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This is an interactive call and we want to you to participate

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When you want to ask a question or make a statement please state your name and the fact you would like to speak and wait for the moderator/presenter to acknowledge you.  
That way we do not over-talk each other.

# Our Email Address

**PMPStudy@pmlessonslearned.com**

# Legalese

Participants are meant to use the contents of this session as additional study material

Much of this session comes from:

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**PM Lessons Learned  
Monthly PMP Exam Study Group**

**Project Time Management  
Part 2**

**6 MAR 2014**

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PMBOK Guide, Fifth Edition

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# PMBOK Fifth Edition Processes

	Initiating	Planning	Executing	Monitoring & Controlling	Closing
<b>4. Project Integration Management</b>	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
<b>5. Project Scope Management</b>		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
<b>6. Project Time Management</b>		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
<b>7. Project Cost Management</b>		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
<b>8. Project Quality Management</b>		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
<b>9. Project Human Resource Management</b>		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
<b>10. Project Communications Management</b>		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
<b>11. Project Risk Management</b>		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
<b>12. Project Procurement Management</b>		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
<b>13. Project Stakeholder Management</b>	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

# Agenda

PMLL Podcast #158

PMBOK 5e

## **Project Time Management**

6.3 Sequence Activities

6.7 Control Schedule

## Project Time Management Overview

### 6.1 Plan Schedule Management

- 1 Inputs
  - 1 Project management plan
  - 2 Project charter
  - 3 Enterprise environmental factors
  - 4 Organizational process assets
- 2 Tools & Techniques
  - 1 Expert judgment
  - 2 Analytical techniques
  - 3 Meetings
- 3 Outputs
  - 1 Schedule management plan

### 6.2 Define Activities

- 1 Inputs
  - 1 Schedule management plan
  - 2 Scope baseline
  - 3 Enterprise environmental factors
  - 4 Organizational process assets
- 2 Tools & Techniques
  - 1 Decomposition
  - 2 Rolling wave planning
  - 3 Expert judgment
- 3 Outputs
  - 1 Activity list
  - 2 Activity attributes
  - 3 Milestone list

### 6.3 Sequence Activities

- 1 Inputs
  - 1 Schedule management plan
  - 2 Activity list
  - 3 Activity attributes
  - 4 Milestone list
  - 5 Project scope statement
  - 6 Enterprise environmental factors
  - 7 Organizational process assets
- 2 Tools & Techniques
  - 1 Precedence diagramming method (PDM)
  - 2 Dependency determination
  - 3 Leads and lags
- 3 Outputs
  - 1 Project schedule network diagrams
  - 2 Project documents updates

### 6.4 Estimate Activity Resources

- 1 Inputs
  - 1 Schedule management plan
  - 2 Activity list
  - 3 Activity attributes
  - 4 Resource calendars
  - 5 Risk register
  - 6 Activity cost estimates
  - 7 Enterprise environmental factors
  - 8 Organizational process assets
- 2 Tools & Techniques
  - 1 Expert judgment
  - 2 Alternative analysis
  - 3 Published estimating data
  - 4 Bottom-up estimating
  - 5 Project management software
- 3 Outputs
  - 1 Activity resource requirements
  - 2 Resource breakdown structure
  - 3 Project documents updates

### 6.5 Estimate Activity Durations

- 1 Inputs
  - 1 Schedule management plan
  - 2 Activity list
  - 3 Activity attributes
  - 4 Activity resource requirements
  - 5 Resource calendars
  - 6 Project scope statement
  - 7 Risk register
  - 8 Resource breakdown structure
  - 9 Enterprise environmental factors
  - 10 Organizational process assets
- 2 Tools & Techniques
  - 1 Expert judgment
  - 2 Analogous estimating
  - 3 Parametric estimating
  - 4 Three-point estimating
  - 5 Group decision-making techniques
  - 6 Reserve analysis
- 3 Outputs
  - 1 Activity duration estimates
  - 2 Project documents updates

### 6.6 Develop Schedule

- 1 Inputs
  - 1 Schedule management plan
  - 2 Activity list
  - 3 Activity attributes
  - 4 Project schedule network diagrams
  - 5 Activity resource requirements
  - 6 Resource calendars
  - 7 Activity duration estimates
  - 8 Project scope statement
  - 9 Risk register
  - 10 Project staff assignments
  - 11 Resource breakdown structure
  - 12 Enterprise environmental factors
  - 13 Organizational process assets
- 2 Tools & Techniques
  - 1 Schedule network analysis
  - 2 Critical path method
  - 3 Critical chain method
  - 4 Resource optimization techniques
  - 5 Modeling techniques
  - 6 Leads and lags
  - 7 Schedule compression
  - 8 Scheduling tool
- 3 Outputs
  - 1 Schedule baseline
  - 2 Project schedule
  - 3 Schedule data
  - 4 Project calendars
  - 5 Project management plan updates
  - 6 Project documents updates

