# Why Database Matters In Card Fraud Detection

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BARCLAYS

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Enterprise Architect [Fraud]

# Introduction

## Barclays

- Is 329 year old Bank (1690); it is older than the UK Itself
- Moves, lends, invests and protects money for customers and clients worldwide
- Offers Banking, Cards, Corporate Banking, Insurance, Markets, Mortgages, Payments Acceptance, Ecommerce, Wealth & Investment Management …
- Financial Innovation

## Dheeraj Mudgil

- Enterprise / Solutions Architect with software engineering background
- 20+ years in the Industry mainly in Financial sector
- Working with Barclays in Chief Technology Office
- Architecture owner for the Fraud Platform

# Question

How much data we generate today?

# Trends - General

- Devices
- New Channels

- Social Media & Info Sharing
- Innovative Products

- Automation
- Desire to release products fast

→

- Software Complexity
- Vulnerabilities

# Trends – Customer

- Customer Patience
- Instant / on-demand

- Loyalty towards Product
  - ➢ Enabler – Options/Choices

- CX Expectations
- Expects protection from Loss

- Complex customer needs
- Complex customer behaviour

# Trends – Fraud & Fraudster

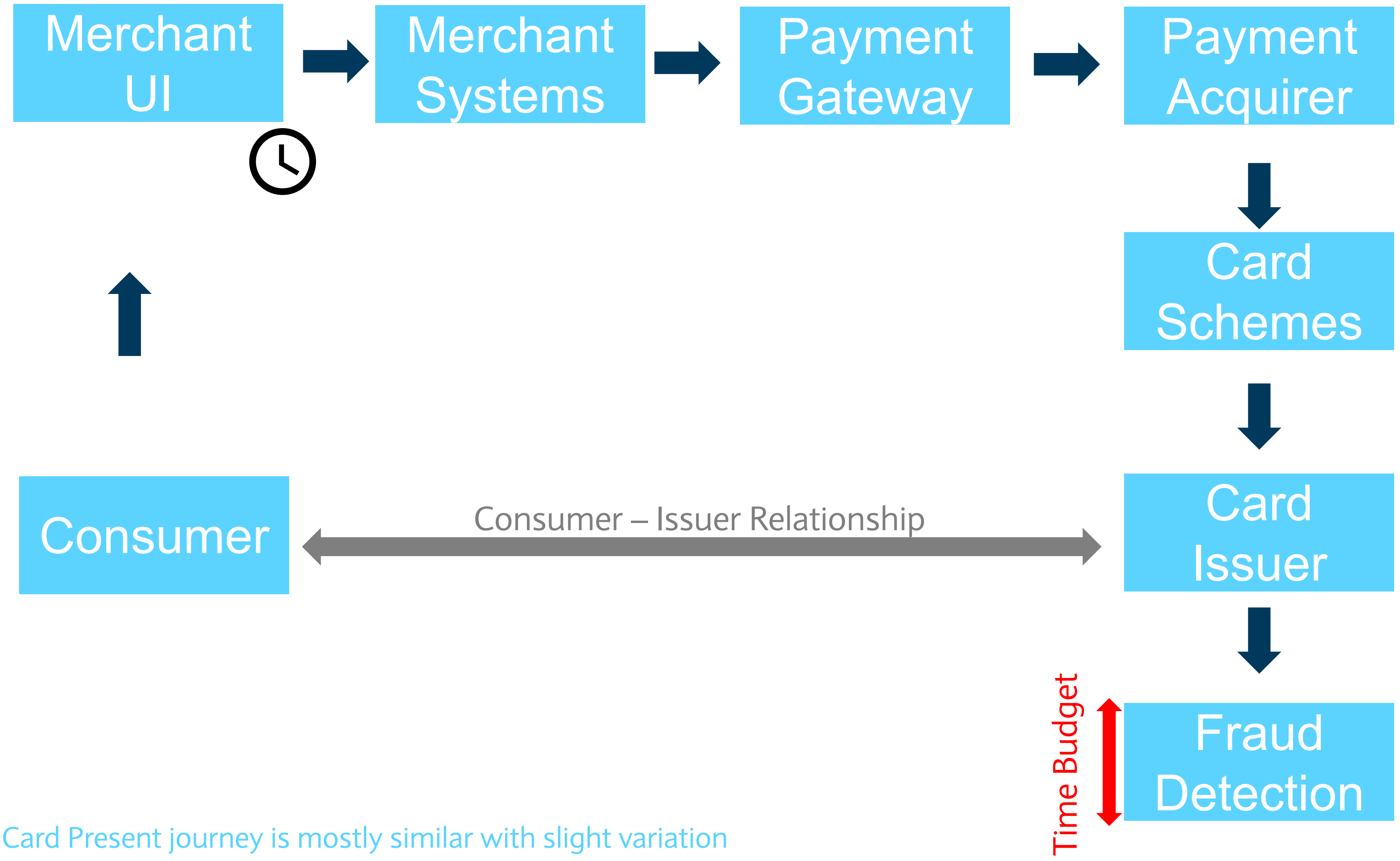
- Barrier to HPC
  - ➢ Enabler - Cloud

- Barriers to collect Info
  - ➢ Enabler – Social Media Platforms

- Sophistication of Fraud Techniques
- Fraud supply chain – more organised

- Subtlety of Fraud
- Complex fraudster behaviour

# Typical Card Payment Journey (Card Not Present)



Merchant UI

Merchant Systems

Payment Gateway

Payment Acquirer

Card Schemes

Card Issuer

Fraud Detection

Consumer

Consumer – Issuer Relationship

Time Budget

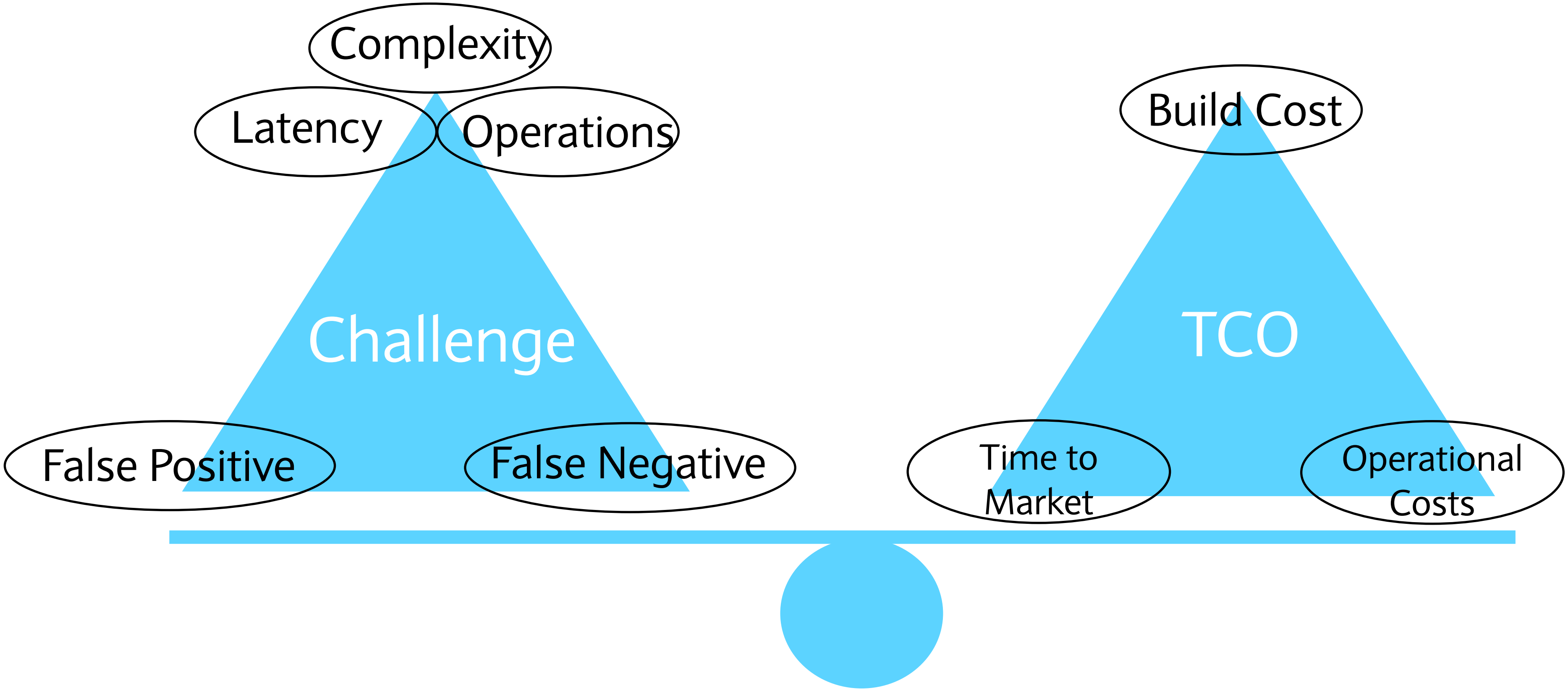
* Card Present journey is mostly similar with slight variation

