - Team Member
        - Lists the name, job, time zone, location, and preferred contact method for each team member
      - Artifact
        - Identifies various communication artifacts needed to address the needs of the stakeholders and team members
      - Communication Channel
        - Selects the best communication channel for each artifact
      - Recipient
        - Identifies who will receive the communication

- Frequency
  - Defines how often each communication needs to get shared
- Outcome
  - Defines what must occur when communicating

- **Develop a Communication Plan**
  - A communication plan sets the tone for the rest of the project by setting expectations with stakeholders and team members
  - Transparency and cadence are important in a communication plan
  - Steps in Developing a Communication Plan
    - Identify the stakeholders
      - List people that need to communicate regularly during the project
      - Capture the stakeholder's name, title, relationship to the project, and requirements
    - Identify the communication preferences
      - Learn how people prefer to be interacted with
      - Define the type of information, how much detail is provided, and how to consume information
    - Create a communication plan, share, and finalize plan
      - Use the elements of a communication plan
        - Communication Goal
        - Stakeholders
        - Team Member
        - Artifact
        - Communication Channel
        - Recipient
        - Frequency
        - Outcome
      - Use a template to help organize the information and ensure everything is covered
      - The template may be linear and straightforward
      - The share and finalize the plan step includes sending the draft to everyone involved
    - Schedule the meeting
      - Schedule the tasks needed to prepare for meetings
      - The communication plan encompasses activities from a static document to an action plan

- Revise the plan
  - Review the communication plan goals to ensure continued alignment with the plan
- Best practices when creating and implementing communication plans
  - Planning is done to be organized, but also easier
  - The communication plan standardizes the communication schedule and artifacts
  - Adapt communication plans to meet the style and frequency of the audience
  - Ask the team for a preferred meeting or way of communicating

- **Build an Escalation Plan**
  - Escalation Plan
    - Also called "escalation matrix", this describes problem scenarios that might occur in your project and how you can resolve them
  - Escalation plan is critical to ensure that project issues are resolved quickly and effectively
  - Any logs created later reflects the plan's intent
  - Escalation plan is done during the project's initiation phase
  - 4 Primary Sections of an Escalation Plan
    - Category
      - Describes the type of escalation
    - Level
      - Indicates the escalation order
    - Owner
      - The person to be contacted when reaching any level
    - Trigger
      - Describes the conditions that initiate an escalation
  - Escalation is a problem-solving technique
  - Appropriate escalation is essential for effective project management

- **Maintain Communication Records**
  - It is important to evaluate and update the records management plan whenever you create or modify the communication plan
  - Consider the following when maintaining communication records
    - Security
      - Communication security plays a crucial role in protecting project information

- 3 Different Types of Data
  - Public Data
    - No restrictions
  - Confidential Data
    - Limited access and only available to authorized users based on the role
  - Critical Data
    - Top secret and access are severely restricted
- When creating project communications, ensure the nature of the information is appropriate for the intended audience
- Archiving
  - Communication archiving outlines how project documents are stored, including what to keep, where and how long to store it
  - Comply with the organization's records retention policy and information security requirements
  - The PMO maintains a centralized archive of all completed projects
  - Archives help in identifying best practices and lessons learned
  - The project archive is also a source of analysis, where PMOs review data to identify trends within their functional area
  - Compliance auditors review archives to audit organizational standards and procedures
  - The archives also contain records that are required for legal compliance
    - Vendor Selection Records
    - Finalized Contracts
    - Evaluation Materials
  - Accurate project records are critical to protecting a company against potential litigation
- Integrity
  - Communication integrity is when shared messages actually match reality
  - Effective communication within a project requires **capturing**, **centralizing**, and **reflecting** the actual progress of the project
  - **Capturing and sharing meeting notes** and notable progress and decisions in project materials ensures integrity
  - **Centralizing information from various platforms**, such as planning platforms, emails, chats, and meetings, into a

summarized communication artifact helps keep track of crucial decisions
- Communication artifacts should **reflect the truth and actual progress** of the project at all times, as trust in the data is essential
- Intentional and unintentional errors can compromise communication integrity

Implementing Solution Design

- **Implementing Solution Design**
  - Ensure that new software additions are compatible with existing products
  - High-Level Design (HLD)
    - Provides stakeholders with an overview of the project approach and what the final solution will look like
  - Low-Level Design (LLD)
    - Gives implementation instructions that the team can follow to execute the project
  - Diminishing Returns
    - Refers to the point at which additional resources or efforts invested will yield increasingly smaller or negligible improvements in project outcomes
  - Pareto Principle
    - States that approximately 80% of the project's results are typically derived from 20% of the efforts or activities
  - IT Infrastructure
    - Refers to the interconnected system of **hardware**, **software**, **networks**, and **data centers**
    - Enables organizations to effectively manage and deliver information technology services, support business operations, and facilitate communication and data storage
  - Data classification and handling in project management involves the systematic **categorization**, **organization**, and **management** of project data
    - This is based on the project data's **sensitivity**, **confidentiality**, and **regulatory** requirements
  - Operational Security (OpSec)
    - Refers to the measures and practices implemented to protect the confidentiality, integrity, and availability of project resources, data, and systems by mitigating risks, implementing access controls, monitoring activities, and responding to security incidents

- **Solution Design Overview**
  - Solution Design
    - Aims to optimize a project within the limitations of its operating environment and involves capturing the architecture and design

requirements, testing requirements, technical risks, and analyzing tradeoffs
- o The solution design process includes the creation of two documents
    - ▪ High-level Design (HLD)
        - ● Created in the analysis phase of the SDLC process, and it assesses technical feasibility
        - ● HLD defines non-negotiable parameters and non-functional requirements (NFRs) and is used to select the solution
    - ▪ Low-level Design (LLD)
        - ● Created in the design phase of the SDLC process, and is a technical decision-making document that sorts out the project details
        - ● LLD serves as a reference document for creating work, whether using a work breakdown structure (WBS) or user stories
- o The final product is a blueprint for the project, which the project team will build based on the HLD and LLD
    - ▪ Blueprint
        - ● This is what the project team is going to build based upon these two documents, HLD and the LLD
- o The solution design process aims to minimize the cost of changes in projects
- o In the event the project team discovers that eight months into the project, the software fails to meet a critical requirement, this could result in a significant loss of time and money
- o It is crucial for a solution design to identify the needs and compare different options early on to find an agreeable set of products that can significantly reduce these risks
- o Collaboration in solution design builds confidence in the project
- o Solution design reduces project risk in business environments
- o Start with the end in mind by thinking about things early on and producing your high level and low-level designs

- **Solution Design Example**
    - o Functional Requirements
        - ▪ Business' requested features, such as product features, user interfaces, administration processes, and implementation support or training
    - o Nonfunctional Requirements (NFRs)
        - ▪ System's attributes that represent its ability to perform, often referred to as the "ilities" of software
        - ▪ Scalability is a great example of an NFR

- Examples of NFR
  - Usability
    - How user-friendly it is
  - Scalability
    - How easily a solution can grow or shrink as needs change
  - Availability/Reliability
    - How long it runs within a given time
  - Security
    - How well the solution and the company's assets are protected
  - Maintainability
    - How easily can it be changed or modified later on
  - Extensibility
    - How easy it is to add new features without altering what is already in place
  - Portability/Compatibility
    - How well the solution works within the existing environment
  - Compliance
    - The need for the solution to comply with relevant legal requirements
- Employing solution design helps to evaluate the tradeoffs involved
- In more complex business situations, employ more sophisticated criteria and profiling techniques
- Functional and non-functional requirements in solution design is really focused on those "ilities" of the software or the thing being built

- **Solution Design Approach**
  - Several enterprise environmental factors when creating the solution design
    - Functional requirements
    - Non-functional requirements
    - Constraints
    - Software products
    - Hardware requirements
  - The architect must also acknowledge limitations when designing the system, considering the project's cost, schedule, and scope boundaries as constraints
  - Hardware requirements must be defined and designed in accordance with the company's hardware strategy

o Environmental factors can impose standard and situational targets, with some factors being temporary or specific to a project too
o Since solution design involves optimizing the solution, the design team should consider multiple options as well
o It's essential to balance the time and money invested in the solution design process against the project's benefits
o The goal of solution design isn't to solve every problem, but to know enough to have confidence that the solution meets the requirements
o 15 Sections of a Solution Design Document
  ▪ Project/Solution Overview
    ● This section provides a brief summary of the project or solution that the document covers
  ▪ Intended Audience
    ● Clearly identify the intended audience of the document
  ▪ Purpose
    ● This section describes how the audience will use the document
  ▪ References
    ● This section lists any other documents that the intended audience may need to refer to, such as the project charter or scope statement
  ▪ Glossary
    ● Technical documents often contain unfamiliar terms and abbreviations, and this section provides definitions for such terms
  ▪ Current System Summary
    ● This section provides a summary of the existing system and its performance or how things are currently being done

  ▪ Detailed Functional Requirements
    ● This section clearly describes the business requirements and expectations of the stakeholders, which the team will use to develop tests
  ▪ Non-Functional Requirement Details
    ● This section describes the non-functional requirements that the project must meet, such as system performance expectations, against which the team will create tests or requirements
  ▪ Assumptions and Prerequisites
    ● This section lists the operating conditions that the team requires and assumes to be in place

- High-Level Design (HLD)
  - This section includes visual aids, such as process flowcharts and data flow diagrams, to describe the systems and integrations
- Low-Level Design (LLD)
  - This section provides detailed technical information about all proposed changes to the system
- Impact Analysis
  - This section evaluates how the proposed solution will impact the existing environment, including any necessary updates or changes that will be required to ensure compatibility
- Out-of-Scope
  - This section clearly defines the boundaries of the project and what is not included in the solution
- Risks and Mitigation
  - This section documents known risks and outlines the current mitigation strategy, including any necessary tests or potential unknowns
- Appendix
  - This optional section includes any supplementary but valuable information that the team may find helpful
- The template and sections used for HLD and LLD documents can be similar with minor modifications
  - HLD
    - Unlikely to include specific software brand names
  - LLD
    - Highly detailed and provides specific configurations and specifications

- **Solution Design in an Agile Project**
  - Solution Design
    - A process that requires thorough documentation
    - In a waterfall approach, it is completed at the beginning
    - In an agile approach, it is completed in each iteration
  - A balanced approach that combines the value of agile and waterfall is recommended
  - Start with NFRs and non-negotiable solution requirements and gradually expand in every iteration

- o User Stories
  - ▪ A common format for expressing design requirements in an agile context, while waterfall projects use a single, lengthy document
- o The agile methodology follows iterations that typically last 1-4 weeks (sprint)
- o Agile teams are more self-organized and have a higher performance level than traditional teams

- **Diminishing Returns and the Pareto Principle**
  - o Law of Diminishing Returns
    - ▪ The law of diminishing returns is an economic principle, but it can be applied to many scenarios
    - ▪ A small initial investment can lead to a sharp increase in productivity or value
    - ▪ Applying the law of diminishing returns to our scenario allows us to identify not the highest possible output, but the highest profitable output
    - ▪ In solution design, architects balance multiple requirements to create an optimal solution using diminishing returns

The law of diminishing returns sets a more realistic expectation for any improvement or growth model.
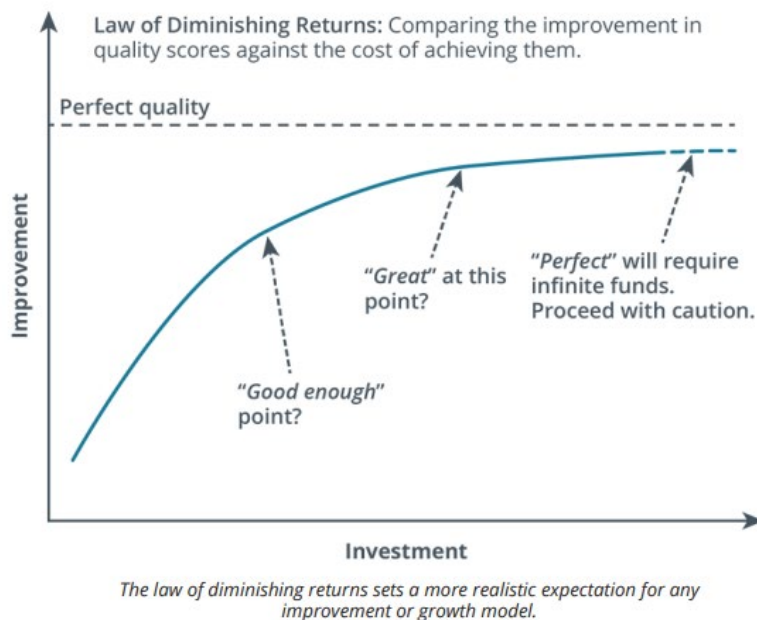
- o Pareto Principle
  - ▪ The Pareto principle, also known as the "80/20 rule", suggests that 80% of a problem can be solved by addressing 20% of its causes
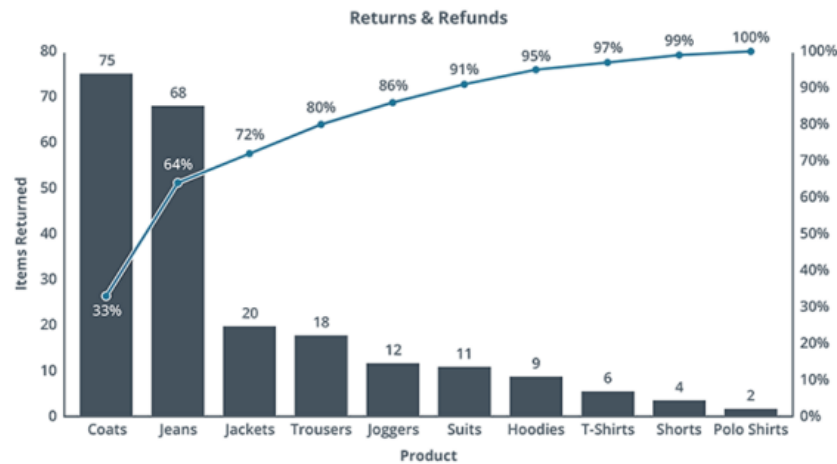
A Pareto chart often shows two vertical axes. The primary axis (on the left) shows the values for the columns. The secondary axis (on the right) shows the value for the percentage line.

- ● **IT Infrastructure**
  - o The architect responsible for creating the solution design must take into account various IT concepts
    - ▪ Computing Models
    - ▪ Infrastructure Requirements
    - ▪ Security Measures
  - o Infrastructure consists of a variety of things
    - ▪ Computing Services
      - ● Encompass all IT infrastructure, including hardware and software, as well as service providers
    - ▪ Multi-tiered Architecture
      - ● A modular software design that breaks software into distinct layers or tiers
      - ● Modularity is a common non-functional requirement (NFR) that enhances system resilience
      - ● A single-tier architecture is used in small production and testing environments
      - ● A three-tier design involves presentation, application, and data

- Networking and Connectivity
  - Refer to how the various users and components within a system connect
  - It encompasses network configurations, protocols, access rules, and hardware such as cabling, switches, and routers
  - Networking is a crucial component of any software project
- Storage
  - Physical technology needs a storage plan, including a physical location, temperature control, and humidity control
- Databases
  - Databases organize electronic information into structured tables that are intentionally designed for ease of retrieval and interpretation by analysts and engineers
- Data Warehouses
  - A comprehensive database utilized for analytics and reporting purposes
  - It does not perform any action
  - It provides the required data for analysis and reporting
  - The data warehouse process cleans and formats the data
- Documentation
  - Compromises all the data and diagrams related to the infrastructure
    - Network diagrams
    - Detailed server information
    - Position
    - Service directions
    - Addresses
    - Scripts
    - Protocols
    - Communications
    - Maintenance
    - End-of-life timetables

- o 2 Ways to Deliver Computing Services
  - ▪ On-premise Computing
    - ● It is done locally
  - ▪ Cloud Computing
    - ● It requires an internet connection
    - ● Different Cloud Computing Models
      - • Infrastructure as a Service (IaaS)
        - ▪ Provides basic computing resources like servers, networks, and storage
      - • Platform as a Service (PaaS)
        - ▪ Delivers development tools like software environments over an Internet connection
      - • Software as a Service (SaaS)
        - ▪ A complete software stack that includes infrastructure, environment, and product that end-users would use
      - • Anything as a Service (XaaS)
        - ▪ Any cloud computing service, where "X' represents a specific service
        - ▪ XaaS refers to the concept of outsourcing a computing a service to a third party
- o Enterprise Resource Planning (ERP)
  - ▪ Used by businesses of all types to manage operational workload
  - ▪ ERP provides valuable data that can be used to update project progress, such as time allocations
- o Financial System
  - ▪ A subset of ERP software that focuses specifically on the financial aspects of an organization
- o Customer Relationship Management (CRM)
  - ▪ Designed to establish and maintain customer relationships to enhance revenue and loyalty
  - ▪ From a project management standpoint, it is beneficial as it can track trends in complaints and other customer feedback, which can be used to identify areas of focus for new projects or research
- o Electronic Document Management Systems (EDMS) and Record Management Systems (RMS)
  - ▪ Companies can create, track, and share documents by automating processes and applying access control

- o Content Management System (CMS)
    - ▪ User-friendly systems that simplify complex tasks such as website creation and information management

- **Data Classification and Handling**
    - o 4 Main Categories of Data
        - ▪ Public Data
            - ● Least sensitive and available to anyone
        - ▪ Internal Data
            - ● Accessible to employees within the company and is not public-facing
        - ▪ Confidential Data
            - ● Highly sensitive and has limited access
            - ● It includes information that's essential for employees to perform duties
        - ▪ Restricted Data
            - ● Most sensitive type of data where access is restricted and granted only on a need-to-know basis with strict business justification
    - o Personally Identifiable Information (PII)
        - ▪ Data that can be used to identify an individual
            - ● Social Security Numbers
            - ● Email Addresses
            - ● Passwords
            - ● Passport Numbers
    - o Personal Health Information (PHI)
        - ▪ Federally protected in the US under HIPAA regulations, which require organizations to safeguard against unauthorized access and disclosure of sensitive health information
        - ▪ PHI is a combination of PII and health information
            - ● PII
                - • Person's identity
            - ● PHI
                - • Health information
    - o General Data Protection Regulation (GDPR)
        - ▪ European Union (EU) data privacy and security law that encompasses 11 chapters of regulations and is considered the strictest privacy law
    - o Data privacy laws provide protection to consumers in their own jurisdiction

- o Non-compliance with regulations has negative repercussions for both individuals and companies
- o Intellectual Property (IP)
    - ▪ Creations of the mind that serve as assets in business
    - ▪ 4 Types of IP Assets
        - ● Patents
        - ● Copyrights
        - ● Trademarks
        - ● Trade Secrets
            - • A unique category of intellectual property that can provide a company with a competitive edge
- o Branding Restrictions
    - ▪ A company may have a logo that is trademarked and permitted for use on its documents and products
    - ▪ The company can limit where the logo is positioned on a page and which document types can include it
    - ▪ The company may create templates for different document types