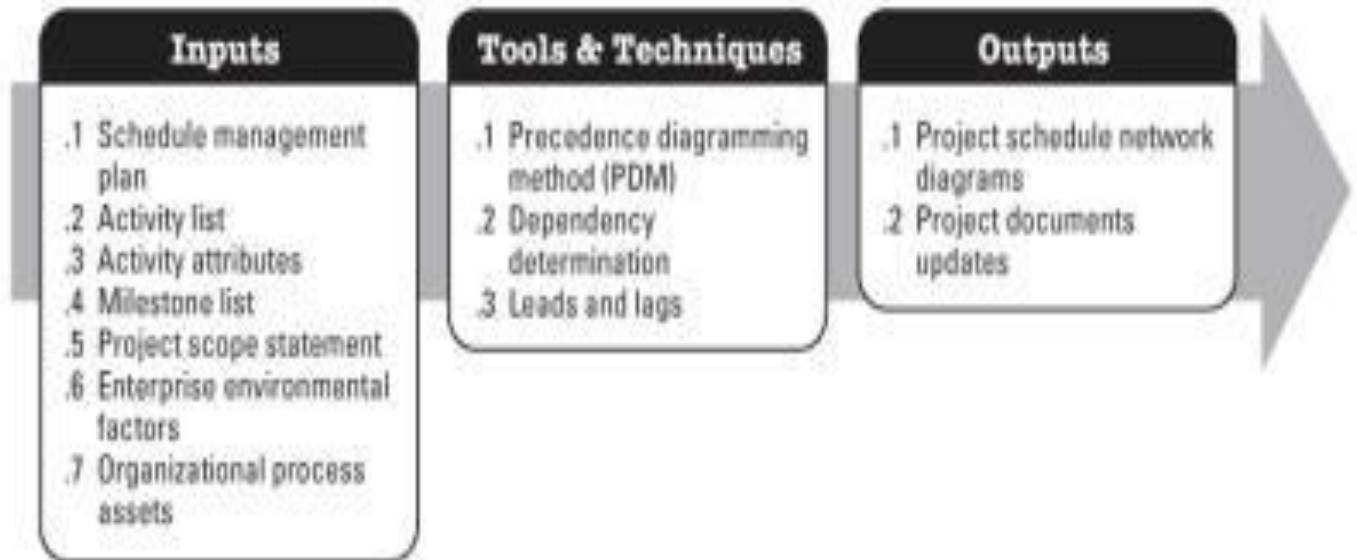
### 6.7 Control Schedule

- 1 Inputs
  - 1 Project management plan
  - 2 Project schedule
  - 3 Work performance data
  - 4 Project calendars
  - 5 Schedule data
  - 6 Organizational process assets
- 2 Tools & Techniques
  - 1 Performance reviews
  - 2 Project management software
  - 3 Resource optimization techniques
  - 4 Modeling techniques
  - 5 Leads and lags
  - 6 Schedule compression
  - 7 Scheduling tool
- 3 Outputs
  - 1 Work performance information
  - 2 Schedule forecasts
  - 3 Change requests
  - 4 Project management plan updates
  - 5 Project documents updates
  - 6 Organizational process assets updates




# Sequence Activities

## 6.3



# Sequence Activities

- Process of identifying and documenting relationships among the project activities
-  The key benefit of this process is that it defines the logical sequence of work to obtain the greatest efficiency given all project constraints
- Every activity and milestone except the first and last should be connected to at least one predecessor with a finish-to-start or start-to-start logical relationship and at least one successor with a finish-to-start or finish-to-finish logical relationship
- Logical relationships should be designed to create a realistic project schedule
- It may be necessary to use lead or lag time between activities to support a realistic and achievable project schedule
- Sequencing can be performed by using project management software or manual or automated techniques

# Sequence Activities: Inputs

- Activity List
- Activity Attributes
- Milestone List
- Project Scope Statement
- Organizational Process Assets
- Enterprise Environmental Factors
- Schedule Management Plan

# Sequence Activities: Inputs

## Activity List

- Contains all the schedule activities that will be performed for the project, with a scope of work description of each activity and an identifier (such as a code or number) so that team members understand what the work is and how it is to be completed

## Activity Attributes

- Describe the characteristics of the activities and are an extension of the activity list
- Activity attributes might include
  - Activity identifier or code
  - Descriptions
  - Associated constraints and assumptions
  - Activities that come before this activity (predecessor activities) and after this activity (successor activities)
  - Resource requirements
  - The individual responsible for completing the work
  - And more

# Sequence Activities: Inputs

## Milestone Lists



Major accomplishments of the project and mark the completion of major deliverables or some other key event in the project

- The milestone list records these accomplishments and documents whether the milestone is mandatory or optional



A zero duration element on your schedule

## Project Scope Statement

- An agreement between the project and the project customer that states precisely what the work of the project will produce
- Can contain schedule constraints and project assumptions

## Schedule Management Plan

- Identifies the scheduling method and tool to be used for the project, which will guide how the activities may be sequenced

# Sequence Activities: Inputs

## Enterprise Environmental Factors

- Government or industry standards
- Project management information system (PMIS)
- Scheduling tool
- Company work authorization systems

## Organizational Process Assets

- Project files from the corporate knowledge base used for scheduling methodology, existing formal and informal activity planning-related policies, procedures, and guidelines, such as the scheduling methodology that are considered in developing logical relationships, and templates that can be used to expedite the preparation of networks of project activities
- Related activity attributes information in templates can also contain additional descriptive information useful in sequencing activities

# Sequence Activities: Tools & Techniques

- Precedence Diagramming Method (PDM)
- Dependency Determination
- Leads And Lags

## Precedence Diagramming Method (PDM) Activity On Node (AON)

- What most project management software programs use to do activity sequencing



Precedence diagrams use boxes or rectangles to represent the activities (called **nodes**)

- The nodes are connected with arrows showing the dependencies between the activities
- Displays the activity name and other options
  - activity number
  - start and stop dates
  - due dates
  - slack time




Remember that the PDM uses only **ONE** time estimate to determine duration



# Sequence Activities: Tools & Techniques

## Precedence Diagramming Method

### Logical Relationships

- Dependencies and Precedence Relationships also are used to describe these relationships
- The four dependencies, or logical relationships, are as follows:
  - **Finish-to-Start (FS)** This relationship says that the predecessor—or *from* activity—must finish before the successor—or *to* activity—can start  
 In PDM diagrams, this is the most often used logical relationship
  - **Start-to-Finish (SF)** The start-to-finish relationship says that the predecessor activity must start before the successor activity can finish. This logical relationship is seldom used
  - **Finish-to-Finish (FF)** The finish-to-finish relationship says that the predecessor activity must finish before the successor activity finishes
  - **Start-to-Start (SS)** The start-to-start relationship says that the predecessor activity must start before the successive activity can start

# Finish-to-Start (FS)

- This relationship says that the predecessor—or *from* activity—must finish before the successor—or *to* activity—can start
  - 📅 In PDM diagrams, this is the most often used logical relationship



