ARCHITECTURE DEFINITION PROCESS

MD. IFTEKHAR ALAM EFAT

Institute of Information Technology
Noakhali Science & Technology University

TOPICS

- Guiding Principles
- Process Outcomes
- The Process Context
- Supporting Activities
- Architecture Definition Activities
- Process Exit Criteria Architecture
- Definition in the Software Development Lifecycle

GUIDING PRINCIPLES

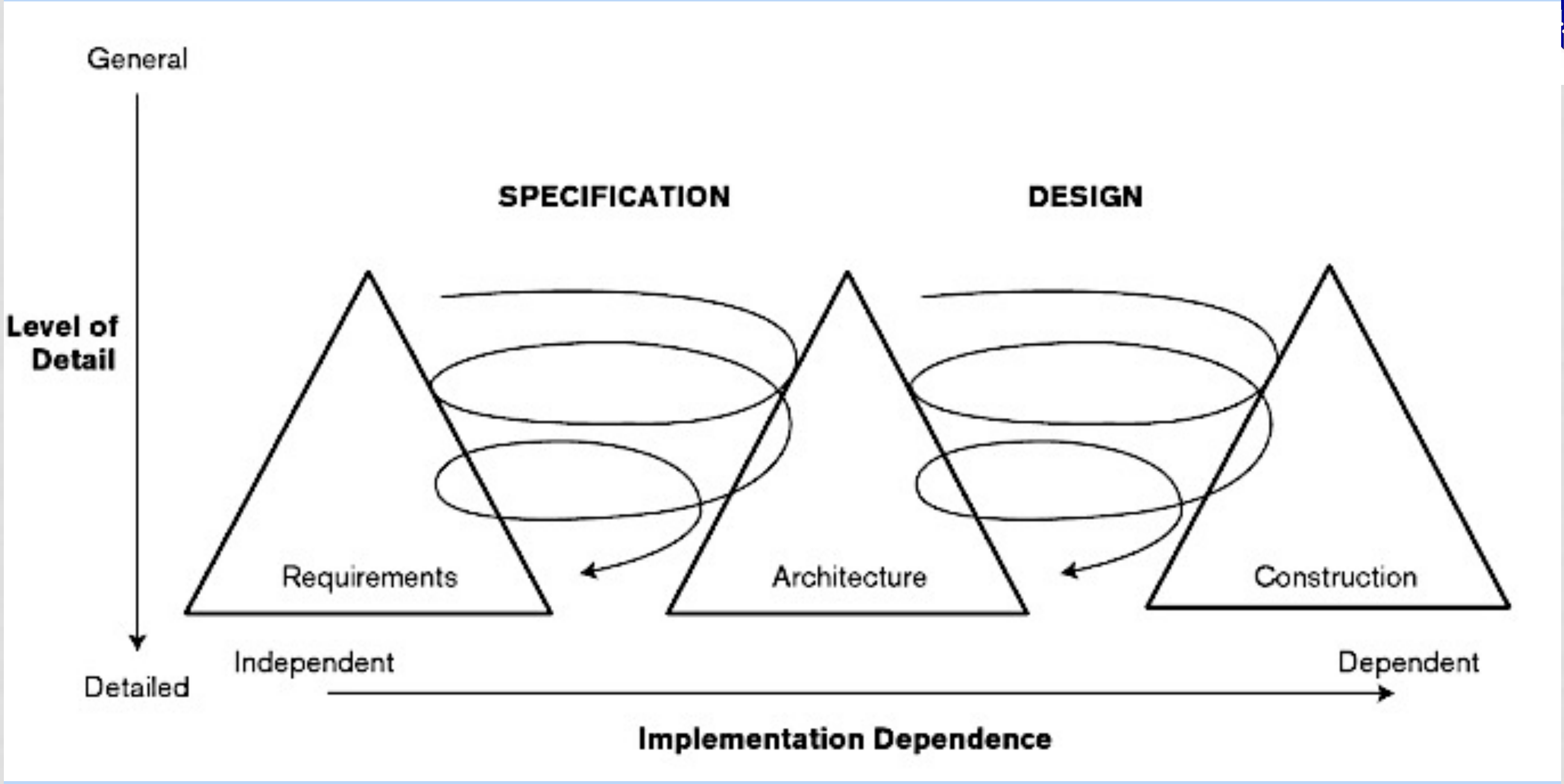
- It must driven by *stakeholder concerns*, the process must *balance* these concerns effectively where they conflict or have incomplete implications
- It must encourage the effective *communication* of architectural decisions, principles, and the solution itself to stakeholders
- It must ensure, on an ongoing basis, that the architectural decisions and principles are *adhered* to throughout the lifecycle up to the final deployment
- It must (as much as possible, given the fluid nature of architecture definition) be *structured*. In other words, it must comprise a series of one or more steps or tasks, with a clear definition of the objectives, inputs, and outputs of each step. Typically, the outputs from one step are the inputs to subsequent steps
- It must be *pragmatic*—that is, it must consider real-world issues such as lack of time or money, shortage of specific technical skills, unclear or changing requirements, the existing context, and organizational considerations
- It must be *flexible* therefore it can be tailored to particular circumstances (This is sometimes referred to as a *toolkit* or *framework* approach, with the idea that you use those elements of the toolkit you need and ignore the rest)
- It must be *technology-agnostic*—that is, the process must not mandate that the architecture be based around any specific technology, architectural pattern, or development style, nor should it dictate any particular modeling, diagramming, or documentation style
- It must *integrate* with the chosen software development lifecycle
- It must align with good *software engineering practices* and *quality management standards* (such as ISO 9001) to that it can integrate easily with existing approaches

PROCESS OUTCOME

- Clarification of the requirements and of other inputs to the process
- Management of stakeholders’ expectations
- Identification and evaluation of architectural options
- Description of architectural acceptance criteria (indirectly)
- Creation of a set of design inputs (ideally)

THE PROCESS CONTEXT

- Requirements analysis provides the context for architecture definition by defining the scope and the system's desired functionality and quality properties
- Architecture definition often reveals Inconsistent and missing requirements and also helps stakeholders understand the relative costs and complexities of meaning their concerns. This feeds back into requirements analysis to clarify and add requirements and to prioritize these when tradeoffs are made between stakeholders' aspirations and what can be achieved given time and budget constraints
- When architecture definition has resulted in an architecture that appears to meet an acceptable set of user requirements, the construction of the system can be planned
- Construction is often organized as a set of incremental deliveries, each of which aims to provide a useful set of functions and to leave the system in stable, usable state (albeit an incomplete one). The construction of each increment provides further feedback to architecture definition, validating or indicating problems with the architecture as currently specified; hence, there is architecture definition activity throughout the lifecycle