- ● **Operational Security**
    - o Digital and operational security are paramount for protecting sensitive information
    - o It is important to grant access to project team members and stakeholders with the least privilege required
    - o Access levels of the products added to a solution design should meet the requirements
    - o Establish a remote access policy that defines who can connect to the network and how
    - o Employ multi-factor authentication to secure systems
    - o Multi-Factor Authentication (MFA)
        - ▪ Enhances security by requiring users to provide at least two pieces of evidence to access a remote system or resource
        - ▪ The process involves two or more credentials, which fall under three categories:
            - ● Something you know
            - ● Something you have
            - ● Something you are

- MFA is commonly used by companies to access their network, with employees having to enter a password and scan a smart card to log into their computer at work
- Operational Security (OPSEC) brings people and the physical environment into security equation
  - Removable Media
    - Removable media, like USB drives, provide users with a convenient way to store and transfer files between computers
    - They also pose a significant security risk as they can be easily copied or moved
    - To mitigate this risk, companies may restrict the use of removable media and implement security policies such as USB management that logs all connections and may block the use of removable media
  - Mobile Devices
    - Mobile devices have become an increasingly popular way for employees to access corporate applications and data
    - It creates additional security risks as company assets can be accessed from a variety of locations
    - To address this, companies may issue corporate devices and require the use of mobile device management (MDM) software, which enables IT functions to monitor and remotely erase compromised devices
  - Facility Access
    - Unauthorized access to company facilities can lead to theft of assets or compromise of networks too
    - To prevent this, companies restrict facility access to authorized users only
    - This helps to ensure that company assets, including computers, mobile devices, and documents, are secured and protected
  - Background Screening
    - If your project involves handling information related to national defense or foreign relations, it is considered national security information in the United States
    - Access to this information is highly restricted, and it should receive the highest sensitivity classification
  - National Security Information or Clearance Requirements

- Individuals who need to access this information must pass a clearance and credit investigation to obtain authorization, similar to a very in-depth background check
- 4 Clearance Levels
  - Confidential
  - Secret
  - Top Secret
  - Sensitive Compartmented Information (SCI)
- The clearance requirement for the project is mandated by the nature of the information being handled

Managing Resources

- **Managing Resources**
  - Resource management is a crucial aspect of project management and encompasses the planning phase through the closing phase of the project
  - The PM is responsible for contributing to the professional development of team members
  - Resources, both physical and human, go through a four-phase life cycle
    - Acquisition
    - Maintenance
    - Improvement
    - Retirement
  - Succession Planning
    - Crucial to identify potential replacements for critical roles, promote career development, and ensure knowledge transfer and resiliency within the organization
  - Project managers play a crucial role in acquiring the necessary resources to successfully complete a project
    - These resources include financial support and tangible assets
  - Insufficient resources can lead to a stressful experience for the team and increase the likelihood of project failure
  - By following a structured needs assessment process, project managers can create a balanced resource plan that ensures the project's success
  - Gap analysis is a flexible approach that aims to investigate the causes of gaps and potential solutions, using tools such as the fishbone diagram, skills matrix, and histogram
  - Resource management in project management involves five key steps
    - Estimating necessary resources
    - Securing the resources
    - Training team members
    - Allocating resources to tasks
    - Monitoring and adjusting resources

- **Types of Resources**
  - Project managers need to acquire, manage, and decommission resources
  - It is essential to understand the difference between human, physical, and capital resources throughout the project management process

- o Human resources encompass the **time**, **skills**, and **knowledge** of individuals applied towards project tasks
- o Physical resources are the goods needed to support a project
    - Equipment
    - Software
    - Office Supplies
    - Workspaces
    - Buildings
    - Vehicles
- o Money is referred to as capital resources, which include the funding required to carry out a project, encompassing team and project budgets and long-term investment possibilities
- o Managing the budget is critical to project management

- ● **Resource Sourcing and Allocation**
    - o Origin of resources is determined by the sourcing method
    - o **Internal** refers to resources that are within the company's possession or that will be acquired by the company
        - Internal resources are less available but more affordable than external resources
    - o **External** refers to resources that the company does not possess and has no intention of purchasing outside of the project's scope
        - External resources are more available but more expensive
    - o Scheduling internal resources can be difficult because they are often shared services
    - o Evaluating vendors early in the procurement process can save time and effort
    - o Projects with high priority are more likely to receive internal resources on their preferred schedule, but they do not control all resource allocations
    - o Highly critical resources are more likely to require external sourcing when an internal option is unavailable
    - o If a project requires external resources, it is a need to develop a procurement plan
        - During the early planning stages, conduct a preliminary needs assessment and create a high-level procurement plan
            - ● Needs Assessment
                - Structured process for identifying the goods and services required to solve the project's problem

- Procurement Plan
  - Serves as the business case for using external resources and outlines a strategy for finding and managing vendors
- Preliminary Plan
  - May have less detail, but will continue to be refined throughout the project
- o The procurement plan may include the following details:
  - An overview of the required goods or services
  - Delivery and implementation dates
  - Critical dates
  - Analysis of the financial and risk impact of procuring these resources
  - Contract types
  - Evaluation methods
  - Vendor performance metrics
  - Available vendor options
  - Detailed financial analysis
- o Developing a procurement plan can improve the project's outcomes
- o All resources are either dedicated or shared and the allocation method describes how a resource's time or capacity is spent during a project
  - A dedicated resource will not guarantee a maximum capacity
  - Dedicated resources are useful when a project requires specialized skills or equipment
  - Shared resources are a better choice when the skill level required is lower or when resources are scarce

- **Calculating Shared Resource Capacity**
  - o Shared resources' capacity is divided among multiple projects
  - o Steps in Calculating Shared Resource Capacity
    - Identify the total hours and overhead hours
    - Subtract the overhead time from the total time to calculate the available time
      - Total Time – Overhead Time = Available Time
    - Divide available time by the number of projects to determine how much time they can spend per project
      - Available Time / Number of Projects
    - Allocate time
  - o Knowing how to calculate capacity will be helpful in preparing for any situation
    - Overestimating availability can cause project delays

- **The Resource Lifecycle**
  - o 4 Phases of Resource Lifecycle
    - ▪ Acquisition
      - ● The company procures goods and hires people based on the needs assessment process initiated by the project manager
      - ● Once acquired, resources require regular maintenance
        - • Repairs
        - • Upgrades
        - • Inventory Tracking
        - • Security Patches
        - • System Updates
        - • Work Schedules
        - • Motivation
        - • Support
        - • Performance Feedback
    - ▪ Maintenance
      - ● Resources receive operational support to function effectively
    - ▪ Improvement
      - ● Involves enhancing equipment, software, and employee performance
    - ▪ Retirement
      - ● Requires advance notice to prepare for a replacement
      - ● Three things should come to mind when we discuss resource retirement
        - • End of Life (EOL) Software
          - ▪ Software reaching its end of life (EOL) is a common issue for companies
          - ▪ EOL means the vendor will no longer provide updates or support for the software after a specified date
          - ▪ Security patches are no longer available for EOL software
          - ▪ EOL notices are a sign to begin decommissioning the product and finding a replacement

- Hardware Decommissioning
  - Companies often keep extra IT equipment like laptops and headsets in stock, and multiple servers in different locations for failover protection
  - Use cloud storage to effectively outsource server distribution
  - During decommissioning, IT staff initiate a new life cycle to acquire IT infrastructure
- Succession Planning
  - A proactive approach where companies develop a plan for identifying potential replacements for critical roles that become vacant
  - It is when the employees leave their positions
  - Employees may leave their positions, either by moving to another company or transitioning to a different role within the same organization
  - Succession planning identifies the necessary knowledge, skills, and responsibilities for the position, and documents the processes involved
  - It helps preserve company knowledge and increases resiliency by eliminating a single point of failure

- **Conduct a Needs Assessment**
  - PMs need to acquire enough resources to complete the project
  - Underutilization can be as big of a problem as overutilization sometimes
  - Needs Assessment
    - Identifies the resources required by a project to solve a business problem
    - These resources can include **skills**, **software**, **equipment**, and other **tangible and intangible assets**
    - Needs assessment should be intentional and structured
  - Conducting a thorough needs assessment can offer several benefits, including the early identification of gaps, allowing the team to consider multiple options
    - It can improve on-time performance
  - 4 Steps in Conducting a Needs Assessment
    - Understanding the project's requirements
      - Project Objective
      - Success Criteria

- Milestones
- Deliverables
  - Identifying the current resources
    - Take a broad look at your resource pool, including specific team members, software, and equipment
  - Identifying any resources gaps
    - Compare your future state and current state summaries to identify any resource gaps
  - Addressing gaps
    - Create a plan to address each identified gap and put it into action
- This assessment will enable us to identify areas that require improvement and provide a clear roadmap towards their cloud adoption journey

- **Gap Analysis**
  - Gap analysis compares the current and future states to identify and describe differences
  - Skill Gap Analysis
    - Identifies the required skills that are currently unavailable within the team
  - Skill requirements are typically measured by two criteria
    - Type
      - Refers to the specific skills required to complete the task, such as graphic design, project management, or a specific coding language
    - Expertise
      - Refers to the level of competency required, such as novice, competent, and expert
  - Feature and Function
    - Capabilities and tasks that physical resources will be able to perform
    - Functions
      - Specific tasks or executions
    - Features
      - Tools to enable functions
    - To resolve any gaps in features and functions, adjustments to configurations, requirements, and plans may be necessary
  - Resource Utilization
    - Measures the effectiveness of project resources

- A resource is considered **underutilized** if the utilization percentage is **below 100%**, while **overallocation** occurs when the percentage **exceeds 100%**
  - o Time Allocated
    - Total amount of time that a resource is scheduled to work on any task within the project
  - o Total Time Available
    - Total amount of time a resource is available to work on the project
  - o The utilization gap occurs when the actual resource utilization percentage differs from the desired or target utilization percentage
    - One possible cause of the underutilization gap could be the **lack of clear task priorities**, leading to inefficient task allocation
    - Another cause could be the team's **lack of necessary skills** to complete tasks, resulting in delays and underutilization
    - Utilization gaps can significantly impact project outcomes

- **Resource Optimization**
  - o Resource optimization techniques can be employed during the planning and execution phases of a project
  - o 2 Primary Techniques of Resource Optimization
    - Resource Smoothing
      - Minimizes the fluctuation of resource utilization across different time periods
      - Resource smoothing is effective in streamlining projects that are on schedule but have irregular scheduling
      - Smoothing creates an even workload from week to week, but it doesn't allow the end date to shift
    - Resource Leveling
      - Optimization strategy that minimizes fluctuations and permits the extension of a project timeline
      - Leveling will rearrange work until nobody is overutilized, but it could extend the project's end date

- **Common Diagrams**
  - o Gap analysis aims to investigate the causes of gaps and potential solutions
  - o Fishbone Diagram
    - Also known as an Ishikawa or Cause and Effect Diagram, helps to visualize how different factors impact a single outcome

- Any category grouping that works for the project can be used, such as the Work Breakdown Structure (WBS) in project management or the standard category set known as the 6Ps
  - 6 Ps
    - Policy
    - Process
    - People
   - Plant Program
    - Product
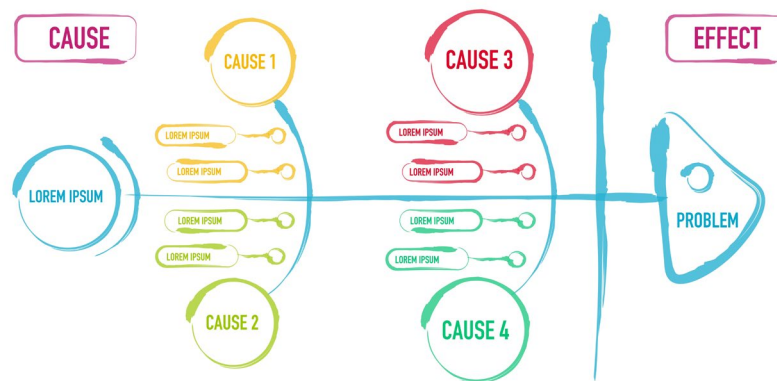
- o Skills matrix is useful for identifying development areas
  - Identify all the skills necessary for a project and record them on the matrix
  - Each team member assesses their competency level for each skill

- o Histogram
  - ▪ A type of column chart frequently used in statistical analysis
  - ▪ PMs can use histograms to summarize large datasets, evaluate processes, and track resource utilization over time
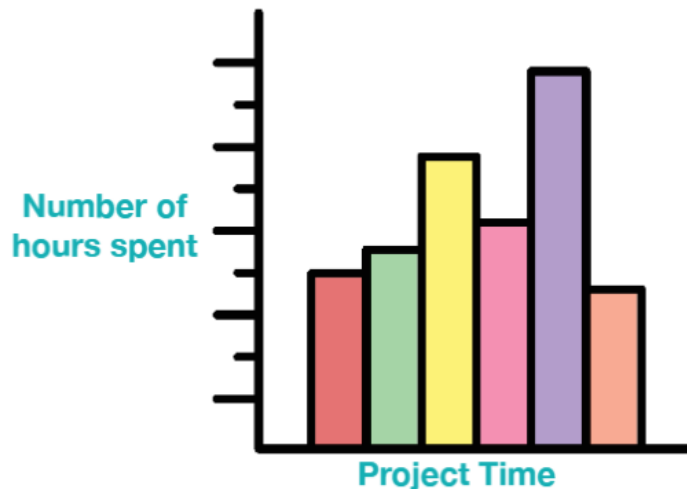
- ● **Resource Management Process**
  - o Resource management steps are not necessarily sequential
  - o Resource Management Process
    - ▪ Estimate the necessary resources
      - ● This requires conducting a needs assessment to determine the human and physical resources needed to complete the project's deliverables
    - ▪ Secure the resources
      - ● This involves completing a gap analysis to determine which resources are unavailable and creating a plan to acquire the necessary resources
      - ● This may include purchasing physical resources, restocking consumables, procuring equipment, or hiring external services
    - ▪ Train team members
      - ● Investing in training the team will need to complete the project successfully is essential
    - ▪ Allocate resources
      - ● This involves assigning resources to discrete tasks and factoring in the various roles required for each activity
      - ● Resource allocation includes project scheduling and workload management activities

- Workload Management
    - Ensures that all resources are working at appropriate utilization levels
- The resource management process should be revisited as the project progresses to ensure that the team has access to the resources they need
- Successful resource management is critical to the success of a project
    - Estimating necessary resources
    - Securing resources
    - Training team members
    - Allocating resources to specific tasks
    - Monitoring the project's resources

Managing Risk

- **Managing Risk**
  - Every project is exposed to risks, and no plan can completely assure smooth progress
  - Risks
    - Unforeseen events that can either positively or negatively affect the project
  - Risk, issue, and change management are interconnected processes in project management
    - Risk management process involves identifying and establishing response plans for these risks
    - Issues are current events that require immediate attention and recovery
    - Changes refer to modifications in project scope, budget, or timeline that require adjustments in project activities or resources
  - Risks can have both negative and positive impacts on the project
  - When a documented risk materializes, it becomes an issue
  - Project changes can also be triggered by issues
  - The risk management process involves four main tasks
    - Risk Identification
      - Involves creating a comprehensive list of potential risks, refining the list, and maintaining it in a risk register
    - Risk Analysis
      - Assesses the likelihood and impact of each identified risk to prioritize them
    - Risk Treatment
      - Involves developing response plans for each identified risk
    - Risk Monitoring
      - Includes tracking progress on response plans and updating the risk register
  - Qualitative Risk Analysis
    - Subjective approach that relies on individual perception and interpretation of risks, using basic scales to evaluate them
    - Two main considerations in qualitative analysis are **interconnectivity** and **detectability**

- o Quantitative Risk Analysis
  - Objective technique that uses verifiable data to assign scores to project risks
  - These quantitative methods provide more accurate probability estimates and help prioritize and manage high-impact risks
- o 4 Strategies for Addressing **Negative** Risks
  - Avoidance
  - Mitigation
  - Transfer
  - Acceptance
- o 4 Strategies for Addressing **Positive** Risks
  - Exploitation
  - Enhancement
  - Sharing
  - Acceptance
- o Risk Mitigation Plan
  - Developed to minimize the impact of negative risks and maximize the benefits of positive risks
- o Contingency Plan
  - Also known as fallback or backup plans, are created to respond in case the risk occurs, enabling a rapid response and recovery
- o A risk register is used to record project risks and includes essential fields
  - Risk ID
  - Description
  - Analysis Summary
  - Priority Scoring Criteria
  - Owner
  - Response
- o Transition Plan
  - Outline how the project team transfers ownership of the product to permanent owners
- o Internal and external transition plans differ in formality and focus
  - Internal plans can be more informal and use company-specific language, while external plans comply with contracts and exclude internal jargon

- **Comparing Risk, Issues, and Changes**
  - Risk, issue, and change management are interrelated processes that require different approaches to create unique management plan
  - Risks
    - Potential future events that may or may not occur
  - Issues
    - Current events that require immediate attention and recovery
  - Changes
    - Modifications in project scope, budget, or timeline that require adjustments in project activities or resources
  - Change control evaluates new change requests and tracks completed changes
  - While risks typically have negative connotations, they can also have positive impacts on the project
  - A comprehensive risk assessment can help a project prepare for potential issues
  - Risk response planning may necessitate changes to the project plan, particularly if the risk's likelihood and impact are high
  - Project changes can also be triggered by issues
    - When an issue arises, it must be evaluated for priority and response, which could result in **immediate remediation**, **no action**, or a **change** to the project plan

- **Risk Management Overview**
  - Risk management involves anticipating potential risks and developing proactive strategies to address them
  - 4 Main Tasks of Risk Management Process
    - Identifying the risk
      - Create a comprehensive list of all potential risks, drawing from past experience, the current environment, and other projects
    - Analyzing the risk
      - Assess the likelihood of each identified risk and its potential impact
    - Treating the risk
      - Develop a risk management strategy for each identified risk, assigning an owner and a response plan for each one
    - Monitoring the risk
      - Establish a plan to monitor the risks throughout the project, including tracking progress on response plans and tracking the occurrence of risk events

- o By following this risk management process, prepare for potential risks and mitigate their impact
- o Risk can be categorized as either known or unknown
- o The purpose of a risk management assessment is to reduce the number of unknown risks
- o By collecting and compiling inputs from everyone involved, the list of risks can be significantly expanded and the amount of unknown risk can be significantly reduced
- o The risk management process shrinks the number of unknown risks, making for a resilient project
- o It's impossible to eliminate all risk
- o Some risk roles to consider
  - ▪ Risk Owner
    - ● The person responsible for managing a risk who creates plans for risk mitigation and response and is the first to be notified when a risk occurs
  - ▪ Risk Manager
    - ● Administers the risk register and leads the overall risk management process, including risk analysis and response
  - ▪ Senior Management
    - ● Responsible for managing organizational risks and may become stakeholders for specific risks in a project depending on their priority and nature

