**Stage 1: Discover Architectural Drivers**

The primary purpose of stage 1 is for the architecture design team to initiate one or more meetings with the client stakeholder community (or communities) to discover and document the system’s architectural drivers, to include high-level functional requirements, business constraints, technical constraints, and quality attributes.

Stage 1 is comprised of the following key activities:

* Architecture design team strategy meeting: The architecture design team meets, possibly for the first time, to identify the client stakeholders, decide how many architecture drivers elicitation workshops are needed, and discuss initial planning issues. After this meeting the managing engineer will create the initial master design plan.
* Architecture drivers elicitation workshops: The architecture design team meets with the client stakeholders to elicit the architectural drivers. One or more workshops may be required. The raw architecture drivers are consolidated after each workshop, and when all the work-shops have been completed, the consolidated raw architecture drivers from each workshop are once again distilled into a single, consolidated raw architecture drivers document.
* Create and update the master design plan: The initial draft of the master design plan will be created in stage 1. The most important element of the master design plan is the schedule. The schedule may be part of the master design plan document or in a separate document. The schedule should be updated after each workshop to reflect the actual time, effort, and cost to track progress. The managing engineer should consider using objective measures to track progress, such as the earned value techniques described in this section. During stage 1 little is known about the project, stakeholders, and deliverables, so change is inevitable during this initial stage in the period of uncertainty. The master design plan should be refined as necessary as more is learned about the domain, the stakeholders, and the architectural drivers.

**Stage 2: Establish Project Scope**

The primary purpose of stage 2 is for the architecture design team to analyze the consolidated raw architecture drivers information gathered in stage 1 to clarify and refine the architectural drivers and firmly establish the scope of the system/product.

Stage 2 is comprised of the following key activities:

* Stage 2 planning: Stage 2 starts as all ACDM stages do—with a bit of planning. Stage 2 focuses on the analysis of information gathered in stage 1, which is inherently difficult to plan. Nonetheless, it is critical for the architecture design team to establish a budget for analysis to avoid analysis paralysis—those never-ending cycles of analysis and refinement. Specific activities and templates are provided to guide the activities of the architecture design team.
* Analyzing the raw architecture drivers: The key activity of stage 2 is to take the information gathered in stage 1, analyze it, and turn it into a clear, concise description of what the user wants. During analysis, the operational descriptions are analyzed and cast as use cases. The quality attribute characterizations are analyzed and cast into six-part quality attribute scenarios. The constraints are also analyzed for inconsistent constraint; overly constraining specifications, invalid constraints, and so forth. Analysis concludes with the architecture design team assigning a difficulty ranking to each of the architectural drivers. Those architectural drivers that were voted as important by the stakeholders (in stage 1) and were ranked as difficult by the architecture design team could be potentially problematic and may warrant early exploration.
* Architecture drivers specification: As the analysis of the raw consolidated architectural drivers concludes, the architecture driver specification must be written. This effort is led by the requirements engineer, but should involve all the members of the architecture design team as authors. The architecture drivers specification should be circulated around the customer stakeholder community for review and comment. After customer stakeholder review and comment it is ready for initial architectural design in stage 3.
* Update the master design plan: The master design plan should be updated as various tasks are completed to reflect the actual time, cost, and effort. Again, if the managing engineer is using earned value as described in stage 1, he or she will see a picture of project progress emerging. The managing engineer should use this information to adjust the project schedule, resources, and so forth to ensure that the project is progressing at a satisfactory rate.

**Stage 3: Create/Refine Notional Architecture**

The primary purpose of stage 3 is for the architecture design team to create the initial architectural design, or refine the architectural design based on the results of the architectural evaluation. If this is the first iteration in stage 3, then the initial notional architecture design will be created. Once the architecture is designed in stage 3 it is evaluated in stage 4. After the evaluation of stage 4, the team will make a decision to build the system or continue refining the design. Stage 5 is where this decision is made. If the decision is to continue refining the design (stage 5), then issues uncovered in the evaluation are addressed in stage 6 through experimentation. After stage 6 experimentation, the architecture design team then returns to stage 3 to refine the architecture design based on the issues uncovered during the evaluation. The team then conducts another evaluation of the refined architecture, and then moves on to stage 5 to once again decide if the design is ready for implementation or if more refinement is needed.

Stage 3 is comprised of the following key activities:

* Stage 3 planning: Stage 3 begins with the managing engineer leading the architecture design team in planning initial creation of the architecture design, or the refinement of the design after evaluation and experimentation. In general, greater time should be budgeted for initial design and less for subsequent refinement activities.
* Initial design: Much of the detailed design techniques presented in Section 1 are applied here to design the notional architecture. In addition to design techniques, it is essential that the architect faithfully record his or her rationale, design decisions, and representations as they are made. This significantly reduces the documentation overhead later. The initial documentation may be less formal in the initial design, but it must completely capture the notional architecture, rationale for the choices made, and so forth (as discussed in Chapter 6), as the information is known.
* Design refinement: Experiments are designed to address risks uncovered in stage 4. The results of these experiments (conducted in stage 6) are used to refine the design. This also includes refining the amount of detail of the design and refining the documentation. While the initial documentation can be less formal, it should be iteratively refined as the architecture is refined, until it is in an acceptable format for downstream designers or implementers.
* Architecture design document: The architecture design team will iteratively document the architecture as it is refined. Documentation techniques and the contents of architecture design documentation were discussed at great length in Chapter 6.
* Update the master design plan: The master design plan should be updated as various tasks are completed to reflect the actual time, cost, and effort. Again, if the managing engineer is using earned value as described in stage 1, he or she will see a picture of project progress emerging. The managing engineer should use this information to adjust the project schedule, resources, and so forth.

