# Design Reviews

Decisions made during the database design process and the application development life cycle (ADLC) must be reviewed to ensure correctness. This is the purpose of a design review

**What Is a Design Review?**

Design reviews are an important facet of the ADLC for database applications. It is during the design review that all aspects of the database and application code are reviewed for efficiency, effectiveness, and accuracy. It is imperative that all database applications, regardless of their size, are reviewed to ensure that the application is designed properly, that the coding techniques are cost-effective, and the database can be accessed and modified correctly and efficiently. The design review is an important process for checking the validity of design decisions and correcting errors before applications and databases are promoted to production status.

> All aspects of the database and application code are reviewed for efficiency, effectiveness, and accuracy.

Multiple design reviews should be conducted over the course of an application's life. For database applications, the DBA must participate in every design review, at every stage. It is imperative that the application be reviewed before, during, and after implementation. Design reviews are critical for ensuring that an application is properly designed to achieve its purpose.

Design reviews address many aspects of the development process and its resulting application. Imposing the design review process on an application exposes it to a thorough review of every underlying component, structure, and nuance of the application. Some of the areas that can be addressed by a design review include

- A validation of the intent and purpose of the application
- An assessment of the logical data model
- An assessment of the physical data model
- A review and analysis of the physical DBMS parameters
- A prediction of SQL performance
- A judgment on the practicality of the programming language techniques deployed
- An analysis of overall performance after production implementation

A group consisting of subject matter experts and the developer's peers and coworkers should conduct each design review. The DBA usually must act as the focal point for organizing and conducting design reviews. Frankly, if the DBA does not organize design reviews, it is unlikely that any design review will be conducted. In addition, if design reviews are not conducted, the application is more apt to suffer performance and availability problems in a production environment.

> *Subject matter experts, peers, and coworkers should conduct each design review.*

**Rules of Engagement**

Let's cover the ground rules of a design review before defining each type of review. A design review is conducted by a group of people—each having different backgrounds, skills, expectations, and opinions. When any such group is convened to discuss potential problems and errors, confrontation is unavoidable. Each participant must possess the ability to discuss and reach consensus on issues without turning the review into an unproductive battle or argument. To accomplish this, participants must avoid being combative. Everyone needs to understand that the only goal is to promote the best performing, most usable application possible.

> *All participants should back up their assertions and suggestions with facts, manual references, and experience.*

One of the biggest threats to the success of a design review is the possibility that negative criticism will be perceived as a personal attack. If the atmosphere of the review is threatening or the developer perceives it to be so, then the developer is likely to resist contributing to the review or accepting an unbiased critique of the work. To avoid such a scenario, be sure that all participants back up their assertions and suggestions with facts, manual references, and experience. As much as possible, everyone should check his or her emotions at the door.

**Design Review Participants**

With respect to choosing the design review participants, two guidelines will help to ensure success. The first is to create formal roles for the design review and assign the proper individuals to fulfill those roles. The second is to make sure that participants possess the appropriate skills to actively engage in the design review process.

*Create formal roles for the design review.*

First, let's discuss the different roles required for a successful design review. Formal roles should include a leader, a scribe, a mediator, and the participants.

**The Leader**

It is imperative that each design review have only one leader. The leader can change from one design review to the next, but within the scope of a single design review, a single leader must be assigned. The leader's role is multifaceted. The leader

- Acts as a master of ceremonies to keep the review process moving along
- Creates and follows an agenda to ensure that all aspects of the current design review are conducted satisfactorily
- Solicits input from all participants
- Ensures that all participants maintain proper decorum
- Works with the participants before the meeting to ensure that all required documentation will be available
- Addresses other tasks as necessary to ensure a successful design review

Though it is not mandatory, the DBA typically acts as the leader of design reviews for applications using a database. If the DBA is not the leader, the DBA group must, at a minimum, have the authority to approve the selection of the leader. Sometimes it is a good idea to hire a consultant who has been exposed to more applications at many different sites to lead a design review. Doing so can result in the identification of design flaws that might not be caught otherwise.

*The DBA typically acts as the leader of design reviews for applications using a database.*

**The Scribe**

The responsibility of the scribe is to capture all points of discussion during the design review. Although the scribe is not an active participant in the design review, a scribe is always required. Failure to record the review can result in loss of vital information from the meeting.

The scribe must be capable of understanding the technical discussion, but need not have a technical position. The scribe could be a member of the development team who has good writing and listening skills. A technically savvy administrative assistant could be another good choice.

