

# System Design Questions (With Answers)

This document contains all system design questions with detailed answers, tradeoffs, technologies, and strategies.

Generated on: 2025-06-16 17:43:58

## Overview

Total Questions: 120

### 1.

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['e-commerce', 'recommendation', 'collaborative-filtering', 'product-ranking']

#### Answer

No detailed answer provided.

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### 2.

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['search-engine', 'indexing', 'ranking', 'web-crawling']

#### Answer

No detailed answer provided.

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### 3.

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['recommendation', 'machine-learning', 'personalization', 'collaborative-filtering']

**Answer**

No detailed answer provided.

---

**4.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['music-recommendation', 'collaborative-filtering', 'audio-analysis', 'playlist-generation']

**Answer**

No detailed answer provided.

---

**5.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['recommendation', 'video-ranking', 'engagement-prediction', 'real-time-ml']

**Answer**

No detailed answer provided.

---

**6.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['video-recommendation', 'content-understanding', 'engagement-prediction']

**Answer**

No detailed answer provided.

---

**7.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['clickstream', 'user-analytics', 'behavioral-data', 'real-time-processing']

**Answer**

No detailed answer provided.

---

**8.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['computer-vision', 'autonomous-vehicles', 'real-time-processing', 'edge-computing']

**Answer**

No detailed answer provided.

---

**9.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['content-based-filtering', 'feature-extraction', 'similarity-matching']

**Answer**

No detailed answer provided.

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**10.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['data-lake', 'big-data', 'storage', 'analytics']

**Answer**

No detailed answer provided.

---

**11.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['etl', 'data-pipeline', 'batch-processing', 'data-transformation']

**Answer**

No detailed answer provided.

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**12.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['data-quality', 'monitoring', 'validation', 'data-governance']

**Answer**

No detailed answer provided.

---

**13.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['data-versioning', 'data-lineage', 'data-governance', 'metadata-management']

**Answer**

No detailed answer provided.

---

**14.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['data-warehouse', 'olap', 'columnar-storage', 'query-optimization']

**Answer**

No detailed answer provided.

---

**15.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['graph-processing', 'distributed-computing', 'graph-algorithms', 'big-data']

**Answer**

No detailed answer provided.

---

**16.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['distributed-training', 'ml-infrastructure', 'gpu-clusters', 'model-parallelism']

**Answer**

No detailed answer provided.

---

**17.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['feature-store', 'ml-infrastructure', 'feature-engineering', 'data-pipeline']

**Answer**

No detailed answer provided.

---

**18.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['experiment-tracking', 'ml-ops', 'model-versioning', 'reproducibility']

**Answer**

No detailed answer provided.

---

**19.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['model-monitoring', 'drift-detection', 'performance-tracking', 'ml-ops']

**Answer**

No detailed answer provided.

---

**20.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['ml-serving', 'model-deployment', 'inference', 'scalability']

**Answer**

No detailed answer provided.

---

**21.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['multi-tenancy', 'analytics', 'data-isolation', 'scalability']

**Answer**

No detailed answer provided.

---

**22.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['nlp', 'text-processing', 'sentiment-analysis', 'language-models']

**Answer**

No detailed answer provided.

---

**23.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['personalization', 'e-commerce', 'user-modeling', 'real-time-recommendations']

**Answer**

No detailed answer provided.

---

**24.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['real-time-analytics', 'data-processing', 'dashboard', 'metrics']

**Answer**

No detailed answer provided.

---

**25.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['anomaly-detection', 'real-time-ml', 'outlier-detection', 'monitoring']

**Answer**

No detailed answer provided.

---

**26.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['feature-engineering', 'real-time-processing', 'streaming', 'ml-pipeline']

**Answer**

No detailed answer provided.

---

**27.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['fraud-detection', 'real-time-ml', 'anomaly-detection', 'risk-scoring']

**Answer**

No detailed answer provided.

---



**28.**

**Category:** Data & AI/ML Systems

**Difficulty:** Hard

**Tags:** ['real-time-recommendations', 'e-commerce', 'personalization', 'ml']

**Answer**

No detailed answer provided.

---

**29.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['time-series', 'forecasting', 'anomaly-detection', 'trend-analysis']

**Answer**

No detailed answer provided.