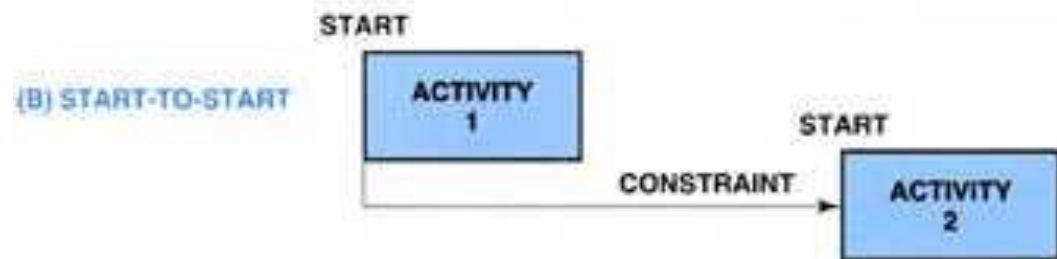
# Finish-to-Finish (FF)

- The finish-to-finish relationship says that the predecessor activity must finish before the successor activity finishes



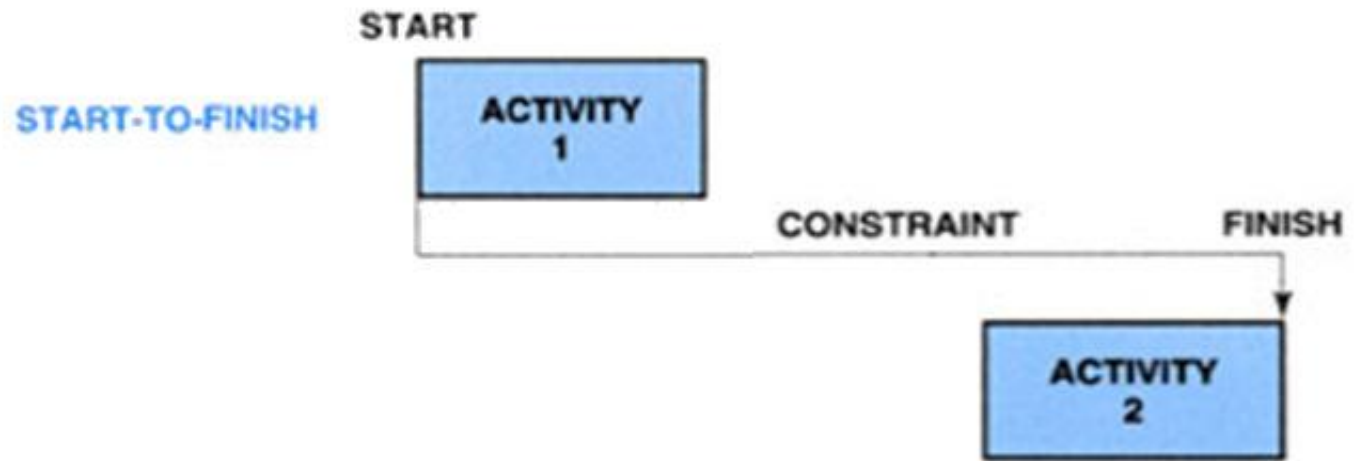
# Start-to-Start (SS)

- The start-to-start relationship says that the predecessor activity must start before the successor activity can start



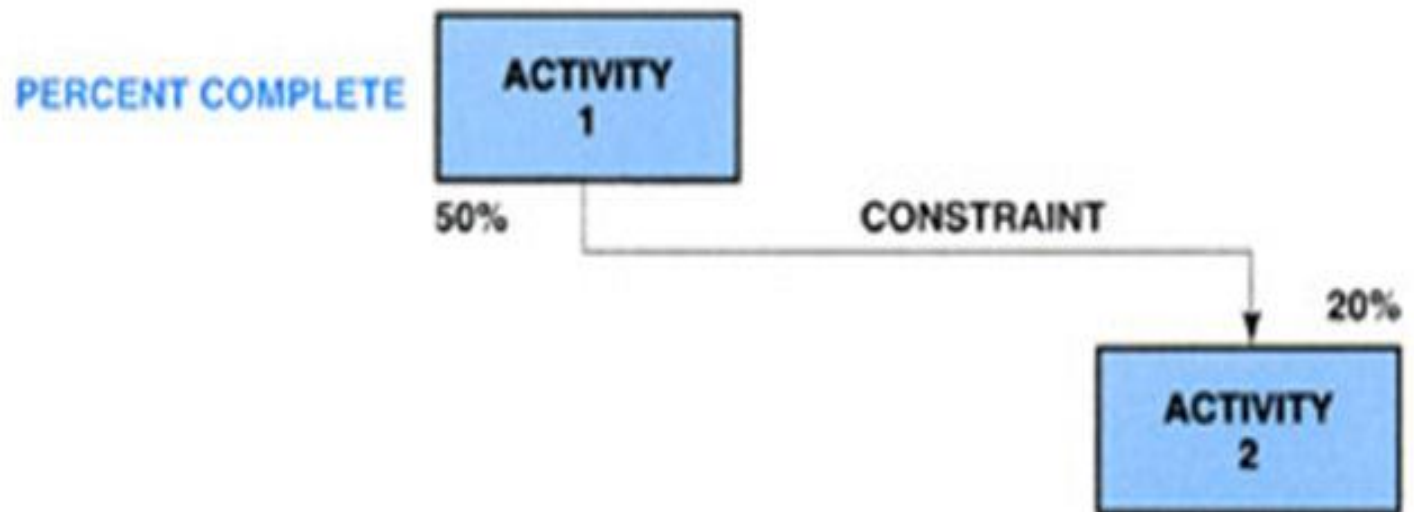
# Start-to-Finish (SF)

- The start-to-finish relationship says that the predecessor activity must start before the successor activity can finish



# Percent Complete (%)

- The percent complete relationship says that x% of the predecessor activity must be complete before x% of the successor activity can finish



# Sequence Activities: Tools & Techniques

## Arrow Diagramming Method (ADM) Activity On Arrow (AOA)

- Visually the opposite of the PDM
- The arrow diagramming method places activities on the arrows, which are connected to dependent activities with nodes
- This technique isn't used nearly as often as PDM, but some industries prefer the ADM to the PDM

