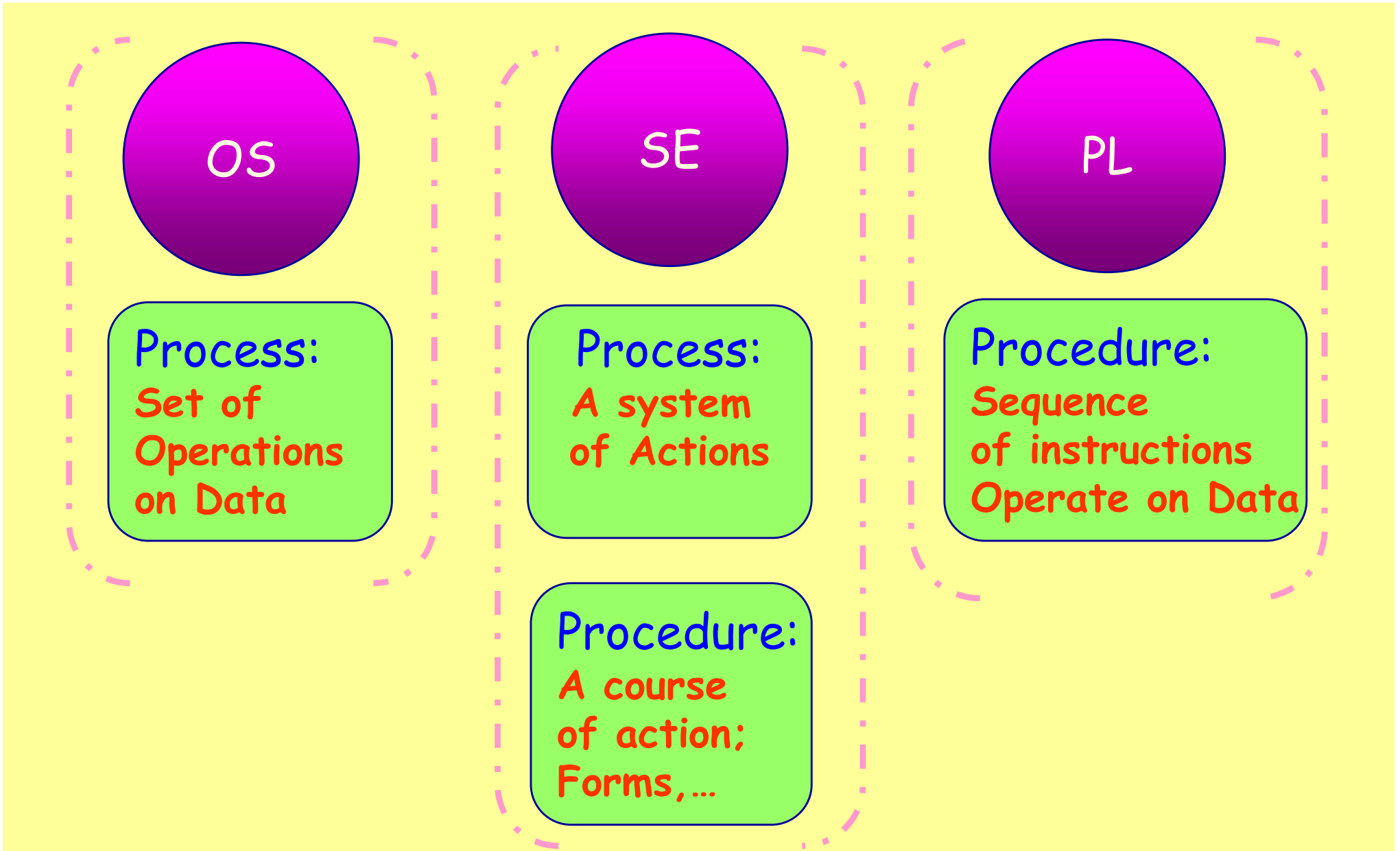
Mapping Process Activities into Project Tasks

How to represent the Software Development Process Activities
By Tasks in the Project Plan?

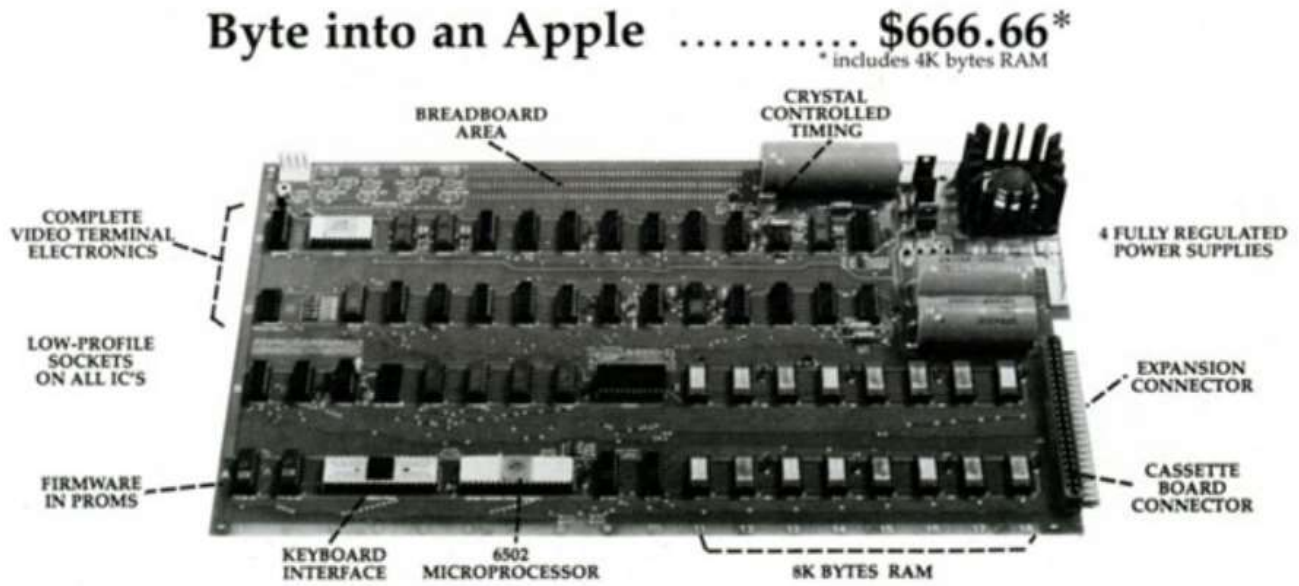
Process vs. Procedure



Software/Hardware Evolutionary Process

The **Apple I** (**Apple 1**) was the first Apple computer that originally sold for $666.66. The computer kit was developed by Steve Wozniak in 1976 and contained a 6502 8-bit processor and 4 kb of memory, which was expandable to 8 or 48 kb using expansion cards. Although the Apple I had a fully assembled circuit board the power supply, display, keyboard, and case to be operational. Below Apple I from an advertisement by Apple.

4 kb of memory



Software/Hardware Evolutionary Process

MacBook

from $1299

- 12-inch (diagonal) LED-backlit Retina display
- 1.1GHz, 1.2GHz, or 1.3GHz dual-core Intel Core M processor
  Turbo Boost up to 2.9GHz
- Up to 9 hours battery life[1]
- Up to 512GB flash storage[2]
- 2.03 pounds[3]
- Available in gold, silver, and space gray

MacBook Air 11-inch

from $899

- 11.6-inch (diagonal) LED-backlit display
- 1.6GHz dual-core Intel Core i5 or 2.2GHz dual-core Intel Core i7 processor
  Turbo Boost up to 3.2GHz
- Up to 9 hours battery life[1]
- Up to 512GB flash storage[2]
- 2.38 pounds[3]

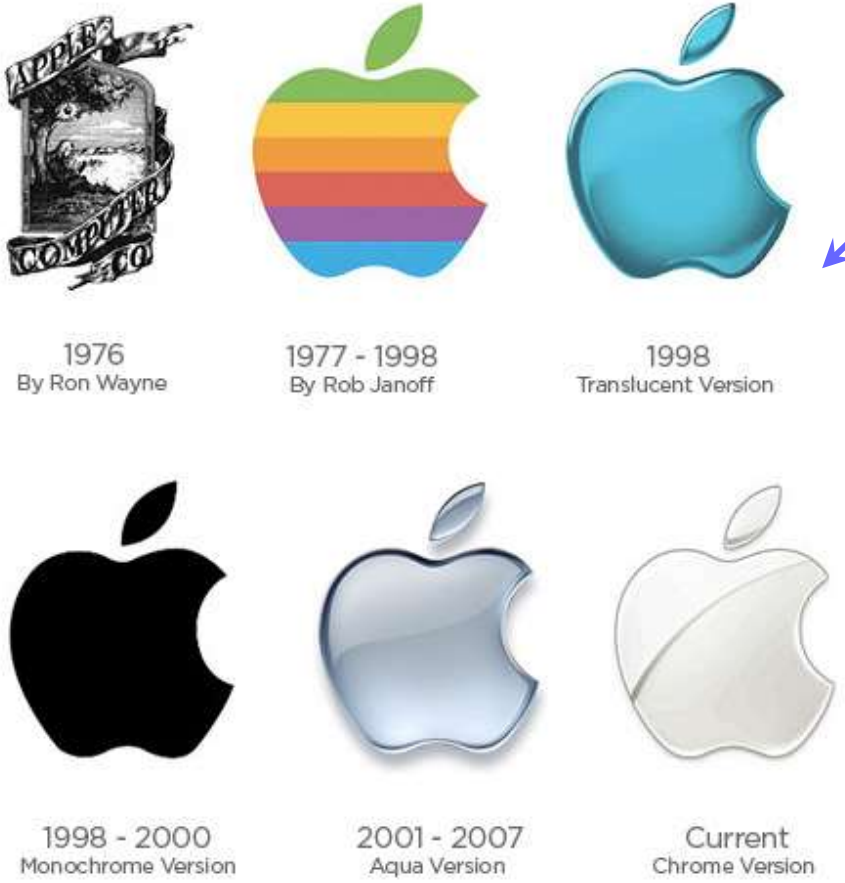
MacBook Air 13-inch

from $999

- 13.3-i
  displa
- 1.6GH
  2.2GH
  proce
  Turbo Boost up to 3.2GHz
- Up to 12 hours battery life[1]
- Up to 512GB flash storage[2]
- 2.96 pounds[3]