# Use-Case Analysis

- Consumer - Swift Checkout & Fraud Protection
- Merchant - Fast Approval & Zero declines
- Issuer – Encourage Card usage & Protect Fraud losses

Key Characteristics:

- Latency Sensitive
- Complex Processing Rules
- Large Datasets
- Consistency



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unrestricted

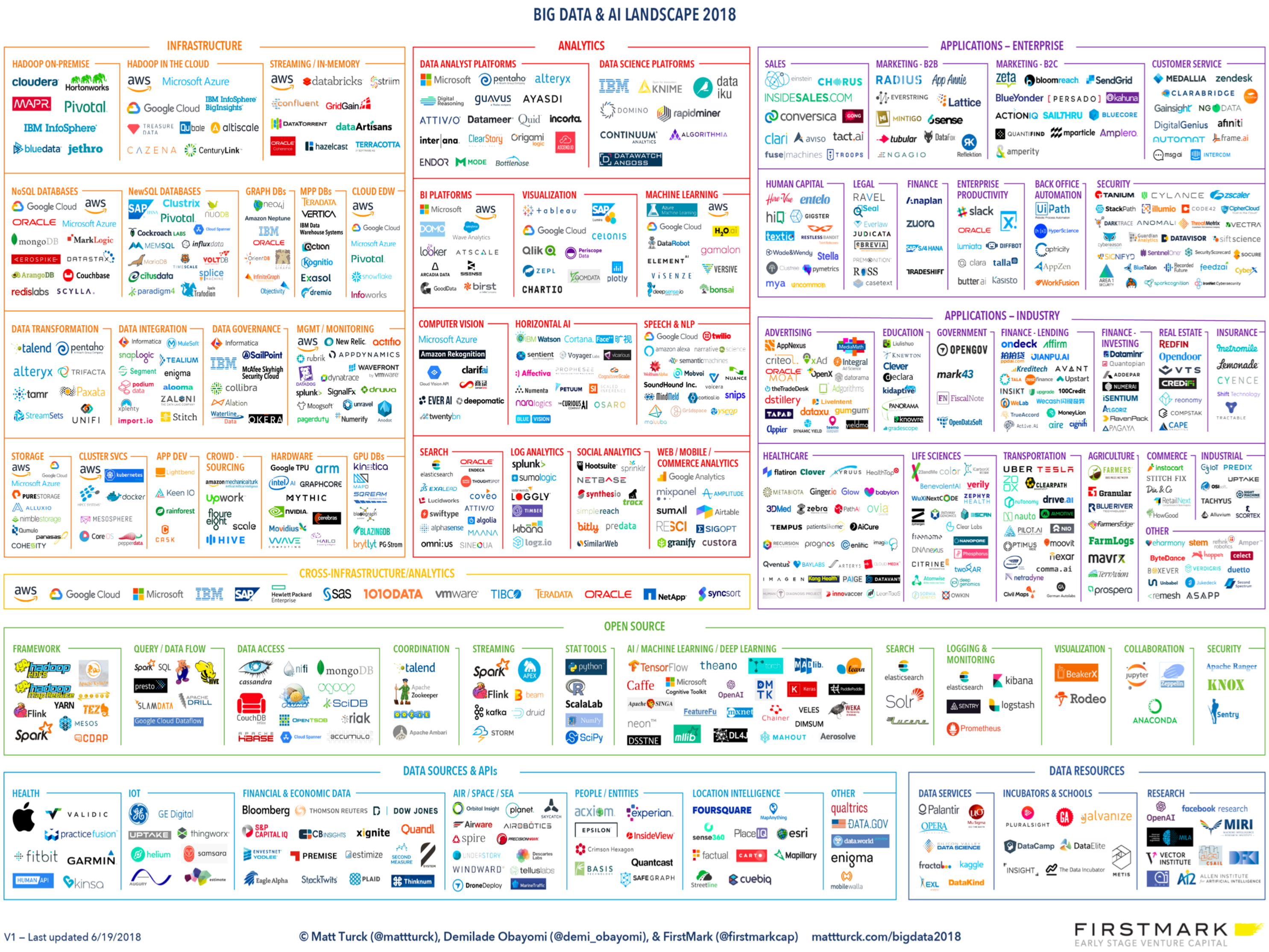
# How to solve ?

