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Cache Me If You Can

Supercharging .NET APIs with Caching

Jonathan “J.” Tower


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Speed Up Your **.NET** Web API with **Redis** Caching

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bit.ly/th-offer

https://github.com/trailheadtechnology/redis-aspnet-core

Overview

- Definitions
  - Caching
  - Redis
- Why Use Caching
- Getting Started in ASP.NET Core
  - StackExchange.Redis
  - ServiceStack.Redis
- The Redis Command Line Interface
- ASP.NET Core Redis Demo
  - ConnectionMultiplexer
  - IDistributedCache
- Common Mistakes

What is Caching?


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CODE
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What is Caching?

Temporarily storing **frequently accessed** data to **fast storage** that's located **close** to the application

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What is Redis?

What is Redis?

- The **open source**, **in-memory data store** used by millions of developers as a database, cache, streaming engine, and message broker.

- **RE**mote **DI**ctionary **S**erver

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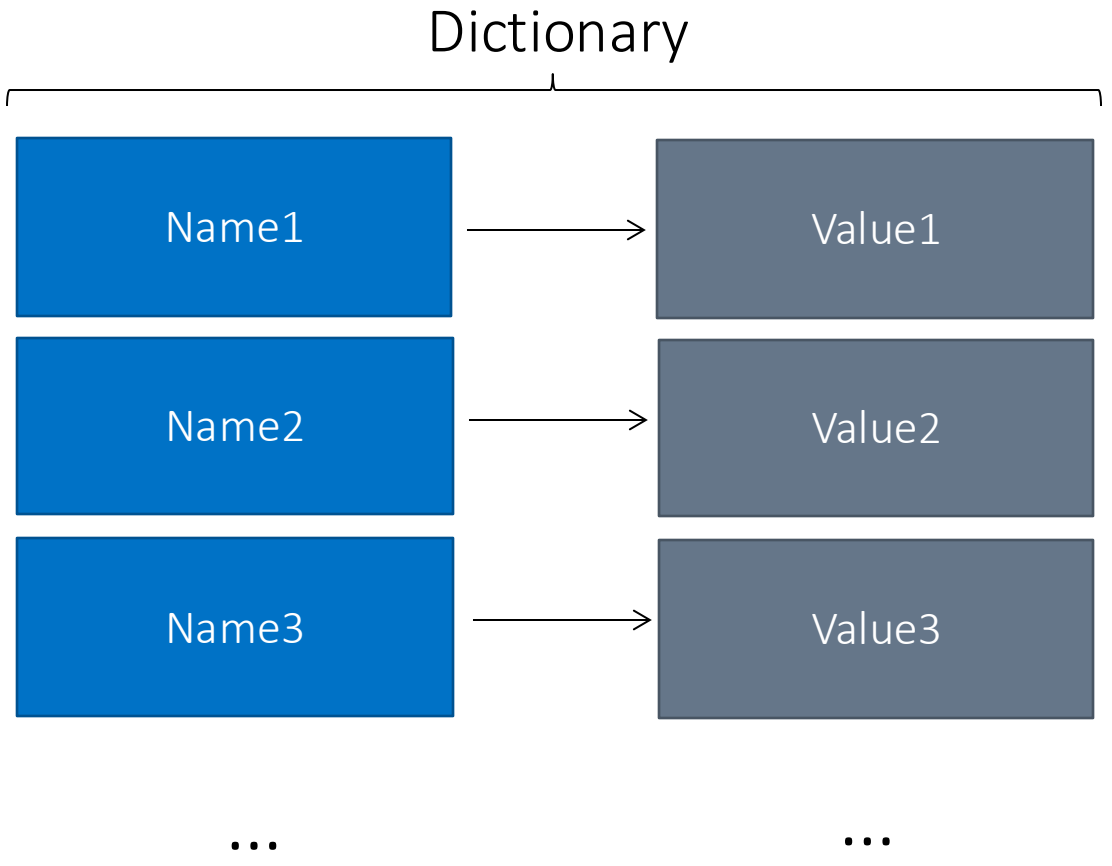
Redis: An In-Memory Dictionary

- Dictionary:
  An **unordered collection** of data represented by a set of **key-value pairs**



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Redis is Not a Relational DB

- Key/Value pairs
- Size limit
- In-memory
- Invalidation/expiration

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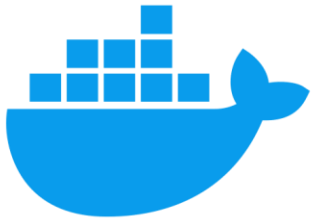
Redis Data Eviction Policy