- **Internal vs External Risk**
  - o During the planning phase of the project, the PM holds a risk assessment meeting
    - ▪ This session includes the project team, key stakeholders, SMEs, and the project sponsor
    - ▪ The team will **brainstorm** all the items that could happen to the project—both good and bad
    - ▪ The team will **assess each risk** to determine how likely it is to happen and how it would impact the project
    - ▪ The team will **create a plan** for what they will do if each risk happens
    - ▪ The team **records all the risks and their responses** in a risk register
  - o Difference between internal and external risk
    - ▪ Internal Risk
      - ● Originates within the organization

- Common internal risks include
  - Projects
    - One of the risks is the possibility of losing resources due to a new, higher-priority project approved by the company
  - Digital Transformation
    - Companies that invest in digital transformation usually evaluate their current technology stack and adopt modern products
  - New Management
    - A change in senior management can also affect project outcomes, as their priorities dictate the organization's operations and project portfolio
  - Reorganization
    - A reorganization is another risk for projects, where changes in reporting structures, job titles, stakeholders, and project sponsors may affect the team's dynamics and project progress
  - Merger and Acquisition
    - It can introduce new risks, such as differences in company culture, work styles, processes, and technology stacks
- External Risk
  - Originates outside the organization
  - Common external risks include
    - Infrastructure End-Of-Life (EOL)
      - A technology or product is no longer supported or maintained by the vendor
    - Cybersecurity Incidents
      - These occur when unauthorized parties gain access to an organization's computer systems, resulting in the theft, modification, or seizure of data

- Regulatory Environment Changes
  - Compliance failures can result in significant adverse impacts, including fines, remediation plans, reinspection, or even shutdown orders

- **Qualitative Risk Analysis**
  - **Qualitative** Risk Analysis is a **subjective approach** that relies on individual perception and interpretation of risks
  - There are two main considerations when discussing qualitative risk analysis
    - Interconnectivity
      - Refers to how risk can have a wider impact beyond a single event
      - Analyzing interconnectivity involves assessing how project risks may interact with one another
    - Detectability
      - An essential measure of how quickly a risk can be identified if it were to materialize
      - Detectability can affect the scope and impact of a risk event
      - Low-detectability risks can be unnoticed and discovered after reaching the end-users
  - Qualitative analysis can be assigned quantitative values

- **Quantitative Risk Analysis**
  - **Quantitative** Risk Analysis is an **objective technique** that employs verifiable data to assign scores to project risks
  - Probability Distribution
    - A way of describing how likely each possible outcome
    - Single average only scratches the surface of the true complexity of a distribution
  - Simulations provide reliable probability estimates for high-impact risks
  - It's important to remember that the accuracy of the simulation depends on the quality of data entered
  - The most common measures of risk are probability and impact
  - Probability
    - Measures the likelihood of a risk occurring and can be represented on a numerical or relative scale
    - Numerical scale typically ranges from 0 to 1, with 1 representing a 100% chance of occurrence
    - Most probability scales exclude 0 and 1

- o Impact
  - ▪ Measures how a risk would affect the business if it were to occur and can be represented on a numerical or relative scale
  - ▪ A multidimensional impact assessment can be used to measure how the risk affects various business measures, such as **cost**, **time**, or **scope**
- o Probability and impact are usually measured together to form a matrix or quadrant scale

- o A probability impact assessment is a good starting point for risk analysis
- o Failure Mode and Effect Analysis (FMEA)
  - ▪ A detailed analysis of a single process to identify multiple risks
  - ▪ FMEAs can proactively identify and eliminate design flaws during product and process design
  - ▪ It is a living document that requires a fair amount of time and analysis to maintain as the process changes
- o Scenario Analysis
  - ▪ Also known as situational analysis or what-if analysis, is a process that involves generating potential events and assessing their impact
  - ▪ Particularly useful for assessing low-probability, high-impact events, such as natural disasters or ransomware attacks
  - ▪ The process of scenario analysis involves asking what-if questions
    - ● For example
      - • What happens to Y if I change X?
      - • If X happens, how will it impact Y?
      - • How does a change in X affect Y?

- Scenario analysis is a valuable tool that can help individuals and organizations prepare for unexpected events and make informed decisions about risk management

- **Risk Management Strategies**
  - Risk management identifies the risks and optimizes the impact
  - The risk management strategy outlines how to address each risk in the event it occurs, also referred to as "risk response" or "risk treatment"
  - 4 Strategies for Addressing **Negative Risks**
    - Risk Avoidance
      - Prevents a risk from occurring by avoiding anything that could cause the event
    - Risk Mitigation
      - Aims to reduce the impact or likelihood of a risk
    - Risk Transfer
      - Assigns the risk to a third party, shifting financial responsibility for the risk to someone else
    - Risk Acceptance
      - A "do nothing" approach that accepts the consequences of a risk if it were to occur
  - 4 Strategies for Addressing **Positive Risks**
    - Risk Exploitation
      - Taking steps to ensure that the event occurs
    - Risk Enhancement
      - Maximizes the positive impact of a risk
    - Risk Sharing
      - Finds others who would benefit from the risk and share it
    - Risk Acceptance
      - A "do nothing" approach where you enjoy the benefits if the risk occurs and receive no benefits if it doesn't

- **Mitigation and Contingency Plans**
  - Once a risk has been **analyzed and a treatment option has been selected**, the risk owner **develops a mitigation plan** that is implemented prior to the occurrence of the risk
    - Risk mitigation plan minimizes the impact of negative risks and maximize the benefits of positive risks

- Despite the name "mitigation," this plan is applicable to any risk response strategy
- Once a **risk treatment has been chosen**, the risk owner creates a **contingency plan**, also known as a **fallback or backup plan**
- Contingency Plan
  - Outlines how to respond in case the risk occurs
  - A contingency plan should include, at minimum, the following information
    - The trigger that signals that the risk has occurred
    - Immediate response processes
    - Timed or phased responses, including immediate reaction, follow-up, and recovery phases
    - Communication details, such as primary contacts, who to inform, and escalation procedures
  - Contingency plan is necessary for each high-priority risk
- The risk management process gathers all necessary risk information, which is then compiled in a risk register
  - The risk register contains several essential fields
    - Risk ID
    - Risk Description
    - Risk Analysis Summary
    - Impact or Priority Scoring Criteria
    - Risk Priority or Ranking
    - Risk Owner
    - Risk Response or Treatment
  - Risk register is first created and populated during the initial risk assessment
  - Updating the register is crucial when the probability or impact of a risk changes so that resources can focus on higher-priority items
- Risk Report
  - Shares pertinent information about the project's risk management process and shared throughout the project's remaining duration
  - The risk report should include the following summary
    - Current status of project risks
    - Total number of identified risks
    - Trends
    - Summary of realized risks
    - Financial, timeline, and scope impacts resulting from realized risks

- Notable emerging risks
- Notable risks that are high-impact and time-sensitive
- Forecasted risk status
    - Risk reporting summarizes the project's risk status and how it impacts the project
  - The PM begins by creating a risk management plan that outlines the approach and tools to be used in the risk management process
    - Risk identification plan should be included and detail how the team will identify risks
    - **Risk Breakdown Structure (RBS)** should be created to classify the nature of risks by category
    - Risk response strategy should summarize the options used to manage risks
    - Financial factors, such as funding availability, funding needs, or resource requirements, should be listed
    - Risk monitoring plan should describe how the PM and risk owners will identify and track risks
    - Outline the timing of all risk management activities
      - Initial risk assessment meeting
      - Ongoing risk reporting
      - Other recurring activities

- **Transition Plans**
  - Transition Plan
    - Outlines how the project team will transfer ownership of the product to permanent owners at the end of the project
    - It also allows the team to schedule transition activities into the project timeline
  - After the project is completed, the product enters a maintenance phase
  - Operations team then takes over the maintenance phase, which involves routine support, updates, and process improvement
  - A transition plan can take the form of a checklist or a detailed document
    - Key elements to include in the plan
      - Roles and Responsibilities
        - Define who is responsible for completing the transition activities, who will own the maintenance activities, and who will be in charge of the transition plan

- Transition Schedule
  - Define the schedule of transition activities, including the official end date of the project and the go-live date

- Maintenance Schedule
  - Identify the ongoing maintenance requirements and schedule of activities that the operations team will need to include in their work
- Training
  - Identify the operational training requirements and delivery channels needed to train the maintenance team, including computer-based training or expert-led training sessions
- Activities
  - List all the other tasks required to complete the handoff, including access setup, asset turnover, and review sessions
- Tools and Techniques
  - List any specific tools, techniques, or processes the operations team will need long term
- Product Documentation
  - Code documentation, product specifications, configurations, and access and credentials
- Asset Turnover Plan
  - Create a strategy for how and when assets will move from the project team to the maintenance team
- Impact Analysis
  - Identify how the successful implementation of the project will change the work
- During the go-live phase, the project team leads the efforts while keeping the operations team informed
- Explicitly identifying the operational handoff in the project schedule is essential
- Transition plans are created for both internal and external audiences
- Internal transition plans can be formal or informal, depending on the organization's procedures
- External transition plans are typically more formal than internal plans
- In some cases, a project handoff may involve switching vendors

Creating a Project Schedule

- **Creating a Project Schedule**
  - Estimating costs, identifying resources, and planning a sequence can make a project appear overwhelming
  - Waterfall projects utilize a Work Breakdown Structure (WBS) for this purpose, while agile projects employ a project backlog
    - The level of detail required for breaking down a project depends on the specific project and team
  - Agile teams aim to create a potentially releasable product in fixed increments of time called sprint
  - The sprint goal signifies project progress and is within the control of the development team
  - The cadence determines the size of work items and the frequency of plan adjustments
  - When creating a Work Breakdown Structure (WBS), there are several key components and design guidelines to consider
    - **Elements** are the deliverables in the WBS, represented by boxes or rows, while work packages are the lowest elements without child elements and represent outcomes-based work
    - **Levels** indicate the layer of the WBS where an element resides, and numbering schemes assign a number to each element based on its hierarchy
    - **Legs and branches** refer to groups of elements with shared ancestors and multiple elements that do not represent the entire top-level element, respectively
  - The backlog serves as the body of work that a team will complete, and it is continuously refined and modified by the backlog owner
  - Backlogs are particularly useful for projects with many unknowns, as they provide flexibility within fixed boundaries to avoid scope creep
  - Key differences between WBS and project backlog
    - WBS
      - Controls scope, time, and cost
      - Details are stored in a WBS dictionary
      - Assumes that all scope items will be delivered
    - Backlog (Agile)
      - Prioritizes flexibility while fixing time and cost

- Details are contained within backlog items
- Works on one deliverable set at a time
  o Project Tasks
    ▪ Specific actions taken to complete deliverables and are not always necessary to document in detail
  o Dependencies play a crucial role in sequencing project activities
    ▪ 4 Types of Dependencies
      - Finish-to-Start (FS)
      - Start-to-Start (SS)
      - Finish-to-Finish (FF)
      - Start-to-Finish (SF)
  o Estimation techniques are essential for forecasting the time, resources, and cost requirements of a project
    ▪ Top-Down Estimating
      - Technique that starts with estimating the total project cost or duration and then breaks it down into smaller components
    ▪ Bottom-Up Estimating
      - Involves estimating the individual components and then aggregating them to determine the overall project cost or duration
    ▪ Analogous Estimating
      - Uses historical data from similar past projects to estimate the current project's cost or duration

    ▪ Parametric Estimating
      - Applies statistical relationships between variables and parameters to estimate project characteristics
    ▪ Three-Point Estimating
      - Considers the most likely, optimistic, and pessimistic estimates to calculate a weighted average estimate
    ▪ Expert Judgment
      - Relies on the knowledge and experience of experts to estimate project parameters

- **Milestones**
  o The first step in creating a project schedule is to break down these large work items into smaller, estimable pieces

o Decision-making guidelines can assist in identifying the appropriate level of detail for any project
o Project Milestones
▪ Represent critical checkpoints in a project and have a duration of zero days and are typically denoted by a diamond on graphic project schedules
o As a PM, it is crucial to ensure that the project schedule is aggressive yet achievable to keep the team productive
o Measuring progress against each milestone helps identify scheduling issues early
o Stakeholders not involved in the project's daily operations require regular updates but don't need to know about every minor decision
o Common Project Milestones
▪ Project Approval
▪ Project Kickoff
▪ Solution Design Approval
▪ Project Schedule Approval
▪ Project Phase Transition
▪ Sprint Demos
▪ Release
▪ Any Approval Events
▪ Sprint Goals
o In an agile team, the goal is to create a potentially releasable product every fixed increment of time, called a sprint, which can last from 1 to 4 weeks
o To ensure alignment between sprint goals, project activities, and milestones, work closely with the product owner and development team throughout the project
o Consider the following steps to identify milestones for your project
▪ Identify common project milestones such as project approval, kickoff, and schedule approval
▪ Determine the expected milestones for your project methodology
▪ Work with the team and functional experts to identify critical events specific to the project
▪ Identify any formal approval events
▪ Review the milestone schedule to ensure the frequency and pace are reasonable
▪ Adjust the milestones upon learning
o A good starting point is to have a milestone about once a month

- **Project Cadence**
  - Project Cadence
    - Determines the frequency and structure of recurring events within a project
      - Sprint Duration
      - Regular Team Meeting
      - Stakeholder Review
  - Establishing an appropriate pace, or cadence, for a project
  - Cadence refers to the rhythm and frequency of recurring events in a project, such as team meetings, stakeholder reviews, and sprint lengths
  - Cadence also affects the size of work items
  - Setting the cadence early in the planning process is crucial to ensure that the work items are appropriately sized and the project progresses smoothly
  - Cadence should reflect how often the plan should change
  - A project may have multiple cadences reflected in its **schedule**, **milestones**, and **communication plan**

- **Work Breakdown Structure**
  - Work Breakdown Structure (WBS)
    - An essential component of project management and informs other project documents, including the project schedule
  - Task
    - An action completed to deliver project work
  - Activity
    - Any work related to the project
  - Work
    - The result of doing something, not the act of doing something
  - Schedule
    - Contains the WBS deliverables, timing, and resource requirements
  - Deliverable
    - The outcomes of the project
  - Key Components of WBS
    - Element
      - The deliverables in a WBS
      - The elements of a WBS include nouns only
    - Work Package/Terminal Element
      - Lowest element in each branch or leg (an element without a child element is a work package)

- Work packages are an outcome-based element of work and not a task
  - Level
    - The layer of the WBS where an element resides
  - Numbering Scheme/Code of Accounts
    - Element that are assigned a number according to its place in the hierarchy
  - Leg
    - A group of elements with a shared ancestor
  - Branch
    - One or more elements that do not represent the whole top-level element in the branch
- Design Guidelines of WBS
  - Mutually Exclusive Collectively Exhaustive (MECE)
    - An organization and problem-solving method
    - MECE is challenging to design, but it helps ensure accountability for a project
  - The 100% Rule
    - Indicates 100% coverage of the project work without including anything beyond the project's deliverables and project management work
- While planning a WBS, include only outcomes instead of tasks
- In most projects, it is recommended to use four levels or fewer
  - Work elements can be broken down until they meet the following criteria
    - The team can estimate the time, cost, and resources required for the work package
    - The work element is expected to last for the 8/80 rule
    - The element produces a measurable deliverable
    - Breaking the element further would not help the project

- **Creating the WBS**
  - Work Breakdown Structure (WBS)
    - Project management tool that provides a visual representation of a project's scope, tasks, and deliverables
  - A WBS also helps to identify project risks, estimate project timelines and costs, and allocate resources effectively
  - To create a WBS, you need to follow six basic steps
    - Determine the scope

- Understand the project's objectives, constraints, requirements, and identify the stakeholders and their expectations
- To determine the scope, use the following techniques
  - Brainstorming
  - Mind Mapping
  - Interviewing Stakeholders
- Identify Deliverables
  - Deliverables are the tangible and intangible products or services that the project will produce, and can include reports, software, hardware, training materials, and more
    - To identify the deliverables, use the following techniques
      - Decomposition
      - Process Mapping
      - Flowcharting
- Identify Team Members
  - Consider the skills, knowledge, and experience required for each task and allocate team members accordingly
  - To identify team members, you can use a Responsibility Matrix or RACI Chart
- Build Level 2
  - Provide more detail about each deliverable and include all the tasks required to complete each one
  - To build Level 2, you can use techniques such as
    - Brainstorming
    - Mind Mapping
    - Decomposition
- Build the Remaining Levels
  - Provide more detail about each task required to complete each deliverable
  - To build the remaining levels, you can use the same techniques as Level 2, such as brainstorming, mind mapping, or decomposition
  - Document each level in a hierarchical structure, starting with the highest-level deliverables and breaking them down into smaller components
- Create the WBS Dictionary
  - Provides additional details that cannot be accommodated on the WBS diagram

- A WBS dictionary is customizable, and it should include the following elements
  - Work Package ID
  - Work Package Name
  - Work Package Description
  - Assigned to
  - Date of Assignment
  - Due Date
  - Estimated Cost
- By creating a WBS, a project manager can assign resources and set timelines for each level of the project, ensuring that the project progresses smoothly and on schedule

- **Project and Product Backlog**
  - A project backlog and a product backlog are not identical
  - WBS and the project backlog focus on creating deliverables and aim to leave execution details to the team
  - WBS and the project backlog employ a hierarchical structure that breaks down large projects into smaller pieces of work
  - WBS details are stored in a WBS dictionary, while product backlog details are contained within backlog items
  - WBS is more structured in design, while backlogs do not have design requirements
  - WBS operates under fixed scope, time, and cost, while project backlog utilizes agile ceremonies to fix time and cost, and the scope of work remains flexible
  - WBS project schedule assumes that all scope items will be delivered, while a backlog schedule assumes that some items may not be delivered
  - Value is not assumed in project backlogs
  - A WBS and a project backlog require breaking work down into manageable pieces
  - Epic
    - A large deliverable that is triggered by a business case and is equivalent to level 1 of a WBS
  - Feature
    - Smaller than an epic and lasts 1-3 iterations
  - User Story
    - The smallest agile deliverable, equivalent to a work package in size and spirit

- o Epics, features, and user stories are deliverable-based products that use nouns
- o WBS and a product backlog define what the team needs to deliver

- **Project Tasks**
  - o Work packages are generated by a WBS, and user stories are generated by a backlog
  - o In project management, a task is a specific action taken to complete a deliverable
  - o Tasks are not visualized at the WBS or user story level
  - o Tasks are not always required for every work package or user story
  - o Some guidelines to help determine when to create tasks
    - ▪ If the team wanted a to-do list to manage available work
    - ▪ If a work package has multiple actions with different owners
    - ▪ If there are multiple dependencies within a user story or work package
    - ▪ If it improves how the team works or how to manage the project

- **Dependencies**
  - o Defining project activities is a crucial step in creating a project schedule
  - o Dependencies
    - ▪ Refer to the relationships between activities
    - ▪ Dependencies control the order of events in a project
  - o When two activities are dependent on each other, they have a predecessor-successor relationship
  - o Dependencies can be visualized in multiple ways, including listing predecessors for each dependency in a project schedule, or through Gantt charts and project network diagrams
  - o 4 Types of Dependencies
    - ▪ Finish-to-Start (FS)
      - ● Activity 2 starts after Activity 1 finishes
    - ▪ Start-to-Start (SS)
      - ● Activity 2 starts after Activity 1 begins
    - ▪ Finish-to-Finish (FF)
      - ● Activity 2 finishes after Activity 1 finishes
    - ▪ Start-to-Finish (SF)
      - ● Activity 2 finishes only after Activity 1 has started
  - o On a diagram or Gantt chart, the relationship type determines how to link two activities visually