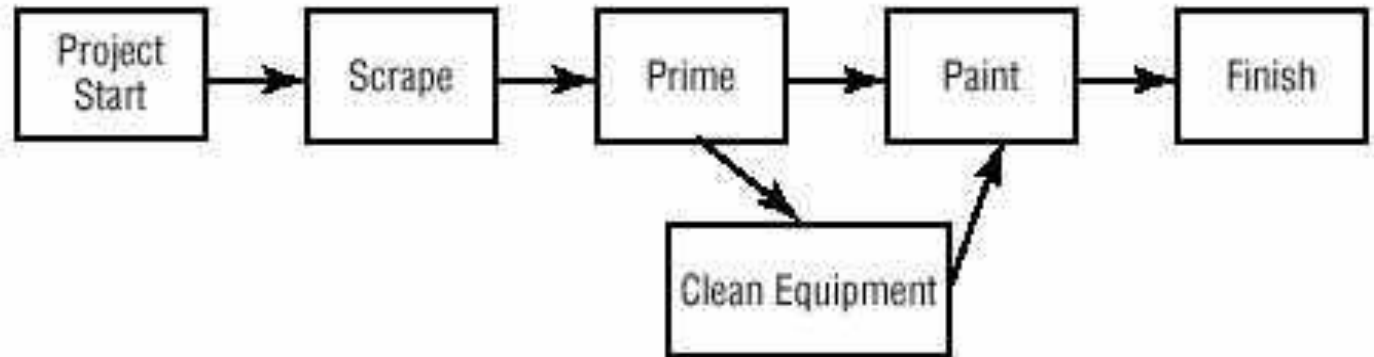


### Important ADM Notes:

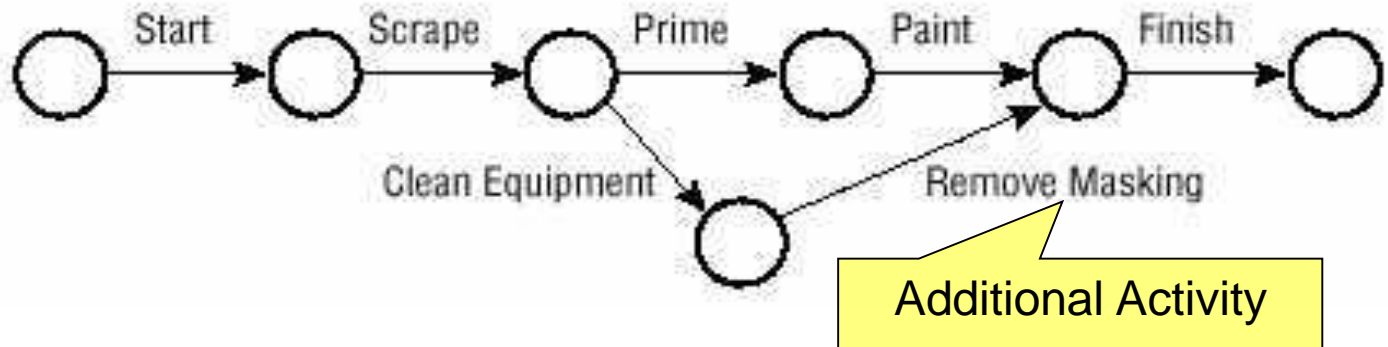
- Uses only the finish-to-start dependency
- Uses **More than ONE** time estimate to determine duration
- Sometimes dummy/additional activities must be plugged into the diagram to accurately display the dependencies

# Methods Are Visually Very Different

## Precedence Diagramming Method (PDM)



## Arrow Diagramming Method (ADM)





## Dependency Determination

### Mandatory Dependencies, Hard Logic, Hard Dependencies

- Defined by the type of work being performed
  - The nature of the work itself dictates the order in which the activities should be performed
  - In house painting, the scraping, primer, and painting sequence is an example of mandatory dependencies
  - Activities with physical limitations are a tell-tale sign that you have a mandatory dependency on your hands

## Dependency Determination

### Discretionary Dependencies, Preferred Logic, Soft Logic, Preferential Logic

- Discretionary dependencies are defined by the project management team
  - Usually process or procedure-driven or "best-practice" techniques based on past experience
  - For example, both past experience and best practices on house-painting projects have shown that all trim work should be hand-painted while the bulk of the main painting work should be done with a sprayer

## Dependency Determination

### External Dependencies

- Are external to the project
- A non-project activity that impacts project activities
  - For example, perhaps your project is researching and marketing a new drug the FDA must approve the drug before your company can market it
  - A project cannot move forward until FDA approval occurs
  - That means FDA approval is an external dependency

# Sequence Activities: Tools & Techniques

## Leads & Lags

- **Lags - Delay** the successor activities (those that follow a predecessor activity) requiring time to be added either to the start date or to the finish date of the activity you're scheduling
- **Leads – Speed-up** the successor activities, requiring time to be subtracted from the start date or the finish date of the activity you're scheduling
- House-painting example
  - Lag Time: In order to paint, you first need to scrape the peeling paint and then prime. You can't begin painting until the primer is dried, so you shouldn't schedule priming for Monday and painting for Tuesday if you need the primer to dry on Tuesday. Therefore, the priming activity requires lag time, forcing you to add time to the end of this activity to allow for the drying time needed before you can start painting
  - Lead Time: Works just the opposite. For this example, you could start priming before the scraping the entire house is finished. Maybe certain areas on the house don't require scraping, so you don't really need to wait until the scraping activity finishes to begin the priming activity. Priming in this example has lead time subtracted from the beginning of the activity so that this activity begins prior to the previous activity finishing