Redis Hosting Options

Self-Host



WSL2

Host in Managed Cloud

Google Cloud

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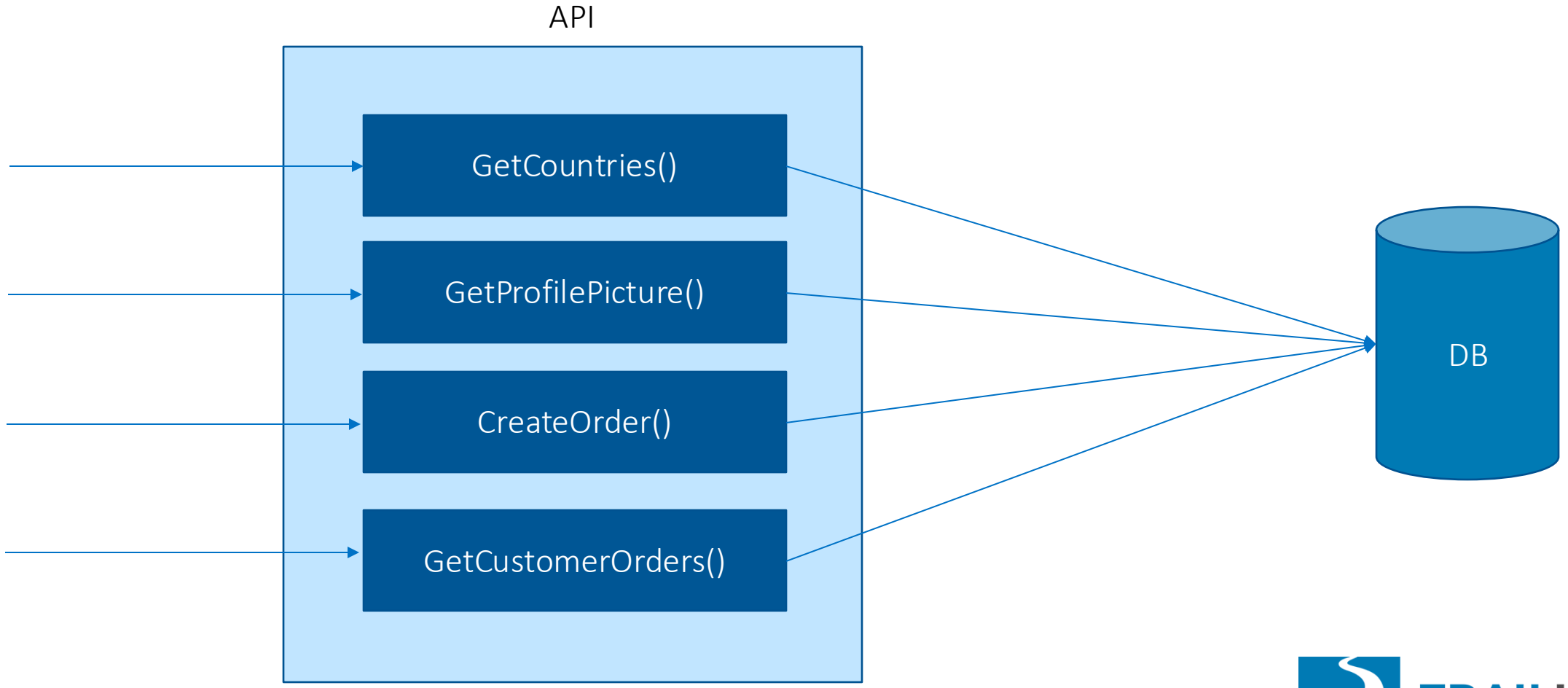
Redis SKUs

		Redis Open Source	Redis Enterprise
Build	Boost app performance with Redis cache	●	●
	Support enterprise caching (read replica, write-behind, write-through)		●
	Build any real-time app on Redis with extended data model and processing engines support (JSON, search, time series, graph)		●
	Rapid development with out-of-the-box object mapping libraries for Spring, ASP.NET Core, FastAPI, and Express		●
	Redis GUI with predefined developer guides and tools	●	●
Deploy	Fully supported deployment on-premise or hybrid cloud		●
	Automated deployment on any cloud or multicloud		●
	Ingest data from external data sources with RedisConnect		●
Run	Deliver consistent real-time customer experience globally with geo-distributed Redis		●
	Automated database and cluster management (scaling, re-sharding, rebalancing)		●
	Built-in high-availability and disaster recovery management		●
	Enterprise-grade customer support from the creators of Redis		●

Why Use Caching?