**The Mediator**

The mediator is an optional role, but depending on the project and the dynamics of the design review team, a mediator can be a blessing. The primary role of the mediator is to negotiate settlements when disagreements occur, and given the nature of a design review, disagreements are almost guaranteed. If a disagreement becomes vocal and volatile, the mediator will hear each side of the disagreement and arrive at an equitable decision.

*The primary role of the mediator is to negotiate settlements when disagreements occur.*

Although a good leader should be able to resolve most disagreements, his or her authority may be compromised by the resentment that can ensue from an intervention. By deferring the most difficult and sensitive decisions to the mediator, the leader can maintain the confidence of the group and keep the design review from breaking down. A technical management representative is the usually the best choice for mediator.

**The Participants**

Design review participants consist of the other actors with a stake in the project. The participants will differ from project to project, and from one design review to the next. From a high-level perspective, though, the following are the recommended personnel to engage in the design review:

- Application development personnel assigned to this development effort
- Representatives from other applications that are affected by the new application or program
- Data administration representative
- Database administration representative
- Representative end users
- End user management
- IT management for the new application and possibly other impacted applications

- Online support representatives for transaction processing and message queueing systems
- Web support personnel for Internet-enabled applications
- Operational support representatives
- Technical support and systems programming representatives

> *Design review participants consist of the other actors with a stake in the project.*

It is not necessary for each of these participants to be involved in each and every facet of every design review. A single application should be subjected to multiple design reviews—with each review focusing on a particular aspect of the application. The scope of each design review should be determined prior to the scheduling of the review so that only the appropriate participants are invited.

**Knowledge and Skills Required**

To be considered for a position on a design review team, candidates should be experienced in database development. It is best to form the design review team using participants who possess considerable skills and knowledge. The following criteria should be used to guide the formation of the design review team:

- Strong technical skills: technicians, programmers, and DBAs
- Strong communication skills: all participants
- Good interpersonal skills: all participants
- DBMS fundamentals: all participants to the degree required by their positions
- Background in data modeling and database design: in-depth knowledge for the DA and DBA; good knowledge for programmers and other technicians; some level of knowledge for all other participants
- Strong knowledge of SQL: technicians, programmers, and DBAs

Of course, not every team member will have all of these skills. However, make sure that each member of the design review team is an expert in his or her field of practice. For example, an IT manager may have limited expertise in SQL, but that should not exclude him from the design review team. The manager will contribute from his field of experience and should be chosen based on his exposure to the project and his skills as a manager.

> *Each member of the design review team should be an expert in his or her field of practice.*

Furthermore, you should strive to maintain the same members of the team throughout the ADLC. Since multiple design reviews are necessary, team member consistency will make design reviews easier because knowledge gained during past design reviews will carry over to subsequent design reviews.

**Types of Design Reviews**

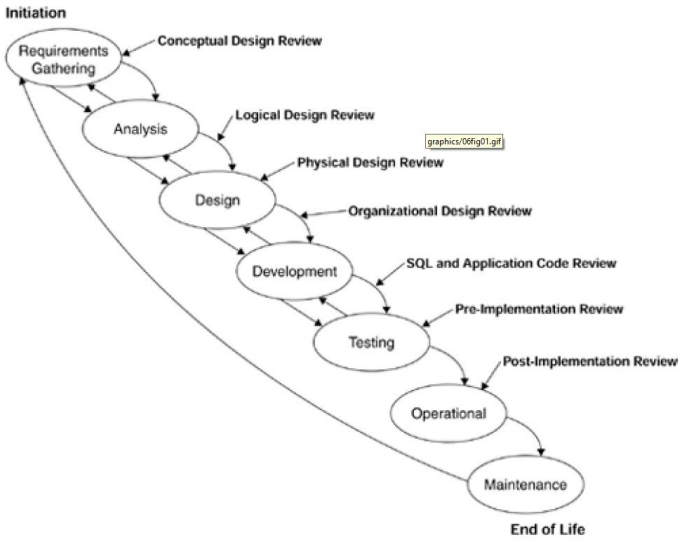
As previously mentioned, it is best to conduct several design reviews over the course of the ADLC. Multiple design reviews are preferable to a single large design review because it will allow errors and design flaws to be caught earlier in the development process while it is still possible and cost effective to fix the problems. Additionally, it is unreasonable to expect a single design review to be conducted at the end of the development process because too many details will need to be inspected and errors are more likely to fall through the cracks.