# Sequence Activities: Outputs

- Project Schedule Network Diagrams
- Project Document Updates

# Sequence Activities: Outputs

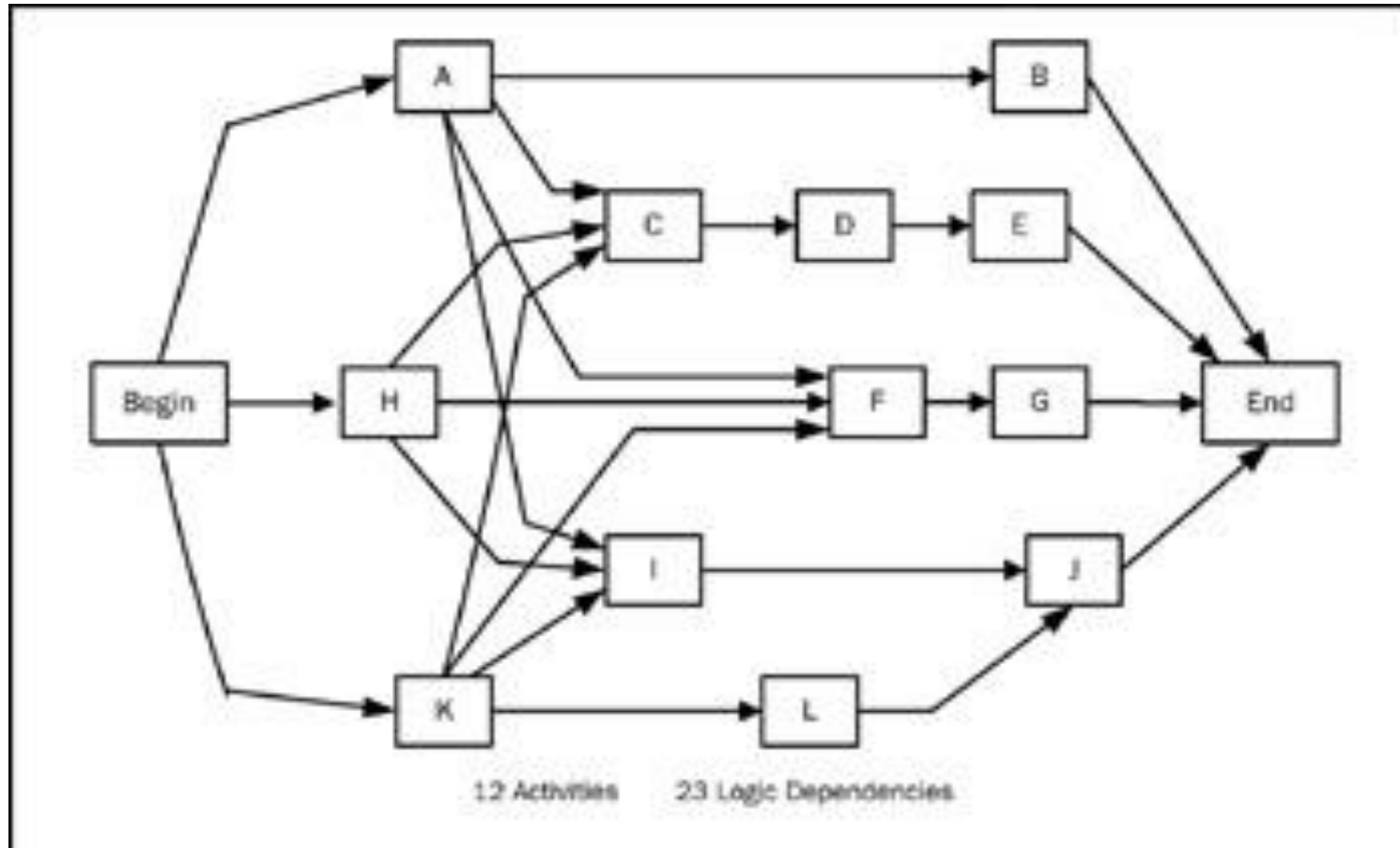
## Project Schedule Network Diagrams

- A graphical representation of the logical relationships, also referred to as dependencies, among the project schedule activities
- A project schedule network diagram is produced manually or by using project management software
- It can include full project details, or have one or more summary activities
- A summary narrative can accompany the diagram and describe the basic approach used to sequence the activities
- Any unusual activity sequences within the network should be fully described within the narrative