Very Simple !

Set up a Database – To store customer history & patterns

Build an Application – Containing logic & expose via API

# Which Database ?

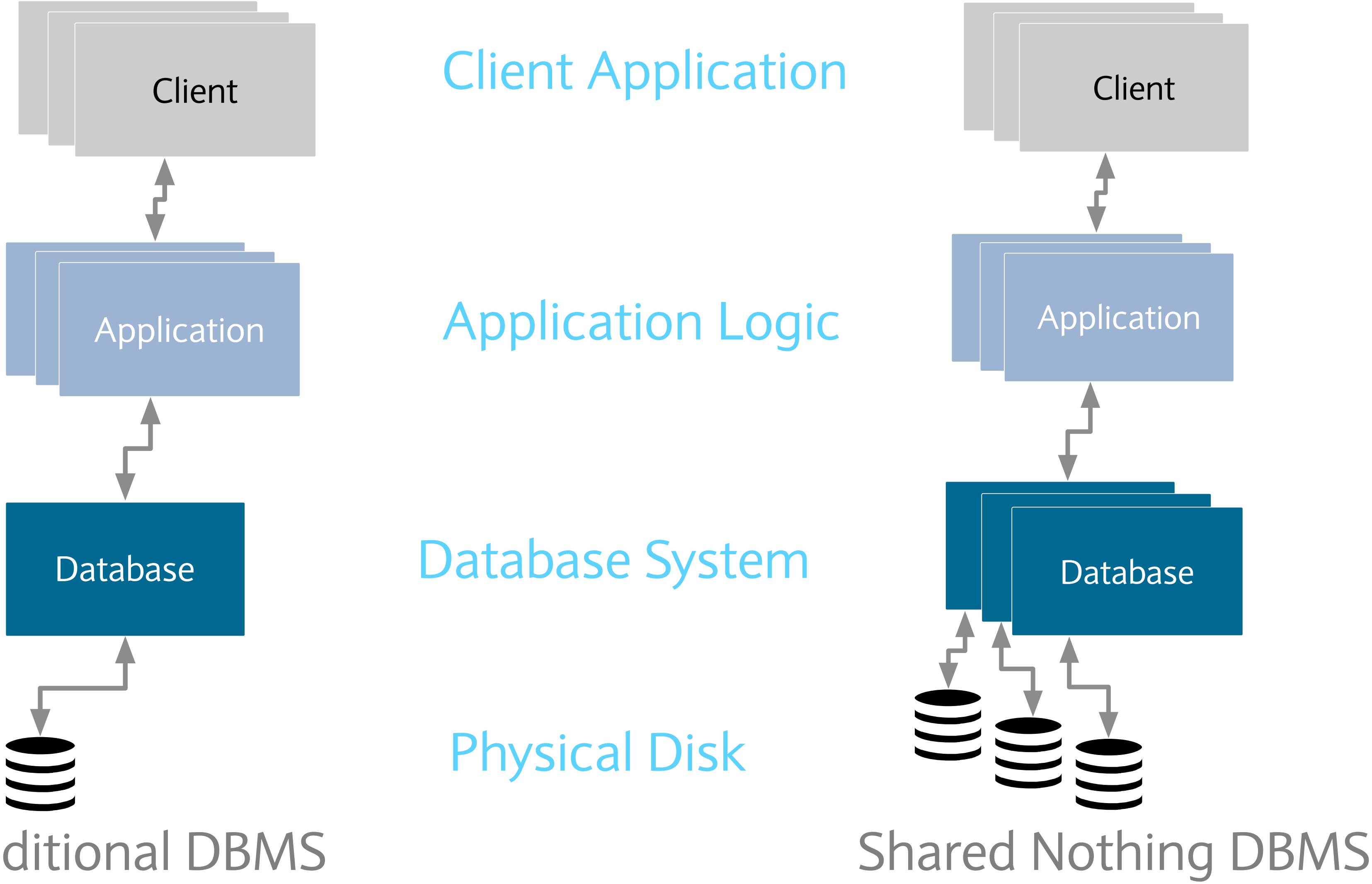


## How to Select:

- Known - Lets use what I am familiar with
- Generic - Lets pick a general purpose database
- Safety - Look at Industry reports (Gartner etc.)
- Enterprise Constraints – No more than one/two DB allowed