The following are the seven basic design review phases for a database application:

- Conceptual design review
- Logical design review
- Physical design review
- Organizational design review
- SQL and application code review
- Pre-implementation design review
- Post-implementation design review

Remember the rendering of the ADLC shown in Figure points out the relative point within the ADLC where each design review should be conducted.

Figure. Design reviews in the application development life cycle




**Conceptual Design Review**

The first review to be conducted is the conceptual design review. The purpose of this review is to validate the concept of the database and application. The conceptual design review begins with a presentation of an overall statement of purpose and a general overview of the desired functionality to be provided by the application.

*The conceptual design review validates the concept of the database and application.*

The conceptual design review should be conducted as early as possible in the application development lifecycle to determine the overall feasibility of the project. The findings of the conceptual review must verify the purpose of the application and the clarity of the vision for building the databases and supporting application programs.

In order to conduct a conceptual design review a conceptual data model must exist, as well as a high- level design for the application.

Failure to conduct a conceptual design review can result in

- Projects that provide duplicate or inadequate functionality
- Cancellation of projects due to lack of funds, inadequate staffing, poor planning, lack of user participation, or waning management interest
- Projects that run over-budget or take longer to complete than anticipated
- Applications that do not deliver the required features and functionality to support the business

The conceptual design review should have the participation of application development, data administration, and database administration staff; end users; and management representatives from the end user team and IT.

**Logical Design Review**

The logical design review follows the conceptual design review. It should be conducted when the first cut of the logical data model has been completed. A thorough review of all data elements, descriptions, and relationships should occur during this review. The logical design review should address the following questions:

- Has the logical data model been thoroughly examined to ensure that all of the required business functionality can be achieved?
- Is the model in (at least) third normal form?
- Have all of the data elements (entities and attributes) required for this application been identified?
- Have the data elements that have been identified been documented accurately?
- Have appropriate data types and accurate lengths been assigned for each attribute?
- Have all of the relationships been defined properly?

*The logical design review examines all data elements, descriptions, and relationships.*

The risk of failing to conduct a logical design review is a poorly designed database, which will likely cause data integrity problems. The logical design review helps to ensure that all required data has been identified, designed

properly, and fully documented. If changes are made to the logical data model after conducting a logical design review, additional logical design reviews should be scheduled as the project progresses.

Participants in the logical design review should be the same as participated in the conceptual design review. If at all possible, the exact same individuals should attend to maintain a level of consistency from review to review. By having the same participants, less up-front preparation will be required because everyone will already be knowledgeable about the purpose of the application and its high- level conceptual design.

**Physical Design Review**

The physical design review comes next—it's the review most often associated with the design review process. In the physical design review, the database is reviewed in detail to ensure that all of the proper database parameter settings and other physical design choices have been made. In addition, the DA and DBA should ensure that a proper translation from logical model to physical database has been made and that all denormalization decisions are formally documented.

> *The physical design review ensures that all of the proper database parameter settings and other physical design choices have been made.*

The overall operating environment for the application should be described and verified at this stage. The choice of transaction processor and a complete description of the online environment should be provided and verified. An estimation of workload, throughput, and number of concurrent users should be provided and reviewed to ensure that the anticipated requirements can be satisfied. Batch workload should also be reviewed; therefore, a complete description of any batch processes must be provided.

The physical design review may be conducted before all of the SQL that will be used for the application is available. However, general descriptions of all the processes are required to verify the proposed physical database design. Using the process descriptions, the database definitions can be fine-tuned. Furthermore, an initial estimate of whether denormalization could be helpful should be attempted at this point.

Portions of the physical database design may need to be reviewed again as the application development process progresses. Ensuring a valid physical design requires a lot of in-depth attention. As such, the review can be broken into discrete processes that can be repeated as changes are made to the database and the application. For example, as SQL statements are written, indexing requirements will change. As indexes are added, the decision making process should be reviewed to ensure that the indexes are viable for the entire application, not just for a single SQL statement.

Participants in the physical design review should include application development staff, data administration staff, database administration staff, online support representatives, and technical support personnel. If the application or database will affect other applications, or be used by other applications, then it would be wise to include representatives from those areas as well.