# Sequence Activities: Outputs

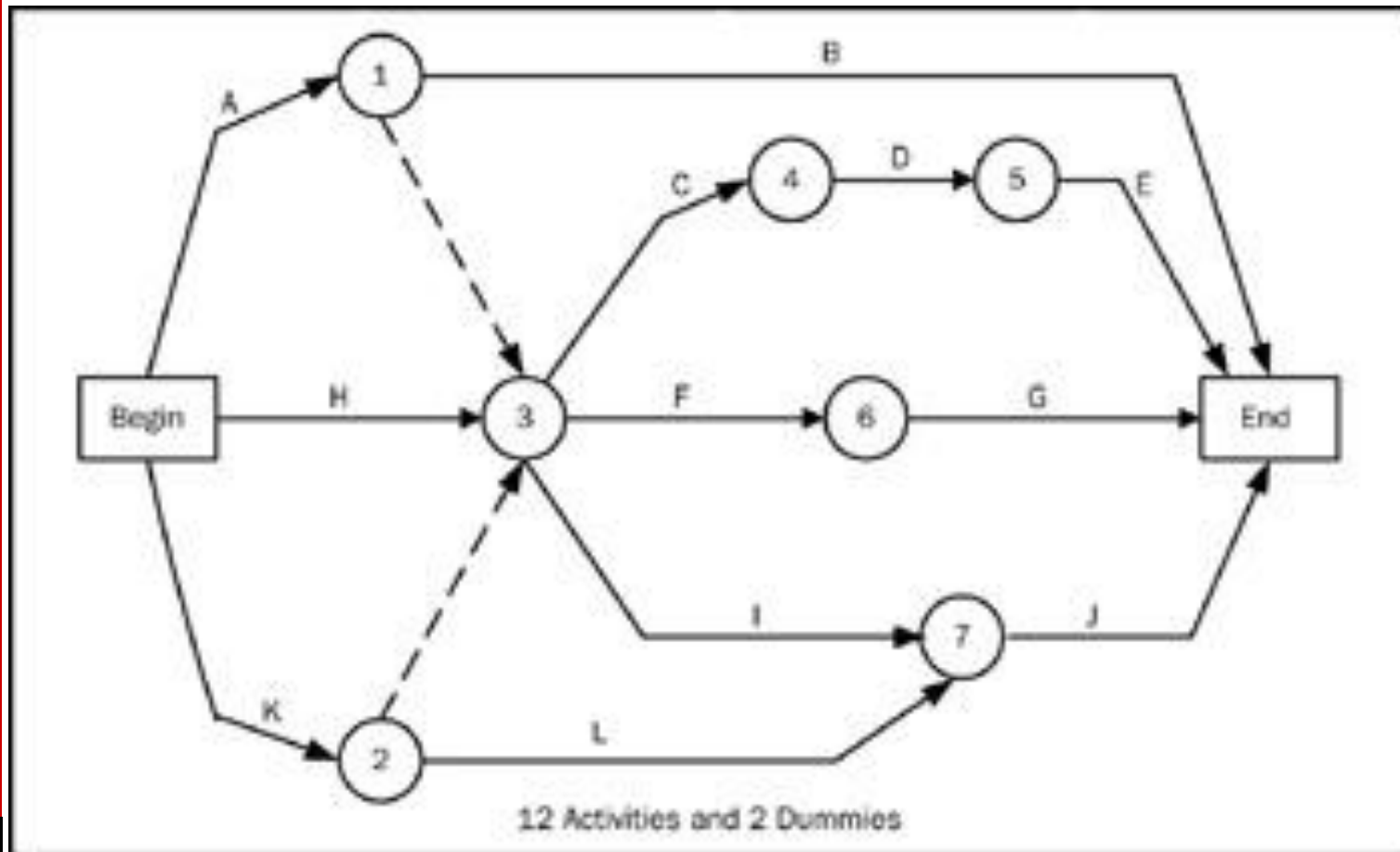
## Project Schedule Network Diagrams

- Precedence Diagramming Method (PDM)  
Activity On Node (AON)
- This diagram is somewhat complicated
- It's also functionally equivalent...



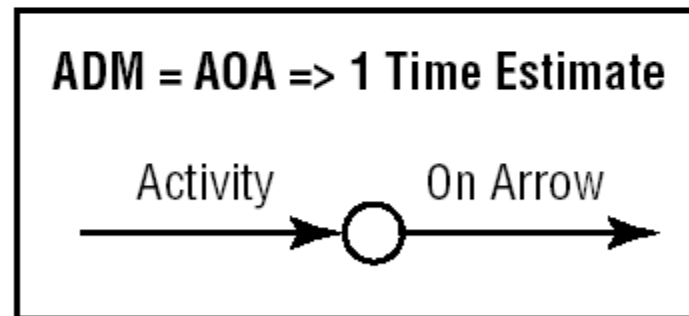
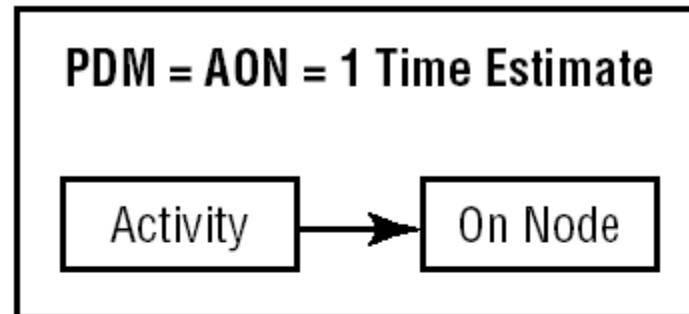
# Less Complicated

- To this one
- Notice there are 2 dummy activities (dotted lines)