Caching Sample



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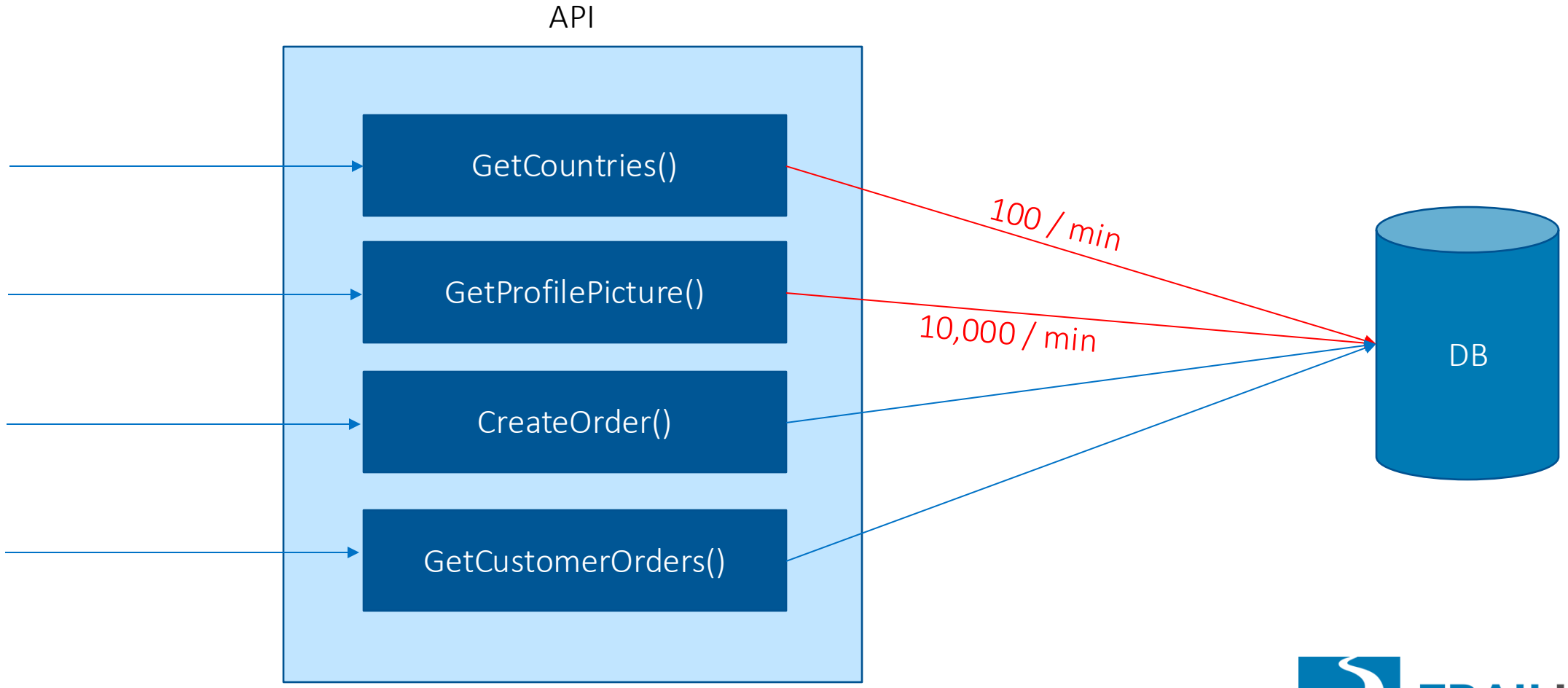
Caching Sample



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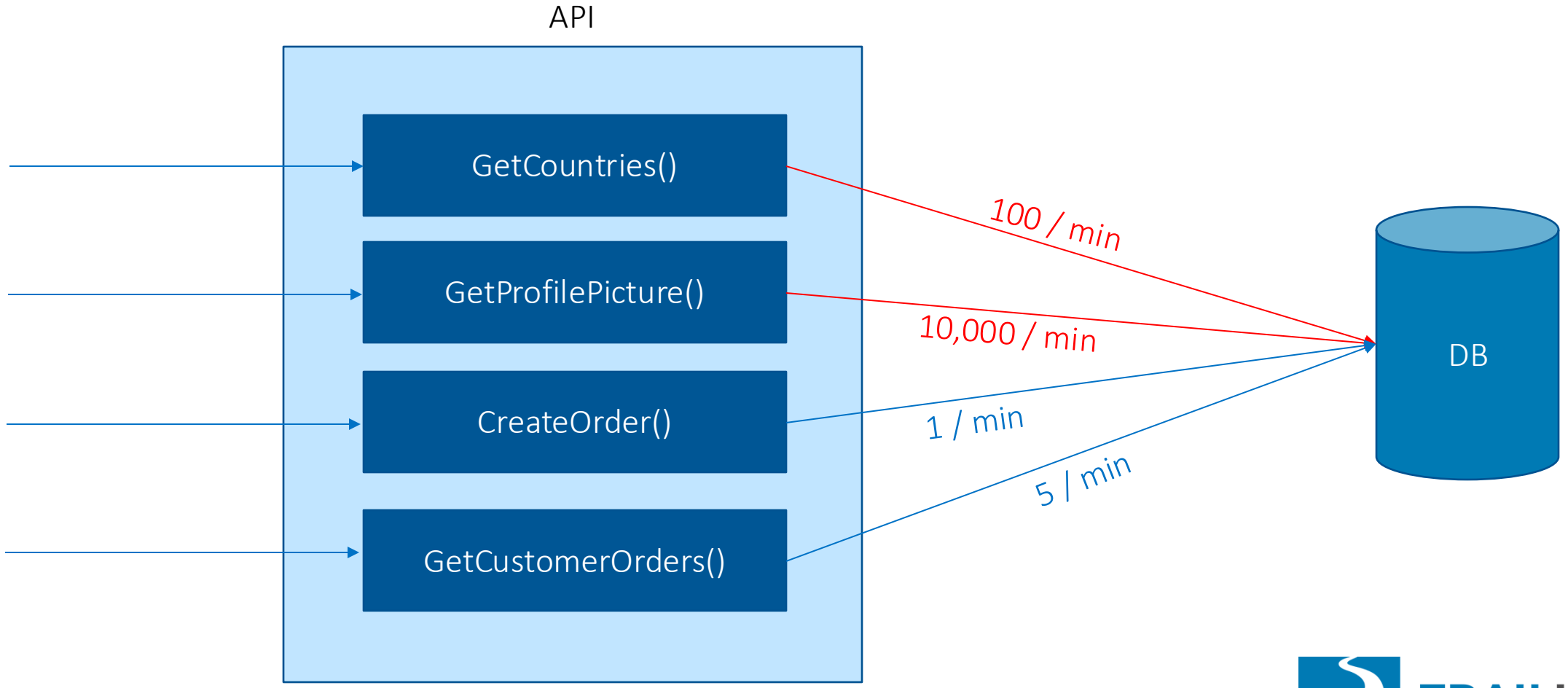
Caching Sample