**Organizational Design Review**

Smaller in scope than the physical design review, but no less critical, is the organizational design review. This review examines the enterprisewide concerns of the organization with respect to the new application. The following are some common organizational design review questions:

- How does this system interact with other systems in the organization?
- Has the logical data model for this application been integrated with the enterprise data model (if one exists)?
- To what extent can this application share the data of other applications?
- To what extent can other applications share this application's data?
- How will this application integrate with the current production environment in terms of the DBMS resources required?
- Will the implementation of this application cause the batch window to be exceeded?
- Are the requirements of the application such that online response time or data availability are negatively impacted for other users?
- Will the implementation of this application cause the data processing needs of the shop to expand? For example, will more memory, CPU power, or storage be required?

> *The organizational design review gauges the impact of the application on the organization.*

Because the purpose of the organizational design review is to gauge the impact of the application on the organization, all the players listed in the Participants section above should attend this design review. Failure to include everyone could result in missing certain aspects of the application's impact on the organization because of ignorance or oversight.

**SQL and Application Code Design Review**

The SQL design review is a rigorous review of every SQL statement in the application. Each SQL statement must be reviewed for performance prior to the turnover to production of the application. The review must analyze each statement's access path, the indexes it uses, and possible alternate formulations—resulting in an overall assessment of how it is likely to perform.

*The SQL design review is a rigorous review of every SQL statement in the application.*

Every DBMS provides a command to show the access path that will be used for a SQL statement. Typically the command is called either EXPLAIN or SHOW PLAN, but I will use EXPLAIN as a generic term. Prior to the SQL design review, an EXPLAIN should be run for each SQL statement. It is important that the EXPLAIN command have access to production statistics. The results of the EXPLAIN statement should be analyzed to determine if the most efficient access paths have been chosen.

Furthermore, every program should be reviewed to validate that efficient programming language constructs were used. Although SQL is more likely to be the cause of poor relational performance, it is quite possible to code an inefficient program using COBOL, Visual Basic, C, or whatever language. For example, a very efficiently tuned SQL statement embedded in a loop within a C program might become very inefficient if that loop runs hundreds or thousands of times. Additional application and SQL performance issues are discussed in detail in Chapter 12.

Once again: Every line of code and SQL statement must be reviewed prior to implementation. The SQL and application design review is the appropriate venue for making suggestions for performance improvements prior to moving the application to a production status. Alternate formulations and indexing strategies can be suggested during this review and then tested to determine their impact. If better performance is achieved, the application code, SQL, or database design should be modified.

The application developers and DBA are mandatory participants in the application and SQL design review. Additional participants might include application development managers and perhaps technically savvy end users. In some cases, developers may feel more comfortable while their code is being reviewed if their managers are invited. Such an invitation can make it seem less like the DBA is picking apart months and months of the programmer's hard work. Of course, this decision should be made on a case-by-case basis depending on the developers' comfort level with their management, the personal interaction skills of the DBA, and the skill level of both the DBA and the programmers.

**Pre-Implementation Design Review**

A pre-implementation design review should be conducted immediately prior to the turning over of the application to production status. This review consists of an overall appraisal of the system components prior to implementation. Each participant must be prepared to discuss the status of any changes required to support the application once it moves to production. Loose ends existing from previous design reviews should be reviewed to verify that necessary modifications were made and tested. A quick, final review of each application component should be performed to make sure that new problems were not introduced as changes were made.

*The pre-implementation design review is an overall appraisal of the system components.*

Participants in the pre-implementation design review should include personnel from the application development staff, application development management representatives, database administration staff, online support representatives, and technical support personnel.

**Post-Implementation Design Review**

Finally, we come to the post-implementation design review. It is necessary to formally review the application once it has run in the production environment for a while to determine if the application is meeting its objectives, both in performance and in functionality. If any objective is not being met, a plan for addressing the deficiency must be proposed and acted on. Although daily performance monitoring of a new application is a must, it does not preclude the need for a formal postimplementation design review for all new application projects.

*A post-implementation design review determines if the application is meeting its objectives.*

Because any portion of the application may be a target for improvement, all the players listed in the Participants section of this chapter may be required to attend the post-implementation design review.

**Design Review Output**

Output from reviews should be clear and concise so that any required application, SQL, or database modifications can be made quickly and correctly. It is imperative that the scribe captures notes in sufficient detail that a nonattendee can make sense of the discussion. The scribe should edit the notes for grammar and spelling and distribute a copy to all attendees (preferably by e-mail).

Output from design reviews should be clear and concise so that any required modifications can be made quickly and correctly.

An additional result of each design review is a separate list of action items. This list should contain every modification or change discussed during the design review. Each action item should be given a deadline and be assigned to a single person, giving him or her the responsibility to make the change, test its impact, and report the progress back to the entire group.