- o 4 Types of Logic Dependencies
    - ▪ Mandatory
        - ● Inevitable and often arises due to legal or contractual reasons
    - ▪ Discretionary
        - ● Often represents a strategy for optimizing efficiency, lowering costs, or improving quality
    - ▪ External
        - ● Beyond the control of the organization
    - ▪ Internal
        - ● One that the organization can control
- o No type of dependency is inherently better than the others
- o Mandatory dependencies are often inflexible and easier to manage, but they are also higher risk
- o Understanding the details of each dependency helps to ensure that the project stays compliant while managing tradeoffs

- **Estimation Techniques**
    - o Estimates are extremely valuable because they give you a starting point for your project
    - o There are different techniques for estimating project costs and durations, each with its advantages and limitations
    - o Some of the most common techniques for estimating project costs and durations
        - ▪ Top-Down Estimating
            - ● Starts by estimating the total cost or duration of the project or major deliverables and then breaks down the estimate into smaller components
        - ▪ Bottom-Up Estimating
            - ● Estimates the cost or duration of each individual activity, task, or user story and then aggregates them to produce a project estimate
        - ▪ Analogous Estimating
            - ● Uses historical data from similar projects to estimate the cost or duration of the current project
        - ▪ Parametric Model Estimating
            - ● Combines historical data with mathematical models to estimate the cost or duration of a project
        - ▪ Combining three-point estimation with any other estimating technique can provide a more nuanced and accurate estimate

- This approach considers multiple possible scenarios and calculates an average estimate based on three values: **optimistic**, **pessimistic**, and **most likely**
- Here's an example of using three-point estimation
  - Suppose a team is estimating the time required to complete a software development project. Using the three-point estimation technique, they determine the following estimates
    - Optimistic estimate (O): 4 months
    - Most likely estimate (M): 6 months
    - Pessimistic estimate (P): 8 months

  - To calculate the average estimate, they can use the formula
    - (O + 4M + P) / 6
  - In this case, the average estimate would be
    - (4 + 4(6) + 8) / 6 = 5.33 months
  - This estimate considers the best-case, worst-case, and most likely scenarios, providing a more comprehensive and accurate estimate
  - How about estimating time and effort?
    - One common approach is to estimate time and effort for project activities, such as using duration and task hours or story points

- **Resource Allocation**
  - Resource Allocation
    - It involves allocating both human and physical resources, as capital resources are typically used to pay for them
    - It provides numerous benefits to a project
      - Clarity
      - Parity
      - Discovery
      - Validity
  - The resource assignment process involves two activities
    - Assigning roles via a Responsibilities Assignment Matrix (RAM)
    - Assigning human and physical resources using a project scheduling tool

o During the project initiation phase, the Matrix (RAM) is initiated and team members with their respective roles are added
o The RACI Matrix consists of four roles which are as follows
  ▪ Responsible (R)
    ● The person who will perform the assigned work
  ▪ Accountable (A)
    ● The person who will be responsible for the final work
  ▪ Consulted (C)
    ● The person who can provide expertise on the work but will not be directly involved
  ▪ Informed (I)
    ● The person who needs to be aware of the work completion
o Responsibility Assignment Matrix (RAM) is a crucial tool for defining project roles and responsibilities
o To effectively manage project resources, a project management scheduling tool should also be utilized
  ▪ Most projects employ project software to **create schedules**, **determine baselines**, and **report on project outcomes**
  ▪ This scheduling software typically includes a comprehensive list
    ● Project Activities
    ● Milestones
    ● Dependencies
    ● Corresponding Dates
  ▪ This information can be visualized using **tables**, **Kanban boards**, and **Gantt charts**
  ▪ The software also maintains a resource list that includes all project resources, their capacity, and associated costs
o Tracking resource assignments can help identify potential issues
o Project Schedule
  ▪ Contains the activities required to complete the project work
    ● Project Timeline
    ● Resources
    ● Due Dates
    ● Dependencies

Creating a Project Plan

- **Creating a Project Plan**
  - o The goal of gathering metrics is to improve an outcome
  - o Project Network Diagrams
    - ▪ Visually represent the logical relationships and dependencies between project activities
  - o Critical Path Method
    - ▪ Technique that identifies the longest sequence of dependent activities, to determine the project's minimum duration and highlight activities that must be closely monitored
  - o Minimum Viable Product
    - ▪ Refers to the development of a basic version of a product or solution that includes only the core features necessary to deliver value to early users or customers
  - o Project Reserves
    - ▪ Allocated resources, such as time, budget, or contingency plans, set aside to address unforeseen risks, uncertainties, or changes during the project execution
  - o Project Baselines
    - ▪ The approved and agreed-upon reference points that define the initial scope, schedule, and cost of a project
  - o Project Budget
    - ▪ Represent the planned financial resources allocated for executing a project, encompassing estimated costs for labor, materials, equipment, and other expenses

- **Project Network Diagrams**
  - o As part of project management, it is a need to create a schedule that included all project activities, dependencies, and time estimates
  - o The project schedule is commonly presented as a spreadsheet or Gantt chart
    - ▪ Gantt chart uses bars to represent activity duration, the resulting chart can be cumbersome to view
    - ▪ Project Network Diagram
      - ● Also known as a project schedule network diagram, provides a clear and concise visual representation of the project schedule using arrows and same-sized rectangles

- o Different Diagram Methods
  - ▪ Precedence Diagram Method (PDM)
    - ● A commonly used project diagram style that utilizes rectangles and arrows to indicate dependencies between activities

FS - Finish to Start
FF - Finish to Finish
SS - Start to Start
SF - Start to Finish
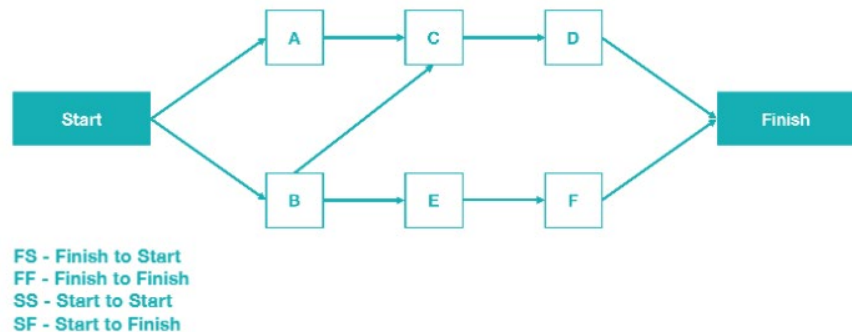
    - ● A PDM chart can be sketched and layered with duration and calculations using another diagram technique
  - ▪ Program Evaluation and Review Technique (PERT)
    - ● Designed to illustrate the duration, activities, and dependencies of a project
    - ● It involves using the three duration estimates for each activity
      - • Optimistic
      - • Pessimistic
      - • Most Likely
    - ● A PERT estimate is helpful for calculating realistic timing estimates
  - ▪ Critical Path Method (CPM)

- ● **Critical Path Method**
  - o Critical Path Method (CPM)
    - ▪ Utilized in a project network diagram to incorporate duration, activities, dependencies, PERT estimates, and additional calculations
  - o To calculate the critical path, it is necessary to identify the longest chain of dependent activities, which may not necessarily be the most important activities in terms of value delivery
  - o 7 Steps of Critical Path Analysis
    - ▪ Draw the project activities and dependencies
    - ▪ Calculate the PERT estimate duration for each activity
    - ▪ Complete a forward pass to calculate the early start and early finish
    - ▪ Complete a backward pass to calculate the late start and late finish

- Calculate the total float (TF)
  - Total Float (TF)
    - Calculated by subtracting the activity's earliest finish date from its latest finish date
- Calculate the free float (FF)
  - Free Float (FF)
    - Calculated by subtracting the activity's earliest finish date from its earliest start date
- Identify the critical path
  - Critical Path
    - The sequence of activities that must be completed on time to meet the project's deadline
  - By using critical path analysis, you can ensure that the project stays on track, and the project team is focusing on the most critical activities
  - The critical path is the longest path through the network diagram in terms of duration
  - CPM is a project management technique used to determine the sequence of dependent activities with the longest duration in a project

- **Usefulness of CPM Outputs**
  - Critical Path Analysis (CPA)
    - Project management technique that helps to plan, schedule, and manage complex projects effectively
  - The critical path represents the longest duration of the project and helps in identifying the activities that are critical to the project's success
  - 5 Main Benefits of Conducting CPA
    - Efficient resource allocation
      - Allows project managers to identify the critical activities that require the most attention and resources, which helps in effective resource allocation
    - Accurate project completion time estimation
      - Conducting a critical path analysis helps project managers to estimate the time required to complete the project accurately
    - Improved project visibility
      - Provides a visual representation of the project's critical path, which allows project managers to identify potential bottlenecks and delays

- Better risk management
  - The critical path analysis helps project managers to identify the critical activities that are most susceptible to risks and delays
- Improved communication
  - Provides a clear and concise representation of the project's critical path, which helps in communicating the project's status and progress to stakeholders
- 7 Steps of Critical Path Analysis
  - Draw the project activities and dependencies
  - Calculate the PERT estimate duration for each activity
  - Complete a forward pass to calculate the early start and early finish
    - During the forward pass, you will determine two values for each activity: the early start and the early finish
      - Early Start (ES)
        - The earliest possible start time for an activity, based on the time required to finish all predecessor activities
      - Early Finish (EF)
        - The earliest possible finish time for an activity based on its duration
      - The following formulas can be used to calculate ES and EF
        - ES = Maximum EF of all direct predecessors
        - EF = ES + t, where t represents the activity's duration
  - Complete a backward pass to calculate the late start and late finish
    - During a backward pass, you will begin at the end of the project and work backward through the dependencies until you reach the start of the project
    - For each activity, you will calculate two new values during the backward pass: the late start and the late finish
      - Late Start (LS)
        - The latest possible start time for an activity that still allows the project to finish on time
      - Late Finish (LF)
        - The latest possible finish time for an activity that still allows the project to finish on time

- To calculate LS and LF, use the following formulas
  - LF = minimum LS of all successors
  - LS = LF – t, where t represents the activity's duration
- The backward pass uses the smallest LF because it represents the longest amount of time that lies ahead in the project
- Calculate the total float (TF)
  - Total Float (TF)
    - Measures the amount of time an activity can be delayed without affecting the project's overall timeline
  - TF is calculated for each activity using either of the following formulas
    - TF = LS – ES
    - TF = LF – EF
- Calculate the free float (FF)
  - Free Float (FF)
    - The amount of time an activity can wait before starting without impacting any other activities
    - Take the minimum early start of all direct successors minus the early finish for the task that is being calculated
- Identify the critical path
  - The critical path is defined as the list of all activities where the total float is equal to zero
- At a high level, everything seems to be a critical path item, but in reality, there are only certain parts of a task that become a critical path item
- CPM is a technique that helps plan, schedule, and manage complex projects effectively by identifying the critical path

- **Minimum Viable Product**
  - Minimum Viable Product (MVP)
    - Initial version of a product that demonstrates enough functionality for early adopters to use and provide feedback
  - When stakeholders see a genuine, working product early in the project, it can also build confidence in the project's success

- o Different Features of MVP
  - ▪ Project Creation
    - ● Allow users to create new projects, set project goals and deadlines, and assign team members to work on the project
  - ▪ Task Management
    - ● Allow users to create tasks within a project, assign them to team members, set deadlines and track progress
  - ▪ Calendar View
    - ● Allows users to view the project timelines, deadlines, and team schedules in a calendar view to help manage project schedules
  - ▪ Communication
    - ● Includes an in-app messaging feature that would allow team members to communicate with each other
  - ▪ Reporting
    - ● Allows users to see project progress and completion rates, track time spent on tasks, and generate reports on project status
- o The MVP would provide a basic set of tools for an IT project manager to manage projects, communicate with team members, and track progress
- o During the project initiation phase, a preliminary scope statement is prepared
- o As the project progresses, the team gains more knowledge about the project's scope and requirements, allowing them to create a more detailed scope statement
  - ▪ The same template can be used for both preliminary and detailed scope statements, but the latter may include additional fields such as significant **project risks**, **milestones**, and **vendor requirements**
  - ▪ Creating a detailed scope statement provides an opportunity to validate the project plan against the preliminary scope statement
  - ▪ The following fields are commonly included in a scope statement
    - ● Project Scope Description
    - ● Project Acceptance Criteria
    - ● Project Deliverables
    - ● Project Exclusions
    - ● Assumptions
    - ● Constraints
  - ▪ It might include additional fields such as
    - ● Milestones
    - ● Requirements
    - ● Tasks

- Risks
- Budget
- Estimates
- Estimation Methods
  - o Cost Estimates
    - ▪ Project costs consist of both direct and indirect costs
    - ▪ Direct Costs
      - ● Incurred as a direct result of the project and can be linked to a specific resource or activity
    - ▪ Indirect Costs
      - ● Overhead expenses that support multiple operations that cannot be attributed directly to a specific resource or activity
    - ▪ When estimating project costs, direct costs are always included, and resource cost rates are required for cost aggregation
  - o The scope statement evolves from a preliminary version to a detailed version throughout the project
  - o Cost estimation involves considering direct and indirect costs, using resource cost rates to estimate expenses at different levels of the project

- **Project Reserves**
  - o During your project execution, unforeseen circumstances can arise, and project budgets need to include financial reserves to safeguard against setbacks
  - o 2 Types of Reserves
    - ▪ Contingency Reserve
      - ● A calculated buffer of time and cost that covers documented risks ("**known unknowns**")
      - ● Contingency reserve is also known as a "contingency buffer"
    - ▪ Management Reserve
      - ● An additional amount of time or money that serves as a contingency for "**unknown unknowns**"
      - ● When requesting management reserves, provide a thorough justification and recovery plan
      - ● Management reserves are meant to cover significant project changes
        - Switching vendors
        - Onboarding time
        - Contract changes
        - Resource cost changes

- Global supply chain issues
- o The reserve provides backup funding for the project in case any of the identified risks materialize

- **Calculating Project Reserves**
  - o Various methods to calculate project reserves
    - ▪ Percentage of a Project's Cost
      - A percentage of the estimated cost of the project is taken into consideration
    - ▪ Monte Carlo Analysis
      - A well-known simulation technique that employs a three-point estimate to construct a probability distribution
      - It tallies the frequency of overall project outcomes
      - It overlays a cumulative probability line on the histogram to indicate the probability of the project staying within budget
    - ▪ Expected Monetary Value (EMV)
      - Requires each risk's probability and impact assessment
      - The probability and the financial impact of its occurrence are multiplied for each risk
      - EMV = Probability x Impact
      - The EMV calculation helps companies make decisions
    - ▪ Decision Tree Analysis
      - A decision-making tool for contingency planning (quantitative decision-making)
      - A decision tree has three components: **decision**, **options**, and **outcomes**
      - To calculate the EMV for each outcome, add up the EMV for each option's outcome to determine the EMV cost
      - Decision tree analysis is best suited for large projects with high-impact and high-probability risks

- **Project Baselines**
  - o Project Baseline
    - ▪ Serves as the initial reference point for the project
  - o A project baseline consists of three parts
    - ▪ Scope Baseline
      - Original scope from the detailed scope statement

- ▪ Schedule Baseline
  - ● Total project duration captured from the project schedule
- ▪ Cost Baseline
  - ● Expected costs plus the contingency reserves
- o Baselining helps to prevent scope creep, cost overruns, and delays in a project
- o Creating a project baseline results in better estimation and tracking of project progress
- o A good baseline aids in the change control process by serving as the source of truth for the original scope
- o 4 Main Steps in Creating a Project Baseline
  - ▪ Define the scope and identify key deliverables
    - ● Review the detailed scope statement and pinpoint the essential deliverables that determine the project's scope
  - ▪ Establish a schedule with a project duration and deadline
    - ● Create the schedule baseline and define the total duration of the project
  - ▪ Create the cost baseline
    - ● Sum up the project cost estimate in contingency reserve
  - ▪ Obtain stakeholder approval
    - ● Share with stakeholders to gain their buy-in

- **Project Budgets**
  - o The project budget comprises all resource expenses and represents the overall cost of the project, incorporating the **cost estimate**, **contingency reserve**, and **management reserve**
  - o A well-defined budget adds impartiality to financial decision-making, which can assist in overcoming resistance
  - o Budget Constraint
    - ▪ Refers to the limit or restriction placed on the amount of money available for a project
  - o Reserves
    - ▪ Refer to funds that are set aside to cover unexpected expenses or risks that may arise during the project's lifespan
  - o Updating the budget when changes occur is vital
  - o Documentation is another essential component of managing a project budget
  - o Recording updates to estimates and the use of reserves is also important

- o Keeping the budget updated is critical
    - ▪ Changes can occur at any time during the project, and it's easy to forget details
- o Budget constraints are vital to the success of a project
    - ▪ **Managing reserves**, **maintaining documentation**, and **keeping the budget updated** are all critical components of ensuring that the project stays on track and within the available resources

Procuring Solutions

- **Quality Assurance Plan Overview**
  - Quality Assurance (QA)
    - Encompasses a range of procedures that can impact every aspect of a project
    - The distinction between QA and QC can be unclear
      - QA
        - Processes and protocols
      - QC
        - Inspecting finished work
  - QA Plan
    - Developed during the planning phase and remains relevant throughout the project's duration
    - The QA plan addresses several crucial questions
      - How to verify that project work meets expectations?
      - How to prevent quality defects?
      - How to recognize and improve ineffective processes?
  - Verification
    - Internal process that objectively confirms that the deliverable meets quality standards
  - Validation
    - Subjective process that occurs outside the team and focuses on the finished deliverables
  - Verification measures internal quality, while validation measures desirability
  - The QA Plan includes the following components
    - Quality Standards
      - Document any relevant industry or regulatory standards, such as health codes, that apply to the project
    - Quality Objectives
      - Create a list of measurable quality targets, including on-time delivery and the number of defects
    - Roles and Responsibilities
      - Identify the individuals responsible for managing the program, adhering to standards, and evaluating products against the standards

- Deliverables and Approach
  - Identify all deliverables and processes that are subject to QA activities
- Regular meetings should be held by the project team to assess their performance and improve
  - Agile methodologies refer to this practice as "retrospectives," while the more general term is "lessons learned"
  - Lessons learned can refer to the end-of-project reflections
    - At the end of the project aim to improve future projects
    - Retrospectives and lessons learned events are recorded in a lesson learned document
- Inspection
  - Type of QC tool that involves examining a finished product and comparing it to the expected result
  - Sprint reviews, retrospectives, and software testing are all examples of inspections within a project's quality plan
- Audit
  - Reviews processes to identify potential sources of quality issues
  - Audit findings occur before work is produced
- Procurement Process
  - Involves obtaining goods and services from external sources through various methods
  - The procurement process encompasses several steps
    - Defining requirements
    - Submitting purchase requisitions
    - Soliciting quotes or proposals from vendors
    - Evaluating and selecting vendors
    - Managing orders
    - Maintaining records and payments
  - Purchase orders, master service agreements, and procurement contracts are common artifacts involved in the procurement process
- In the evaluation process for solutions, **Statement of Work (SOW)**, **Terms of Reference (TOR)**, and **Market Research** are crucial factors for optimizing vendor and product selection
  - Statement of Work (SOW)
    - Formal document that specifies the work a vendor is required to complete, defining the project's scope and technical requirements