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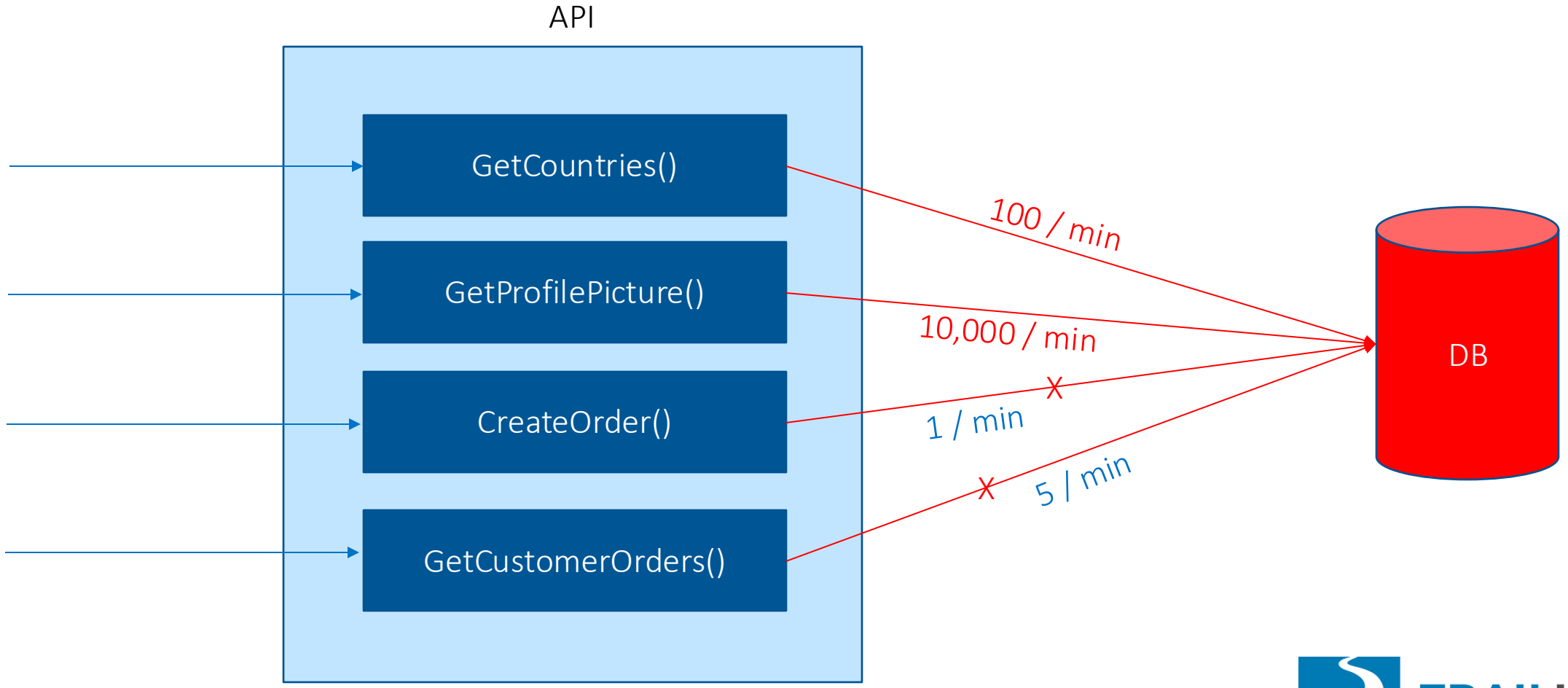
Caching Sample