512 GB of memory

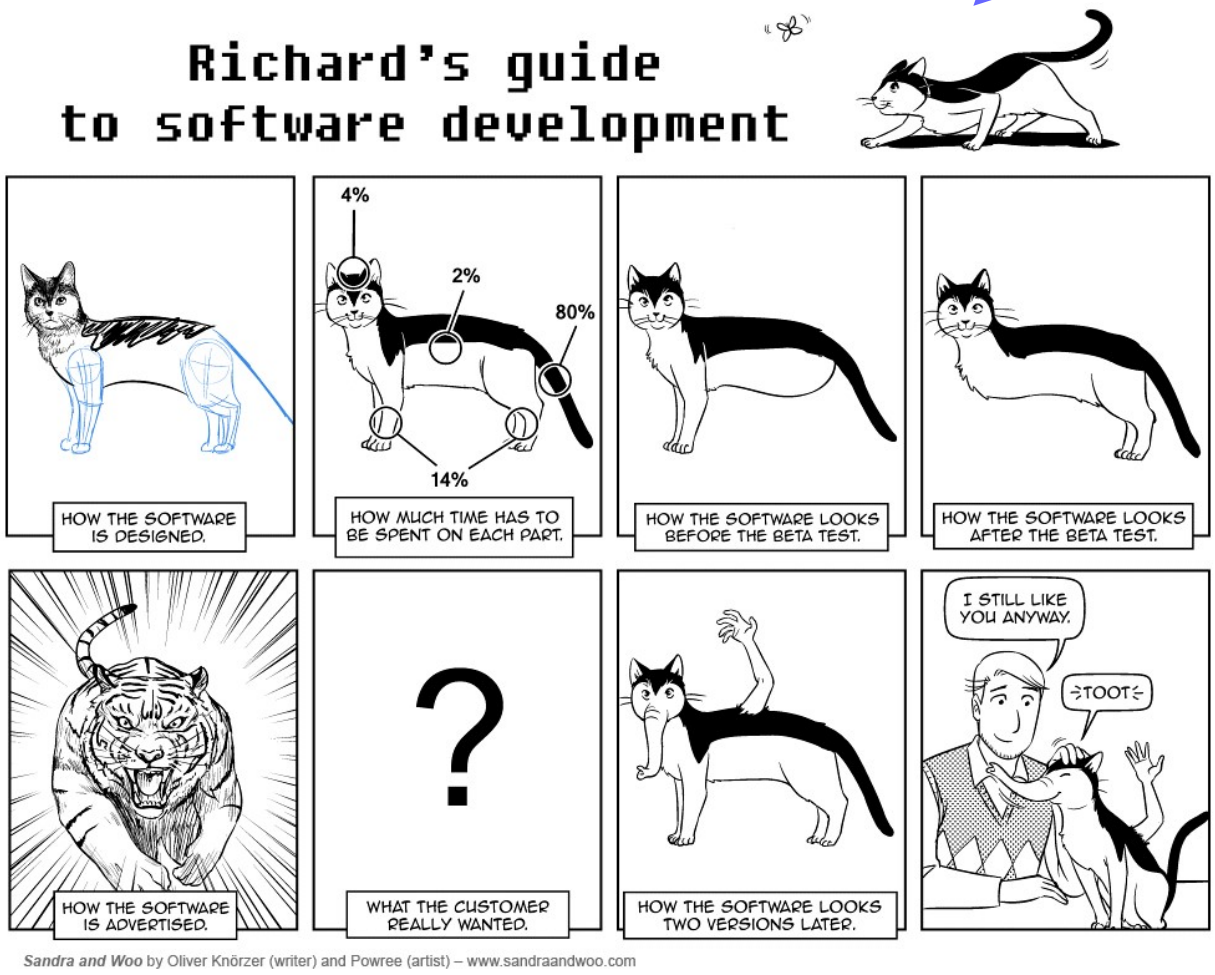
Software/Hardware Evolutionary Process



Even the logo of the company has its own evolutionary process

Software/Hardware Evolutionary Process

Software Process aligns perceptions with expectations



Software/Hardware Evolutionary Process

Project evolves over multiple phases

Software/Hardware Evolutionary Process

Processes evolved over the years

1970s

- Structured programming since 1969
- Cap Gemini SDM, originally from PANDATA, the first English translation was publishe
  Development Methodology

1980s

- Structured systems analysis and design method (SSADM) from 1980 onwards
- Information Requirement Analysis/Soft systems methodology

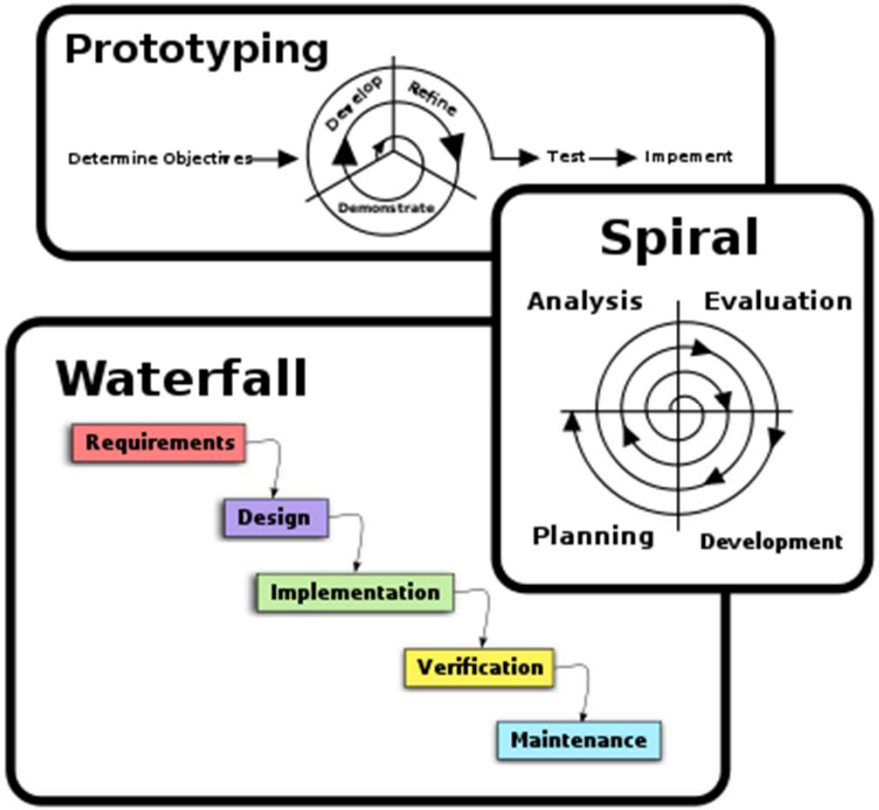
1990s

- Object-oriented programming (OOP) developed in the early 1960s, and became a dominant programming approach during the mid-1990s
- Rapid application development (RAD), since 1991
- Dynamic systems development method (DSDM), since 1994
- Scrum, since 1995
- Team software process, since 1998
- Rational Unified Process (RUP), maintained by IBM since 1998
- Extreme programming, since 1999

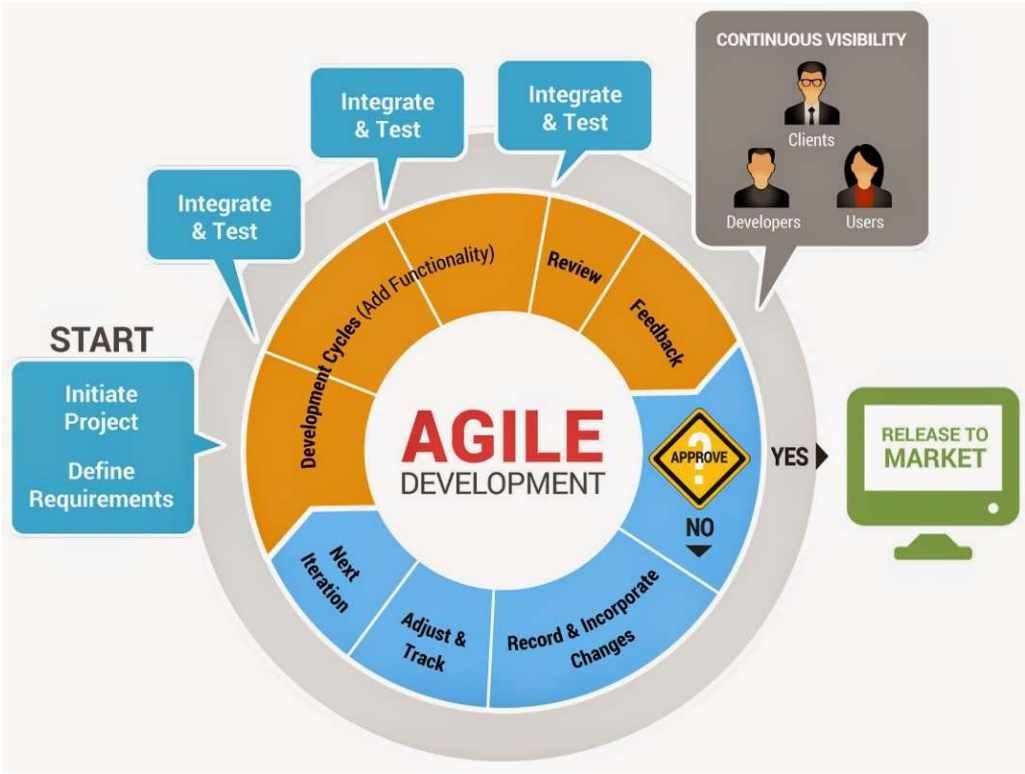
2000s

- Agile Unified Process (AUP) maintained since 2005 by Scott Ambler
- Disciplined agile delivery (DAD) Superseded of AUP