- Terms of Reference (TOR)
  - Focuses on the relationship between the parties involved and emphasizes delivering work
- Market Research
  - Conducted by procurement specialists about products, services, suppliers, and industry trends
- Evaluating alternative solutions and considering capital expenses (CapEx) and operational expenses (OpEx) provides flexibility in finding the most suitable options
- There are three main types of contracts that project managers encounter
  - Fixed-price
    - Establishes a set price for a fixed scope of work and places most of the contract risk on the vendor
    - There are three types
      - Firm fixed-price
      - Fixed-price plus incentive fee
      - Fixed-price with economic price adjustment
  - Cost-plus
    - Reimburses the vendor for all resource costs and adds a fee for profit
      - Cost-plus fixed fee
      - Cost-plus incentive fee
      - Cost-plus award fee
      - Cost-plus percentage of cost
  - Hybrid
    - Combines fixed and cost-plus features
- Contract terms like warranties and non-disclosure agreements are important in procurement
  - Warranties provide assurance that the vendor will address defects
  - Non-disclosure agreements protect confidential information
- The project manager plays a role in managing vendor relationship

- **Types of Software Tests**
  - Software testing is crucial for IT organizations because it helps ensure that the software being developed meets the requirements and works as intended

- o Some reasons why software testing is important for IT organizations
  - ▪ Quality Assurance
    - ● Verifies and validates the software, ensuring it meets the desired quality standards
  - ▪ Cost-effective
    - ● Detects and fixes bugs during the development phase
  - ▪ User Satisfaction
    - ● Ensures the software meets the user's requirements and expectations
  - ▪ Compliance
    - ● Ensures the software meets the requirements, reducing the risk of legal and financial penalties
  - ▪ Reputation
    - ● Helps to prevent incidents by maintaining the organization's reputation and credibility
- o The tests can be categorized into two types
  - ▪ Manual
    - ● Involves a person manually completing each step of the test, one clicks at a time
    - ● Manual testing is highly adaptable, as humans can detect slight changes in software appearance
  - ▪ Automated
    - ● Involves machines completing tests through software scripts that flag errors for developers to address
    - ● Automated tests require human intervention to build and maintain
- o Unit Testing
  - ▪ Involves testing the smallest functional unit to ensure its functionality
- o Regression Testing
  - ▪ Involves running existing tests after a code change to ensure that the change does not affect any existing functionality
- o Smoke Testing
  - ▪ A high-level system test that confirms that the main features of the software are working before detailed testing is conducted
- o User Acceptance Testing
  - ▪ Evaluates the final outputs against specifications to determine if a user would accept the product

- o   Performance Testing
  - ▪   Evaluates the system's stability and speed under various workloads
- o   Stress Testing
  - ▪   A testing approach that evaluates the system's stability and speed under various workloads

- **Create a Test Plan**
  - o   The test plan includes the test strategy, a specific schedule of events, tests to run, and manual and automated tests
  - o   Transparency ensures a shared understanding of the product's quality expectations
  - o   Test plans are reusable, as every development project includes User Acceptance Testing (UAT)
  - o   There are several elements in a test plan
    - ▪   Scope
      - ●   Provides an overview of the project scope, including objectives, exclusions, and other scenarios
    - ▪   Test Type
      - ●   Identifies the types of tests used in the project, what the tests are for, and when they are used
    - ▪   Schedule
      - ●   Outlines the start and end dates for testing and the dates for each test category
    - ▪   Resources
      - ●   Lists the required systems and personnel needed to complete the testing process and the roles and responsibilities of team members
    - ▪   Environment
      - ●   Outlines the configurations, hardware, and software required to create a test environment
    - ▪   Tools
      - ●   Lists all the software requirements needed for building and running tests, and reports test results, records defects, and shares progress
    - ▪   Defect Management
      - ●   Outlines clear expectations for defect handling, including system to use for recording, when to record a defect, and what information to capture

- Risk Management
  - Summarizes the risks relevant to the testing process, including new risks discovered during the execution of the test plan
- Exit Parameter
  - Sets the standard that the QA team measures against and the development team writes against
- Different validation activities
  - Service Level Agreements (SLA)
    - Service contract that outlines performance expectations and consequences for not meeting expectations
    - SLA cannot guarantee a specific level of performance
    - Many SLAs are associated with on-time service or system performance, improving schedules
  - Post-implementation Support
    - Provides adoption assistance after the go-live date
    - Post-implementation support in the project plan is crucial because it's often overlooked after implementation
    - Post-implementation support differs from technical support
  - Warranty
    - A contractual obligation that guarantees a product meets specific requirements
    - Warranties require resources for support throughout the warranty period

- **Project Management Plan**
  - The project management plan encompasses a series of documents that detail the project team's **deliverables**, **approach**, and **performance metrics**
  - Project Plan
    - A dynamic resource that evolves throughout the project lifecycle
  - The project sponsor, project manager, and functional managers must approve the project plan
  - The Project Management Plan has the following contents, over them briefly and their subordinate components
    - Introduction
      - Background
      - Purpose of the Plan
      - Scope of the Plan
      - Project Scope Statement

- Project Objectives
- Deliverables
- Scope Exclusions
- Assumptions and Constraints
- Acceptance Criteria
▪ Work Breakdown Structure (WBS) or Backlog
  - WBS or Backlog Description
  - WBS or Backlog Hierarchy
  - WBS or Backlog Dictionary
▪ Resource Plan
  - Resource Requirements
  - Resource Allocation
  - Resource Schedule
  - Resource Management
▪ Project Schedule
  - Project Timeline
  - Milestone Schedule
  - Critical Path Analysis
  - Schedule Baseline
▪ Quality Management Plan
  - Quality Objectives
  - Quality Metrics
  - Quality Control Activities
  - Quality Assurance Activities
▪ Risk Management Plan
  - Risk Identification
  - Risk Assessment
  - Risk Response Planning
  - Risk Monitoring and Control
▪ Communication Plan
  - Stakeholder Identification
  - Communication Channels
  - Communication Objectives
  - Communication Frequency
▪ Stakeholder Management Plan
  - Stakeholder Analysis
  - Stakeholder Engagement Plan
  - Stakeholder Communication Plan

- Project Baselines
    - Scope Baseline
    - Schedule Baseline
    - Cost Baseline
- Project Budget
    - Budget Breakdown
    - Cost Estimation
    - Budget Tracking
- Project Plan Approval
    - Approval Process
    - Approvals Required
    - Signatories
- Appendices
    - Glossary of Terms
    - List of Acronyms
    - Change Management Plan
    - Issue Management Plan
    - Procurement Plan
    - Training Plan
    - Other Relevant Plans and Documents

- **Procurement Process Overview**
    - Procurement Process
        - Secures goods and services from other companies
    - The procurement process has dedicated professionals who specialize in it
    - Steps of the Procurement Process
        - Define requirements
            - PM defines the procurement requirements to meet the project's objective
        - Submit a purchase requisition
            - PM requests assistance from the procurement team to acquire resources
        - Complete the solicitation process
            - Procurement specialist prepares a request to solicit quotes, bids, or proposals from vendors
        - Evaluate and select vendors
            - Evaluation committee evaluates and scores vendor proposals based on predetermined objective criteria

- Manage orders
  - Procurement specialist or PM generates POs, and the vendor begins work in response
- Manage records and payments
  - Accounting, purchasing, and procurement teams review order records to identify discrepancies
- Common Procurement Artifacts
  - Purchase Order (PO)
    - A request made by a customer for specific goods or services, initiating a transaction
  - Master Service Agreement (MSA) / Contract
    - Comprehensive document outlining the terms of the vendor-buyer relationship
    - **Contract** establishes an agreement to purchase something, while a **PO** fulfills the contract by initiating specific purchases
  - Procurement Contract
    - Work together with PO to ensure that the agreed-upon terms are met
- Lease
  - Fixed-term contract paid with an initial fee and regular recurring payments for the duration of the lease
  - At the end of the contract, you generally have three options: **return the asset to the owner**, **renew the lease**, or **purchase the asset**
- Subscription/Pay-as-you-go
  - All-inclusive rental model paid with a flat fee for access to a resource for a set duration
  - Subscription works well as a low-maintenance option with the latest models or for short-term or low-volume use, pilot activities, or a small budget
  - The subscription provider pays for maintenance and repairs
- Different Exploratory Documents
  - Requests For Information (RFI)
    - A document used to gather information about potential vendors and capabilities
  - Request For Proposal
    - A formal document that outlines an organization's needs and solicits proposals from vendors to provide solutions or services to meet those needs

- Request For Bids (RFB)
  - Formal document that solicits bids from vendors for the supply of goods or services
- Requests For Quote (RFQ)
  - Formal document that solicits quotes from vendors for the supply of goods or services

- **Evaluating Solutions**
  - Statement of Work (SOW)
    - Formal document that specifies the work that a vendor is required to complete
    - 3 Main Types of Statement of Work
      - Design Statement of Work
        - Prescriptive and details the specific process and resources required to deliver the work
      - Functional Statement of Work
        - Outcome-focused and describes only the requirements of the finished product
      - Performance Statement of Work
        - Focuses on the expected outcomes along with minimum performance standards
  - Terms of Reference (TOR)
    - A version of the statement of work that contains the same information but focuses on delivering work
    - TOR is a formal document that creates a shared understanding of a group's scope of work or expectations
  - The elements of both an SOW and a TOR are the same which includes
    - Background and Overview
    - Requirements
    - Deliverables
    - Standards for Acceptance
    - Schedule
    - Payment Terms
  - Procurement specialist conducts market research about a product or service, suppliers, and industry trends
  - Market research can be conducted in several ways
    - RFI
    - Networking

- ▪ Research Firms
- ▪ Demo or Conferences
- ▪ Internal Research
- o Competitive analysis is often discussed alongside market research as it looks at the same information from a different angle
  - ▪ While market research identifies a list of potential vendors, competitive analysis compares them against each other and evaluates how firms are competing in the market
- o Conducting market research and competitive analysis are practical recurring procurement activities
- o Reviewing options provides insight for a decision to switch vendors or renegotiate terms
- o Evaluation considerations includes alternative solutions and current vendor options
- o Predetermined Client
  - ▪ A model user or a preferred configuration that optimizes the product's performance
- o Capital Expenses and Operational Expenses (CapEx and OpEx) are two types of expenses in an organization
  - ▪ Capital Expenses (CapEx)
    - ● Permanent assets like data centers, vehicles, and equipment that fall outside the operating budget
  - ▪ Operational Expenses (OpEx)
    - ● Regular expenses like salaries, taxes, subscriptions, rentals, and utilities that are built into the budget and do not depreciate
- o Ensure that the vendor has the capacity, capability, and interest to deliver the project requirements

- **Evaluation Techniques**
  - o Vendor selection is a crucial process that requires objectivity, fairness, and ethical practices
  - o To select vendors objectively, an evaluation panel can use multiple vendor evaluation techniques
    - ▪ The evaluation method and source selection criteria are determined before sending out the Request for Proposal (RFP) to ensure a fair vendor selection process
    - ▪ Several evaluation techniques
      - ● Best Value vs Lowest Cost

- Cost-benefit Analysis
  - o When evaluating a vendor, it's important to consider whether they have the capacity to meet your contract demands
    - ▪ Physical Capacity
      - Refers to the vendor's ability to produce the required volume of goods or services, including units sold, consulting hours, or any other relevant measure
      - The evaluation of physical capacity should also consider the vendor's overall business
      - Consider the risk of delays or cancellations if scheduling conflicts arise
      - Physical capacity evaluations should take into account both current and long-term growth projections
  - o In addition to physical capacity, it's essential to evaluate a vendor's financial stability
    - ▪ Financial Stability Evaluation
      - Involves assessing the vendor's overall financial health or viability
      - Financial evaluations should include a review of the following
        - Financial Statements
        - Credit Documentation
        - Public Documentation
      - Consider the vendor's governing body to gain insight into how company finances are managed
  - o Qualifying a vendor involves assessing their ability to meet the needs of the buying organization
    - ▪ This evaluation process requires vendors to demonstrate their capacity to deliver goods or services that meet the required standards
    - ▪ Qualification may involve assessing the condition of a vendor's facilities, as well as the expertise and qualifications of their staff
  - o Fit Evaluation Techniques
    - ▪ Vendor Demonstration
      - Interactive session where a vendor showcases their solution
    - ▪ Technical Approach
      - Involves comparing vendor submissions to the project requirements
      - Vendors offering products beyond the requirements do not receive a higher score, and they do not directly compete against each other

- References
  - Reference checks are conducted with the vendor's other clients
  o The procurement specialist asks about the client's experience with the vendor, their interaction, technology used, and performance, including **responsiveness**, **work quality**, **on-time performance**, and **cost management**

- **Procurement Contracts**
  o 3 Main Types of Contracts
    - Fixed-Price Contract (Lump Sum Contract)
      - Establishes a set price for a fixed scope of work and places most of the contract risk on the vendor
      - A fixed-price contract is suitable when the contract's scope remains unchanged
      - 3 Types of Fixed-Price Contracts
        - Firm Fixed-Price (FFP)
          - A model where the buyer agrees to pay a fixed price for a specific product or set of products
          - FFP contracts are suitable for well-defined products with clear specifications
        - Fixed-Price Incentive Fee (FPIF)
          - A buyer can add incentives to a fixed-price contract
          - Incentives could be based on quality, safety, or other measurable targets
          - Measurable performance is crucial as it allows both parties to agree on the payment schedule
          - FPIF contracts work best when the buyer has a budget for stretch goals
        - Fixed-Price with Economic Price Adjustment (FP-EPA)
          - A fixed-price contract that takes into account inflation costs
    - Cost-Plus Contract / Cost-Reimbursable Contract
      - Reimburses the vendor for all resource costs incurred in completing the work and adds a fee to cover the vendor's profit margin
      - The buyer is responsible for any inefficient resource management on the part of the vendor
      - Effective expense tracking is critical to controlling costs in a cost-reimbursable contract

- Cost-Plus Award Fee (CPAF)
  - Additional fee is awarded based on the vendor's performance during the project
  - The CPAF contract incentivizes the vendor to meet the buyer's needs by offering a bonus fee if the vendor exceeds expectations
- Cost-Plus Incentive Fee (CPIF) Contract
  - Contract that offers vendors an incentive to complete a project under specific circumstances
- Time-and-Material (T&M) Contract
  - Pays for the actual hours worked by the vendor at a predetermined hourly rate
  - Buyers prefer T&M contracts when there is confidence in the vendor's ability to complete the project within budget
- Cost-Plus Percentage of Cost (CPPC) Contract
  - A vendor receives a fee equal to a percentage of all costs
  - CPPC contract is beneficial when the buyer wants the flexibility to change materials or adjust the scope of work as the project progresses
- Hybrid Contract
  - Like unit price and time and materials
  - It is suitable for purchasing repetitive work when the quantity or scope is unknown at the project's outset
  - Time and materials (T&M) contract are suitable for projects with a fixed cost and flexible scope
  - Buyers prefer T&M contracts to control the maximum cost but retain flexibility during project execution

- **Contract Terms**
  - There are some contract terms that you need to know before you start procuring solutions like **warranties** and **non-disclosure agreements**
  - Including a warranty in a procurement agreement can mitigate risk for the buyer by providing the vendor's assurance to address any defects
  - Warranty
    - Outlines the duration of time the vendor anticipates the product to be free from flaws and specifies the course of action in the event of a malfunction

- ▪ Common Elements of Warranty
  - ● Length
    - • The warranty period is specified, usually lasting for a defined period, such as one year
  - ● Scope
    - • A warranty usually covers defects resulting from the production process, such as sudden Wi-Fi antenna failure in a cell phone
  - ● Remediation
    - • The vendor outlines the course of action in the event of a defect, often including a refund, replacement, or both
  - ● Limitations and Exclusions
    - • The vendor specifies their responsibility boundaries, including limitations and excluded situations
  - ● Commencement
    - • The commencement clause is relevant for projects, such as a software implementation warranty in a procurement agreement that offers free remediation for failures
- o Non-Disclosure Agreements
  - ▪ Enables the exchange of sensitive or valuable information with a certain level of confidence that it will not be divulged
  - ▪ Several scenarios may require an NDA which includes
    - ● New product development
      - • If both parties are working together to create a new product or design, they should sign an NDA
    - ● Non-public information
      - • If the vendor has access to any information that is not publicly available, an NDA can protect proprietary and sensitive data
    - ● Facilities
      - • If the vendor will have access to your facilities where they may see proprietary processes, equipment, or information, request an NDA
    - ● Consulting
      - • Consultants should sign an NDA for their clients because the consulting process involves sharing non-public information

- o Once the contracts have been signed and the project is underway, the PM assumes a primary role in managing the vendor relationship
- o The PM possesses a deeper understanding of the project's deliverables, quality standards, and customer expectations
- o PM will engage in several vendor management activities throughout the project
    - ▪ Rules of Engagement
        - ● The operating agreements that dictate how the vendor and project team will collaborate to execute a project
        - ● Rules of engagement are crucial for any project, especially those that involve diverse groups of individuals who haven't worked together before
    - ▪ Performance Monitoring
        - ● The PM also has the ability to monitor and evaluate a vendor's quantifiable performance, such as their compliance with SLAs
        - ● It is important to collaborate with the vendor to adjust targets, if necessary, as initial targets can often be overly ambitious
    - ▪ Approval of Deliverables
        - ● Involves a thorough review of the work submitted, ensuring it meets the project's quality standards
        - ● Each deliverable should contribute to the project's overall completion, and any work that fails to do so must be evaluated

Managing Project Execution

- **Managing Project Execution**
    - The beginning of the execution phase marks a significant point in the project
    - During the discovery, initiation, and planning phases, the project manager takes the lead and drives most of the project's activities
    - To keep track of this information effectively, the team must plan how they will organize it and commit to following the process
    - The project manager is responsible for monitoring the project's progress
        - They gather data, analyze reports, and measure progress, reporting to stakeholders and ensuring that communication is flowing smoothly
    - The project manager receives change requests, analyzes them, and adjusts the project plan accordingly
    - Project manager enables the team to deliver the plan, providing positive support and constructive feedback, maintaining momentum, clearing impediments, and trusting the team members to deliver their work