# Kim Heldman's Memorization Tool

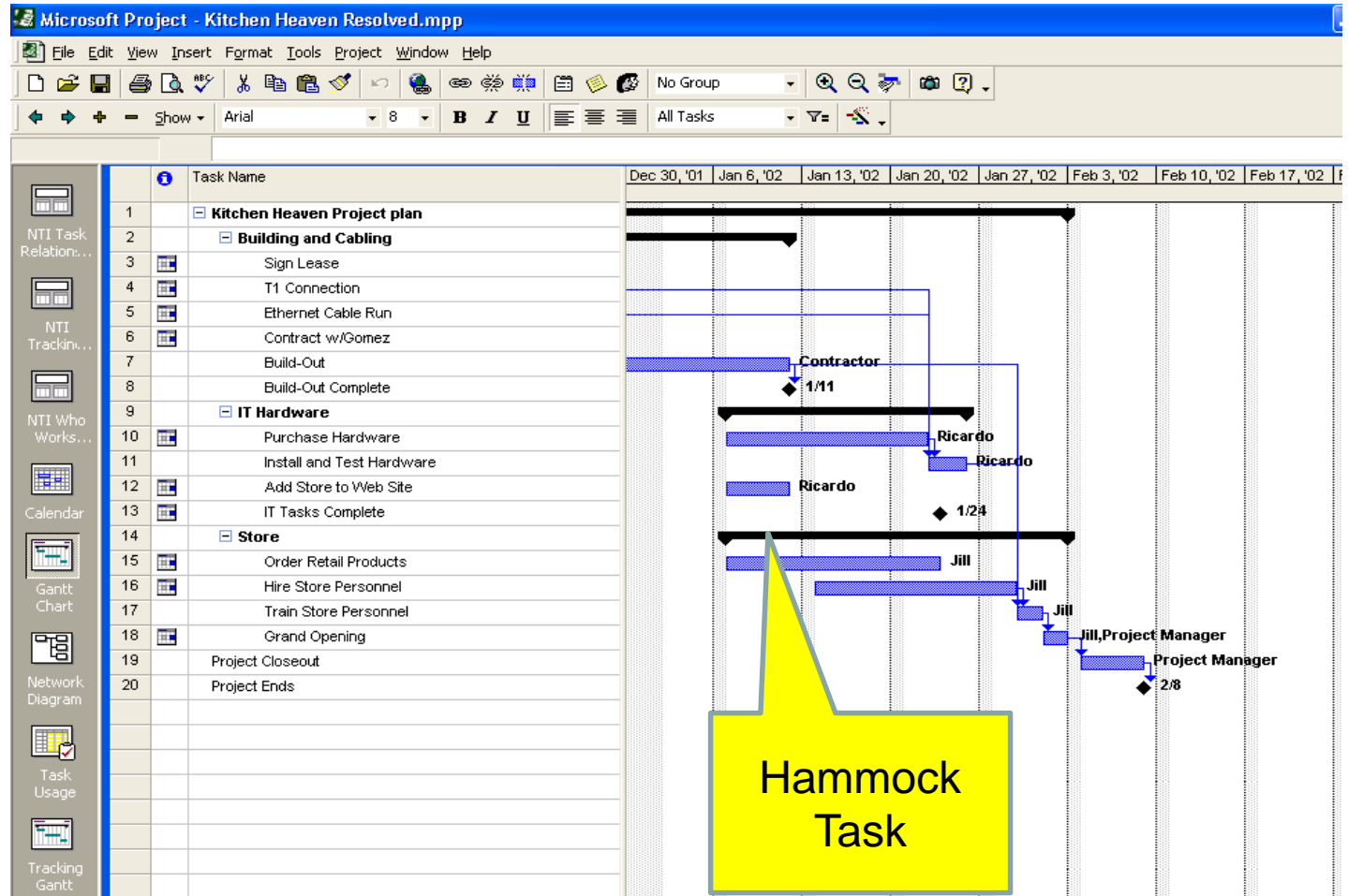


# Sequence Activities: Outputs

## Project Document Updates

- Activity lists
  - Activity attributes
  - Risk register
- Summary-level activities are a collection of related activities also known as **hammocks**
    - Think of hammocks as a group of related activities rolled up into a summary heading that describes the activities likely to be contained in that grouping
    - The entire house painting example could be placed into a hammock activity for a larger house renovation project
  - While constructing project schedule network diagrams you might identify a new activity, or it might make you break an activity down into two activities in places where you thought one activity might work
    - If this is the case, you will produce both activity list updates based on this new information as well as activity attributes updates

# Microsoft Project Gantt Chart



# Control Schedule




## 6.7



# Control Schedule

- Control Schedule is the process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan
- The key benefit of this process is that it provides the means to recognize deviation from the plan and take corrective and preventive actions and thus minimize risk

# Monitoring and Controlling Schedule Changes

-  Control Schedule involves determining status of project schedule, if changes have occurred or should occur, and influencing and managing schedule changes
-  Remember that the Control Schedule process works hand in hand with the Perform Integrated Change Control process (as all the change control processes do) and that means any changes to the schedule baseline must be processed through Integrated Change Control
-  Keeping the schedule on track means you're monitoring and controlling time—one of the classic triple constraints

# Control Schedule In an Agile Framework

Agile delivers incremental “value” in small chunks (instead of delivering the entire project at the end)

- Determine the current status of the project schedule by comparing the total amount of work delivered and accepted against the estimates of work completed for the elapsed time cycle
- Conduct retrospective reviews (scheduled reviews to record lessons learned) for correcting processes and improving
- Reprioritize the remaining work plan (backlog)
- Determine the rate at which the deliverables are produced, validated, and accepted (**velocity**) in given time per iteration (agreed work cycle duration, typically two weeks or one month)
- Determine that the project schedule has changed
- Manage the actual changes as they occur

# Control Schedule: Inputs

- Project Management Plan
- Project Schedule
- Work Performance Data
- Project Calendars
- Schedule Data
- Organizational Process Assets



# Control Schedule: Inputs

## Project Management Plan

- Contains the schedule management plan and the schedule baseline
- The schedule management plan describes how the schedule will be managed and controlled
- The schedule baseline is used to compare with actual results to determine if a change, corrective action, or preventive action is necessary

## Project Schedule

- The most recent version with notations to indicate updates, completed activities, and started activities as of the indicated data date

## Work Performance Data

- Information about project progress such as which activities have started, their progress (e.g., actual duration, remaining duration, and physical percent complete), and which activities are completed

# Control Schedule: Inputs

## Project Calendar

- Some schedules require more than one project calendar to allow for different work periods for some activities to calculate the schedule forecasts

## Schedule Data

- Schedule data will be reviewed and updated in the Control Schedule process

## Organizational Process Assets

- Schedule data will be reviewed and updated in the Control Schedule process

# Control Schedule: Tools & Techniques

- Performance Reviews
- Project Management Software
- Schedule Compression
- Scheduling Tool
- Resource Optimization Techniques
- Modeling Techniques
- Leads And Lags

# Schedule Control: Tools & Techniques

## Performance Reviews

- Performance measurements for schedule control include the schedule variance (SV) and schedule performance index (SPI) will be helpful in determining the impact of the schedule variations and in determining whether corrective actions are necessary
- There are several techniques you can use in this process, including trend analysis, critical path method, critical chain method, and earned value management
- Remember the critical path is the longest path on the project schedule with zero or negative float
  - If there are variances in critical path tasks, your schedule is likely at risk
  - Examining critical path tasks, or those near a critical path task, can help alert you to schedule risk
- Remember the critical chain method uses buffers to minimize resource risk
  - You should compare the amount of buffer needed to the amount of buffer remaining to see if the schedule is on track or needs adjustment

# Schedule Control: Tools & Techniques

## Project Management Software

- Provides the ability to track planned dates versus actual dates, to report variances to and progress made against the schedule baseline, and to forecast the effects of changes to the project schedule model

## Schedule Compression

- Used to find ways to bring project activities that are behind into alignment with the plan by fast tracking or crashing schedule for the remaining work

## Scheduling Tool

- Updated and compiled into the schedule model to reflect actual progress of the project and remaining work to be completed
- The supporting schedule data are used in conjunction with manual methods or other project management software to perform schedule network analysis to generate an updated project schedule

# Schedule Control: Tools & Techniques

## Resource Optimization Techniques

- Involve the scheduling of activities and the resources required by those activities while taking into consideration both the resource availability and the project time