Software/Hardware Evolutionary Process



Processes evolved over the years

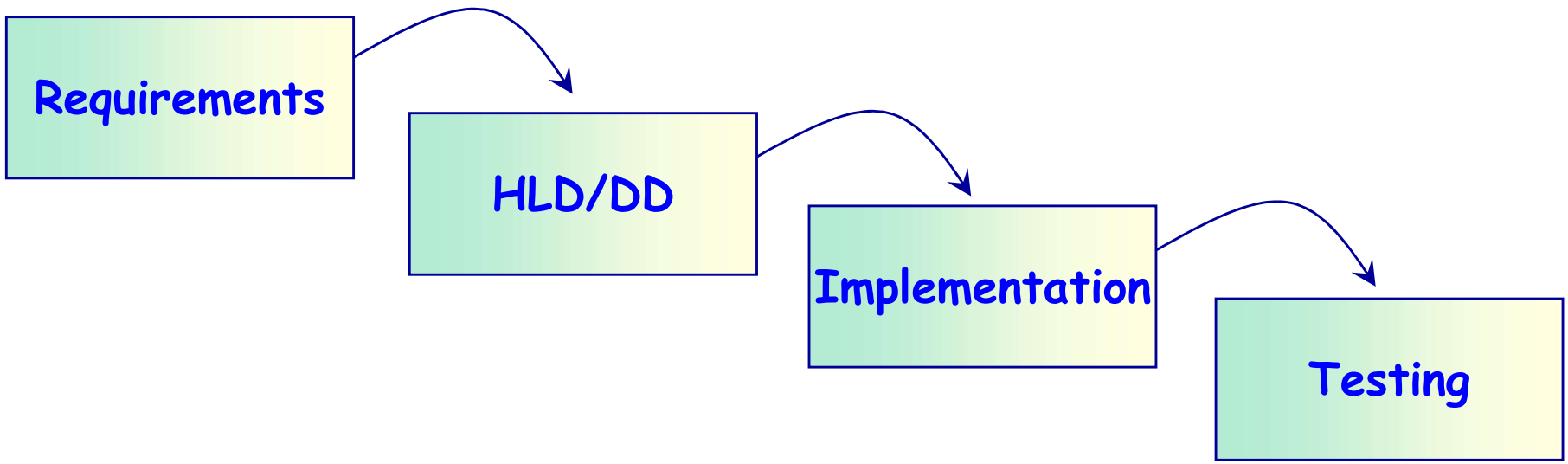


The Software Process

- A documentation for a sequence of steps that shall be followed when :
  - Starting/Closing the project
  - Writing/review requirement document
  - Writing/review High-level/detailed design document
  - Implementation and Code inspection
  - Writing test plan and Execute test cases

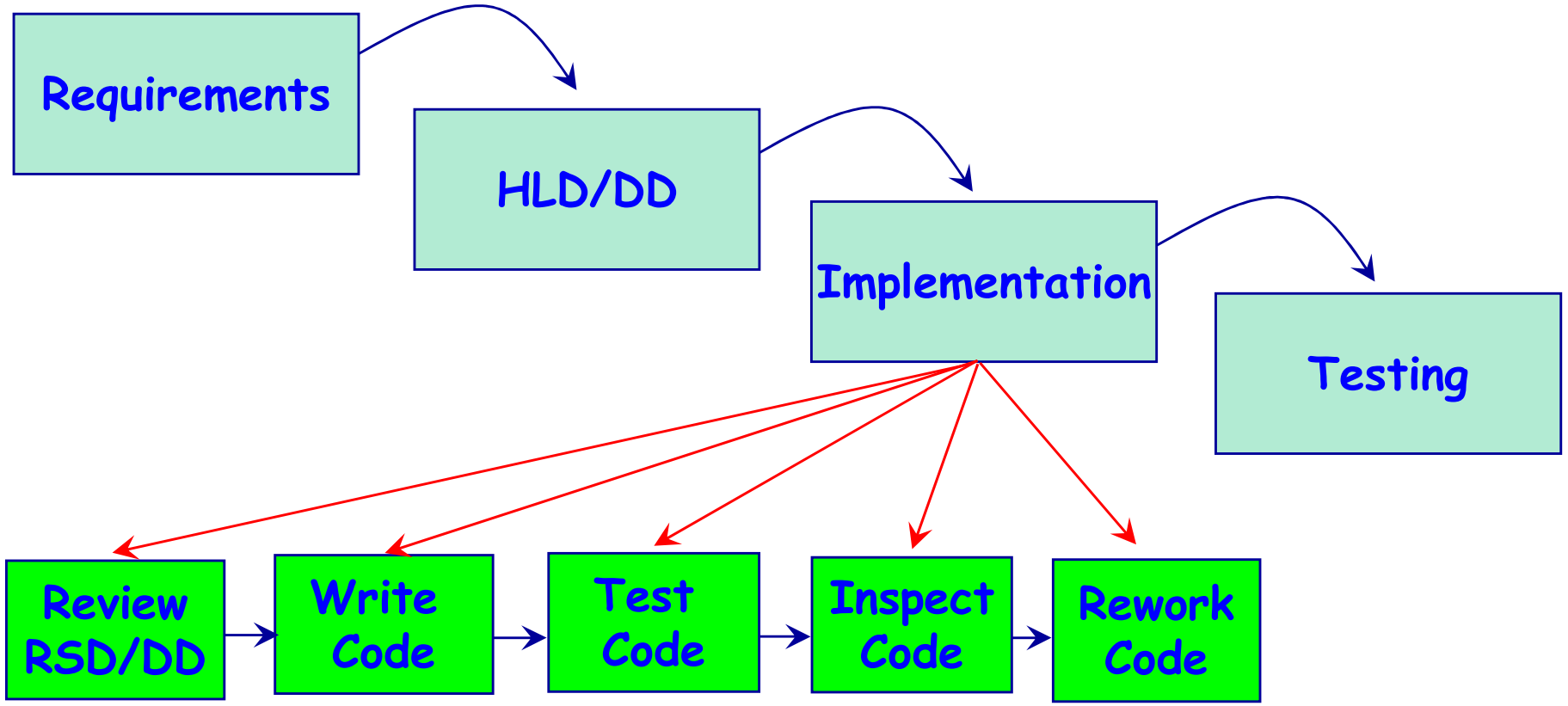
The Detailed Process

- For each phase in the software development, we need to have a detailed process that has been tailored mainly to that phase



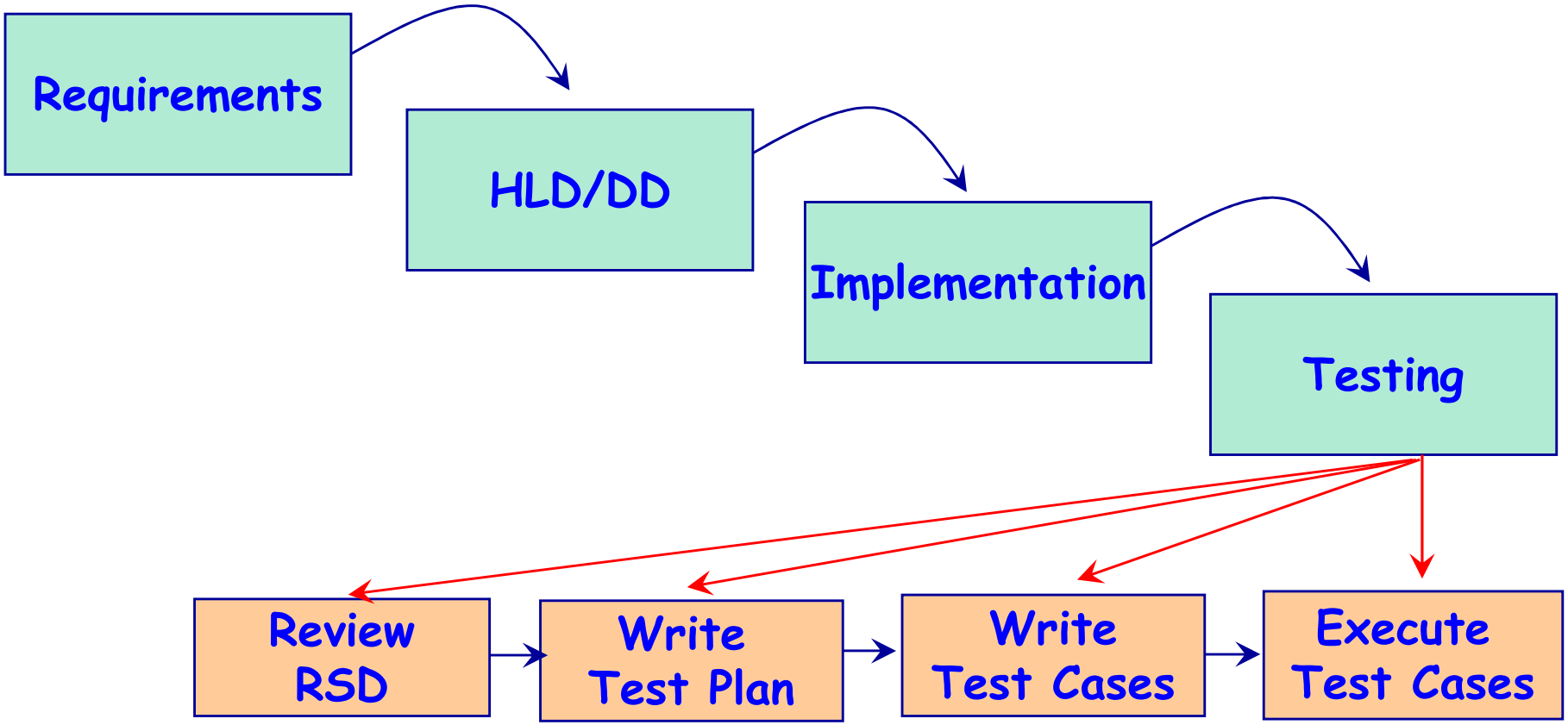
The Implementation Phase Process

- Here is the tailored process for the implementation phase:



The Testing Phase Process

- Here is the tailored process for the testing phase:



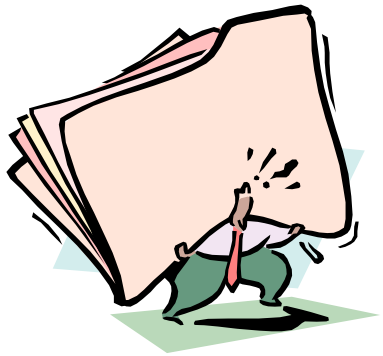
Tailoring the Process

How to tailor a process?