- **Project Momentum**
    - Managing a project is like overseeing an extensive, intricate system with numerous components
        - This requires a combination of project management and leadership skills, and a genuine desire to support others
    - To establish and sustain project momentum, consider implementing these methods
        - Starting Strong
        - Setting the Pace
        - Looking Forward
        - Motivating the Team
    - To ensure project success, it's crucial to begin with a clear vision
        - This means understanding why the project is important and what it needs to achieve
    - Project sponsors, stakeholders, and team members must all comprehend why the company has chosen to invest in this project above all others
    - The PM also sets the pace by enforcing deadlines and establishes clear expectations that the team will fulfill them
        - They anticipate and eliminate the roadblocks to keep the project on track

- They understand the value of the project more than anyone else and make sure the team comprehends its significance too
  - o It's also about creating a conducive project environment that doesn't drain their energy
  - o The PM should solicit feedback from the team to improve the system they work in

- **Requirements Traceability Matrix (RTM)**
  - o Requirements Traceability Matrix (RTM)
    - ▪ Document that maps and tracks the relationship between requirements, design, development, testing, and deployment
    - ▪ RTM helps to ensure that all requirements of a project are met and that the project is delivered on time and within budget
    - ▪ The RTM also provides a transparent view of the project progress
  - o Traceability
    - ▪ Refers to the ability to follow the path of something
    - ▪ Traceability is crucial for solving problems and updating systems
    - ▪ In some instances, traceability is a legal requirement
  - o The bidirectional traceability of an RTM is crucial as it allows tracing work from requirements to tests and vice versa
    - ▪ Forward Traceability
      - ● Goes from the original requirements to the resulting tests
    - ▪ Backward Traceability
      - ● Starts with the tests and goes back to the requirements
  - o An RTM provides many other advantages to the project
    - ▪ Useful for impact analysis as it centralizes all requirements information
    - ▪ Helps determine if the project is meeting requirements
    - ▪ Simplifies audit and quality processes
    - ▪ Identifies which requirements are not being met

- **Progress Tracking Tools**
  - o Project management application enables to track projects and plan required activities
  - o Monitor Progress
    - ▪ Enables project managers to monitor progress on a project and ensures that tasks are being completed on schedule

- o Improve Resource Allocation
  - ▪ Project managers can allocate resources and ensure that team members are working efficiently
- o Accurately Estimate Project Timelines
  - ▪ Tracking the time, it takes to complete tasks can help project managers make accurate estimates for future projects
- o Enhance Communication
  - ▪ Used to generate reports and other visualizations that provide valuable insights into project progress
- o Application for Time Tracking
  - ▪ Monitors the time needed to complete tasks in detail
- o Project and Time Tracking Application
  - ▪ Include useful features such as report generation, which simplifies communication processes
    - ● Project Management
      - • Break down work, organize resources, manage dependencies, and control the project schedule
    - ● Time Tracking
      - • Plan the work day and report progress
- o Task Board
  - ▪ A visual tool for tracking tasks

- ● **Version Control**
  - o Version control software is utilized by software development and DevOps teams to streamline their development and release processes
    - ▪ They keep a record of what was changed, when it was changed, and who made the change
  - o A software product's source code is extensive and includes numerous interdependencies
  - o Version control tools operate in the background, tracking all changes made to the source code
  - o Without version control, the burden of traceability falls on developers
  - o Testing is also likely to take longer, as resolving failed tests involves searching through developers' offline files to identify changes
  - o Version Control is an essential tool for any IT project manager

- **Logs**
  - Issue logs, defect logs, and change logs are important for an IT project manager for several reasons
    - Logs allow the IT project manager to track the progress of the project
    - Logs also help us identify patterns in the types of issues, defects, and changes that occur
    - Issue and defect logs help the IT project manager to quickly identify and resolve issues and defects
    - Change logs provide a record of all changes made to the project
      - When the changes were made
      - Who made them
      - Why
  - Issue Log
    - A tool that tracks and manages issues that arise in a project
    - Each issue is recorded with a **description**, **date found**, and the **person who found it**
    - Common fields in an issue log include
      - Issue Number
      - Description
      - Priority
      - Impact
      - Raised By (the person who reported the issue)
      - Owner (the person responsible for fixing the issue)
      - Status
      - Date Found
      - Date Closed
      - Comments
    - Issue log ensures that issues are not overlooked and helps to prioritize them based on their impact on the project
  - Defect Log
    - Used primarily in software projects to track and manage issues where a product was built to meet a requirement but fails to do so
    - It should provide enough information for the engineer to **research**, **recreate**, and **resolve** the defect
      - Failed test
      - Environment or inputs
      - System's behavior
      - Screenshots

- Recordings
- Log files
  - Common fields in a defect log include
    - Defect Number
    - Description
    - Failed Test(s)
    - How to Reproduce
    - Priority
    - Impact
    - Found By
    - Owner (Person responsible for resolving the defect)
    - Status
    - Date Found
    - Date Fixed
    - Comments
  - Defect log ensures that defects are resolved, and the product meets the requirements
- Change Log
  - Refers to a record of alterations made to a project plan
  - Changes are a common occurrence in any project which includes
    - Addition of a new feature
    - Departure of a team member
  - Common fields in a change log include
    - Change Number
    - Description
    - Type of Request
    - Priority
    - Impact
    - Requested By
    - Owner
    - Status
    - Date of Request or Identification
    - Date of Completion
    - Comments
- PM often uses a single register to record risks, issues, changes, and defects

- **Burnup and Burndown Charts**
    - Regular updates prepared in advance allow for quick and efficient responses
    - Burnup and burndown charts are useful tools for managing project scope and time
        - It tracks two key values
            - Target Work
            - Actual Work
    - Burnup Chart
        - Tracks the total amount of work completed each day
        - Burnup charts are most effective when the project's scope is fixed but the timeline is flexible
    - Burndown Chart
        - Tracks the amount of remaining work each day
        - Burndown charts are best suited for projects with fixed timelines

- **Velocity and Throughput Charts**
    - Velocity Chart
        - Measures how many story points a team can complete within a given sprint or iteration
        - The velocity chart helps the IT project manager measure and manage the team's productivity over time
    - Throughput Chart
        - Measures the number of work items completed per iteration, regardless of complexity or effort required
        - Teams can use the data to identify capacity, prioritize work items, and plan workload for upcoming sprints
        - Using a throughput chart, the IT PM is able to track the team's performance and set goals for upcoming sprints
    - Both velocity and throughput charts are valuable for agile teams
        - Provide a way to measure the team's progress and performance
        - Identify areas to improve, adjust workload, and plan capacity for future sprints
        - Maintain a steady pace of work by setting goals based on their historical performance
        - Enable agile teams to work efficiently, deliver projects on time, and improve performance

- **Meetings**
  - Team Status Meeting / Team Touchpoint Meeting
    - A recurring meeting that's used to update the overall progress of the project and resolve any issues
    - Team status meetings are working meetings
    - An effective agenda for a team meeting should include the following topics
      - Open action items
      - Status updates
      - Task updates
      - Open risks and issues
      - New risks and issues
      - Performance related to scope, time, and cost
      - Updates on RACI (Responsible, Accountable, Consulted, and Informed) assignments
    - Dashboards contain detailed project information and resemble a simple interface or dashboard
  - Sprint Planning Meeting
    - The team will plan the work for the upcoming sprint
    - At the beginning of each sprint, the team will come together to plan their work for the upcoming sprint
      - Set the sprint capacity based on historical throughput or velocity
      - Review the top priority items in the backlog and break them down into smaller work items
    - The agenda for a sprint planning meeting should include the following
      - Review of project goals
      - Discussion of any issues, defects, or changes that could affect the project plan
      - Setting the sprint target (velocity or throughput)
      - Development of the sprint backlog
  - Stakeholder Meeting
    - Held to report the project's overall progress, gather feedback, and highlight upcoming deliverables
  - External Stakeholder Meeting
    - Requires restraint and positivity, focuses on successes, and discusses only externally visible deliverables and milestones
    - The external stakeholder meeting agenda includes
      - Project status

- Upcoming releases
- Major milestones and deadlines
- Next steps
- Feedback solicitation
    - o Internal Stakeholder Meeting
        - ▪ Includes critical roadblocks, risks and issues, major milestones and deadlines, scope, time, and cost performance, next steps, and feedback solicitation
    - o Conditional Meeting
        - ▪ Occurs on request or when support is needed from a specific group
        - ▪ 3 Types of Conditional Meeting
            - Phase Gate Meeting
                - Held at the end of each project phase to review the deliverables, assess the project's progress, and decide to continue with the project or not
            - Change Control Meeting
                - Held to review and approve any proposed changes to the project's scope, schedule, or budget
            - Ad Hoc Reporting
                - Reporting that is performed on an as-needed basis

- **Providing Feedback**
    - o The PM's main responsibility is to optimize the project's performance by tracking progress and making necessary adjustments to the project management plan
    - o Positive Feedback
        - ▪ Recognizes effective project contributions
    - o Negative Feedback
        - ▪ Highlights areas that require improvement
    - o 2 Golden Rules
        - ▪ Treat others as you want to be treated
        - ▪ Praise in public and correct in private
    - o A feedback loop is a process cycle where you inspect and improve a system
        - ▪ Gather Feedback
        - ▪ Analyze Feedback
        - ▪ Act on Feedback
        - ▪ Follow Up
    - o Feedback sources which you can derive insights from, tying into our first step of the feedback process

- Performance Metrics
  - Generate project performance reports that can provide valuable feedback
- Stakeholder Comments
  - Stakeholders will provide feedback in meetings, emails, and informal conversations
- Observation
  - Look for how each person is contributing to the product and take note of any areas where improvements can be made
- Teammate Feedback
  - Solicit comments from teammates through formal feedback systems or one-on-one meetings
- Lessons Learned
  - Monitor the feedback and look for trends that support other feedback you've gathered
- Providing feedback is a skill
- When someone does something well, be specific and praise their actions
- Be sensitive to potential reactions
- If the feedback raises legal, safety, or human resources issues, the relevant department and others outlined in your company policy should be informed
- Timely feedback is more valuable than delayed feedback
- Share feedback close to the event so that team members can learn and adjust their behaviors accordingly
- Some feedback is best discussed in a group setting, such as functional feedback about a work item
- Other feedback might need to be delivered privately, so consider using asynchronous methods like email
- Imagine yourself in the recipient's position and think about how you would like to receive the feedback
- Be comfortable with giving feedback

Resolve Issues

- **Resolve Issues**
  - Risk
    - Potential future events that may or may not occur
  - The issue management process involves several steps
    - Identify the issue and record it in an issue log
    - Analyze the issue, determine the cause and impact, and prioritize
    - Resolve the issue by deciding which actions to take and implementing them
    - Monitor the issue to ensure it is resolved and closed in the issue log
  - To effectively manage issues, it is important to establish an issue tracking process and escalation points
  - Analyzing issues involves conducting a root cause analysis to determine why the issue occurs
  - Various tools can be used for analysis, including **scatter diagrams**, **run charts**, **pareto charts**, **five-why analysis**, and **fishbone diagrams**
  - Issue analysis process is used to determine the relative priority of an issue
    - It is recommended to reevaluate issues as the severity and criteria may differ
    - Factors such as **issue severity**, **urgency**, **impact on the project and organization**, **issue escalation**, and **issue prioritization** are considered in the analysis
  - Severity measures the extent of the issue's effect, while urgency determines how quickly it needs to be addressed
  - After resolving issues, it is important to monitor them to ensure they stay resolved and to identify new issues
  - Control Chart
    - Statistical chart used to track the variation in a process
    - They include a **center line**, **upper control limit**, and **lower control limit** to identify when a process is out of control
  - Effective issue management requires a culture of **transparency**, proactive **reporting of issues**, and clear **communication** channels

- **Issue Management Overview**
  - Risk
    - A potential future event that may or may not occur
    - Risks can be positive or negative
  - Not every issue is identified in the risk management plan
  - Unknown risks will turn into current events (issues)
  - Issue management processes will vary by organization but generally cover four broad categories
    - Identify and record issue
    - Analyze the issue
    - Resolve the issue
   - Monitor and close the issue

- **Identify the Issue**
  - The issue log should be publicly available so all of your team members and stakeholders can view progress
  - A simple issue tracking process makes it more likely that issues will appear in the log before they are forgotten
    - Always ensure that users are adopting the processes
  - A simple centralized list allows decision makers to compare the relative priority
    - This also allows you to quickly generate reports and follow up on open issues
  - Escalation Point
    - Event that will activate a need to notify increasingly higher levels of authority
  - An escalation path generally moves one or more levels up in the management hierarchy at each escalation point
  - Dependencies are automatic escalation points
  - Ensure issue reporting process is easy to use and accessible
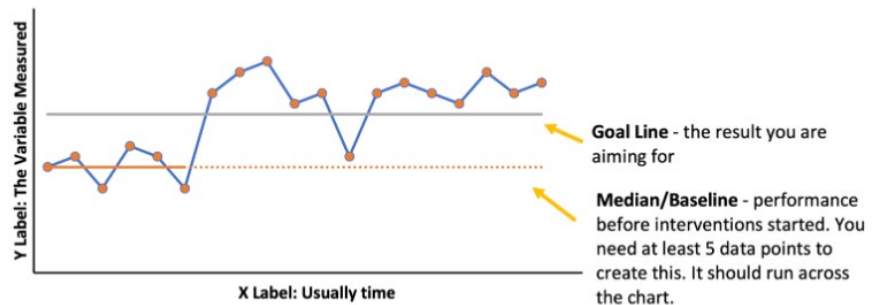 - Establish effective communication channels

- **Analyze the Issue**
  - An issue is just a visible manifestation of a deeper underlying problem
  - Employing various quality tools can aid in detecting an issue and identifying its root cause
  - Conducting a root cause analysis is crucial in determining why the issue is occurring
  - Reviewing the issue log can help identify any other symptoms

o RCA enables better issue analysis and prioritization
o Resolving an issue may require several activities since you want to address both the symptoms and the root cause
  ▪ Scatter Diagram
    ● It involves plotting two variables, one on the x-axis and the other on the y-axis, and representing each occurrence of the (x,y) variable with a dot
    ● The diagram is useful in depicting the correlation between the variables
    ● It returns a mathematical value "R2" and the value ranges from -1 to 1

Positive Correlation	Negative Correlation	No Correlation
R2 >= 0.8	R2 =< -0.8	R2 = 0
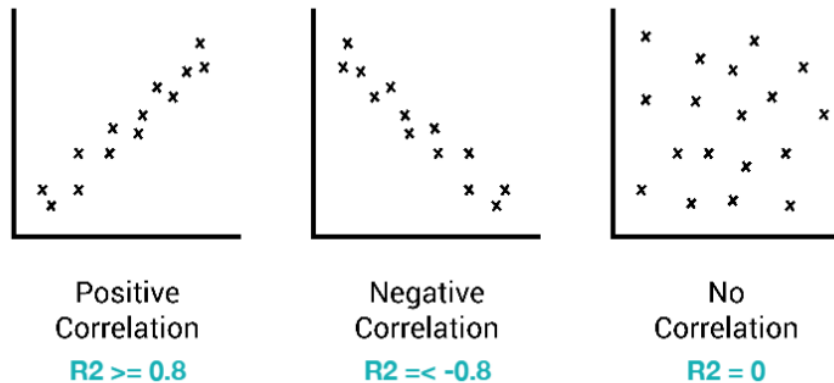
    ● Scatter diagrams are effective for large datasets and create an easy-to-read diagram
  ▪ Run Chart
    ● Line graph that displays data over time

Goal Line - the result you are aiming for

Median/Baseline - performance before interventions started. You need at least 5 data points to create this. It should run across the chart.

  ▪ Pareto Charts
    ● The Pareto Principle suggests that fixing a small portion of root causes can solve most problems, with the 80/20 rule stating that 80% of issues stem from 20% of causes

- A Pareto chart can reveal that work was late for six reasons, with three of those reasons accounting for most of the delays
  - Underestimating time requirements
  - Needing to divert attention to operational work
  - Experiencing hardware issues
- Five-Why Analysis
  - Problem-solving technique that involves asking "why" questions to identify the root cause of a problem
- Fishbone Diagram
  - The fish's head represents the problem, and the ribs represent possible related causes
  - The fish's head represents the problem, and the ribs represent possible related causes, which can be categorized using the 6Ps (**policy**, **process**, **people**, **plant**, **program**, and **product**) or customized categories

- **Issue Prioritization Tools**
  - Issue Analysis
    - Used to determine the relative priority of an issue
    - It is recommended to reevaluate the issue for two reasons
      - The severity of the issue can be different from the risk assessment, especially with broad risks
      - Evaluating issues against more detailed criteria can be useful since you have more information about them compared to unknown risks
  - Several factors can be considered for analyzing issues, depending on the project and organization
    - Severity
    - Urgency
    - Impact
    - Scope of Impact
    - Issue Escalation
    - Issue Prioritization
  - To measure the severity of an issue, estimate how it affects the average user
  - Critical Issue
    - Render the system completely inaccessible or nonfunctional

- o Major Issue
  - ▪ Allows the user to access the system, but one or more features are unavailable
- o Minor Issue
  - ▪ Do not affect the user experience, but they require a workaround
- o Low-Severity Issue
  - ▪ Do not affect functionality but should be resolved for branding, consistency, or improved user experience
- o Urgency
  - ▪ A metric that measures the time sensitivity of an issue and indicates how quickly it needs to be addressed
- o Most companies use a simple scale with time limits for each level
  - ▪ Critical Urgency
    - ● Requires immediate resolution
  - ▪ Major Urgency
    - ● Requires resolution within hours
  - ▪ Medium Urgency
    - ● Requires resolution within days
  - ▪ Minor Urgency
    - ● Resolved at the earliest convenience
- o The measure of impact quantifies the degree of influence an issue will have
- o Examine how the issue will impact the project's scope, schedule, or budget
- o A simple scale is used to measure the impact on a project
  - ▪ High
    - ● A project completion is at risk
  - ▪ Medium
    - ● A project delay is possible
  - ▪ Low
    - ● A project won't be affected
- o Assessing an issue's likelihood of escalation is a useful practice
  - ▪ Issue Escalation
    - ● Ensures critical risks and issues receive appropriate follow-up
    - ● Escalated issues should be given a higher priority
- o The issue escalation prioritization metric can also be measured using a simple scale, as follows
  - ▪ High
    - ● Has an escalation plan in place and has already been escalated
  - ▪ Medium

- Has an escalation plan that has not been activated
  - Low
    - Do not have an issue escalation plan in place
- o Issue Prioritization
  - Involves a descriptive scale with paired numerical values that represent the actual score for each factor
  - Typically, scores are arranged on a 1-9 scale, with 9 being the highest priority
    - 1-3-9 scale is ideal for scoring three options, such as low, medium, and high
    - 1-2-3 scale would result in most items having a relatively medium priority
    - The same effect can be achieved with four values by using a 1-3-7-9 scale
      - This scale forces decisions by pushing high-priority items to the top
- o To prioritize issues, you should identify relevant factors and add them as new columns in your issue log
- o Calculate the relative issue prioritization score by summing the scores of each factor

