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# System Design Essentials

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# Introduction to Modern System Design

Get an overview of the topics we'll cover in this module.

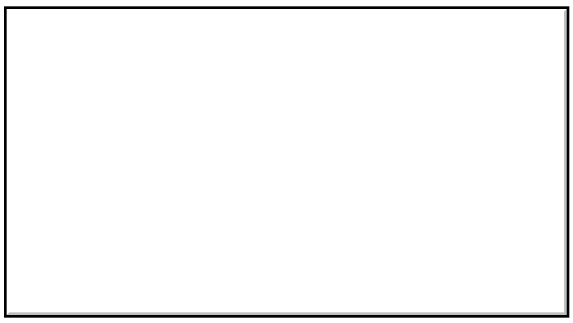
We'll cover the following



# What is system design?#

**System design** is the process of defining components and their integration, APIs, and data models to build large-scale systems that meet a specified set of functional and non-functional requirements.

System design uses the concepts of computer networking, parallel computing, and distributed systems to craft systems that scale well and are performant. Distributed systems scale well by nature. However, distributed systems are inherently complex. The discipline of system design helps us tame this complexity and get the work done.



System design aims to build systems that are reliable, effective, and maintainable, among other characteristics.

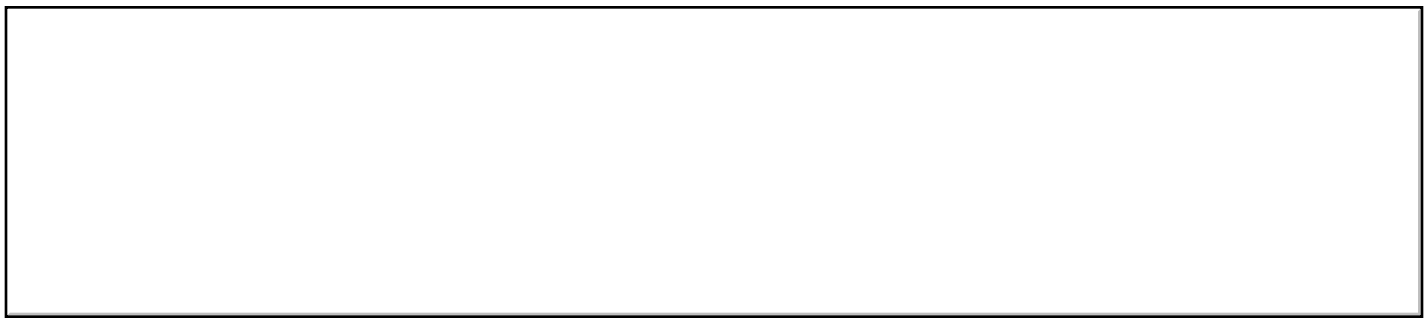
**Reliable systems** handle faults, failures, and errors.

- **Effective systems** meet all user needs and business requirements.
- **Maintainable systems** are flexible and easy to scale up or down. The ability to add new features also comes under the umbrella of maintainability.

# Modern system design using building blocks #

We have separated out commonly-used design elements, such as load balancers, as the basic building blocks for high-level system design. This serves two purposes. First, it allows us to discuss all the building blocks in detail and discuss their interesting mini-design problems. Second, when we tackle a design problem, we can concentrate on problem-specific aspects, mention the building block we'll use, and how we'll use it. This helps us remove duplicate discussions of commonly-occurring design elements.

We have identified sixteen building blocks that are crucial in designing modern systems.



Modern systems are designed using fundamental building blocks

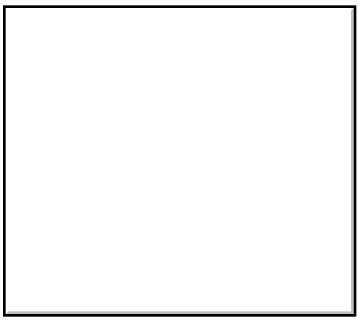
# About this module #

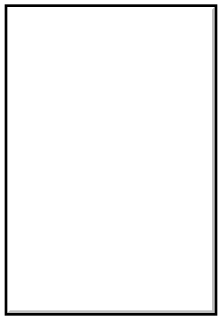
This module is about designing systems that scale with increasing users, remain available even under different faults, and meet functional goals with good performance. Real-world system building is an iterative process where we start with a reasonably good design, measure how it performs, and improve the design in the next iteration.

The focus of this module is to immerse ourselves into carefully-selected system design endeavors to enable ourselves to tackle any novel design problem, be it in a systems

design interview or a task at the office. This module aims to teach concepts instead of giving out boilerplate designs. Some gaps that this module aims to fill are listed below.

**A fresh look at system design:** Many system design courses provide a formula to attack a specific problem. This might seem attractive in a high-stress situation like an interview, but it might encourage memorizing a design solution instead of actually understanding the problem and devising an appropriate solution. If system design were that formulaic, then we probably wouldn't need people for system designing. System design is as much an art as it is a science, and attacking a design problem from the first principles gives a fresh feel to it.





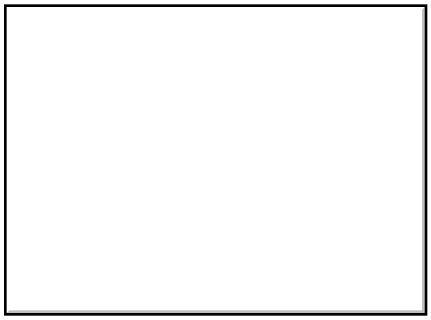
**Going deep and broad:** We tackle some traditional problems, but with added in-depth discussions on them. We give proper rationale for why we use some components despite their tradeoffs. For example, we explain why we use a particular database, a caching system, or a load balancing technique in a design.

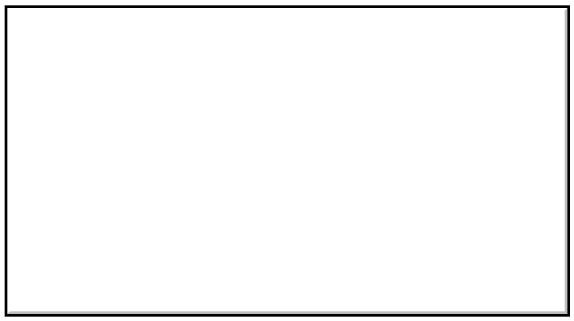
We address some new design problems as well that touch upon not only scalability but also availability, maintainability, consistency, and fault-

tolerance. Collectively, traditional and new problems cover all aspects of modern system design activity. Our hope is that this module prepares learners to effectively tackle any new design problem they encounter.

Real systems are complex and, often, we might need to make appropriate assumptions to properly scope a problem. We cover problems in more detail to properly grasp the real-world systems.

**Iterative process:** Systems, in reality, improve over iterations. We often start with something simple, but when bottlenecks arise in one or more of the system's parts, a new design becomes necessary. In some design problems, we make one design, identify bottlenecks, and improve on it. Working under time constraints might not permit iterations on the design. However, we still recommend two iterations—first, where we do our best to come up with a design (that takes about 80 percent of our time), and a second iteration for improvements. Another choice is to change things as we figure out new insights. Inevitably, we discover new details as we spend more time working with a problem.





**Interactive learning:** We provide ample opportunities to get experience with system design. Some design problems guide learners through many steps to design a system. We also have a few examples where the learner designs the full system end-to-end without any guided steps. We reinforce the important concepts by testing learners with questions and quizzes.

Next

Why Are Abstractions Important?

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