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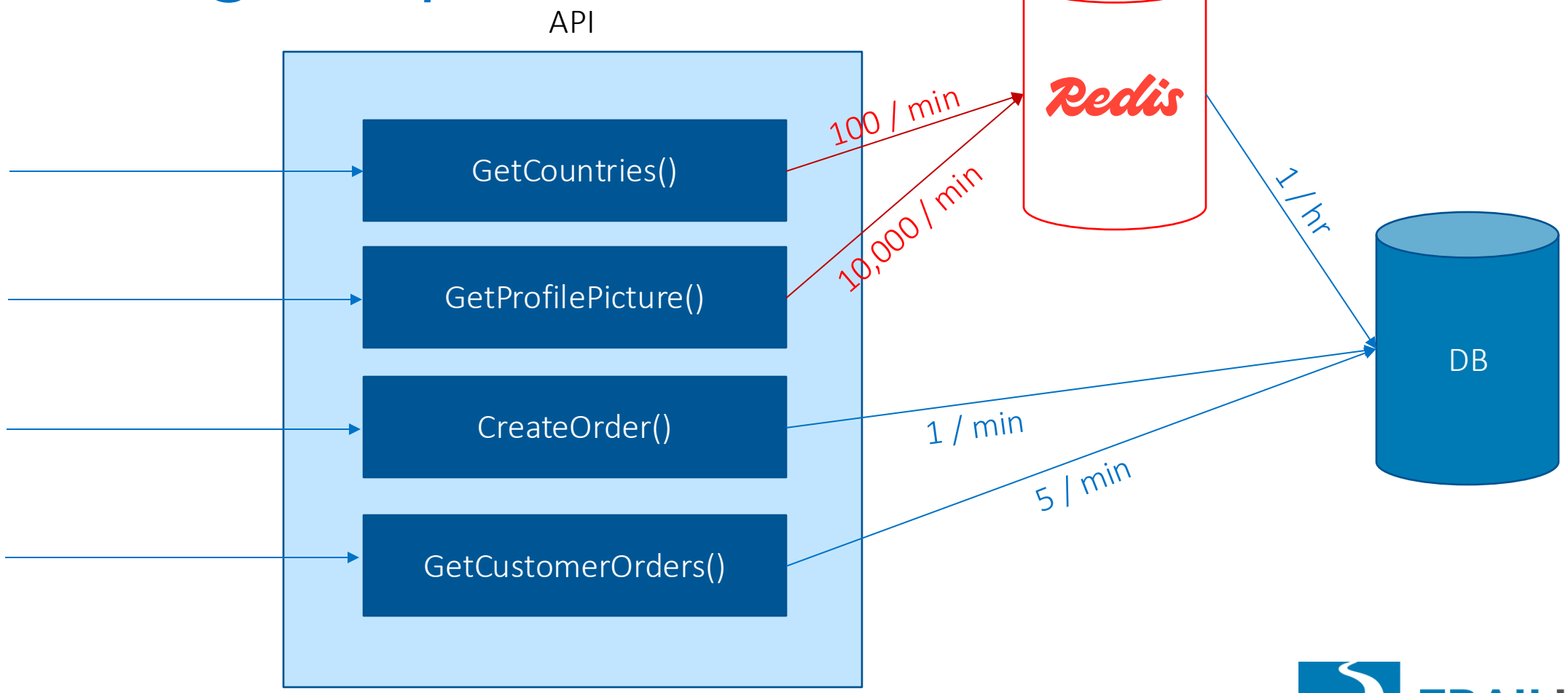
Caching Sample