- **Resolve and Monitor the Issue**
  - o Review the escalation plan to determine if an issue has been previously addressed
  - o Identify the owner of the issue and follow the escalation plan to notify the appropriate parties
  - o Issue owner is responsible for resolving the issue
  - o Lower-priority items may receive less attention than higher-priority items
  - o Contingency plans facilitate quick issue resolution by providing response plans
  - o Execute the contingency plan to safeguard assets and restore services
  - o Contingency plan enables the team to recover and resume work quickly
  - o The IT project managers need to conduct various monitoring activities to effectively implement the issue resolution plan, including
    - Monitoring resolved issues
    - Monitoring open issues
    - Monitoring project performance
  - o PM is responsible for owning the issue log and following up with the listed owners

- o It is also important to review assessment scores occasionally to ensure they still reflect reality
- o To verify issue resolution, the project manager must verify and approve each completed resolution
    - ▪ Check for any unintended consequences
    - ▪ Confirm completion of all actions
    - ▪ Ensure that the resolution addressed the problem
- o Monitor which workarounds are implemented for each issue
- o If the issue reoccurs, conduct another root cause analysis and work to resolve it
- o By monitoring closed issues, you can identify trends and recurring problems, which can be used to make systemic improvements
- o Include a summary of the issue in the lessons learned document
    - ▪ This document should detail how the team approached the issue, what they learned, and what they would do differently next time

- **Control Charts**
    - o Control Charts
        - ▪ Charts that use statistical methods to track the variation in a process over time
    - o When a process is performing as expected, it is said to be "in control"
    - o If the process shows unacceptable levels of variation, it is considered "out of control"
    - o The horizontal axis represents time or sequence, while the vertical axis represents the corresponding output
    - o A control chart distinguishes between statistically significant patterns in data and ordinary variation
        - ▪ While run charts may appear to show trends, they can be misleading as common variation is present in every process
    - o Common Cause Variation
        - ▪ The expected variation in a process and the control chart's limits are based on this
    - o Special Cause Variation
        - ▪ Unique and changes something about the process, resulting in an unusual outcome
    - o Variation is a natural part of any process and does not necessarily indicate good or bad performance
    - o Use a control chart to verify that it is having the desired effect
    - o Identify areas where improvements can be made

Control Change

- **Control Change**
    - Change control helps identify which requests can be part of the project
    - Change Control
        - Systematic process of evaluating, approving, and managing proposed changes to project scope, objectives, deliverables, or other key aspects
        - Ensuring that changes are properly **assessed**, **documented**, **authorized**, and **implemented** while minimizing disruption and maintaining project alignment
    - Scope Change
        - Modification, addition, or removal of project deliverables, objectives, requirements, or boundaries
    - Scope Creep
        - Gradual and uncontrolled expansion of project scope beyond its originally defined boundaries
    - Different IT Change Delivery Methods
        - Maintenance Windows
        - Releases
        - Customer Notifications

- **Change Control Overview**
    - Change control process involves the submission of change requests, which are evaluated and either approved or denied
    - The specific steps involved in the change control process may differ depending on the organization, but generally include four phases
        - Initiating the request
        - Evaluating the impacts
        - Making a decision on the outcome
        - Implementing the change
    - Implementing a change control process ensures that a project remains aligned with business needs
    - Change control improves traceability for project requirements
    - Change control simplifies work and eliminate confusion
    - Not every change requires a formal change control process
    - The purpose of change control is to manage changes to the project's **scope**, **time**, and **cost** baselines

- o Numerous events can trigger change requests during a project's execution phase as well
  - ▪ Inconsistencies
  - ▪ Aggressive goals
  - ▪ Team improvements
  - ▪ Strategic changes
  - ▪ Scope changes
  - ▪ Product changes
- o A project is an activity that should be managed
  - ▪ Project
    - ● Creates or modifies products
  - ▪ Product
    - ● Outcome or component of value
- o A product change may or may not cause a change in your project
- o Change control can help to manage modifications to a **project**, **product**, or **system**
  - ▪ It ensures that changes are:
    - ● Aligned with business needs
    - ● Enable stakeholders to review and approve changes
    - ● Improve traceability for project requirements
- o Difference between a project and product change
  - ▪ Project Change
    - ● Always impact the project
  - ▪ Product Change
    - ● May or may not require a project change
- o Change control process helps manage changes in a more deliberate and informed manner

- ● **Scope Change vs Scope Creep**
  - o Scope Creep
    - ▪ Refers to an unsanctioned alteration that generally increases work and extends the project, which is undesirable because it starts using additional resources, either **time**, **money**, or **people**
  - o Scope Change
    - ▪ Sanctioned project adjustment that moves through approved channels
    - ▪ A scope change also necessitates renegotiating **scope**, **time**, and **budget**, and altering any or all three baselines is an option
  - o To avoid scope creep, make scope change a possibility

- o Focusing on the most crucial tasks helps deliver a high-quality product
- o When we implement our changes, we have steps that must be followed
    - Initiate the request
    - Evaluate the impacts
    - Decide on an outcome
    - Implement the change
- o Implementing a cloud solution involves using two important documents
    - Change Request Form
        - Used to gather information about a single change request
        - It includes several fields that are commonly used in IT projects
            - Project Name
            - Date Requested
            - Description
            - Reason for Change
            - Priority
            - Impact
            - Requested By
            - Owner
            - Deadline(s)
            - Comments
    - Change Log
        - Contains all change requests for the project and is also known as a "Change Control Log"
        - The project manager enters the change request into the change log, adding relevant details such as an ID
- o Implementing a cloud solution involves using two important documents
- o The PM analyzes the request to determine how it will affect the project's **resources**, **budget**, **scope**, and **schedule**
- o Hardware and software requests often necessitate a change in the product's requirements
- o The PM compiles all the information about the change request
    - Schedule Changes
    - Scope Changes
    - Risks
    - Resource Requirements
    - Notable Impacts
- o After completing the impact analysis and developing a recommendation,

PM presents these findings to the appropriate decision makers responsible for approving or denying the change
- Operational changes typically relate to the day-to-day business of running a project and have minimal impact on a project's **cost**, **scope**, or **baseline**
- CCB's authority establishes the PM's degree of authority over operational decision-making
- Strategic changes have effects beyond the boundaries of a project and impact the company's **finances**, **book of business**, or **long-term goals**
- The **project sponsor**, **CCB**, and **PMO** are the strategic decision makers for a project, with executive management delegating decision-making authority to these groups
- Changes related to a risk require the involvement of the risk owner as a decision maker
- As a project manager working on a project with a Change Control Board (CCB), responsibilities may be reduced
  - PM will still receive change requests, maintain logs, conduct analyses, and make recommendations, the CCB formally takes ownership of project changes
- The following are some common types of software change approvals
  - Technical Approval
    - Involves review and input from subject matter experts who are familiar with the system
    - This peer-review process can take various forms
      - Technical Review
      - Code Review
      - Pair Programming

  - Product Owner Approval
    - Involves review and approve changes to confirm that the product meets all requirements
  - Architectural Approval
    - Ensures that the product positively affects the system
- Identify requests that are not technically feasible early on and flag them for review
- Once the change request outcome has been decided, the project manager (PM) will communicate the status of the change to relevant parties

- o Consistent communication of project changes creates a shared understanding among stakeholders of the project's scope and schedule, builds strong relationships, and manages expectations
- o The PM updates the project plan, depending on the nature of the change, by updating the following
    - Schedule
    - Deliverables
    - Budget
    - RACI Matrix
    - Business Case
    - Stakeholder Management Plan
- o After validation, the PM notifies stakeholders of the completed change, including updates in recurring meetings and reports, such as the project status report

- **IT Change Delivery Methods**
    - o Different IT Change Delivery Methods
        - Maintenance Windows
            - Are blocks of time when IT systems are taken offline for maintenance or new releases
            - By creating a timebox where multiple teams can perform functions on a system during the maintenance window, intentional changes can be consolidated, reducing downtime
            - IT systems play a critical role in the operations of an organization
                - Access to vital information such as **customer data**, **payroll**, **website**, **orders**, and **product specifications** is reliant on technology
        - Releases
            - Comprises a product's source code, including a collection of software improvements and modifications
        - Customer Notifications
            - Customers must be informed of any maintenance windows since they may experience disruptions and outages
            - The IT technical team has many methods of notifying customers of maintenance windows
                - Banner or Notice
                - Message or Push Notification
                - Email
                - Text

- Social Media
- It's important to note that not every IT and software change warrants customer notification
  - The IT Infrastructure Library (ITIL) categorizes changes into three types
    - Standard Change
      - Recurring changes with established policies and procedures that don't require additional approval
    - Normal Change
      - Modifications that don't have a set process and don't occur frequently, but they're also not emergency change
    - Emergency Change
      - Unplanned, recovery events that usually don't allow time for advance notice
  - Infrastructure changes are communicated through the same channels as software changes
  - In general, customers should be notified if changes impact their **user experience**, **access**, **account settings**, or **relationship** with the company
    - Example include changes to the following
      - User Login Process
      - Password Requirements
      - Contracts
      - Subscription Prices
      - User Navigation
  - Customers don't need to be notified of changes to internal workflows or data storage if it's undetectable by customers and not required by regulation

- **IT Change Risk Mitigation**
  - 2 Primary Forms of Backup Plans
    - Rollback Plan
      - It ensures that the team is prepared to restore the previous version of a system in case of a failed release
      - It is a contingency plan that should be developed in advance
      - A rollback plan serves as a last-resort option
    - Post-Production Validation
      - Are necessary to confirm that the software in production is performing as intended
      - The QA team tests all changes in a test environment that match the production environment exactly

- The deployment procedures must flow in a specific sequence
- During the validation process, the QA engineer follows the same path as they did to test the software initially
  - Complete the tests and record the results
  - Report the results and identify issues and defects

- **IT Environments**
  - On-premises change control is a more manual process compared to cloud changes
  - Cloud deployments utilize automation to increase efficiency, leading to more frequent releases
  - In an on-premises solution, the operations staff manually creates and manages data backups to support the rollback plan
  - Cloud models integrate configuration and security checks
  - Cloud computing adopts a shared responsibility model for security
  - The organization is accountable for their **internal policies**, **data security**, and **system configurations**
  - In contrast, on-premises infrastructure puts the organization in control of all security aspects, resulting in more significant responsibility
  - As a note, organizations can improve on-premises deployments with **process automation** and **supplemental integrations**
  - The software development environment is where software is **developed**, **tested**, and **deployed**
    - The environment can also be referred to as a "stage" or "tier"
  - Organizations can create as many stages as they need to cover the entire DevOps cycle, but typically, three basic tier types are used
    - **Development Tier** is where software is created, and it's available only to a single user locally
    - **Beta Tier** is a test environment where developers push code from their development environment to test the changes made
    - **Production Tier** is the live environment that end-users can access
  - Cloud models also provide built-in features
    - Data Backup
    - Version Control
    - Roll Back
    - Security Checks

Managing Performance

- **Managing Performance**
  - Project's cost and schedule are not fixed
  - Scope Burndown Chart
    - Tracks the progress of a project's scope completion, helping the PM monitor the work and identify issues or delays
  - Budget Burndown Chart
    - Tracks the project's expenses against the budget
  - Gap Analysis
    - Used to identify variances between expected and actual results
  - Contingency Reserve
    - Process of using set-aside resources in a project to handle unforeseen risks or changes
  - Earned Value Management (EVM)
    - Monitoring method that uses planned value, earned value, and actual cost to track project performance
  - The Estimate at Completion (EAC) and Estimate to Complete (ETC) are important metrics in earned value management
    - 4 Standard Methods for Calculating ETC
      - Bottom-up
      - Budgeted rate
      - Cost Performance Index (CPI)
      - Combination of CPI and Schedule Performance Index (SPI)
  - The project schedule can be maintained at different levels of information
    - Executive
    - Milestone
    - Detailed

- **Scope and Budget Burndown Charts**
  - Scope Burndown Chart
    - Graphical representation that tracks the progress of a project's scope completion over time
    - The chart displays the remaining work (in terms of scope items) that needs to be completed on the vertical axis and the time on the horizontal axis

- Burndown chart can be used to identify if the team is ahead or behind schedule
  o Budget Burndown Chart
    - Variation of the burndown chart that tracks the progress of a project's expenses over time
    - Budget burndown compares the pace of expenses to the pace of the project
  o Key difference between the budget burndown and other types of burndown charts
    - Task Hours Burndown
      ● Have fewer task hours remaining than initially anticipated because it indicates that the project is ahead of schedule
    - Budget Burndown
      ● Remaining actual budget to be equal or higher than the target budget
  o PM interacts with the budget burndown at least weekly to assess the project's burn rate
    - PMs manage vendor performance, which can significantly affect costs, and they are involved in **selecting vendors**, **authorizing or managing resource utilization**, **scope changes**, and **buffer utilization**
  o **Scope Burndown Chart** helps the PM to understand how the progress of completing tasks affects the project's scope
  o **Budget Burndown Chart** enables the PM to understand how the project's expenses affects the project budget

- **Project Performance Gap Analysis**
  o Conducting gap analysis can help identify why the gap exists, followed by root cause analysis to identify the true cause of the variance
  o Gap analysis allows the freedom to adjust either parameter, such as improving performance or changing the target
  o Overly generous estimates can make data less reliable, so re-estimating work can be done to create a more realistic plan
  o A burndown chart can identify a gap, it does not reveal the reason for it
  o It's crucial to note that resolving gaps may take time, and gradual improvement should be expected
  o Gap analysis can be a useful technique in agile projects to identify discrepancies between current and desired states and guide the development of solutions

- By using gap analysis to identify and prioritize key issues, the team is able to focus their efforts on the most impactful improvements

- **Contingency Reserve Utilization**
    - Contingency Reserve Utilization
        - The process of using contingency reserves in a project to address unexpected risks or changes that may impact project scope, timeline, or budget
    - In an IT project, contingency reserve utilization can be used in several ways
        - Addressing unforeseen risks
        - Managing changes
        - Mitigating schedule delays
    - To use contingency reserve effectively, the project manager must have a clear understanding of the project risks and uncertainties, and develop a plan for how to address them
    - By proactively allocating resources and developing a plan to address potential issues, project managers can help ensure project success and deliver on project objectives
    - Using contingency reserves does not change the project cost baseline

- **Earned Value Management**
    - Earned Value Management (EVM)
        - A monitoring method used to track project performance based on three key values that monitor schedule and cost performance
        - The three values used in EVM are
            - Planned Value (PV)
                - Represents the target cost and schedule
            - Earned Value (EV)
                - Represents the actual schedule
            - Actual Cost (AC)
                - Represents the actual cost
    - Budget at Completion (BAC)
        - Equals the project's cost baseline
    - The basic Earned Value Management (EVM) metrics can be calculated as follows
        - Planned Value (PV)
            - Represents the authorized budget assigned to the scheduled work
            - PV = (planned percentage of work schedule) x (total budgeted cost of the work)

- Earned Value (EV)
  - Represents the budgeted cost of the actual work performed
  - EV = (actual percentage of work completed) X (total budgeted cost of the work)
- Actual Cost (AC)
  - Represents the actual cost incurred in performing the work
- EVM metrics such as schedule variance (SV), cost variance (CV), schedule performance index (SPI), and cost performance index (CPI) can be computed

- **Cost and Schedule Performance Metrics**
  - Earned Value Management (EVM)
    - A monitoring method used to track project performance, based on three key values that monitor schedule and cost performance
    - The three values used in EVM
      - Planned Value (PV)
        - Represents the target cost and schedule
      - Earned Value (EV)
        - Represents the actual schedule
      - Actual Cost (AC)
        - Represents the actual cost
  - Cost Variance (CV)
    - Measures the difference between earned value and actual cost
    - Cost Variance = Earned Value – Actual Cost
      - CV > 0
        - Project is under budget
      - CV = 0
        - Project is spending exact amount
      - CV < 0
        - Project is over budget
  - Cost Performance Index (CPI)
    - Compares earned value against actual cost
    - Cost Performance Index = Expected Value / Actual Cost
      - CPI > 1
        - Project is under budget
      - CPI = 1
        - Project is spending exact amount
      - CPI < 1
        - Project is over budget

- o Schedule Variance (SV)
    - ▪ Measures the difference between earned value and planned value
    - ▪ Positive schedule variance means that the project delivers work faster than expected
    - ▪ Schedule Variance = Expected Value – Planned Value
        - ● SV > 0
            - • Project is ahead of schedule
        - ● SV = 0
            - • Project is on pace with the estimates
        - ● SV < 0
            - • Project is behind schedule
- o Schedule Performance Index (SPI)
    - ▪ Compares expected value and planned value
    - ▪ Schedule Performance Index = Expected Value / Planned Value
        - ● SPI > 1
            - • Project is ahead of schedule
        - ● SPI < 0
            - • Project is not delivering value as fast as expected

- ● **Forecasting Performance**
    - o Estimate at Completion (EAC)
        - ▪ Projected measurement of the overall cost of the project, based on previous performance
    - o Estimate to Complete (ETC)
        - ▪ Anticipated cost to finish the remaining project work
    - o Estimate at Completion (EAC) = Actual Cost (AC) + Estimate to Complete (ETC)
    - o 4 Standard Methods for Calculating the Estimate to Complete (ETC)
        - ▪ Bottom-up
            - ● Involves breaking down the remaining work into smaller components and estimating the cost of each component individually
            - ● EAC = AC + ETC
                - • Where ETC is the sum of all remaining activities
        - ▪ Budgeted Rate
            - ● Involves calculating the budgeted rate for the remaining work and multiplying it by the remaining work
            - ● EAC = AC + (BAC – EV)

- Cost Performance Index (CPI)
  - Involves using the cost performance index (CPI) to forecast the cost of completing the remaining work
  - EAC = BAC / CPI
- Combination of CPI and SPI
  - Used to forecast the cost of completing the remaining work, taking into account both cost and schedule performance
  - EAC = AC + ([BAC-EV] / [CPI * SPI])
- Variance at Completion (VAC)
  - Measures the total variance the project is expected to experience
  - VAC = BAC – EAC

- **Rebaseline and Revise the Baseline**
  - Original baselines may no longer be an accurate reflection of the project's reality
  - When change requests are introduced to a project, the cost, scope, or budget may be affected
  - An increase in scope leads to an increase in cost and schedule
  - PM is responsible for maintaining an up-to-date project budget
  - The process of updating the project budget is similar to its creation, utilizing the same tools and processes
  - What are some common reasons for updating the budget and timeline?
    - When a new change request is received, the project team must assess its potential impact on the budget
    - This analysis should consider resource allocation changes and changes to the number of project activities
  - Approval of change requests can alter the project end date if the change affects the critical path
  - Defect resolution activities must be included in the project schedule and budget
  - As the project progresses, the team may gain insight into the required effort and activities needed, leading to improved estimation
    - Improved estimation can positively or negatively impact the project's situation
  - Rebaselining can be a recurring activity
  - What types of project schedules are expected when we talk about adjusting timeline?
    - Executive Schedule
      - Outlines the project's progress and outcomes, but it doesn't include detailed activities

