

# Spiral Model

# Iterative models

## Iterative Models

- Iterative models, extend upon the linear models
- allow for repeating stages of the process; be cyclical.
- a forerunner to truly agile practices,

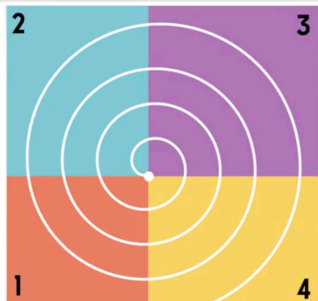
## Advantage of iterative model: iterations

- add the ability to loop back on previous steps
- -> allow for feedback within the process.

# Spiral process model

Spiral model: introduced by Barry Boehm in 1986

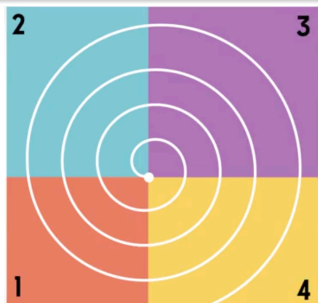
- a basic process for designing and implementing a software system,
- revisiting phases of the process, after they've been completed.



# Spiral process model

## Model structure

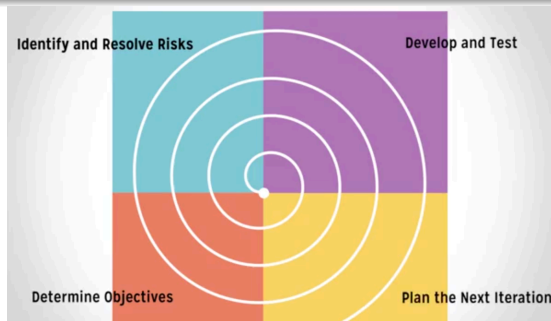
- four quadrants, phases of an iteration;
- move from one quadrant to another in the process
- an iteration: the duration of one full spiral / all four quadrant phases being completed one time.



# Spiral process model

## Activities in the four phases

- determine objectives and needs, and generate solutions for the current iteration
- identify and assess risks, and evaluate those solutions
- develop and test the product in the current iteration
- move on to planning the next iteration [have a product that satisfies the objectives]
- -> gradually build up a product, by repeating the phase cycle.



# Spiral Model

## Example of iterations in a Spiral model

### initial iteration

- determining the client and user requirements.
- evaluate the solutions
- build an initial prototype of the product
- review what needs to be done for the next iteration

### the next iteration

- defining the objectives of the iteration:  
-> e.g., add features to the prototype
- evaluate these features
- build the features
- review what needs to be done for the next iteration

# Iterative Models, e.g., Spiral Model

## Feature

- iterative models, like Spiral, tend to repeat elements of the process throughout [unlike linear models]
- allows for a development team to review their product at the end of each spiral iteration
- -> better ensure that the product is being built to specification.

# Quiz

## Context

- Johnatan is using the Spiral model to build his software.
- He has extensive experience with programming with punch cards, and using the Waterfall model.
- So Spiral iterations are a big step for him.
- He just finished developing and testing his product, but can't remember what stage of the model comes next.

Which stage of the Spiral model comes after development and testing?

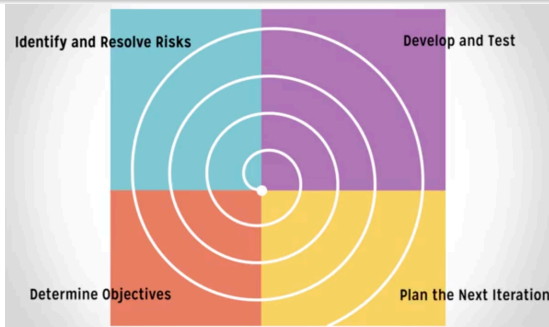
- A. The next iteration.
- B. Planning for the next iteration.
- C. Product release.
- D. Further testing.



# Quiz

Which stage of the Spiral model comes after development and testing?

- A. The next iteration.
- ✓ B. Planning for the next iteration.
- C. Product release.
- D. Further testing.



# Six invariants of a Spiral Model

## Six invariants

- variants: aspects of projects following Spiral model may change from project to project
- invariants : six conditions almost always stay the same
  - six invariants of a Spiral model
  - first described by Boehm<sup>a</sup>
  - (the invariants also apply to a lot of other process models)

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<sup>a</sup>Boehm, Barry, and Wilfred J. Hansen. *Spiral development: Experience, principles, and refinements*. No. CMU/SEI-2000-SR-008. Carnegie-Mellon Univ Pittsburgh PA Software Engineering Inst, 2000.

# Six invariants of a Spiral Model

## The first invariant of the Spiral model:

"All work products, of a software project, should be created concurrently, at the same time. "

Without defining things at the same time, you put your project at risk e.g., with Waterfall, doing things sequentially means making decisions based on only a limited amount of information.

# Six invariants of a Spiral Model

## The second invariant of the Spiral model

“All the quadrants in the model must be addressed, there's no skipping steps. ”

Each quadrant of the model, brings value, if you skip one, you put your project unnecessarily at risk.

- Because what you're likely doing is making assumptions about the project.
- Assumptions can be false.
- A project should not be built based on false assumptions.

# Six invariants of a Spiral Model

## The last four invariants [more technical]

- Every project implementing the Spiral model should base the amount of time they spend on any particular activity, on the amount of risk involved in carrying that activity out.
- Decisions are based on risk data
- Each iteration of the Spiral should result in a tangible work product.
- the process should be on improving the process.

# Spiral Model

## Disadvantages

- planning tends to be done upfront at beginning of each Spiral.
  - » Depending on the duration of the Spiral, this could make it difficult to make good estimates.
- the ability to minimize risk in a calculated fashion
  - requires an immense amount of analytical expertise.
  - need a great amount of data and consume a great deal of resources in order to get right

## Where can a real Spiral Model be found

- on large projects
- and manager with years of experience, data, and technical expertise.