THE 3 PEAKS MODEL

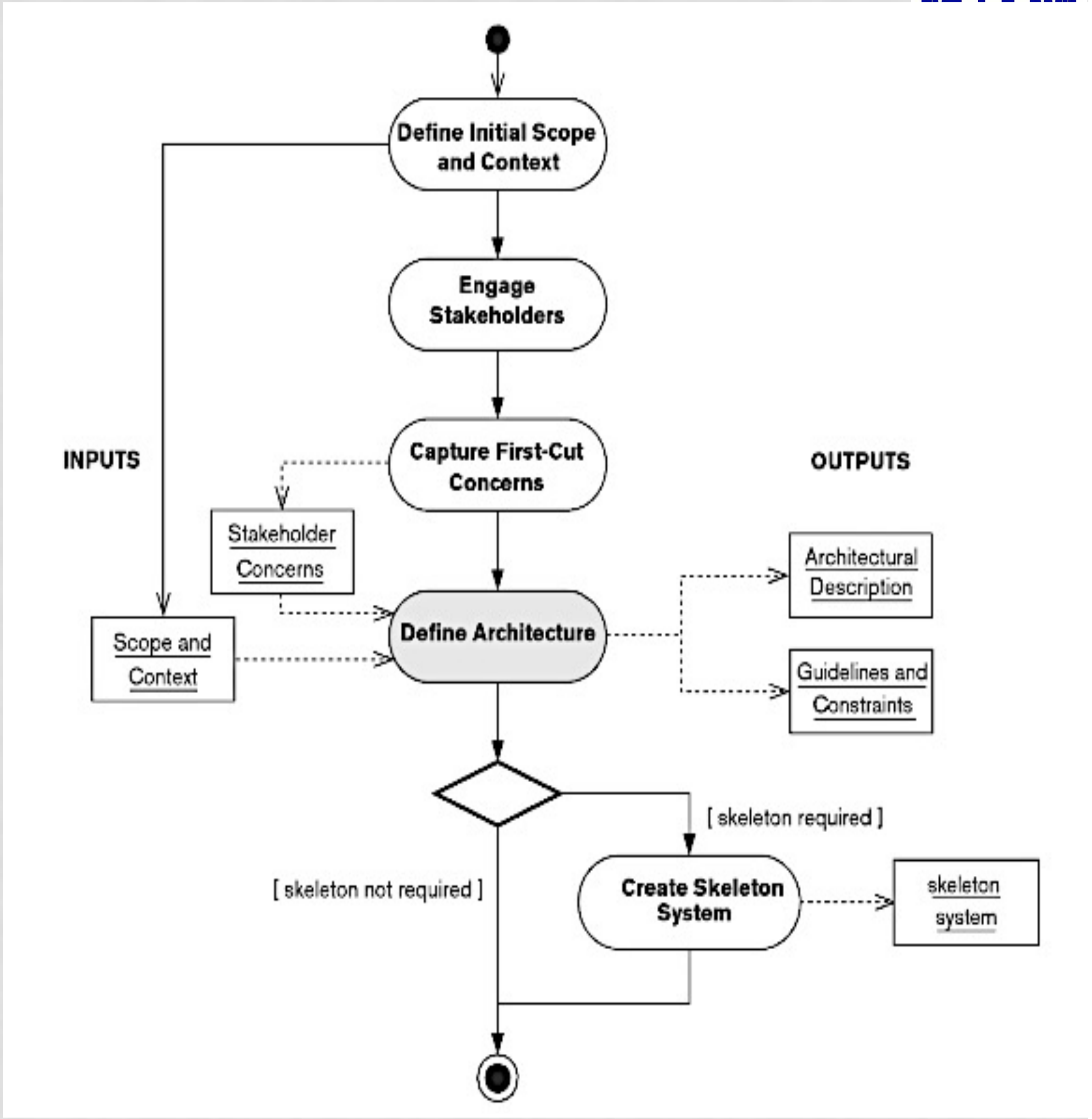
ARCHITECTURE DEFINITION CONTEXT

SUPPORTING ACTIVITIES

- Before start, the following should be available:
  - A definition of the system's baseline *scope* and *context*
  - A definition of key stakeholder *concerns*
- The supporting activities are as follows:
  - Define the initial scope and context
  - Engage the stakeholders
  - Capture the first-cut concerns
  - Define the architecture
  - Optionally, create a skeleton system