- Executive schedule changes only when there is a change in milestone or summary activity
    - Milestone Schedule
        - Used to monitor the project's progress towards deliverables
        - Milestone schedule changes when there is a change in the milestones or when activity changes result in new milestones
    - Detailed Schedule
        - Outlines project activity, duration, dependency, and milestone
        - Changes to the project schedule require a change in the detailed schedule
    - An updated milestone schedule should be prepared every time a change request is made
    - Regularly updating the project management plan, including the project schedules, is good practice, and the project manager should maintain the schedule at least weekly
        - The following are some of the schedule maintenance tasks that should be performed regularly
            - Review the critical path
            - Review resource utilization
            - Review the current sprint plan
            - Update the project schedule
            - Publish updated project schedules
            - Review project dashboards
            - Prepare project status reports

- **Project Dashboards**
    - Business Dashboard
        - Provides a visual summary of comprehensive data from multiple sources
        - Create dashboards for any summarize data, including **projects**, **products**, **programs**, **departments**, or **teams**
    - KPIs measure how likely a project is to meet its goals, and if performing well, you can assume that the project is doing well
        - A project should have 4-10 KPIs, consisting of a mix of outcome-focused and performance goals
            - Number of users
            - Generated revenue
            - Performance to budget
            - Cost per requirement

- Cost Variance (CV)
- Schedule Variance (SV)
o Some key differences between dashboards and reports
  ▪ Dashboards
    - Updates continuously
    - Interactive
  ▪ Reports
    - Updated periodically
    - Static
    - Includes a snapshot of a dashboard but also provide additional information
o Executive Dashboard
  ▪ Designed for top-level management and provide a high-level overview of the organization's performance
    - Audience
      • Executive dashboards are designed for top-level management and provide a high-level overview of the organization's performance
    - Content
      • Executive dashboards typically display KPIs and metrics that are important to the organization's strategic goals
    - Visualization
      • Executive dashboards often use charts and graphs to present data in a visually appealing way
    - Interactivity
      • Executive dashboards may not be interactive, as they are designed to provide a high-level overview of the organization's performance
o Team Dashboard
  ▪ Designed for specific teams or departments and focus on team-specific metrics
    - Audience
      • Team dashboards are designed for specific teams or departments and focus on team-specific metrics
    - Content
      • Team dashboards focus on metrics that are relevant to the team's objectives, such as customer satisfaction or team productivity

- Visualization
  - Team dashboards may use more detailed visuals, such as heat maps or sparklines, to display trends or patterns
- Interactivity
  - Team dashboards may be more interactive, allowing team members to drill down into specific metrics or data points
- Project Manager Dashboard
  - Designed for project managers and provide project-specific data
    - Audience
      - Project manager dashboards are designed for project managers and provide project-specific data
    - Content
      - Project manager dashboards show project-specific data, such as project status, task completion, and resource utilization
    - Visualization
      - Project manager dashboards may use Gantt charts or timelines to display project progress
    - Interactivity
      - Project manager dashboards are typically the most interactive, allowing project managers to make adjustments to the project plan or allocate resources as needed
- Dashboards can take on many different appearances, but they typically include **graphic tiles**, **lists**, **gauges**, and **information blocks**
  - Design Principles of a Dashboard
    - Intuitiveness
      - A dashboard should be designed in a way that even a person with minimal training can interpret the information
    - Actionable
      - It should contain valuable information that allows the owner to know what actions they need to take within 30 seconds of looking at it
    - Relevance
      - They should contain information that the audience needs to know to make good decisions
    - Timely
      - Information should refresh at least as often as it is needed

- Brevity
  - A dashboard should contain only the necessary information and should not overwhelm users with unnecessary metrics
- Accuracy
  - High-quality data that reflects reality should be used to make decisions
- Sustainability
  - An automated dashboard that updates as source data is updated is ideal for long-term use

Wrapping Up the Project

- **Wrapping Up the Project**
    - The team prepares final reports, holds final meetings, and sends out surveys for the project
    - As the team approaches the end of the execution phase, it's essential to begin planning for the end of the project
    - Project teams can use OCM to reduce the stress generated by change
    - Organizational Change Management (OCM)
        - Systematic approach to managing and implementing changes within an organization
    - High adoption rates are crucial for the success of change initiatives
    - Monitoring and reinforcing adoption through feedback collection and ongoing support are important
    - To effectively connect with end users during OCM, effective communication is key
        - This includes frequent and early communication using various channels and encouraging two-way communication through open office hours or surveys
        - **Demonstrations**, **small group sessions**, and **personalized interactions** can help gather feedback and address concerns
    - Project closeout reviews involve finalizing activities to formally close the project
    - The project scope document should be reviewed to confirm if objectives and deliverables have been met
    - Contracts are closed by reviewing terms and ensuring all deliverables and payments have been completed
    - Budget reconciliation verifies that transactions match actual activities or payments and resolves any discrepancies
    - The closing phase of a project is often overlooked but is crucial for maintaining relationships and protecting the company
        - Common deliverables in the closing phase include
            - Project Closure Report
            - Lessons Learned Report
            - Final Project Documentation
            - Final Deliverables
            - Contract Closure Documentation
            - Budget Reconciliation

- Handover Documentation
  - o Proper project closeout procedures should not be neglected as they maximize benefits, avoid negative consequences, and provide documentation for future reference
  - o Project Evaluation
    - ▪ A methodical and unbiased assessment of a project's performance to identify areas for improvement
    - ▪ Types of evaluations include **self-evaluation**, **external evaluation**, **pre-project evaluation**, **ongoing evaluations**, and **post-project evaluation**
  - o When planning a post-project evaluation, important steps include
    - ▪ Create an evaluation plan
    - ▪ Prepare for the evaluation
    - ▪ Gather and analyze data
    - ▪ Develop a summary report
    - ▪ Impact
    - ▪ Strengths
    - ▪ Areas of improvement
    - ▪ Plan for the next steps
  - o Project Closure Meeting
    - ▪ Marks the end of the project and serves as the last working session
  - o Project Closeout Report
    - ▪ Summarizes the meeting's discussions and additional performance data
  - o Resource Management Activities
    - ▪ Collect feedback, remove accesses, release resources, archive document, and celebrate the project's success

- **Organizational Change Management**
  - o Organizational Change Management (OCM)
    - ▪ Systematic approach to developing change plans that help change leaders overcome resistance
  - o Resistance is a natural defense mechanism against any event that could create discomfort
  - o Change adoption is a crucial metric that measures how many people use a new offering
  - o OCM is a strategy that ensures projects have high adoption rates
  - o OCM Plan
    - ▪ A strategic approach to aid users in adjusting to changes

- ▪ The team then devises a plan to **simplify the change**, **minimize resistance**, and **provide support**
  - o During OCM implementation, the project team provides various forms of support, which serve as tools for stakeholders
    - ▪ OCM is a customized and humanized approach
    - ▪ The list of tools below should be treated like a menu rather than a checklist
      - ● Training
        - • The team should identify the training requirements for different users, such as tool usage, concept comprehension, and process administration
      - ● New Knowledge Base
        - • A knowledge base (KB) is a modular and living system containing instructions, articles, self-service guides, and troubleshooting tips for a product
      - ● Documentation
        - • Documentation includes artifacts that can aid users in adopting and maintaining the new system over time
      - ● Processes
        - • Documented instructions that describe how to complete tasks

- ● **Connecting with End Users**
  - o Effective communication is a crucial element of organizational change management
    - ▪ It is important to communicate early and frequently using various channels
      - • Email
      - • Personal Conversations
      - • Group Meetings
      - • Relevant Training Sessions
  - o By maintaining consistent communication, you can **address concerns**, **identify opportunities for improvement**, and **support the teams** as they adapt to the changes
  - o Organizational change management requires a concerted effort to promote user adoption through **effective communication**, **documentation**, and **training**
  - o Change adoption percentage, measured by the number of active users, can serve as a useful metric

- **Prepare for Project Closeout Reviews**
    - Before the formal closure, some project closing activities can be initiated
        - Transferring deliverables
        - Validating them
        - Closing contracts
        - Reconciling the budget
    - Ensure that stakeholders are informed of the transition effects
        - New Points of Contact
        - Service License Agreement (SLA)
    - To begin the closing process, start by reviewing the project scope document
        - If the project is complete, confirm that it has achieved its objectives and delivered all the required deliverables
        - If the project is suspended or canceled, prepare a summary outlining which deliverables are complete and to what degree, and communicate this to the stakeholders
    - It is essential to obtain documented approval from each identified stakeholder that the project has met all the deliverables
    - To close contracts, it is important to ensure that all stakeholders have approved the project closure
        - Review the contract terms and ensure that all deliverables and activities have been completed
        - Verify that all purchase orders (POs) have been submitted and invoices have been paid
        - Confirm with vendors that they are not expecting additional payment, such as outstanding invoices or open expense reports
    - When reconciling the budget, separation of duties should be employed whenever possible
        - A reviewer who did not **initiate**, **approve**, or **record** the expenses should be used if possible
        - Reconciliation
            - A verification process in which each transaction in the budget is confirmed to match an actual activity or payment
        - Verify that resource costs are correct for project activities and confirm that all POs are counted against the project budget
        - Discrepancies should be researched and resolved

- **Closing Phase Overview**
  - PM plays a vital role as the driving force behind initiating all closing activities
  - Although the closing phase may seem routine, it is important to follow through with all necessary tasks
    - Finalize documents
    - Tie up loose ends
    - Officially end the project
  - It's important to note that stakeholders are already reaping the benefits of the project, and team members have mentally moved on to their next project
  - PM must recognize when a project is ready to close
    - Project objectives have been met
    - Project is cancelled
    - Project is suspended
  - The specific deliverables included in the closing phase of a project may vary depending on the nature of the project and the organization's processes
  - Some common deliverables that are typically included in the closing phase of a project
    - Project Closure Report
      - Documents the final status of the project and provides an overview of its accomplishments and challenges
      - It includes the following information
        - Objectives
        - Scope
        - Budget
        - Schedule
    - Lessons Learned Report
      - Outlines the successes and failures of the project
    - Final Project Documentation
      - Includes all project documentation
        - Project Plans
        - Schedules
        - Status Reports
        - Meeting Minutes
        - Other Project-Related Information
    - Final Deliverables
      - Services that were produced as a result of the project

- Contract Closure Documentation
  - This includes all necessary paperwork to formally close out contracts with vendors, contractors, or other third-party providers
- Budget Reconciliation
  - This involves comparing the final project budget to the actual expenditures and ensuring that all expenses are accounted for
- Handover Documentation
  - This includes all necessary information and instructions for the operations team or other stakeholders who will be taking over the project's ongoing support and maintenance
  - o Do not neglect proper closeout procedures of a project

- **Project Evaluation Overview**
  - o A project evaluation is a methodical and unbiased assessment of a project's performance
  - o Project evaluations improve the current project's performance and the overall project management system
  - o To ensure that lessons learned benefit future projects, data should be consistently gathered, documented, and shared
  - o Evaluations foster a more engaging project by soliciting feedback from stakeholders
  - o Participation in project evaluations requires reflection and critical thinking
  - o Few types of evaluations that a project manager can utilize
    - Self-Evaluation
      - An activity that involves self-reflection to identify areas for improvement
    - External Evaluation
      - An evaluation conducted by a third party to provide an objective assessment of a product, service, or project
      - External evaluations provide a fresh perspective and identify blind spots or weaknesses that may have been missed internally
    - Pre-Project Evaluation
      - An assessment of a project idea to determine if it's worth pursuing
      - Pre-project evaluations avoid wasting resources on projects that are not feasible or viable

- Ongoing Evaluation
    - Evaluations conducted throughout the life cycle of a project to assess progress and identify opportunities for improvement
- Post-Project Evaluation
    - An evaluation conducted after the completion of a project to assess its results and impact
    - Post-project evaluations are important to learn from successes and failures and improve future projects
    - When we start to plan our post-project evaluation, there are some steps involved
        - Develop an evaluation plan
            - Define the areas of interest
        - Prepare for the evaluation
            - List all the data points and performance metrics
        - Gather and analyze data
            - Implement the evaluation plan and set a time limit for collecting data
        - Develop a summary report
            - Create a concise report that provides the project evaluation results
            - Summary includes stakeholder feedback to evaluate the project and its actual impact
        - Plan for next steps
            - Share the report with the project team and stakeholders, identify areas for improvement, and assign ownership

- **Project Closure Meeting**
    - Project Closure Meeting
        - Marks the end of the project and serves as the last working session
    - During the meeting, the team discusses the project which includes
        - Accomplishments
        - Failures
        - Challenges
    - It's important to take note of every idea discussed during the meeting to determine how to apply them in future projects
    - The agenda for a project meeting typically includes several items that cover the different aspects of the project

- ▪ Project Overview
  - ● Which lists the **goals**, **objectives**, and **success criteria** of the project
- ▪ Project Highlights
  - ● Outlines the project team's significant accomplishments
  - ● Project Challenges are also discussed, as they are an excellent learning opportunity for the project team and other teams that may face similar issues
  - ● Transparency is beneficial for everyone, so this item identifies the project's challenges and how the team met them
    - • Process Issues
    - • Technical Issues
    - • Underperforming Metrics
- ▪ Lessons Learned Workshop
  - ● Is the largest agenda item, requiring about half of the scheduled meeting time?
  - ● An end-of-project lessons learned session is held in this meeting
    - • This project closure activity aims to identify ways to improve future projects and is also called a "post-mortem," "project retrospective," or "project review"
  - ● During the lessons learned session, the PM discusses the project's final performance metrics, including cost, budget, and schedule
  - ● Additionally, the group discusses the stakeholder feedback, remaining project evaluation topics, and any other project reflections

- ● **Project Closeout Report**
  - o Once the closure meeting concludes, the project manager (PM) must generate a project closeout report that outlines the meeting's discussions and includes additional performance data
  - o Project Closeout Report
    - ▪ A comprehensive summary of the entire project and serves as an official request for project sign-off
  - o A project closure report typically includes the following contents
    - ▪ Project Overview
      - ● A brief description of the project, including the goals, objectives, and scope

- Deliverables
    - A list of all the deliverables that were completed during the project, along with any relevant details
- Success Criteria
    - A summary of how the project met its success criteria, including any metrics or KPIs that were used to measure success
- Project Highlights
    - A section that outlines the project team's significant accomplishments, including any process improvements or successful delivery methods
- Project Challenges
    - A description of the project's challenges and how the team overcame them, along with any lessons learned
- Future Considerations
    - Ideas for future enhancements or follow-up work, along with action items and due dates
- Lessons Learned
    - A summary of the lessons learned throughout the project, including feedback from stakeholders and customers
- Project Evaluation
    - A final evaluation of the project's performance, including cost, budget, and schedule
- Sign-off Request
    - A request for the project stakeholders and sponsor to sign off on the report, which officially closes the project

- **Finish Resource Management Activities**
    - Effective resource management enables project managers to **plan**, **allocate**, and **optimize** resources to ensure that they are used efficiently and effectively throughout the project lifecycle
    - PMs can identify and address any potential resource constraints or bottlenecks
    - Completing resource management activities enables project managers to monitor and control resource usage
        - This helps to **maximize productivity**, **reduce waste**, and **increase profitability**

- To reiterate, finishing resource management activities is critical for project success
    - It enables project managers to optimize the **use of resources**, **minimize project risks**, and ensure that the **project is delivered on time**, **within budget**, and to the **required quality standards**
    - What should we do to make this happen?
        - Collect feedback from stakeholders
        - Removes accesses
        - Release resources
        - Archive documentation
        - Celebrate
- In the closing phase, collect feedback from both team members and stakeholders
    - A survey is an effective way to gather final feedback as stakeholders have recently provided more interactive feedback during the project closure meeting
    - This feedback should focus more on **objective ratings** and **final comments**, and an anonymous survey can generate the most transparent feedback
- At the end of the project, it is important to remove unnecessary access to prevent security issues and control costs
- Access management is a vital function in most organizations, and these tasks can be delegated to responsible groups
- PM should also check the access levels of team members, stakeholders, and vendors and identify which resources they have access to and which ones they no longer require
- We need to release the resources and officially disband the project team
    - Acknowledge the end of the project work to anyone working on the project, including team members, contractors, and suppliers
- The project files will move to the organization's archives, so it is a good idea to keep a copy of any materials that will be useful for future projects
    - Keep a copy or running list of lessons learned and maintain copies of **templates**, **reusable processes**, and **checklists**
- Take the time to acknowledge the team's contributions and celebrate the project's success

Conclusion

- **Conclusion**
  - 4 Domains of Project+
    - Domain 1: Project Management Concepts
      - It makes up **33%** of the exam
    - Domain 2: Project Life Cycle Phases
      - It makes up **30%** of the exam
    - Domain 3: Tools and Documentation
      - It makes up **19%** of the exam
    - Domain 4: IT Basics and Governance
      - It makes up **18%** of the exam
  - How do you sign up and schedule your exam?
    - Pearson VUE
      - You can take it at any Pearson VUE testing center worldwide, at either a local testing center or online
      - You can buy that exam voucher by going to Pearson Vue directly when you're scheduling your exam at **pearsonvue.com**, or going to the voucher store at lpi.org to buy it from their online store
      - Pearson VUE and LPI have now created a capability for you to take your certification exam online from the comfort of your home or office, using the Pearson VUE OnVue testing system
    - Dion Training
      - If you'd like to pre-purchase your exam voucher before you schedule the exam, you can actually **save 10% off** the price by going to our website at **diontraining.com/vouchers**
      - Currently, we carry vouchers for over 50 countries around the world, and we are adding countries all the time
      - As a LPI Platinum Partner, we receive a special discounted rate on these exam vouchers and we pass those savings onto our students when they order their exam vouchers from us
  - Top five tips for increasing your score on the exam
    - Use a cheat sheet
      - You're not allowed to actually carry anything into the exam with you, but if you're at a local testing center, they will give you a whiteboard or a dry erase sheet that's about the size of a normal piece of paper

- Once the clock starts on the exam, you can brain-dump anything you want onto that paper
- Use the sheet and spend the first 1-2 minutes writing down those important things you may forget later on
  - Skip any questions that are giving you trouble
    - If you find yourself struggling with a really hard question, just mark it for review and skip it
    - Students who do this end up increasing their score by at least 5% to 10% over their peers who try to do the simulations at the beginning of their exam
  - Take a guess
    - If you're in doubt, I want you to take a guess from the possible answer choices
    - There is no penalty for guessing incorrectly on the exam
    - If you are in doubt of the right answer, try to eliminate as many choices as possible and guess between the remaining answer options
  - Pick the best time for your exam
    - Pick the time of day that works best for you
    - Don't try to squeeze the exam in after working a long day at the office
  - Be confident
    - You've got this!
    - You should already know you're going to pass!
    - You should have already studied all the information in this course, you've watched the videos, you've taken the quizzes, you've studied your downloadable study notes
    - If you're not confident right now, then wait a few days to schedule your exam
    - Take a bunch of practice exams and build up your confidence
- When you take a practice exam, your goal is **not to memorize the answer key**
  - You need to understand why the right answer was right and the wrong answers are wrong
- Good luck, and we hope to see you again in a future course as you continue upwards in your project management, IT, or cybersecurity career and continue to climb the CompTIA certification ladder!