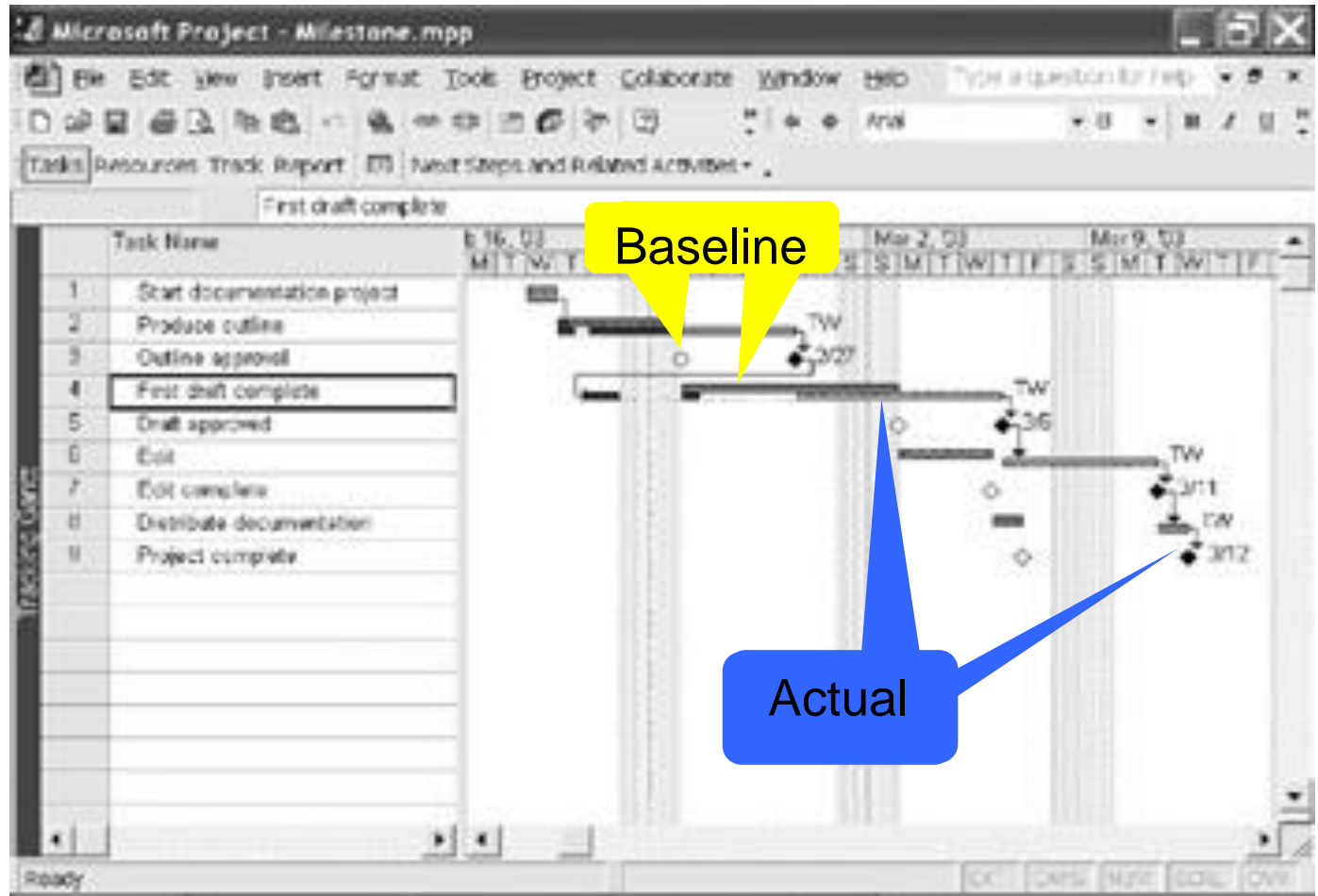
## Modeling Techniques

- Used to review various scenarios guided by risk monitoring to bring the schedule model into alignment with the project management plan and approved baseline

## Leads and Lags

- Adjusting leads and lags is applied during network analysis to find ways to bring project activities that are behind into alignment with the plan

# Schedule Comparison Bar Charts



- Baseline is the top portion and empty milestone diamonds
- Actual performance is the bottom portion and filled in diamonds

# Control Schedule: Outputs

- Work Performance Information
- Schedule Forecasts
- Change Requests
- Project Management Plan Updates
- Project Documents Updates
- Organizational Process Assets Updates



# Control Schedule: Outputs

## Work Performance Information

- The calculated SV and SPI time performance indicators for WBS components, in particular the work packages and control accounts, are documented and communicated to stakeholders

## Schedule Forecasts

- Estimates or predictions of conditions and events in the project's future based on information and knowledge available at the time of the forecast
- Forecasts are updated and reissued based on work performance information provided as the project is executed
- The information is based on the project's past performance and expected future performance, and includes earned value performance indicators that could impact the project in the future




# Control Schedule: Outputs

## Change Requests

- Schedule variance analysis and the results of reviews of project scope or schedule may result in change requests to the schedule baseline, scope baseline, and/or other components of the project management plan
- Change requests are processed for review and disposition through the Perform Integrated Change Control process (Section 4.5)
- Because you're dealing with time issues, it's imperative that you act as quickly as possible to implement corrective actions so that the schedule is brought back in line with the plan and the least amount of schedule delay as possible is experienced

# Control Schedule: Outputs

## Project Management Plan Updates

- Changes to the schedule baseline are incorporated in response to approved change requests related to project scope changes, activity resources, or activity duration estimates
  - The schedule management plan may be updated to reflect a change in the way the schedule is managed
  - The cost baseline may be updated to reflect approved change requests or changes caused by compression techniques
-  Changes to approved schedule start and end dates (in the schedule baseline) are called **revisions**
-  Never rebaseline a schedule without first having it approved by the project sponsor and archiving a copy of the original baseline and schedule
-  **Don't lose the original baseline information**

# Control Schedule: Outputs

## Project Documents Updates

- New project schedule network diagrams may be developed to display approved remaining durations and approved modifications to the schedule
- An updated project schedule will be generated from the schedule model populated with updated schedule data to reflect the schedule changes and manage the project
- The risk register, and risk response plans within it, may also be updated based on the risks that may arise due to schedule compression techniques

## Organizational Process Assets Updates

- Causes of variances
- Corrective action chosen and the reasons
- Other types of lessons learned from project schedule control

# Questions?