---

**30.**

**Category:** Data & AI/ML Systems

**Difficulty:** Medium

**Tags:** ['ab-testing', 'experimentation', 'statistical-analysis', 'feature-flags']

**Answer**

No detailed answer provided.

---

**31.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['social-media', 'feed-generation', 'ranking', 'real-time']

**Answer**

No detailed answer provided.

---

**32.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['ci-cd', 'automation', 'deployment', 'testing']

**Answer**

No detailed answer provided.

---

**33.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['cdn', 'caching', 'global-distribution', 'edge-computing']

**Answer**

No detailed answer provided.

---

**34.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['monitoring', 'metrics', 'alerting', 'observability']

**Answer**

No detailed answer provided.

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**35.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['container-orchestration', 'kubernetes', 'scheduling', 'resource-management']

**Answer**

No detailed answer provided.

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**36.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['api-gateway', 'rate-limiting', 'authentication', 'load-balancing']

**Answer**

No detailed answer provided.

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**37.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['auto-scaling', 'resource-management', 'load-monitoring', 'elasticity']

**Answer**

No detailed answer provided.

---

**38.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['backup', 'disaster-recovery', 'replication', 'data-protection']

**Answer**

No detailed answer provided.

---

**39.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['distributed-cache', 'redis', 'sharding', 'replication']

**Answer**

No detailed answer provided.

---

**40.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['circuit-breaker', 'fault-tolerance', 'resilience', 'failure-handling']

**Answer**

No detailed answer provided.

---

**41.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['configuration-management', 'distributed-config', 'consistency']

**Answer**

No detailed answer provided.

---

**42.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['consensus', 'raft', 'distributed-systems', 'leader-election']

**Answer**

No detailed answer provided.

---

**43.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['distributed-database', 'nosql', 'consistency', 'partition-tolerance']

**Answer**

No detailed answer provided.

---

**44.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['event-sourcing', 'cqrs', 'event-store', 'eventual-consistency']

**Answer**

No detailed answer provided.

---

**45.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['distributed-storage', 'fault-tolerance', 'replication']

**Answer**

No detailed answer provided.

---

**46.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Easy

**Tags:** ['health-checks', 'service-discovery', 'monitoring', 'availability']

**Answer**

No detailed answer provided.

---

**47.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['job-queue', 'task-processing', 'worker-nodes', 'async-processing']

**Answer**

No detailed answer provided.

---

**48.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['distributed-locks', 'coordination', 'consensus', 'high-availability']

**Answer**

No detailed answer provided.

---

**49.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['logging', 'elasticsearch', 'log-aggregation', 'search']

**Answer**

No detailed answer provided.

---

**50.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['message-queue', 'kafka', 'streaming', 'pub-sub']

**Answer**

No detailed answer provided.

---

**51.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['metrics', 'monitoring', 'time-series', 'alerting']

**Answer**

No detailed answer provided.

---

**52.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['rate-limiting', 'throttling', 'distributed-systems', 'api-protection']

**Answer**

No detailed answer provided.

---

**53.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['distributed-search', 'indexing', 'sharding', 'full-text-search']

**Answer**

No detailed answer provided.

---

**54.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['secret-management', 'encryption', 'access-control', 'security']

**Answer**

No detailed answer provided.

---

**55.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['session-management', 'distributed-cache', 'user-sessions', 'scalability']

**Answer**

No detailed answer provided.

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**56.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['task-scheduling', 'workflow', 'dag', 'orchestration']

**Answer**

No detailed answer provided.

---

**57.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['distributed-tracing', 'observability', 'performance-monitoring']

**Answer**

No detailed answer provided.

---

**58.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Medium

**Tags:** ['load-balancing', 'traffic-distribution', 'health-checks']

**Answer**

No detailed answer provided.

---

**59.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['microservices', 'service-mesh', 'api-gateway', 'distributed-systems']

**Answer**

No detailed answer provided.

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**60.**

**Category:** Distributed Systems & Infrastructure

**Difficulty:** Hard

**Tags:** ['service-mesh', 'istio', 'traffic-management', 'security']

**Answer**

No detailed answer provided.