- First, each process shall have an owner.
- Adopt a standard process or borrow an existing one
- Add/Delete tasks or artifacts as you see appropriate but remember there are always risks for deleting an artifact and there is an overhead for adding one.
  - For example, you may not have formal requirement review or a test plan document

The Risk to Tailor a Process

- A process shall be documented, however to tailor a process may entail some risks; therefore the software organization shall provide general guidelines for process changes:



  - What are the artifacts or tasks
  - Who relies on these artifacts
  - What are the risks of deleting or modifying a task or an artifact
  - Guidelines for tailoring the process to certain domains
  - Document the rational behind the changes

Software Development Process Artifacts

- What is the artifact?

- The software artifact is an item produced as a result of the process execution
- The artifact could be a document, code, test results, …
- Examples:
  - Source Code and executable image
  - Test Results
  - RSD
  - HLD, class-diagram, sequence-diagram
  - Test Plan

Documentation Plan

- **Documentation plan is an essential part of the SW Development Plan and it provides answers to the following questions:**

- What are the artifacts to be produced?
- Who produces these artifacts?
- Who uses these artifacts?
- What is the format of the artifact?
- Who is the owner of the artifact?

Documentation Release

- Like software, documentation shall be kept under configuration management.

- Ideally, the documentation and the software releases shall be kept synchronized

Artifact dependencies and Ownership

Artifact	Produced By	Used By	Owner
Requirement Document	Customer	System Engineer Developer Tester	Customer
HLD/DD Document	System Engineer	Developer	System Engineer Process owner
Source Code	Developer	Developer Tester	Developer Process owner
Testing Plan	Tester	Tester	Tester Process Owner
⋮	⋮	⋮	⋮

Common Artifacts in the SW Development

Artifact	Description
Statement of Work	•The requirements for the project and the process •What is the outcome of the project
Requirement Specifications	•Technical specifications (functions, performance, standards met, etc.) of the final product
High-Level and Detailed Design Specification	•Modules and components of the system and how they interact •What are the software development files that will be implemented
Implementation	•What are the files that will be produced •Procedure for the build •End User Documentation •Maintenance Documentation •Installation Guide
Testing	•Test Plan •Test Cases •Test Results

How to honor the Software Process?

- **The process has to be practiced in order to ensure the quality control and quality assurance for the software system.**

- Reviews and Audits are the means by which we ensure the integrity and health of the process.
- Reviews are conducted by peers and managers
- Audits are conducted by independent organization

Reviews and Audits

Why we need reviews?

- **We can check a program for quality by testing, …**

- But:
  - How do we check that the test plan being used for testing has the right test cases?
  - How we check the requirement specification documents for defects?
  - How we check the design document for design errors?

Reviews

- **Reviews are the most effective method to improve quality by identifying defects.**

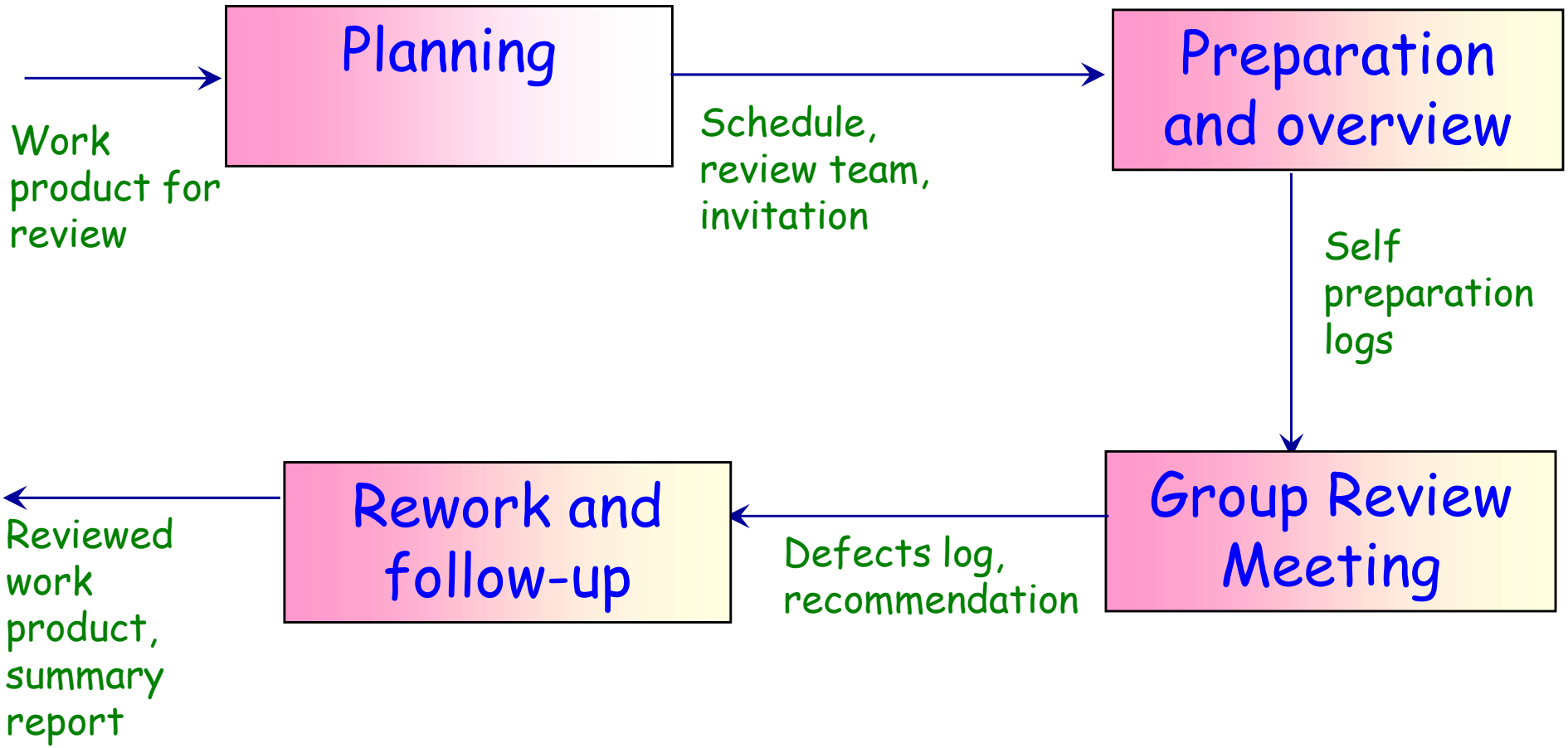
- Applied in
  - Design document
  - Test plan
  - Code "inspection"

- Can be used to
  - Track progress
  - Prevent defects discovered by Customer
  - Improve productivity by finding defects in effective ways

Reviews

- **Reviews can come in different forms:**
  - Formal Group Review or inspection
  - Desk Review, one person involved in the review
- **Reviews are conducted by**
  - Technical people for technical people
- **Reviews intent**
  - To identify problems NOT to resolve them

The Review Process



The Planning Phase of the Review Process

- **Objective:**
  - Prepare for the review by selecting the group review team and schedule the review
- **Participants:**
  - Author
  - Project Manager
  - Moderator
  - Reviewers

The Overview and Preparation Phase

- **Objective:**
  - Deliver and explain the work package to the reviewers
- **Work package includes:**
  - **Work product**
  - **Specifications**
  - **Checklists**
  - **Standards**
- **Outcome:**
  - The self-review forms are completed; defects, actual time spent are recorded

The Group Review Meeting Phase

- **Objective:**
  - Come up with a final defect list that agreed upon by the whole group
- **Logistics**
  - **Moderator is controlling the Review Report**
  - **Moderator logs actual time spent for preparation**
  - **Start/End time of the session**
  - **Concerns/issues from team members**
- **Two Roles have to be filled from the reviewers:**
  - Scribe
  - Reader

The Rework and Follow-Up Phase

- **Objective:**
  - The author performs the rework to fix the defects raised during group review meeting
- **Moderator**
  - Has to decide on fix reworks
  - Has to decide whether a re-review meeting is required to go over the fixes.
  - Has to ensure that all data and review results are recorded and must be submitted along with group review summary to the project leader

Guidelines for Reviews in Projects

- Not all products shall go under a formal group review because :

  - Reviews are expensive
  - Reviews are overhead activities

Review Types

- **What are the types of the reviews?**

1. Technical
   - Peer Reviews
2. Managerial
   - Status Reviews
   - Quality Gates Reviews

Guidelines for RSD Reviews

Work Product	*Focus*	*Entry Criteria*	*Participants*
Requirement Specification Document	• Requirements meet customer needs • Requirements are implementable • Omissions, inconsistencies, and ambiguities in the requirements	• The Document conforms to the standards	• Customer • Designers • Testers • Installation team members User documentation author

Guidelines for High-Level Design Reviews

Work Product	*Focus*	*Entry Criteria*	*Participants*
High-Level Design	• High-level design implements the requirements • The design is implementable • Omissions and other defects in the design	• The document conforms to standards • The requirements have been reviewed and finalized	• Requirements Author • Detailed Design author • Developer

Guidelines for Code Reviews

Work Product	*Focus*	*Entry Criteria*	*Participants*
Code	• Code implements the design • Code is complete and correct • Defects in code	• The code compiles and passes style and other norms	• Designer • Tester • Developer

Guidelines for Test Cases Reviews

Work Product	*Focus*	*Entry Criteria*	*Participants*
System Test Cases	• The set of test cases checks all conditions in the requirements • System test cases are correct • Test cases are executable	• Requirements have been base lined • System test plans is consistent with the standards	• Requirements author • Tester • Project Leader

Guidelines for High-Level Design Reviews

Work Product	*Focus*	*Entry Criteria*	*Participants*
Project Management Plan	**PProject management plan meets project management and control needs** **• Completeness** **• Project management plan is implementable** **• Omissions and ambiguities**	**• The project management plan follows the standard template**	**• Project leader** **• Another Project Leader**