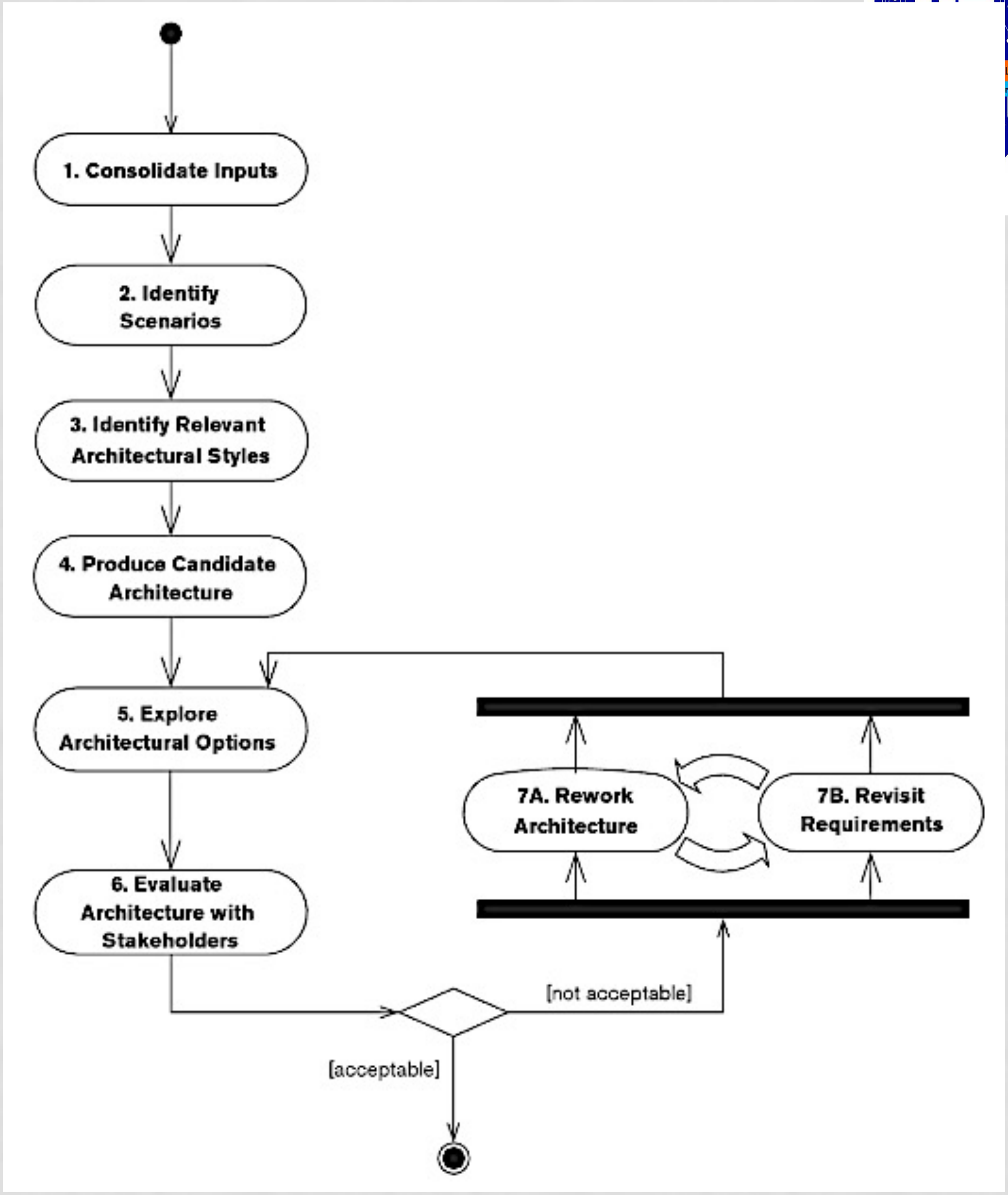
FLOW CHART

Architecture
Supporting
Activities

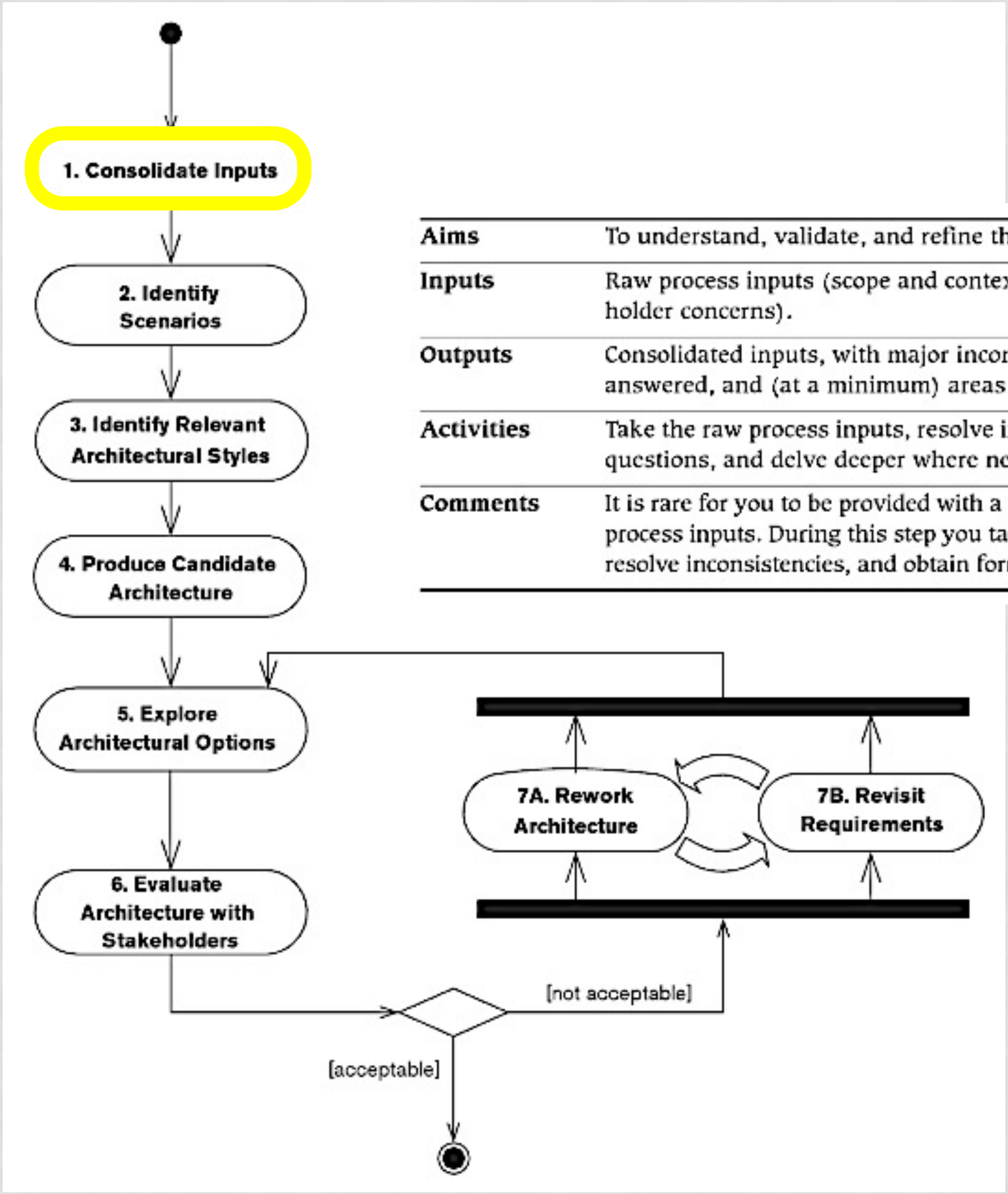


DETAILS OF