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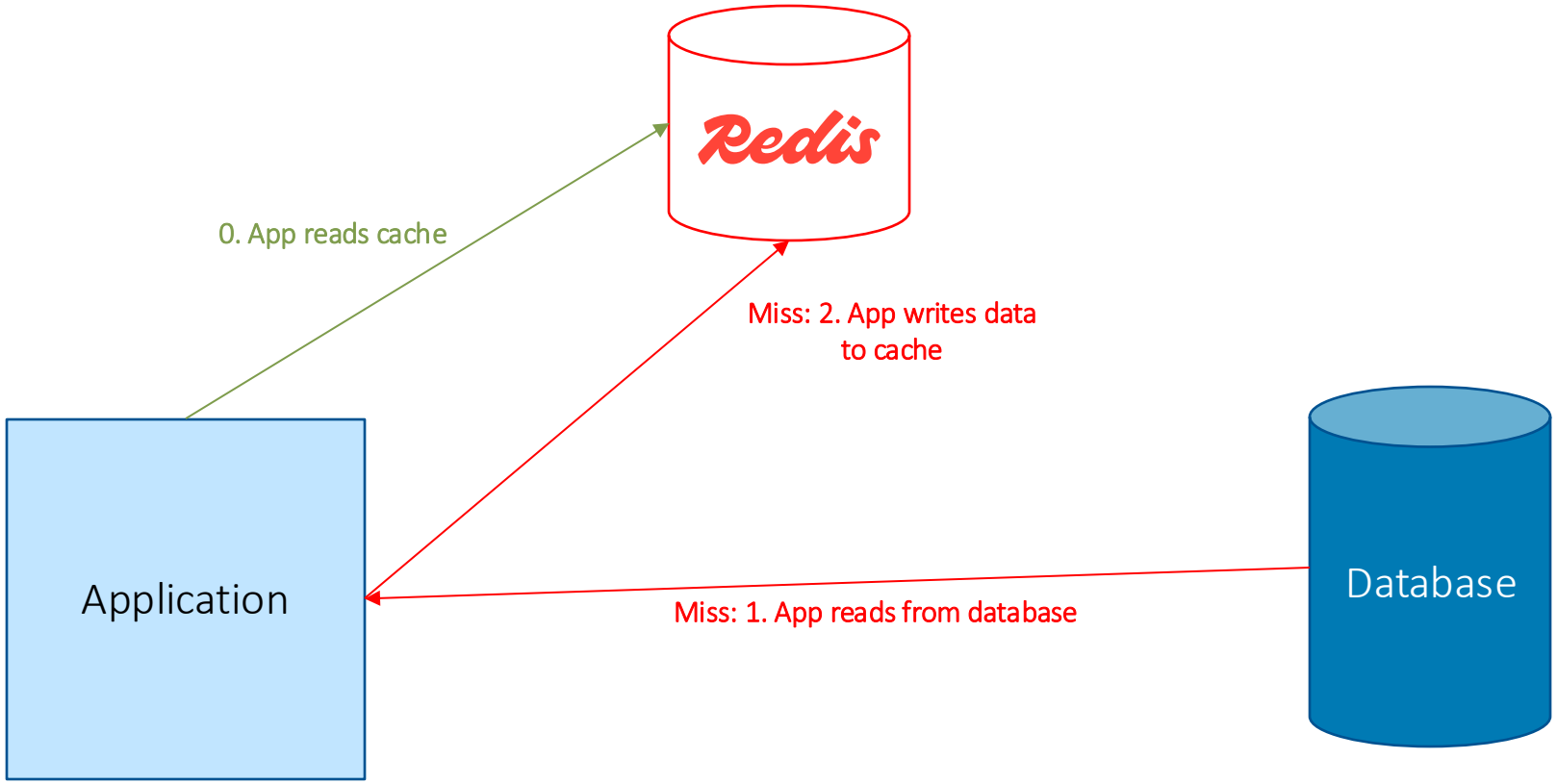
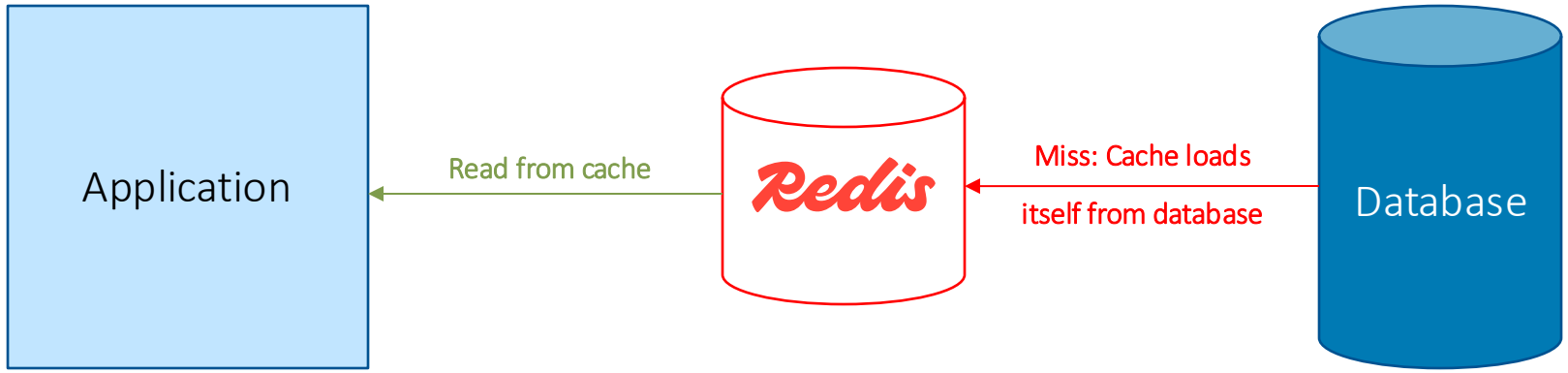
Caching Strategies

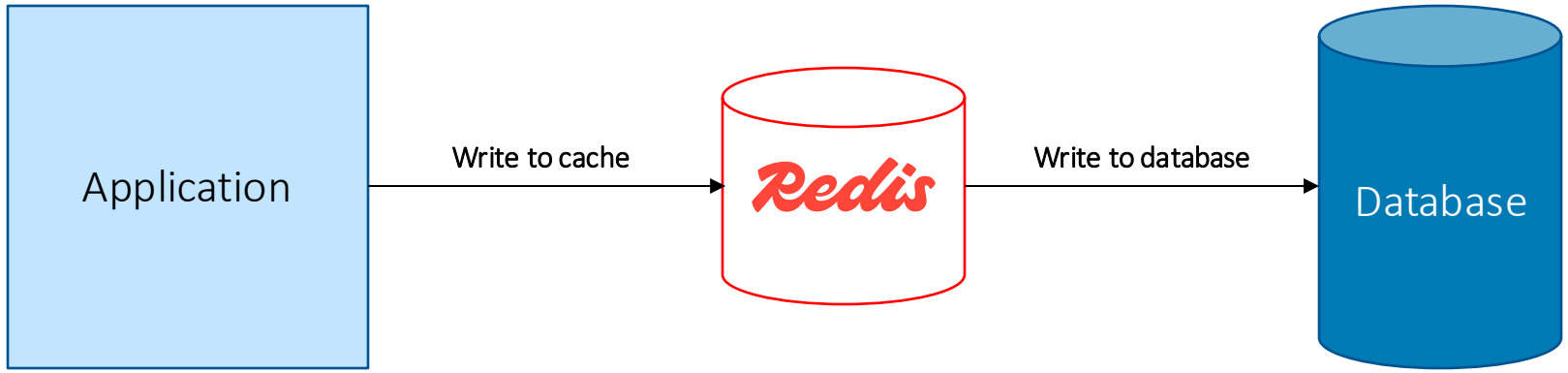
Cache-Aside


Redis
0. App reads cache
Miss: 2. App writes data
to cache
Application
Database
Miss: 1. App reads from database