Data Collection During Reviews

- **Reviews are mainly human processes, therefore:**
  - We need to record the data
- **What to record ?**
  - Effort Data
  - Defect Data
- **Why to record ?**
  - Analyze the effectiveness of the reviews
  - Construct the Review Capability Baseline

Data Collection During Reviews

- **Reviews are mainly human processes, therefore:**
  - We need to record the data
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  - Defect Data
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Data Collection Forms in Technical Reviews

- Forms used for data collection during technical reviews:

  - Self-Preparation log
  - Group Review Meeting Log
  - Group Review Summary report

Self-Preparation Log

- **Objective :**
  - **Record all defects**
  - **Record Effort Spent**
- **The Form:**

Project Code:
Work Product ID:
Reviewer Name
Effort Spent for Preparations (hours):
Issue list:

SI	Location	Description	Criticality

Group Review Meeting Log

- **Objective :**
  - **Record defects agreed upon by the team**
  - **Record Effort Spent by the team**
- **The Form:**

Project Code:
Moderator:
Author:
Date:
Effort Spent on review meeting (hours):
Defects to be closed by (date):
Defect List:

Meeting Type:
Scribe:
Reviewers:
Observers:
Work Product ID:

SI	Location	Description	Reviewer	Criticality

Group Review Summary Report

- Objective :
  - To analyze the effectiveness of the review
- The Form:

Group Review Summary Report

- **The Form:**

Project Work Product Type Size of Product Moderator Reviewers Author	
Effort (Person-Hours) Overview meeting Preparation Group review meeting	
Defects Number of critical defects Number of major defects Number of minor defects Number of defects found during preparation Number of defects found during group review meeting	
Result	***Moderator reexamination***
Recommendations for next phase	
Comments (Moderator)	
Prepared by:	***Date:***

The Review Capability Baseline

- The effectiveness of the review process depends on how well the process has been executed
- How does the project manager or the moderator evaluate whether a review has been effective?

- The statistical process control (SPC) can be used to monitor and control the reviews

The Review Capability Baseline

- How can the SPC be applied to monitor the reviews?
  - Project managers must
    1. Identify Performance parameters
    2. Control limits for performance parameters
    3. Monitor actual performance
    4. Determine effectiveness through
       a) Control charts (plot performance parameters)
       b) Control limits (see whether parameters within the ranges); EASY to APPLY

The Review Capability Baseline

- Examples of Performance Parameters
  - Coverage rate during preparation
  - Coverage rate during group review meeting
  - Defect density for minor defects
  - Defect density for major defects
- Control limits are determined from past data and group review capability baseline

The Review Capability Baseline

Review Item	Preparation Coverage Rate	Group Review Coverage Rate	Minor Defect Density	Major Defect Density
Requirements	5-7 pages/hour	0.5-1.5 defects/page	0.1-0.3 defects/page	
High-Level design	4-5 pages/hour (200-250 specification statements/hour)	0.5-1.5 defects/page	0.2-0.6 defects/page	
Detailed design	3-4 pages/hour (70-100 specification statements/hour)	0.5-1.5 defects/page	0.2-0.6 defects/page	
Code	160-200 LOC/hour	110-150 LOC/hour	0.01-0.06 defects/LOC	0.01-0.06 defects/hour
Integration test plan	5-7 pages/hour	0.5-1.5 defects/page	0.1-0.3 defects/page	
Integration test cases	3-4 pages/hour			
System test plan	5-7 pages/hour	0.5-1.5 defects/page	0.1-0.3 defects/page	
System test cases	3-4 pages/hours			
Project management and configuration management plan	4-6 pages/hour	2-4 pages/hour	0.6-1.8 defects/page	0.1-0.3 defects/page

Charting the Reviews

- Monitoring the reviews using the SPC Charting tool:
  - The SPC tool is a spreadsheet that has the review capability baseline built into it
  - If process changes, then we need to change the control limits that affect the control charts
  - Change the control limits based on the past 10-15 performance data points

Analysis Guidelines for the Reviews

- If the number of the defects found during the review is within the range given in the baseline, the review is considered effective, and the exit criteria is satisfied, ELSE :
  - The moderator or the project leader needs to determine the cause and take preventive and corrective actions
  - There are two sets of guidelines, one if the defect density below the limit and another one when defect density above the limit

Analysis Guidelines for the Reviews

- If defects found are less than norms:

Possible Reason	Actions to Consider
Work product was very simple	•Convert group review of similar work product to one person review (desk review) •Combine reviews
Reviews may not be thorough	Check coverage rate; if too low, reschedule a review, perhaps with a different team
Reviewers do not have sufficient training on group reviews or experience with the reviewed material	•Schedule or conduct group review training •Re-review with a different team
Work product of very good quality	•Confirm this fact by coverage rate, experience of the author, reviewers, and so on; see if this quality can be duplicated in other parts of the project. •Revise defect prediction in downstream activities; see if there are general process improvement lessons

Analysis Guidelines for the Reviews

- **If defects found are more than norms:**

Possible Reason	Actions to Consider
Work product is of low quality	•Examine training needs for author •Have the work product redone •Consider reassigning future tasks (easier tasks to the author)
Work product is very complex	•Ensure good review or testing downstream •Increase estimates for system testing •Break the work product into smaller components
There are too many minor defects and two few major defects	•Identify causes of minor defects; correct in the future by suitably enhancing checklists and making authors aware of the common causes •Reviewer may have insufficient understanding of the work product. If so, hold an overview meeting or have another review with different reviewers
Reference document against which review was done is not precise and clear	•Get the reference document reviewed and approved
Reviewed modules are the first ones in the project	•Analyze the defects, update the review checklist, and inform developers. Schedule trainging.

The NIH and NAH Software Syndromes

- In the old days, the rule for software tool usage
  - NIH : Not Invented Here
- In the current days, the rule for software process and review practices
  - NAH : Not Applicable Here

Status Reviews

- This review focuses on the project progress
- Planned vs. actual progress
- Status on issues raised in previous status review meeting
- Identify and address concerns that may have negative impact on the project
    1. Schedule
    2. Cost
    3. Quality

Conducting the Audit

- What to audit and why?
  - The auditors focus on whether the defined process is being followed in the project
  - It discovers problems but doesn't solve them
- Who execute it?
  - EXPENSIVE Independent Auditors

Conducting the Audit

- When to audit?
  - Regularly
  - Audits are sign of healthy projects and organizations
  - Audits shall be thought of as preventive measures rather than reactive measures

Conducting the Audit

- The audit methodology:
  - Verify stakeholders are practicing their processes
  - Look how an activity is done
  - Verify the output (artifacts) of the activity
  - Number of questions are asked from the audit checklist

The Audit Checklist

1. Is the project plan documented in the standard project plan template?
2. Has the project plan been group reviewed?
3. Has the project plan been approved and baselined, and is it under configuration management?
4. Is there a signed contract?
5. Have commitments to customer or other group been approved?
6. Is there an estimated effort for the project that is based on historical data?
7. Have the effort estimates and the schedule been reviewed?

The Audit Checklist

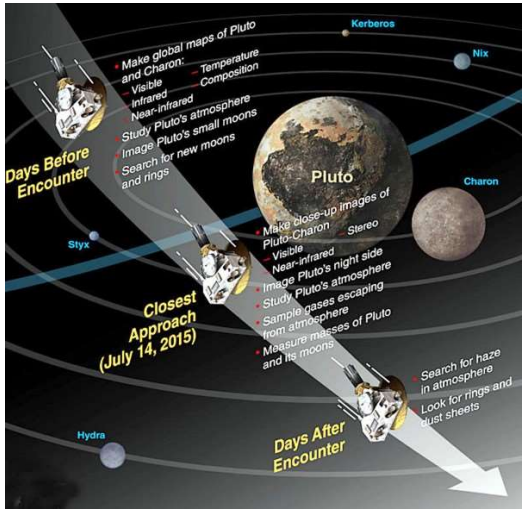
8. Is the quality plan complete, and has it been reviewed?
9. Is the life cycle in the project identified and documented?
10. Are personnel identified and the responsibility for each work element defined and tracked?
11. Are deliverables to the customer, including the documentation, clearly identified?
12. Are risks and risks mitigation plans identified and properly documented?
13. Are reviews, progress reporting, tracking, and approval mechanisms identified?

The Audit Follow-Up

- The Audit intent is to Audit the applied process rather auditing the people
- If evidence suggests that the approved processes are not followed, a noncompliance report(NCR) will be issued
- People involved with this process shall not be punished because of the NCR report, rather it shall be an opportunity to take corrective actions.
- Identifying the noncompliance is the goal of these audits

Finalize the Schedule Based on Resource Availability

Resources


Kerberos
Nix
Make global maps of Pluto and Charon:
Visible
Infrared
Near-infrared
Temperature
Composition
Study Pluto's atmosphere
Image Pluto's small moons
Search for new moons and rings
Days Before Encounter
Pluto
Charon
Styx
Make close-up images of Pluto-Charon
Stereo
Visible
Near-infrared
Image Pluto's night side
Study Pluto's atmosphere
Sample gases escaping from atmosphere
Measure masses of Pluto and its moons
Closest Approach (July 14, 2015)
Search for haze in atmosphere
Look for rings and dust sheets
Hydra
Days After Encounter


New Horizons

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https://en.wikipedia.org/wiki/Apollo_Guidance_Computer

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Apollo Guidance Computer

From Wikipedia, the free encyclopedia

The **Apollo Guidance Computer** (**AGC**) was a digital computer produced for the Apollo program that was installed on board each Apollo Command Module (CM) and Lunar Module (LM). The AGC provided computation and electronic interfaces for guidance, navigation, and control of the spacecraft.[2] The AGC had a 16-bit word length, with 15 data bits and one parity bit. Most of the software on the AGC was stored in a special read only memory known as core rope memory, fashioned by weaving wires through magnetic cores, though a small amount of read-write core memory was provided.