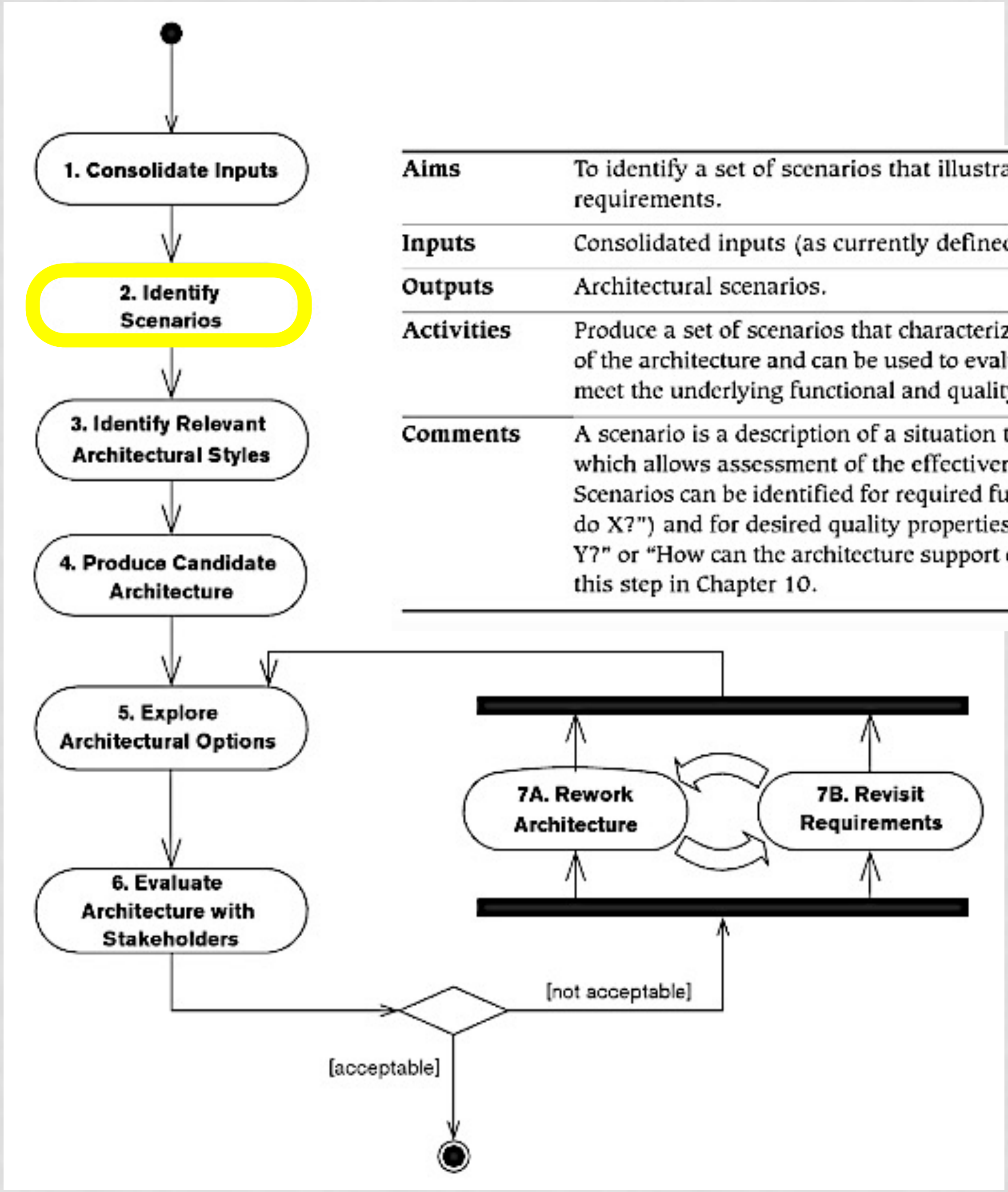
Architecture Definition



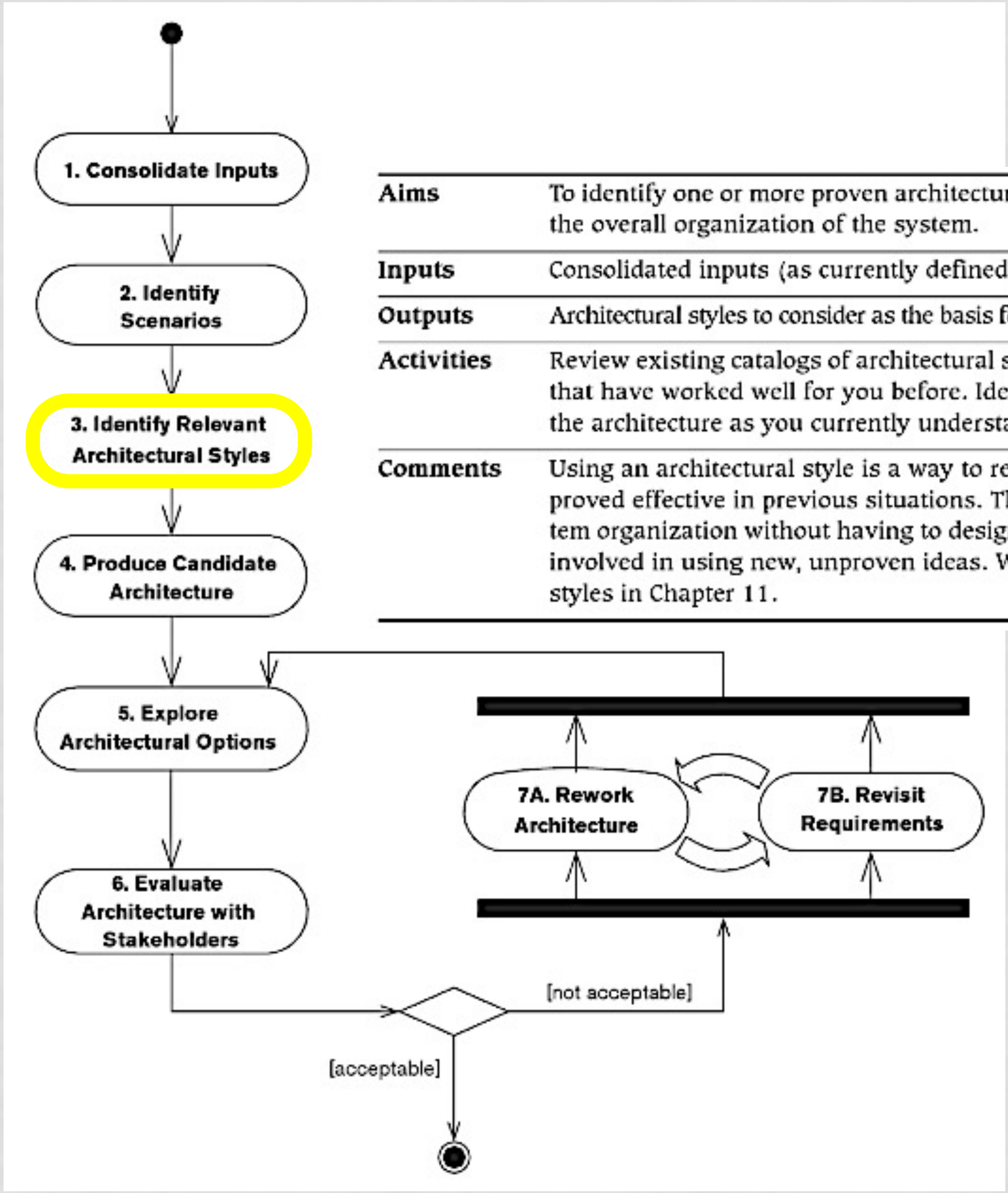
1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