---

**61.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['booking-system', 'availability-management', 'payment-processing', 'two-sided-marketplace']

**Answer**

No detailed answer provided.

---

**62.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['cloud-storage', 'file-sync', 'collaboration', 'version-control']

**Answer**

No detailed answer provided.

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**63.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['cms', 'content-management', 'publishing', 'themes']

**Answer**

No detailed answer provided.

---

**64.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['customer-support', 'ticketing', 'knowledge-base', 'automation']

**Answer**

No detailed answer provided.

---

**65.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['dating-app', 'matching-algorithm', 'geolocation', 'user-preferences']

**Answer**

No detailed answer provided.

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**66.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['digital-wallet', 'payments', 'financial-services', 'security']

**Answer**

No detailed answer provided.

---

**67.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['event-ticketing', 'payments', 'event-management', 'qr-codes']

**Answer**

No detailed answer provided.

---

**68.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['financial-trading', 'real-time-data', 'order-execution', 'portfolio-management']

**Answer**

No detailed answer provided.

---

**69.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['fitness-tracking', 'wearables', 'health-data', 'social-features']

**Answer**

No detailed answer provided.

---

**70.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['food-delivery', 'three-sided-marketplace', 'logistics', 'real-time-tracking']

**Answer**

No detailed answer provided.

---

**71.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['freelancer-platform', 'matching', 'payments', 'project-management']

**Answer**

No detailed answer provided.

---

**72.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['telemedicine', 'video-consultation', 'patient-records', 'scheduling']

**Answer**

No detailed answer provided.

---

**73.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['hotel-booking', 'availability', 'pricing', 'reviews']

**Answer**

No detailed answer provided.

---

**74.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['inventory', 'supply-chain', 'tracking', 'optimization']

**Answer**

No detailed answer provided.

---

**75.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['e-learning', 'course-management', 'video-streaming', 'assessment']

**Answer**

No detailed answer provided.

---

**76.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['marketplace', 'auctions', 'payments', 'trust-safety']

**Answer**

No detailed answer provided.

---

**77.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['mvp', 'scalability', 'startup-architecture', 'cost-optimization']

**Answer**

No detailed answer provided.

---

**78.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['multi-tenancy', 'saas', 'data-isolation', 'scalability']

**Answer**

No detailed answer provided.

---

**79.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['news-aggregation', 'voting', 'communities', 'content-ranking']

**Answer**

No detailed answer provided.

---

**80.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['password-manager', 'encryption', 'security', 'sync']

**Answer**

No detailed answer provided.

---

**81.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['photo-storage', 'image-recognition', 'search', 'sharing']

**Answer**

No detailed answer provided.

---

**82.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['professional-networking', 'job-matching', 'content-feed', 'messaging']

**Answer**

No detailed answer provided.

---

**83.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['project-management', 'issue-tracking', 'workflow', 'reporting']

**Answer**

No detailed answer provided.

---



**84.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['real-estate', 'property-search', 'valuation', 'marketplace']

**Answer**

No detailed answer provided.

---

**85.**

**Category:** Product & Platform Systems

**Difficulty:** Easy

**Tags:** ['recipe-sharing', 'social-features', 'search', 'user-generated-content']

**Answer**

No detailed answer provided.

---

**86.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['ride-sharing', 'two-sided-marketplace', 'matching-algorithm', 'pricing']

**Answer**

No detailed answer provided.

---

**87.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['social-media', 'photo-sharing', 'feed-generation', 'content-moderation']

**Answer**

No detailed answer provided.

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**88.**

**Category:** Product & Platform Systems

**Difficulty:** Medium

**Tags:** ['subscriptions', 'billing', 'recurring-payments', 'customer-management']

**Answer**

No detailed answer provided.

---

**89.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['video-streaming', 'content-delivery', 'recommendation', 'adaptive-bitrate']

**Answer**

No detailed answer provided.

---

**90.**

**Category:** Product & Platform Systems

**Difficulty:** Hard

**Tags:** ['e-commerce', 'inventory-management', 'payment-processing', 'order-fulfillment']

**Answer**

No detailed answer provided.

---

**91.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['voice-chat', 'text-chat', 'gaming', 'real-time-communication']

**Answer**

No detailed answer provided.