Astronauts communicated with the AGC using a numeric display

Apollo Guidance Computer

Apollo Guidance Computer and DSKY

Invented by	MIT Instrumentation Laboratory
Manufacturer	Raytheon
Introduced	August 1966; 49 years ago
Discontinued	July 1975; 40 years ago

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IdeaPad Y Series - Wikipe...

https://en.wikipedia.org/wiki/IdeaPad_Y_Series#Y50

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Y50 [edit]

Lenovo IdeaPad Y50 was released in the second quarter of 2014.

- CPU/Chipset: 4th Generation Intel Core i7-4710HQ Processor (2.5 GHz 1600 MHz 6MB)
- Memory: up to 16 GB PC3-12800 DDR3L SDRAM 1600 MHz
- Hard Drive: 256 or 512 GB SSD or Hybrid 500 GB or 1TB 5400 RPM + 8 GB SSHD
- Graphics: NVIDIA GeForce GTX 860M 2GB or 4GB
- Display: 15.6" UHD LED Glossy (3840x2160)or FHD (1920x1080) or FHD (1920x1080) multitouch
- Operating System: Windows 8.1
- Weight: 2.4 kg (5.29 lbs)
- ODD: External BD/DVD
- Keyboard: Backlit AccuType® keyboard
- Camera: 720P
- Storage: Up to 1TB HHD or up to 1TB Hybrid SSHD with integrated
- Audio: JBL® 2.1 speakers with Dolby® Advanced Audio V2
- Battery: Up to 5 hours WiFi browsing depending on configuration
- Bluetooth®: Bluetooth® 4.02, 802.11 a/b/g/n or 802.11 a/c WiFi
- Connectors: 2 x USB 3.0, 1 x USB 2.0, Audio Combo Jack (headphone and mic), HDMI-out, 4-in-1 (SD / MMC / SDXC / SDHC) card reader, RJ45, SPDIF

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From Wikipedia, the free encyclopedia

LG G3 is an Android smartphone developed by LG Electronics. First released in South Korea on May 28, 2014, it is a successor to 2013's LG G2.[2][3] Inheriting design elements from the G2, such as its thin screen bezels and rear-mounted power and volume buttons, the G3 is distinguished primarily by being the first smartphone from a major manufacturer to incorporate a quad HD (1440p) display, and its inclusion of an infrared hybrid autofocus system for its camera. LG also touted the device's plastic "metallic skin"—designed to give the device a higher quality appearance, and a "simpler" user interface with an integrated intelligent personal assistant system.

The G3 received mostly positive reviews, with critics praising the overall appearance, performance, and software of the device. However, several aspects of the G3 received mixed reviews, including the company's decision to use a faux metallic plastic instead of actual metal, and the high resolution display which was criticized for artificial sharpening and poor brightness while ...tively affecting battery life.[4][5]

https://en.wikipedia.org/wiki/Intelligent_personal_assistant

LG G3

LG G3 in metallic black

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The **Apollo Guidance Computer** (**AGC**) was a digital computer produced for the Apollo program that was installed on board each Apollo Command Module (CM) and Lunar Module (LM). The AGC provided computation and electronic interfaces for guidance, navigation, and control of the spacecraft.[2] The AGC had a 16-bit word length, with 15 data bits and one parity bit. Most of the software on the AGC was stored in a special read only memory known as core rope memory, fashioned by weaving wires through magnetic cores, though a small amount of read-write core memory was provided.

GC using a numeric display
play&KeYboard,
nd its DSKY user interface
r the Apollo program by the
AGC is notable for being
one of the first integrated circuit-based computers.

- NASA needed roughly 40KB of memory to put a man on the moon

Contents [hide]

1 Operation

Apollo Guidance Computer

Apollo Guidance Computer and DSKY

Invented by	MIT Instrumentation Laboratory
Manufacturer	Raytheon
Introduced	August 1966; 49 years ago
Discontinued	July 1975; 40 years ago
Type	Avionics Guidance Computer
Processor	Discrete IC RTL based
Frequency	2.048 MHz
Memory	16-bit wordlength, 2048 words RAM (magnetic core memory), 36,864 words ROM (core rope memory)

https://en.wikipedia.org/wiki/Core_rope_memory

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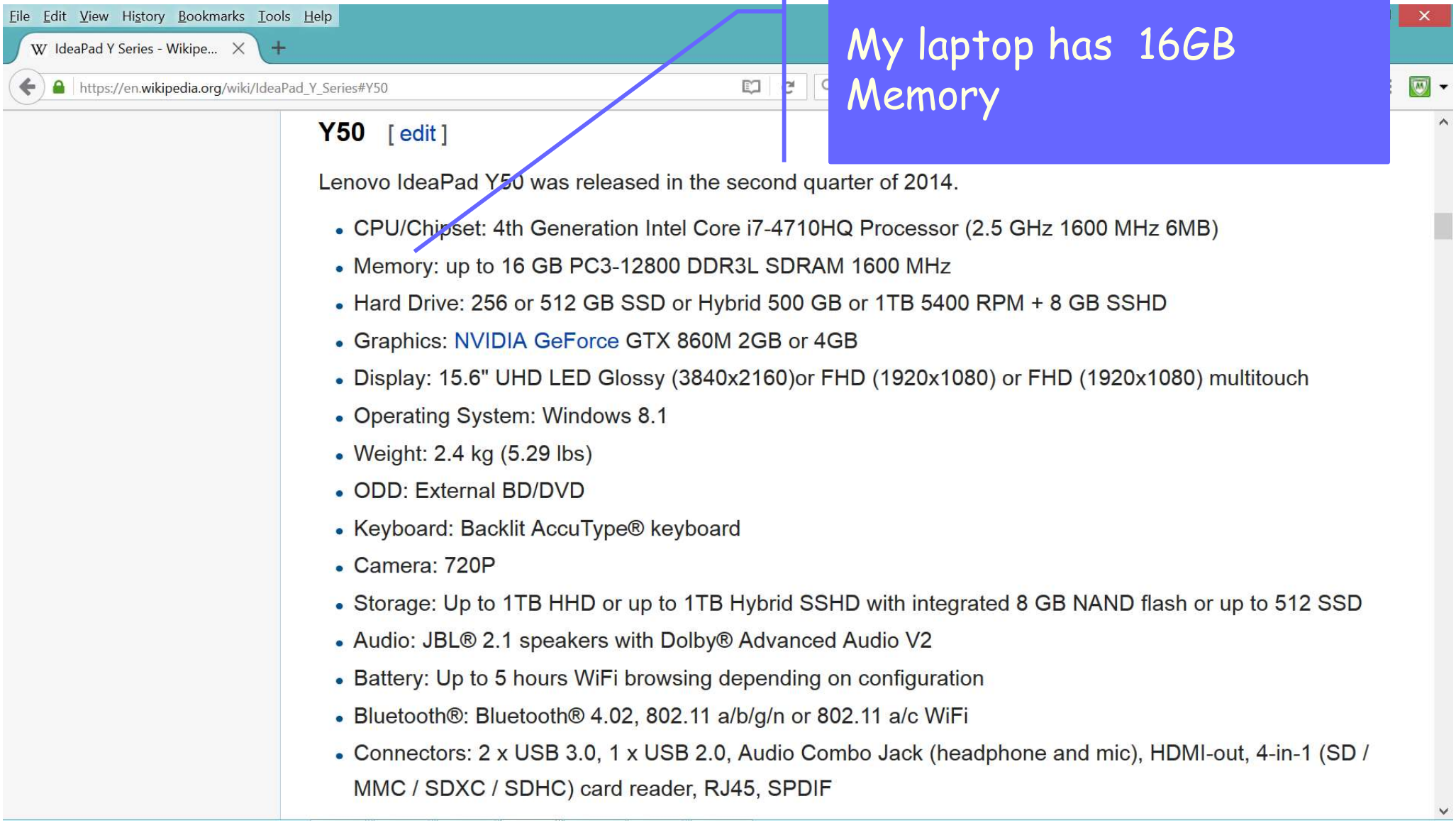
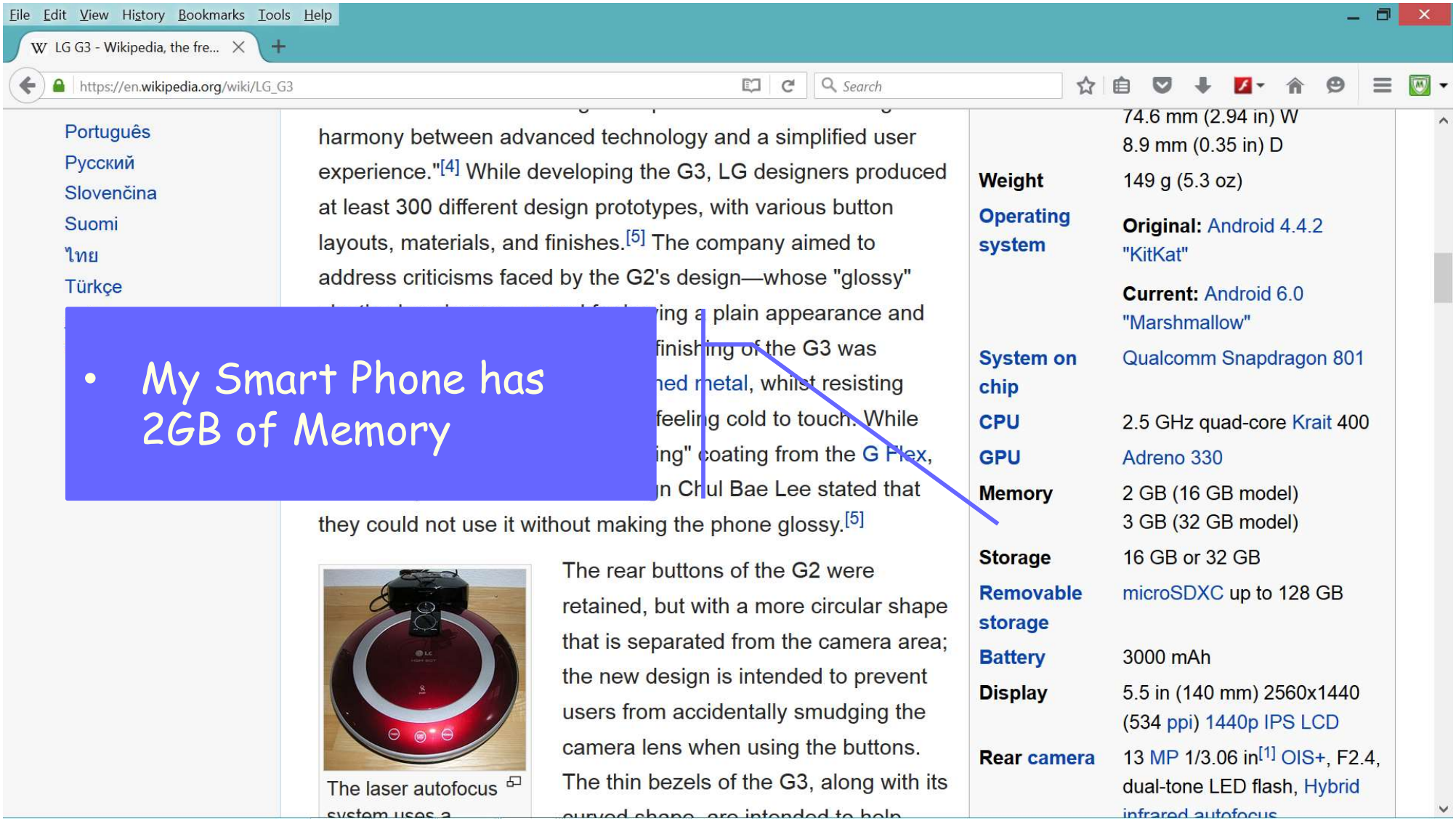
Resources