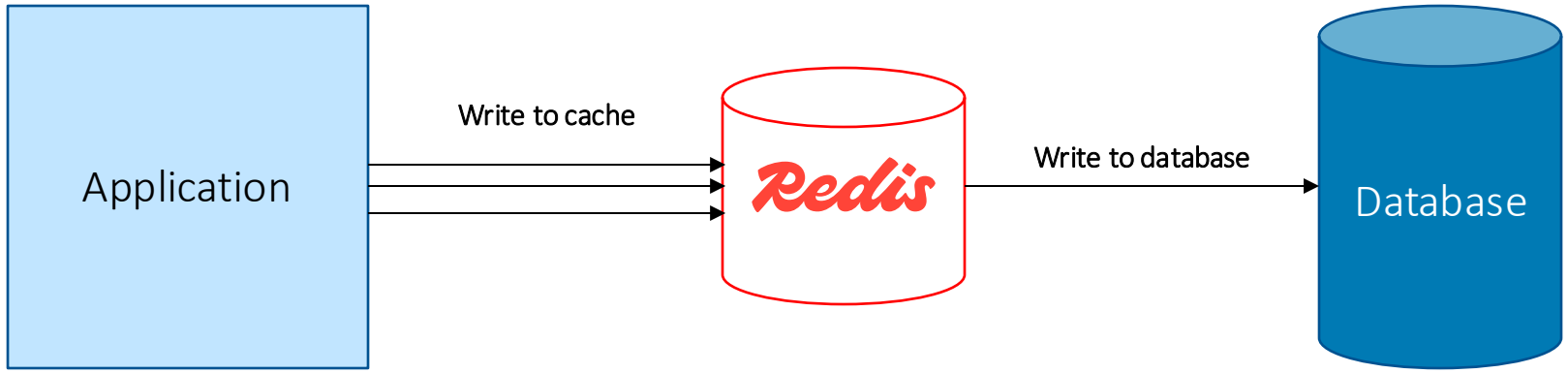
Read-Through



Write-Through



Write-Behind (or Write-Back)



Getting Started

Adding Redis to Your ASP.NET Core Project

Dev Env Install

Windows *Enable/install WSL2 (pre-req)*

```
sudo apt-get install redis
```

Mac

```
brew install redis
```

Linux

```
sudo apt-get install redis
```

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Deploying Redis

- On-prem or VM (No additional cost)
- Dockerized Redis (No additional cost)
- Managed Redis ($5+/ mo)
  - Redis Cloud
  - AWS ElastiCache for Redis
  - Azure Cache for Redis
  - Google Memorystore

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Adding Redis to ASP.NET Core

- Add StackExchange.Redis nuget package

- Either:
  - Wrapper for SINGLE instance of ConnectionMultiplexer
  - IDistributedCache through builder.Services.AddStackExchangeRedisCache(…)

StackExchange.Redis vs ServiceStack.Redis

	StackExchange.Redis	ServiceStack.Redis
Cost	Free	$300 - $1,000 / dev
Support	None	Commercial Support

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DEMO

Redis Command Line Interface (CLI)

DEMO

User Profile Images

Redis API vs IDistributedCache

- Microsoft.Extensions.Caching.StackExchangeRedis nuget package

```
builder.Services.AddStackExchangeRedisCache(options =>
{
    options.Configuration = "127.0.0.1:6379,allowAdmin=true";
    options.InstanceName = "dev-redis:";
});
```

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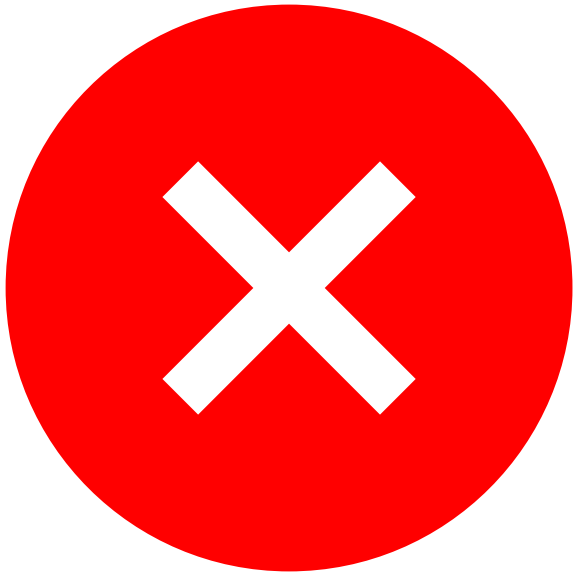
Common Mistakes

With Redis Caching

Too Many ConnectionMultiplexers

```
var app = builder.Build();
app.MapGet("/", (ICacheService cache) => {
    using (var redis = ConnectionMultiplexer.Connect("localhost"))
    {
        var db = redis.GetDatabase();
        return db.StringGet(key);
    }
});
app.Run();
```



Too Many ConnectionMultiplexers

```
builder.Services.AddScoped<ICacheService, CacheService>();

var app = builder.Build();
app.MapGet("/", (ICacheService cache) => cache.GetCachedValue("foo"));
app.Run();
```