**Stage 4: Architectural Review**

The primary purpose of stage 4 is for the architecture design team to evaluate the initial architectural design, or reevaluate the refined design after architectural evaluation and experimentation.

Stage 4 is comprised of the following key activities:

* Stage 4 planning: Stage 4 begins with the managing engineer estimating the duration and resources required for the evaluation workshop. In general, greater time should be budgeted for external evaluations than for internal evaluations. Evaluation planning templates were provided to guide the estimation of the time and resources, and for planning the logistics of the evaluation. Evaluation workshops are typically short in duration. Experience with ACDM has shown that ACDM evaluation workshops can take anywhere from a few hours to two days.
* Internal evaluations: Internal evaluation workshops are evaluations of the architecture design that are conducted by the architecture design team. Internal evaluations are easier and less expensive to conduct, but also suffer from not having the broader participation of other stakeholders. It is strongly recommended that at least the first evaluation be conducted internally because the design is relatively immature, and the cost of external evaluations is relatively high in comparison to internal evaluations.
* External evaluations: External evaluations involve a significant number of stakeholders external to the architecture design team. Typically the number of attendees at external evaluation workshops is higher than the number of attendees at internal evaluations. The cost of an external evaluation is higher than that for an internal evaluation, and it is much more difficult to facilitate. Because of this, the architecture design should be relatively mature before conducting an external evaluation. However, the benefit is that with more stakeholders engaged, the architecture design is scrutinized more closely, and stakeholders with domain experience can bring their experience to bear on the evaluation. It is strongly recommended that at least one external evaluation be conducted if possible and practical.
* Update the master design plan: The master design plan is initially updated at the beginning of stage 4, with the estimates of the time and resources required to conduct the evaluation workshop. At the conclusion of the evaluation workshop, the master design plan is updated with the actual time and resources expended during stage 4.

**Stage 5: Production Go/No-Go**

The primary purpose of stage 5 is for the architecture design team to analyze the issues uncovered in stage 4 during the architectural design evaluation and devise concrete strategies for how to address each issue. Each issue will be analyzed, and a specific deposition action for each will be decided upon. The team will then decide whether the design is ready for the production stages, or if the architecture design should be further refined and evaluated.

Stage 5 is comprised of the following key activities:

* Stage 5 planning: Stage 5 begins with the managing engineer estimating the duration and resources required for the issue analysis meetings. In general, greater time should be budgeted for the first analysis meetings.
* Issue analysis meetings: These can, and should, be discussion-oriented meetings largely facilitated by the engineering manager, but are dependent upon the technical expertise of the entire team. Although external stakeholders could participate in the issue analysis meetings, in most cases they will be attended by members of the architecture design team. There will be at least one issue analysis meeting, but there could be several. At the end of the last meeting the engineering manager should put the go/no-go question to the vote. The architecture design team should vote on whether more refinement and evaluation is required, or if the team is ready for production.
* Update the master design plan: The master design plan is initially updated at the beginning of stage 5 with the estimates of the time and resources required to conduct the issue analysis meetings. At the conclusion of the evaluation, the master design plan is updated with the actual time and resources expended during stage 5. Because of the discussion-oriented nature of the issue analysis meetings, the engineering manager should try to aggressively stick to the schedule budgets established at the beginning of stage 5. The go/no-go decision and the factors contributing to the decision the team makes should also be recorded in the master design plan.

**Stage 6: Experimentation**

The primary purpose of stage 6 is for the architecture design team to resolve issues uncovered during the evaluation in stage 4 by carrying out the actions described for each issue in the issue deposition document developed in stage 5. Each action will be planned, executed, and tracked until resolved.

Stage 6 is comprised of the following key activities:

* Stage 6 planning: Stage 6 begins with responsible engineers creating experimentation plans to address each issue deposition established in stage 5. The experimentation plans are short descriptions of how the issues will be resolved. The experimentation plans are reviewed by the managing engineer, who uses them to create the stage schedule. The chief scientist and chief architect review the experimentation plans for technical merit.
* Experimentation: The responsible engineers will conduct the experiments according to the experimentation plans. As experiments are conducted, experimentation data is collected and recorded by the responsible engineers. The responsible engineers will also update the experimentation plans with actual performance data and experimentation results as the information is available.
* Experiment review meeting: This meeting is conducted by the architecture design team to share and review the results of the experiments and provide an opportunity to allow team members to provide comment on the various experiments.
* Update the master design plan: The master design plan is initially updated at the beginning of stage 6 with the estimates of the time and resources required to conduct experiments based on the experimentation plans. At the conclusion of stage 6, the master design plan is updated with the actual time and resources expended on experimentation.
* Archive the results: It is essential that the experimentation plans, the resulting artifacts, and the results of the experiments are recorded and archived.