File Edit View History Bookmarks Tools Help
IdeaPad Y Series - Wikipe...
https://en.wikipedia.org/wiki/IdeaPad_Y_Series#Y50
My laptop has 16GB Memory
Y50 [edit]
Lenovo IdeaPad Y50 was released in the second quarter of 2014.
CPU/Chipset: 4th Generation Intel Core i7-4710HQ Processor (2.5 GHz 1600 MHz 6MB)
Memory: up to 16 GB PC3-12800 DDR3L SDRAM 1600 MHz
Hard Drive: 256 or 512 GB SSD or Hybrid 500 GB or 1TB 5400 RPM + 8 GB SSHD
Graphics: NVIDIA GeForce GTX 860M 2GB or 4GB
Display: 15.6" UHD LED Glossy (3840x2160)or FHD (1920x1080) or FHD (1920x1080) multitouch
Operating System: Windows 8.1
Weight: 2.4 kg (5.29 lbs)
ODD: External BD/DVD
Keyboard: Backlit AccuType® keyboard
Camera: 720P
Storage: Up to 1TB HHD or up to 1TB Hybrid SSHD with integrated 8 GB NAND flash or up to 512 SSD
Audio: JBL® 2.1 speakers with Dolby® Advanced Audio V2
Battery: Up to 5 hours WiFi browsing depending on configuration
Bluetooth®: Bluetooth® 4.02, 802.11 a/b/g/n or 802.11 a/c WiFi
Connectors: 2 x USB 3.0, 1 x USB 2.0, Audio Combo Jack (headphone and mic), HDMI-out, 4-in-1 (SD / MMC / SDXC / SDHC) card reader, RJ45, SPDIF

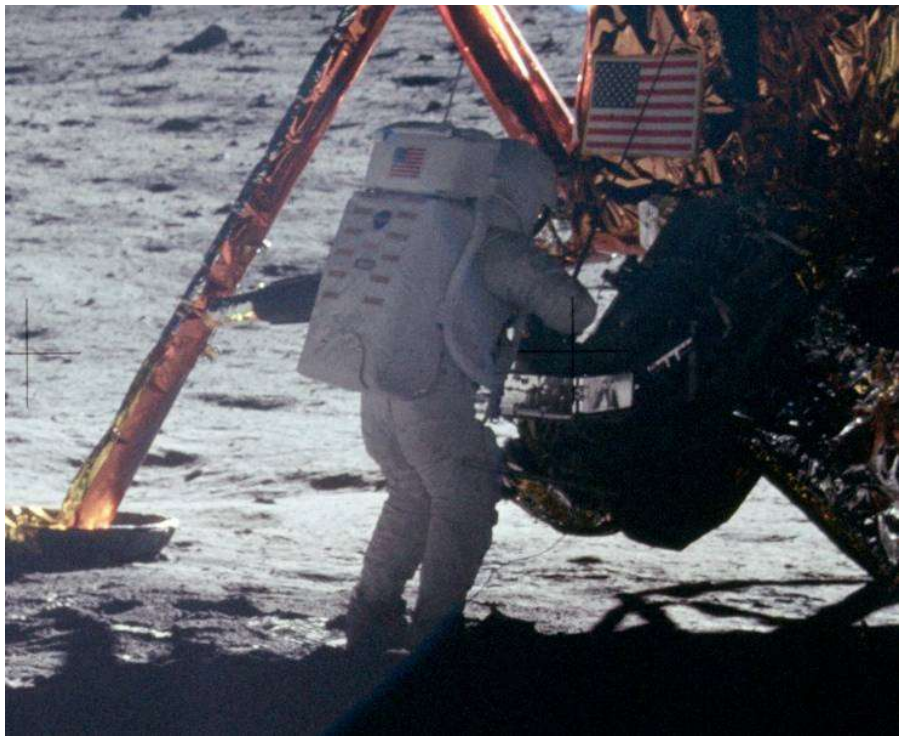
Resources



- My Smart Phone has 2GB of Memory

Resources

- Good Resource Management and Planning made it possible to land a man on the moon



Resources

- Resources might not be available according to the project schedule.
- In such cases, the project manager alter the original project budget, time, and resource allocations to resolve the scheduling problem.
- Therefore, additional time, budget will be needed in order to comply with the new schedule.

Leveling Resources

- Resource leveling is a process that the project manager follows to schedule how each resource is allocated to activities in order to accomplish the work within the scheduled start and finish dates of the activity.
- Resource leveling always creates problems for organizations, some of these problems are:
  - Committing people to more than they can reasonably handle in the given time frame
  - Changing project priorities and not considering the impact on existing resource schedules
  - The absence of a resource management that can measure and monitor the capacity of the resource pool and the extent to which it is already committed to project

Leveling Resources

- When we were creating the project network diagram, the critical path was the principal focal point for trying to finish the project on specific date.
- Resource over-allocation or under-allocation was not a consideration, because it is important to focus our attentions on planning one portion of the project at a time.

Leveling Resources

- The scheduled start and finish dates of every activity are constrained by the project plan to lie entirely within their ES-LF window.
- As resources are leveled, they must be constrained to the ES-LF window of the activities which they are assigned, or the project manager must seek other alternatives to resolve the conflict between resource availability and project schedule.

Leveling Resources

- The resource schedule needs to be leveled for two reasons:
  - The first is to ensure that no resource is over-allocated.
  - A second reason to level resources is that the project manager wants the number of resources (people in most cases) to follow a logical pattern throughout the life of the project. We don't want the number of people working on the project to fluctuate wildly from day to day or from week to week.
  - Resource leveling avoids this by ensuring that the number of resources working on a project at any time are fairly constant.

Resources Leveling Strategies

- Three approaches to level project resources:
  - Slack
  - Shifting the project finish date
  - Smoothing

Slack

- Slack is the difference between the ES-LF window of an activity and its duration. For example, if the ES-LF window is four days and the duration of the activity is three days, its slack is 4-3, or one day.
- Slack can be used to alleviate the over- allocation of resources. With this approach, one or more of the project activities are postponed to a date that is later than their early start date but no later than their late finish date. In other words, the activities are rescheduled but remain within their ES-LF window.

Shifting the Project Finish Date

- Not all projects are driven by the completion date. For some projects, resource availability is their most severe constraint.
- For these type of projects, the critical path may have to be extended to achieve an acceptably resource-leveled schedule.
- In cases where the project manager is caught between over-allocated resources on a schedule that cannot be acceptably leveled and a firm fixed completion date, you may have to consider reducing the scope of the project. Consider delaying some of the features to the next release as one way of resolving the issue.

Smoothing

- Overtime may accomplish the work within the scheduled start and finish dates of the activity.

- Overtime can help alleviate some resource over-allocation because it allows more work to be done within the same scheduled start and finish dates.

Alternative Methods of Scheduling Activities

- Rather than treating the activity list as fixed, you could resolve the leveling problem by considering further decomposition of one or more activities:
  1. Further Decomposition of Activities
  2. Stretching Activities
  3. Assigning Substitute Resources

Further Decomposition of Activities

- Suppose that an activity requires one person for the three days within a five-day window. There are two days of slack in the schedule for that activity. In other words, the ES-LF window of the activity is five days and the activity duration is three days.

- If the resource is available for the first two days in the five-day window and for the last day in the in the five-day window.

- To simplify the scheduling of the resource the project manager could decompose the five-day activity into two activities—one two-day activity and one one-day activity.

- The two-day activity would then have an FS dependency on the one-day activity. The scheduled start and finish dates of the two activities would be set so that they fit the availability of the resource.

Stretching Activities

- Another alternative that preserves the continuity of the activity work is to stretch the work over a longer period of time by having the resource work on the activity at a percent per day lower than was originally planned.
- For example, suppose the resource is available 80 percent of each day in the five-day window and you need four days of work. The resource is therefore available for .80 times five days, or four days of work, over the five-day window
- Because the resource can only work 80 percent of the time on the activity, the resource will accomplish four days of work in five days.

Assigning Substitute Resources

- The estimates of activity durations are based on the assumption that a typically skilled resource will be available to work on the activity. That may not be possible, though, because of unavailability of the resource.

- This will be especially true in the case of scarce resources such as some of the newer technologies.

- One approach to solve this problem would be to use less-skilled resources and add to the total number of hours requested; a less-skilled resource would require a longer period of time to complete the activity work.

Work Packages

- Within the JPP session, the project work has been defined as a list of activities; activity duration and resource requirements are specified, the project network is built, the activity schedule is done, and resources have been scheduled.

- During the JPP session, the project team has agreed on the activity list, activity duration and resource requirements.