---

**92.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['team-messaging', 'channels', 'real-time', 'collaboration']

**Answer**

No detailed answer provided.

---

**93.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['live-streaming', 'video-processing', 'chat', 'content-delivery']

**Answer**

No detailed answer provided.

---

**94.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['real-time-feed', 'social-media', 'timeline-generation', 'fanout']

**Answer**

No detailed answer provided.

---

**95.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['real-time-matching', 'geospatial', 'optimization', 'location-services']

**Answer**

No detailed answer provided.

---

**96.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['messaging', 'real-time', 'end-to-end-encryption', 'group-chat']

**Answer**

No detailed answer provided.

---

**97.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['video-conferencing', 'real-time-communication', 'media-streaming', 'webrtc']

**Answer**

No detailed answer provided.

---

**98.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['live-sports', 'real-time-updates', 'data-ingestion', 'push-notifications']

**Answer**

No detailed answer provided.

---

**99.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['iot', 'sensor-data', 'real-time-processing', 'edge-computing']

**Answer**

No detailed answer provided.

---

**100.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['auction-system', 'bidding', 'real-time-updates', 'payment-processing']

**Answer**

No detailed answer provided.

---

**101.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['content-moderation', 'real-time-processing', 'ml', 'safety']

**Answer**

No detailed answer provided.

---

**102.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['collaborative-editing', 'code-editor', 'real-time-sync', 'conflict-resolution']

**Answer**

No detailed answer provided.

---

**103.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['collaborative-editing', 'operational-transform', 'conflict-resolution', 'real-time-sync']

**Answer**

No detailed answer provided.

---

**104.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['collaborative-editing', 'real-time-sync', 'drawing', 'conflict-resolution']

**Answer**

No detailed answer provided.

---

**105.**

**Category:** Real-time & Communication Systems

**Difficulty:** Easy

**Tags:** ['comments', 'real-time-updates', 'moderation', 'social-features']

**Answer**

No detailed answer provided.

---

**106.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['real-time-dashboard', 'data-visualization', 'streaming', 'analytics']

**Answer**

No detailed answer provided.

---

**107.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['delivery-tracking', 'real-time-location', 'logistics', 'notifications']

**Answer**

No detailed answer provided.

---

**108.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['event-streaming', 'real-time-processing', 'pub-sub', 'kafka']

**Answer**

No detailed answer provided.

---

**109.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['fraud-detection', 'real-time-ml', 'payments', 'risk-scoring']

**Answer**

No detailed answer provided.

---

**110.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['leaderboard', 'real-time-updates', 'ranking', 'gaming']

**Answer**

No detailed answer provided.

---

**111.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['location-tracking', 'gps', 'real-time-updates', 'geofencing']

**Answer**

No detailed answer provided.

---



**112.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['multiplayer-gaming', 'real-time-sync', 'game-state', 'latency-optimization']

**Answer**

No detailed answer provided.

---

**113.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['notifications', 'push-notifications', 'real-time', 'messaging']

**Answer**

No detailed answer provided.

---

**114.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['polling', 'voting', 'real-time-results', 'aggregation']

**Answer**

No detailed answer provided.

---

**115.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['presence', 'online-status', 'real-time-updates', 'user-activity']

**Answer**

No detailed answer provided.

---

**116.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['price-monitoring', 'real-time-updates', 'alerts', 'e-commerce']

**Answer**

No detailed answer provided.

---

**117.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['real-time-recommendations', 'personalization', 'streaming', 'ml']

**Answer**

No detailed answer provided.

---

**118.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['social-feed', 'real-time-updates', 'personalization', 'content-ranking']

**Answer**

No detailed answer provided.

---

**119.**

**Category:** Real-time & Communication Systems

**Difficulty:** Hard

**Tags:** ['stock-trading', 'real-time-data', 'order-matching', 'market-data']

**Answer**

No detailed answer provided.

---

**120.**

**Category:** Real-time & Communication Systems

**Difficulty:** Medium

**Tags:** ['weather-monitoring', 'sensor-networks', 'data-aggregation', 'forecasting']

**Answer**

No detailed answer provided.

---