

System Development Life Cycle

Spiral Model

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- The spiral model emphasizes more on risk analysis.
- The spiral model has four phases: Planning, Risk Analysis, Engineering and Evaluation. A software project repeatedly passes through these phases in iterations called Spirals. Requirements are gathered during the planning phase.
- In the risk analysis phase, a process is undertaken to identify risk and alternate solutions.
- A prototype is produced at the end of the risk analysis phase. Software is produced in the engineering phase, along with testing at the end of the phase.
- The evaluation phase allows the customer to evaluate the output of the project to date before the project continues to the next spiral.

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- The spiral model is called a meta model since it encompasses all other life cycle models.
- Risk handling is inherently built into this model.
- The spiral model is suitable for development of technically challenging software products that are prone to several kinds of risks.
- This model is much more complex than the other models.
- Spiral model is a combination of iterative development process model and sequential linear development model i.e. waterfall model with very high emphasis on risk analysis.

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Spiral Model design

The spiral model has four phases. A software project repeatedly passes through these phases in iterations called Spirals.

Identification: This phase starts with gathering the business requirements in the baseline spiral. In the subsequent spirals as the product matures, identification of system requirements, subsystem requirements and unit requirements are all done in this phase.

This also includes understanding the system requirements by continuous communication between the customer and the system analyst. At the end of the spiral the product is deployed in the identified market.

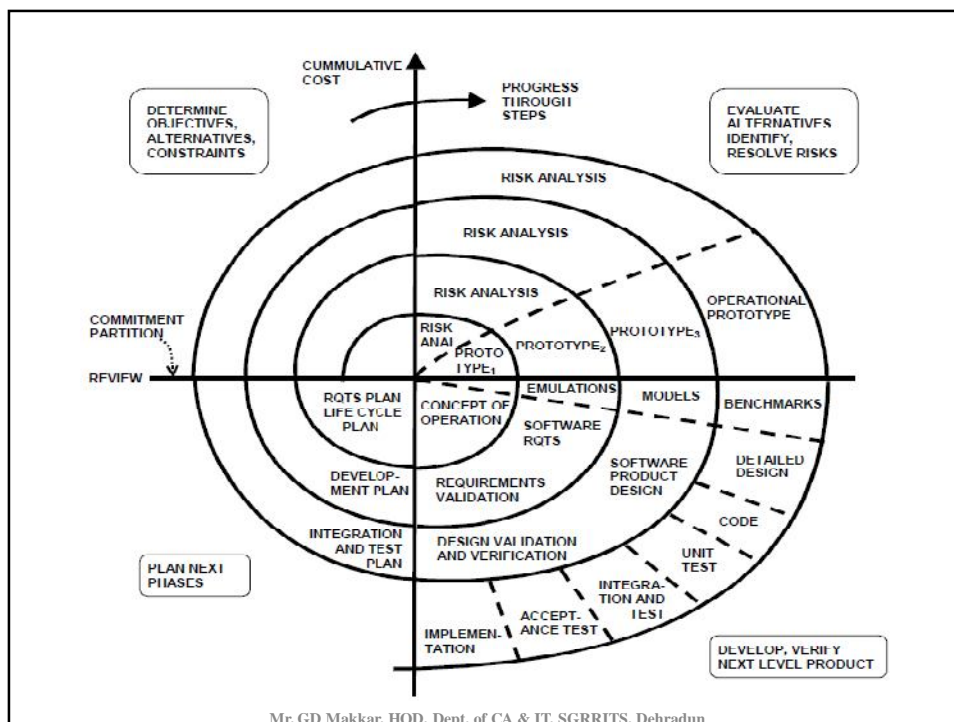
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Design: Design phase starts with the conceptual design in the baseline spiral and involves architectural design, logical design of modules, physical product design and final design in the subsequent spirals.

Construct or Build: Construct phase refers to production of the actual software product at every spiral.

Evaluation and Risk Analysis: Risk Analysis includes identifying, estimating, and monitoring technical feasibility and management risks, such as schedule slippage and cost overrun. After testing the build, at the end of first iteration, the customer evaluates the software and provides feedback.

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The radial dimension in Figure 1 represents the cumulative cost incurred in accomplishing the steps to date; the angular dimension represents the progress made in completing each cycle of the spiral.

A typical cycle of the spiral. Each cycle of the spiral begins with the identification of

- The objectives of the portion of the product being elaborated (performance, functionality, ability to accommodate change, etc.);
- The alternative means of implementing this portion of the product (design A, design B, reuse, buy, etc.); and
- The constraints imposed on the application of the alternatives (cost, schedule, inter-face, etc.).

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A prioritized top-ten list of software risk items

Software Risks	Detail
Personnel shortfalls	Staffing with top talent, job matching; teambuilding; morale building; cross-training; pre-scheduling key people
Unrealistic schedules and budgets	Detailed, multisource cost and schedule estimation; design to cost; incremental development; software reuse; requirements scrubbing
Developing the wrong software functions	Organization analysis; mission analysis; ops-concept formulation; user surveys; prototyping; early users' manuals
Developing the wrong user interface	Task analysis; prototyping; scenarios; user characterization (functionality, style, workload)

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Software Risks	Detail
Gold plating	Requirements scrubbing; prototyping; cost-benefit analysis; design to cost
Continuing stream of requirement changes	High change threshold; information hiding; incremental development (defer changes to later increments)
Shortfalls in externally furnished components	Benchmarking; inspections; reference checking; compatibility analysis
Shortfalls in externally performed tasks	Reference checking; pre-award audits; award-fee contracts; competitive design or prototyping; teambuilding
Real-time performance shortfalls	Simulation; benchmarking; modelling; prototyping; instrumentation; tuning
Straining computer-science capabilities	Technical analysis; cost—benefit analysis; prototyping; reference checking

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Spiral Model Application

- When there are budget constraint and risk evaluation is important. For medium to high-risk projects.
- Long -term project commitment because of potential changes to economic priorities as the requirements change with time.
- Customer is not sure of their requirements which are usually the case.
- Requirements are complex and need evaluation to get clarity.
- New product line which should be released in phases to get enough customer feedback.
- Significant changes are expected in the product during the development cycle.

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Spiral Model Pros and Cons

Pros

- High amount of risk analysis.
- Good for large and mission-critical projects.
- Software is produced early in the software life cycle. So Users see the system early.
- Changing requirements can be accommodated.
- Allows for extensive use of prototypes
- Requirements can be captured more accurately.
- Development can be divided into smaller parts and more risky parts can be developed earlier which helps better risk management.

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Cons

- Can be a costly model to use.
- Risk analysis requires highly specific expertise.
- Project's success is highly dependent on the risk analysis phase.
- Management is more complex.
- End of project may not be known early.
- Not suitable for small or low risk projects and could be expensive for small projects.
- Process is complex
- Spiral may go indefinitely.
- Large number of intermediate stages
- Requires excessive documentation.

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