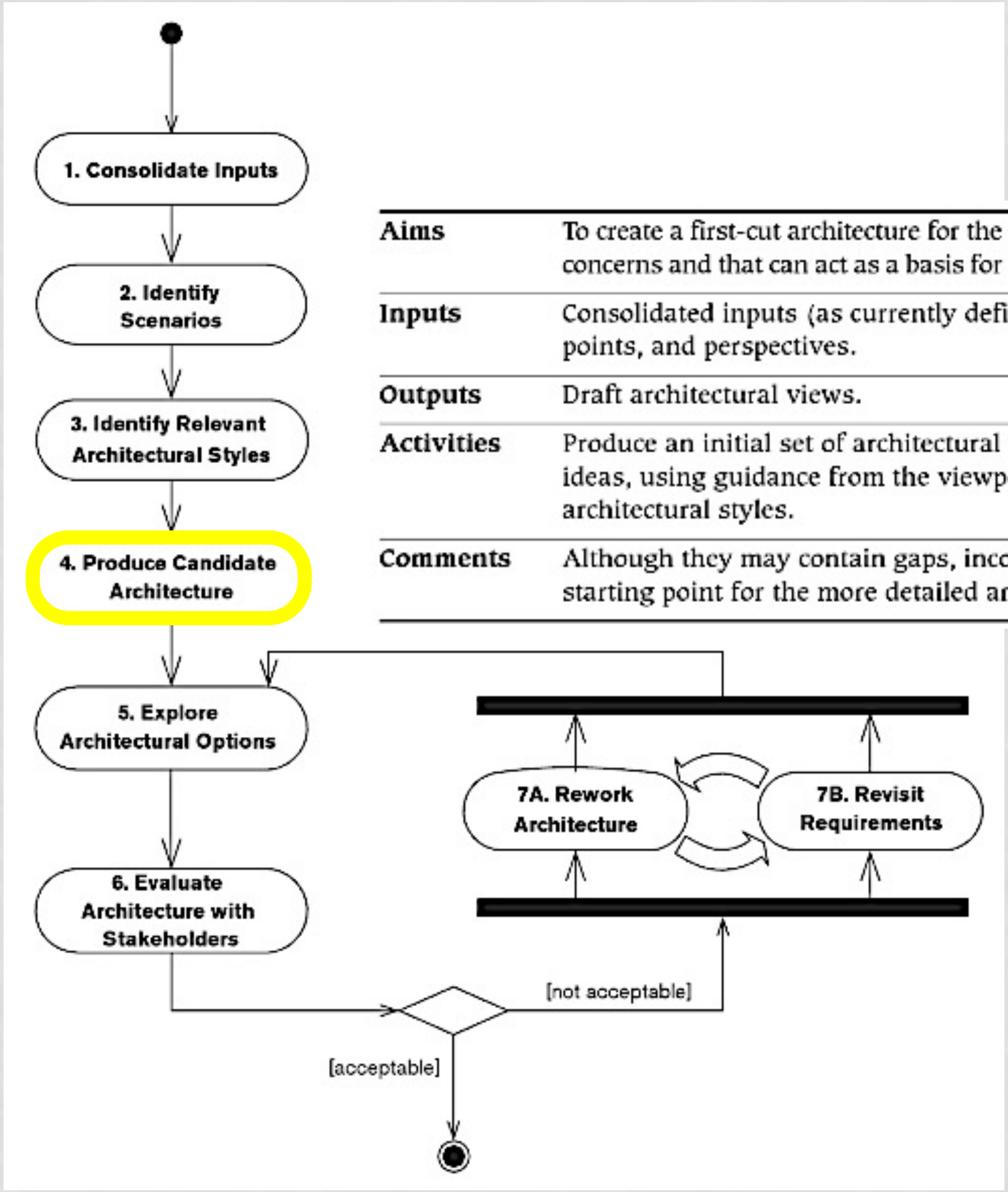
Aims	To understand, validate, and refine the initial inputs.
Inputs	Raw process inputs (scope and context definition from draft Context view, stake-holder concerns).
Outputs	Consolidated inputs, with major inconsistencies removed, open questions answered, and (at a minimum) areas requiring further exploration identified.
Activities	Take the raw process inputs, resolve inconsistencies between them, answer open questions, and delve deeper where necessary, to produce a solid baseline.
Comments	It is rare for you to be provided with a consistent, accurate, and agreed-upon set of process inputs. During this step you take the information available, fill in gaps, resolve inconsistencies, and obtain formal agreement from the key stakeholders.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