Not Using a Password

redis.conf

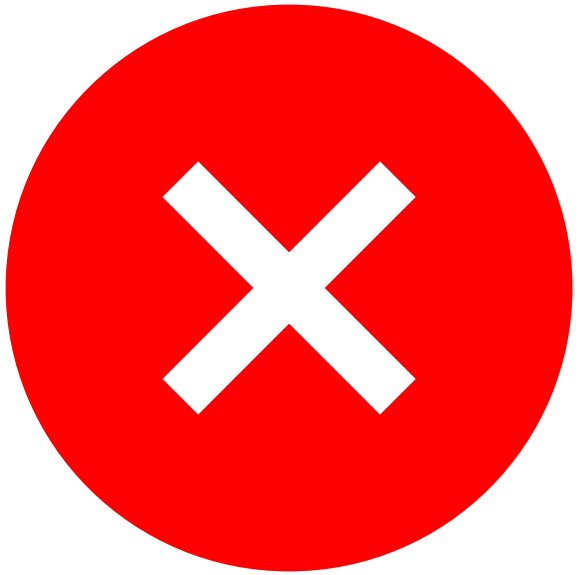
```
requirepass your_redis_password
```

code.cs

```
var redis = ConnectionMultiplexer.Connect(
    "servername:6379,password=your_redis_password");
```

Not Expecting Cache Misses

```
var cachedUser = db.StringGet($"user:{userId}");
return JsonConvert.DeserializeObject<User>(cachedUser);
```

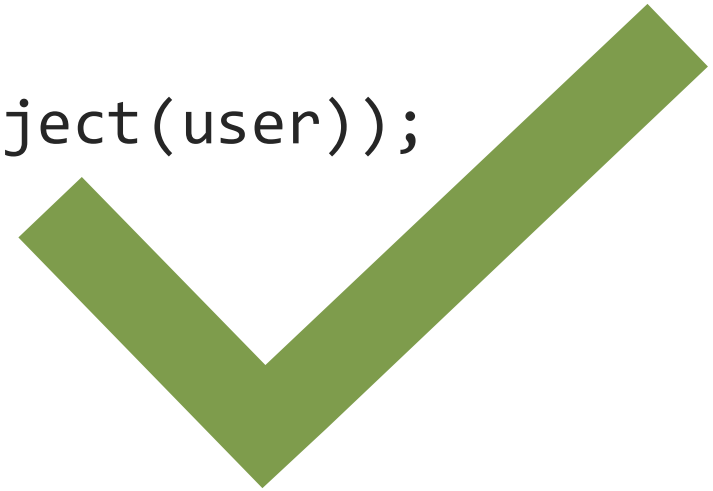


Not Expecting Cache Misses

```
var json = db.StringGet($"user:{userId}");
var user = !json.IsNullOrEmpty
    ? JsonConvert.DeserializeObject<User>(json)
    : _userRepository.GetUserById(userId);

if (json.IsNullOrEmpty && user != null)
    db.StringSet(key, JsonConvert.SerializeObject(user));

return user;
```

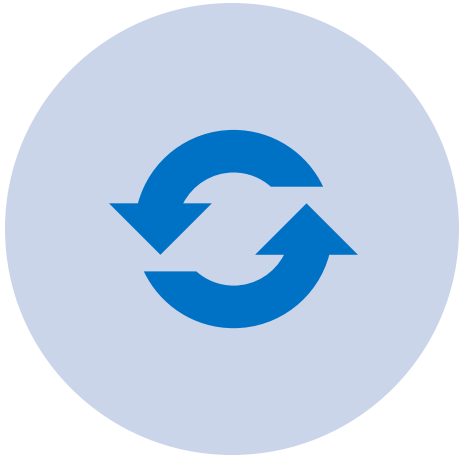


Caching Infrequently-Accessed Data

USES LIMITED STORAGE

LIMITED IMPACT ON PERFORMANCE

Caching Frequently-Changing Data



HIGH CHURN

NEGATIVE IMPACT ON PERFORMANCE

Not Having a Key Naming Convention

- Use colon (:) to separate items:
  - `namespace:object-type:id:field`
- Examples:
  - *user:1000:password*
  - *comment:1234:replyto*
- Optionally use # for ids
  - *logistics:building#23*

Not Setting Expiration (TTL)

- Memory bloat
- Stale or outdated data

- TTL & Programmatically Invalidate

```
db.StringSet("user:123:name", "...", TimeSpan.FromMinutes(30));

db.KeyDelete("user:123:name");
```

Over-Serialization

```
[MessagePackObject]
public class UserProfile
{
    [Key(0)]
    public int Id { get; set; }

    [Key(1)]
    public string Name { get; set; }
}

await redisDatabase.StringSetAsync("user:1", MessagePackSerializer.Serialize(
  new UserProfile { ... }));

var profile = MessagePackSerializer.Deserialize<UserProfile>(
  await redisDatabase.StringGetAsync("user:1"));
```

Summing Up

1. Using Redis correctly can speed up your application and take load off your database
2. Host Redis wherever you want (on-prem, cloud, etc)
3. Use StackExchange SDK for free or ServiceStack for commercial support
4. ConnectionMultiplexer or IDistributedCache

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Recap

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Thank You! Questions?

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