- What is left by now is to define the work to be done in each activity but at the task level; activities are made up of tasks.

- The work to be done within an activity is called a work package.

- The work package is a statement by each activity manager as to how he or she plans to complete the activity within the scheduled start and finish dates.

Purpose of a Work Package

- It describes in detail the tasks, start/end dates, that need to be done in order to complete the work for an activity.
- The work package manager, or activity manager, may choose to include the start and end dates for each task in the package but that may allow others to micromanage your work items.
- The work package also can be adapted to status reporting. Some organizations use the percent of tasks completed as the percent of activity completion.

Format of a Work Package

- There are two work package documents:
  - The first is called a ***work package assignment sheet***. It is used as a ready reference for the project manager and contains some basic information about each work package and its manager.
  - The second is a detailed description of the activity plan, called the ***work package description report***. It contains much of the same information that is found in a project plan but focuses on activities, not projects.

Work Package Assignment Sheet

- The work package assignment sheet is available for the project manager only.
- It includes the earliest start and latest finish times for each activity.
- This is one of the few resources available to the project manager and should not be made available to anyone other than the project manager.
- The work package assignment sheet has limited value in smaller projects but very valuable in larger ones. Especially for cases where we have thousands of activities, 5+ years life-span, and 5000+ activity managers.

Work Package Assignment Sheet

WORK PACKAGE ASSIGNMENT SHEET	Project Name	Project No.	Project Manager

Work Package		Schedule			
Number	Name	Early Start	Late Finish	Work Package Manager	Contact Information
A	DESIG	03/01/00	04/01/00	ANNA LYST	
B	PROD.EVAL	04/02/00	07/02/00	HY ROWLER	
C1	PLACE.LOCATE.PT1	04/02/00	03/04/01	SY YONARA	
M	SYSTEM.ACCEPT	05/01/02	06/19/02	ANNA LYST	

Prepared by	Date	Approved by	Date	Sheet 1 of 1

Work Package Description Report

- A work package is a document prepared by the activity manager in which he or she describes the details of how he or she will accomplish the work of the activity.
- Once the project plan has been approved, it is the activity manager's responsibility to generate the work package documentation.
- It is the project manager who will decide which activities need a work package description report.

Work Package Description Report

WORK PACKAGE DESCRIPTION	Project Name	Project No.	Project Manager

Work Package Name	Work Package No.	Work Package Manager	Contact Info.	Date

Start Date	End Date	Critical Path Y N	Predecessor Work Package(s)	Successor Work Package(s)

TASK	

No.	Name	Description	Time days	Responsibility	Contact Info.

Prepared by	Date	Approved by	Date	Sheet 1 of 1

Organize and Conduct the Joint Project Planning Sessions

Joint Project Planning Sessions

- All of the planning activities take place in the Joint Planning session (JPP) in order to create the detailed project plan.
- The JPP is a group session in which all of the people who are involved in the project meet to develop the detailed plan.
- The session can last from one to three days, and it can be work-intensive.
- The final result of the JPP session is an agreement about how the project can be accomplished within a specified time frame, budget, resource availabilities, and customer specification.
- The objective of a JPP session is to develop a project plan that meets the Conditions of Satisfaction as negotiated between the Customer and the project manager (Product Line Manager), and as described in the Project Overview Statement.

Planning the JPP Session

- Team planning is needed from a technical perspective; more attention into task milestones.
- Project planning need by the project manager to lead the project into a successful completion; more geared toward activity milestones.
- Who are the attendees in JPP session?

The JPP session Attendees

- The JPP participants are the people who have input into the project or may provide deliverables should be invited to participate in the JPP. The following is a typical list of participants:

1. **Facilitator**. This person is responsible for conducting the JPP; more or less an advocate
2. **Project manager**. The project manager is not the leader of the planning session, only in charge of planning the project.

The JPP session Attendees

3. **Technographer (Recorder)**. The JPP facilitator is supported by a technographer. JPP facilitator is coordinating the planning activities, the JPP technographer is recording planning decision on the computer as they occur in real time.
4. **Core project team**. professional expertise needed for estimating activity duration and resource requirements.
5. **Customer representative**. Only needed in cases there would be a dispute regard the final delivery date.
6. **Resource managers**. Needed in order to get their input regard availability of resources within certain time window.
7. **Functional managers**. functional managers manage areas that can either provide input to or receive output from the project deliverables and they will be responsible for the success/failure of tasks/activities.

The JPP session Attendees

8. **Project champion**. The project champion drives the project and sells it to senior management; the champion can be the customer. In some cases, the project champion can be the one of the senior managers of the division, department.
9. **Process owner**. If the project deliverables do not smoothly integrate into the process of the process owner, either the project plan or the affected process (es) will have to be altered.

The JPP session Agenda

- The agenda for the JPP session can be completed in one, two, or three sessions.
- Session # 1 : Negotiate the Conditions of Satisfaction
- Session # 2 : Write the Project Overview Statement
- Session # 3
  1. Entire planning team creates the first-level WBS.
  2. Subject matter experts develop further decompositions
  3. Estimate activity durations and resource requirements.
  4. Construct project network diagram.
  5. Determine critical path.
  6. Revise and approve project completion date.
  7. Finalize resource schedule.
  8. Approve the final project plan.

The JPP session Deliverables

1. Work Breakdown Structure
2. Activity duration estimates
3. Resource requirements
4. Project network schedules
5. Project notebook

Project Proposal

- It represents the roadmap for the project
- The project proposal is the deliverable from the JPP session and that will be sent to the senior management team for approval to do the project.
- It describes the business value of the project to the higher level management; cost and time estimates. In addition to this information, the proposal details what is to be done.

Contents of the Project Proposal

- The exact format for the project proposal will depend highly on the corporate culture and its industry segment.

- The following is a general list for the contents of project proposal:

Contents of the Project Proposal

1. **Background**. Description of the situation that led to the project proposal; business conditions, opportunities, and problems that motivated the emergence of the project.
2. **Objective**. What will be achieved from conducting this project. States the business case not the technical details.
3. **Overview of approach to be taken**. High-level outline of the approach that will be practiced. No low-level technical details.

Contents of the Project Proposal

4. **Detailed statement of work**. Details about the approach that will be applied
    - what will be done,
    - when it will be done,
    - who will do it,
    - what criteria will be used to measure completeness/success/failure. This is the roadmap of all the project work.
    - Use Gantt charts to present the schedule.

Contents of the Project Proposal

4. **Time and cost summary**
5. **Appendices:** Generally it includes supporting data like High-Level architecture view of the existing system and how the new system will fit into it, etc.

Managing the Project Team

Project Manager vs. Functional Manager

- The objective of the project manager is to complete the project on time, within budget, and according to specification.

- The objectives of the functional (or technical) manager include development of staff skills to meet project requirements and assignment of technical staff to projects.

Conflicting Objectives

- Functional managers look for opportunities to deploy staff to project assignments that provide opportunities to learn new skills.

- On the other hand, the project manager, would like to have experienced staff.

MOTIVATORS & DEMOTIVATORS

- A survey conducted by Herzberg in 1959 listed the following:
  - **MOTIVATORS**
    - Recognition
    - Advancement and growth
    - Responsibility
    - Work itself
  - **DEMOTIVATORS**
    - Company policy
    - Administrative practices
    - Working conditions
    - Technical supervision
    - Interpersonal relations
    - Job Security
    - Salary

Recruit the Project Team

- To ensure the successful completion of the project we have to recruit and build an effectives team; technical skills are not enough communications skills must have.
- A project team has three separate components:
  1. Project manager
  2. Core team
  3. Contracted team

The Project Manager

- Project managers are the leaders of the projects.
- The project manager represents the project to the organization and to external groups.
- Selection criteria for project managers:
  1. Background and experience
  2. Leadership and strategic expertise
  3. Technical expertise
  4. Interpersonal competence, to “interact successfully”

The Core Team Members

- Selection Criteria for the core team members
  1. Commitment
  2. Shared responsibility
  3. Flexibility
  4. Task orientedness; results to be delivered
  5. Ability to work within schedule and constraints
  6. Willingness to give trust and mutual support "Operate in good faith"
  7. Team-orientedness
  8. Ability to work across structure and authorities
  9. Ability to use project management tools

The Contracted Team Members

- It is becoming more common that companies are outsourcing services and processes that are not part of their core business.
- And the software development and testing is no exception for outsourcing.
- Outsourcing will be mainly needed whenever we have a shortage in:
    1. Skills
    2. Staff

Selection Criteria for the Contracted Team

- Identify the types of skills needed, the number of personnel, and the time frame within which they will be needed.
- Write the request for proposal.
- Establish the criteria for evaluating responses and selecting the vendor(s).
- Distribute the request for proposal.
- Evaluate the responses.
- Reduce the list of vendors to a few who will be invited on site to make a formal presentation.
- Conduct the onsite presentations.
- Choose the final vendor(s), and write and sign the contract.

Types of Proposals

- Three types of proposals to provide contracted members:

1. **Request for Information (Discover)**: purpose of the RFI is to discover vendors and products that the organization will investigate further
2. **Request for Proposal (Evaluate)**: The REP includes specification and price; discover good vendors.
3. **Request for Quote (Negotiate)**: the (RFQ) is used to find the best price-to-performance ratio for a certain product; pool of vendors is known.

Types of Contracts

- Four types of contracts:
  1. **Retainer (Borrow a service: manpower + horsepower)**. organizations pay the contractor a fixed fee per period (monthly) and can terminate the contract any time.
  2. **Time and materials**. detailed specification and product delivery is expected; no limit on cost, huge risk for the company.
  3. **Time and materials-not to exceed**. Same as above but limit on cost; huge risk for vendor.
  4. **Fixed bid**. detailed specification and product delivery is expected; vendor is willing to meet the deliverables and a deadline date for a specified figure. There a schedule for payment and delivery.

Team Meetings

- The team will need to decide on the following:
- **Meeting frequency**.
- **Agenda preparation**. A team member can receive agenda items and prepare and distribute the agenda; this role is circulated among the team members
- **Meeting coordinator**. Coordination involves reserving a time, place, and equipment.
- **Recording and distributing meeting minutes**.