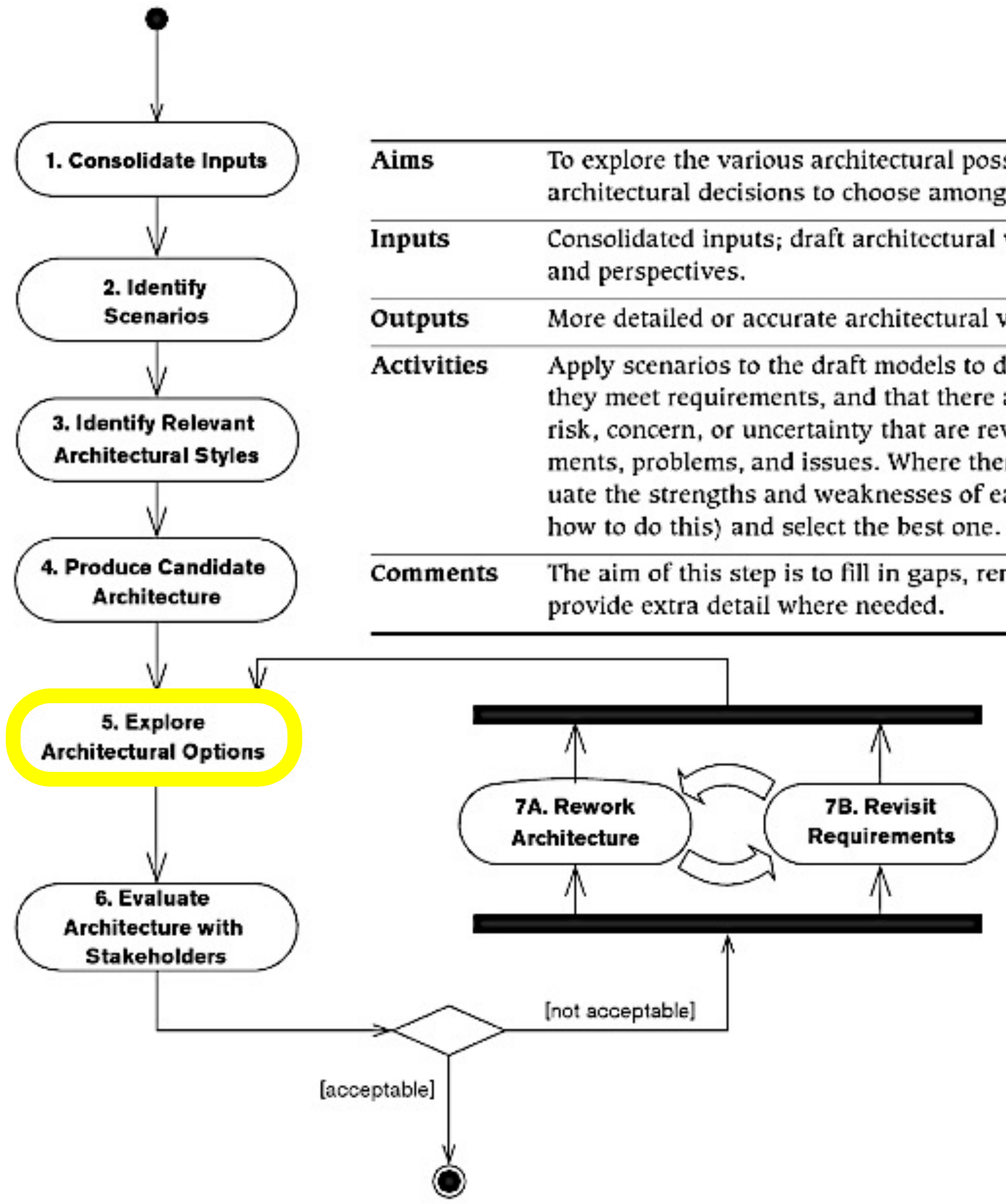
Aims	To identify a set of scenarios that illustrates the system's most important requirements.
Inputs	Consolidated inputs (as currently defined).
Outputs	Architectural scenarios.
Activities	Produce a set of scenarios that characterize the most important attributes required of the architecture and can be used to evaluate how well a proposed architecture will meet the underlying functional and quality property requirements.
Comments	A scenario is a description of a situation that the system is likely to encounter, which allows assessment of the effectiveness of the architecture in that situation. Scenarios can be identified for required functional behavior ("How does the system do X?") and for desired quality properties ("How does the system cope with load Y?" or "How can the architecture support change Z?"). We explain how to approach this step in Chapter 10.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

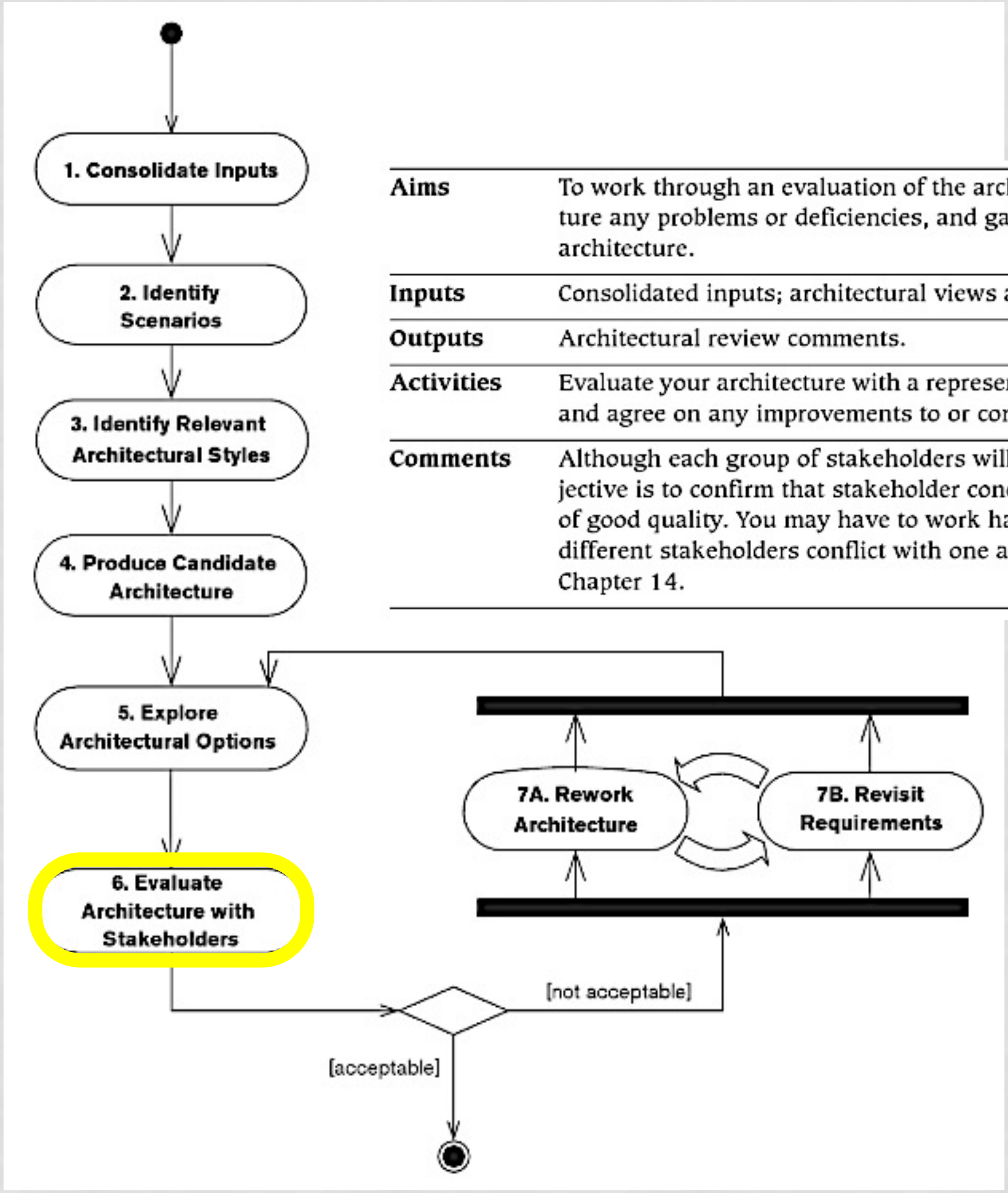
Aims	To identify one or more proven architectural styles that could be used as a basis for the overall organization of the system.
Inputs	Consolidated inputs (as currently defined); architectural scenarios.
Outputs	Architectural styles to consider as the basis for the system's main architectural structures.
Activities	Review existing catalogs of architectural styles, and consider system organizations that have worked well for you before. Identify those that appear to be relevant to the architecture as you currently understand it.
Comments	Using an architectural style is a way to reuse architectural knowledge that has proved effective in previous situations. This can help you arrive at a suitable system organization without having to design it from scratch and so reduces the risks involved in using new, unproven ideas. We talk more about using architectural styles in Chapter 11.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

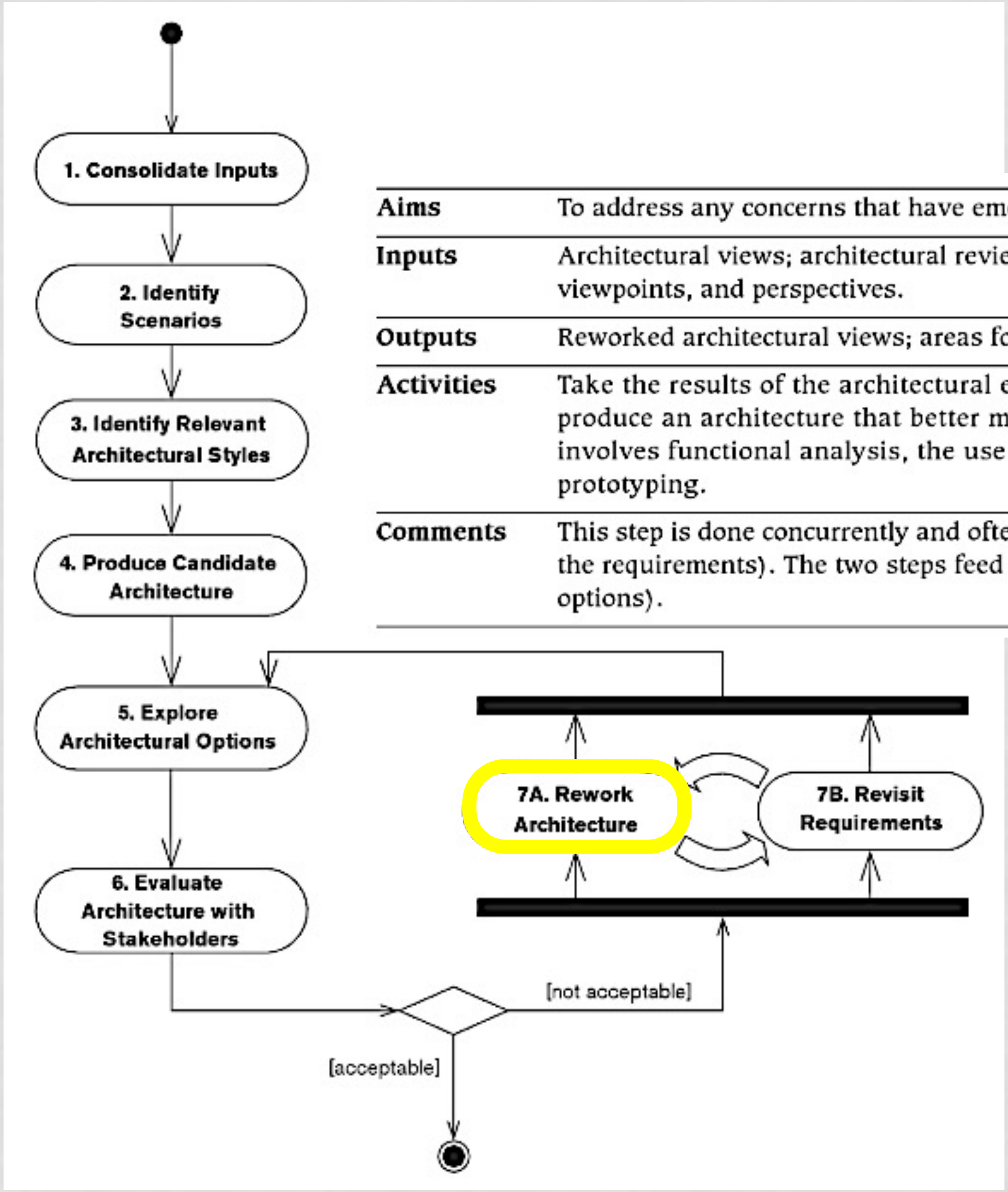
Aims	To create a first-cut architecture for the system that reflects its primary architectural concerns and that can act as a basis for further architectural evaluation and refinement.
Inputs	Consolidated inputs (as currently defined); relevant architectural styles, viewpoints, and perspectives.
Outputs	Draft architectural views.
Activities	Produce an initial set of architectural views to define your initial architectural ideas, using guidance from the viewpoints and perspectives and any relevant architectural styles.
Comments	Although they may contain gaps, inconsistencies, or errors, the draft views form a starting point for the more detailed architecture work later.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

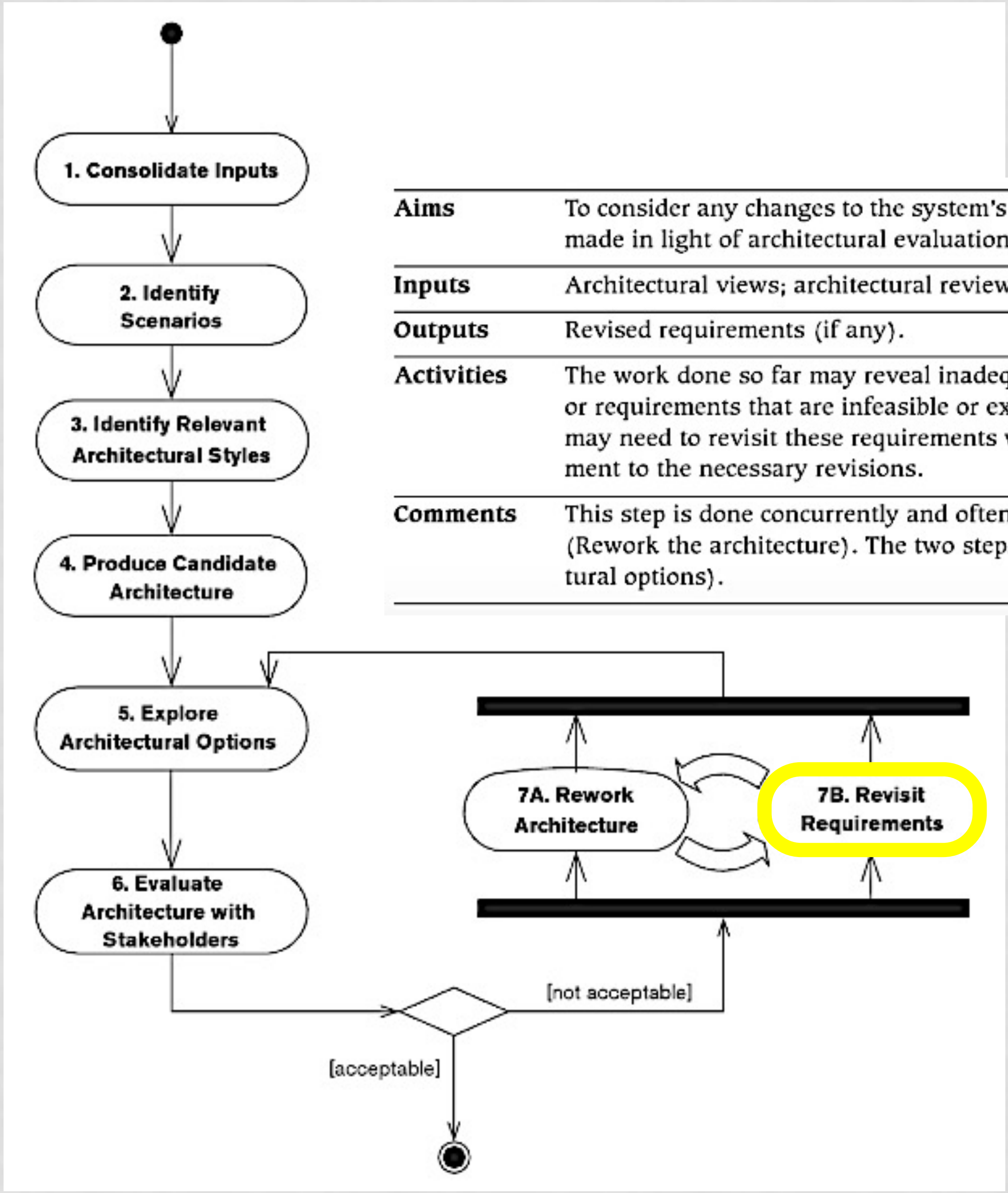
Aims	To explore the various architectural possibilities for the system and make the key architectural decisions to choose among them.
Inputs	Consolidated inputs; draft architectural views; architectural scenarios, viewpoints, and perspectives.
Outputs	More detailed or accurate architectural views for some parts of the architecture.
Activities	Apply scenarios to the draft models to demonstrate that they are workable, that they meet requirements, and that there are no hidden problems. Take any areas of risk, concern, or uncertainty that are revealed and further explore the requirements, problems, and issues. Where there is more than one possible solution, evaluate the strengths and weaknesses of each (refer to Chapter 14 for guidance on how to do this) and select the best one.
Comments	The aim of this step is to fill in gaps, remove inconsistencies in the models, and provide extra detail where needed.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

Aims	To work through an evaluation of the architecture with your key stakeholders, capture any problems or deficiencies, and gain the stakeholders' acceptance of the architecture.
Inputs	Consolidated inputs; architectural views and perspective outputs.
Outputs	Architectural review comments.
Activities	Evaluate your architecture with a representative collection of stakeholders. Capture and agree on any improvements to or comments on the models.
Comments	Although each group of stakeholders will have different interests, the overall objective is to confirm that stakeholder concerns are met and that the architecture is of good quality. You may have to work hard to obtain consensus if the concerns of different stakeholders conflict with one another. We talk about this activity in Chapter 14.


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

Aims	To address any concerns that have emerged during the evaluation task.
Inputs	Architectural views; architectural review comments; relevant architectural styles, viewpoints, and perspectives.
Outputs	Reworked architectural views; areas for further investigation (optional).
Activities	Take the results of the architectural evaluation and address them in order to produce an architecture that better meets its objectives. This step normally involves functional analysis, the use of viewpoints and perspectives, and prototyping.
Comments	This step is done concurrently and often quite collaboratively with step 7B (Revisit the requirements). The two steps feed back into step 5 (Explore the architectural options).


1. Consolidate Inputs
2. Identify Scenarios
3. Identify Relevant Architectural Styles
4. Produce Candidate Architecture
5. Explore Architectural Options
6. Evaluate Architecture with Stakeholders
7A. Rework Architecture
7B. Revisit Requirements
[not acceptable]
[acceptable]

Aims	To consider any changes to the system's original requirements that may have to be made in light of architectural evaluation.
Inputs	Architectural views; architectural review comments.
Outputs	Revised requirements (if any).
Activities	The work done so far may reveal inadequacies or inconsistencies in requirements or requirements that are infeasible or expensive to implement. In this case, you may need to revisit these requirements with stakeholders and obtain their agreement to the necessary revisions.
Comments	This step is done concurrently and often quite collaboratively with step 7A (Rework the architecture). The two steps feed back into step 5 (Explore architectural options).

PROCESS EXIT CRITERIA

Principle

Architecture definition (or an iteration of it) can be considered complete once the material risks that the system faces have been mitigated, which can be judged by the absence of significant comments or actions after stakeholder evaluation of the architecture.

Strategy

- Include yourself in the reviewers of the architectural description, and do not finish initial architecture definition until you are satisfied that there are no significant issues with the architecture
- Aim to produce an architectural description that is good enough to meet the needs of its users, rather than strive for a perfect version that will take significantly more resources to complete without providing any real benefit to the system's stakeholders

ARCHITECTURE DEFINITION IN SDLC

Waterfall Approach

Forward & Backward strategy

Linear Approach

Iterative Approach

Feature Driven Development

Rational Unified Process

Agile Methods

Reduction of Documentation

SUMMARY

- Process of *Architecture Definition,* applicable to most software development projects
- Stakeholder driven *Architecture Definition* principle and processes
- Context of process and the outcome
- Essential inputs to the process: a baseline *definition* (scope & context) and stakeholder *concerns* (functional & technical requirements)
- The *Iterative Process of Architecture Definition* aligning with state-of-art SDLC methods