- Retrofit - We already have something lets use it
- Luck – Toss a coin / dice!
- …

*Credit for Infographic* – https://mattturck.com/bigdata2018/

# Simple Solution



Client

Client Application

Client

Application

Application Logic

Application

Database

Database System

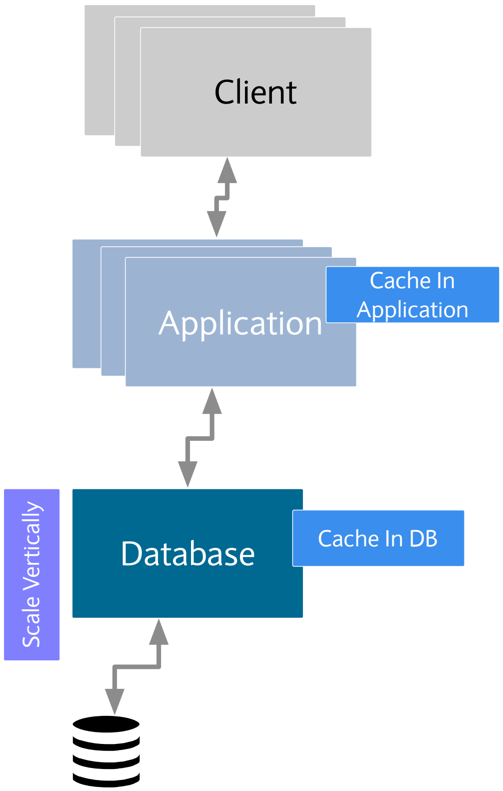
Database

Physical Disk

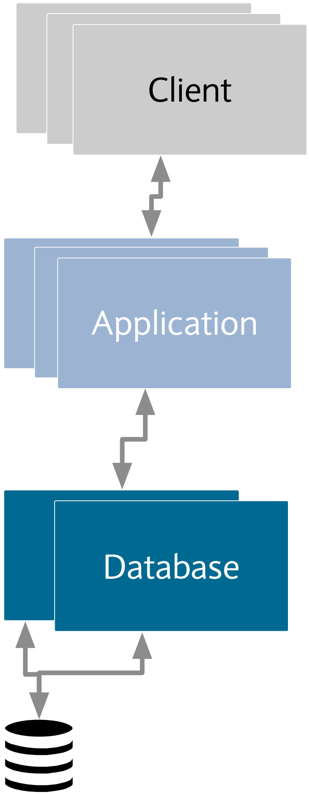
Traditional DBMS

Shared Nothing DBMS

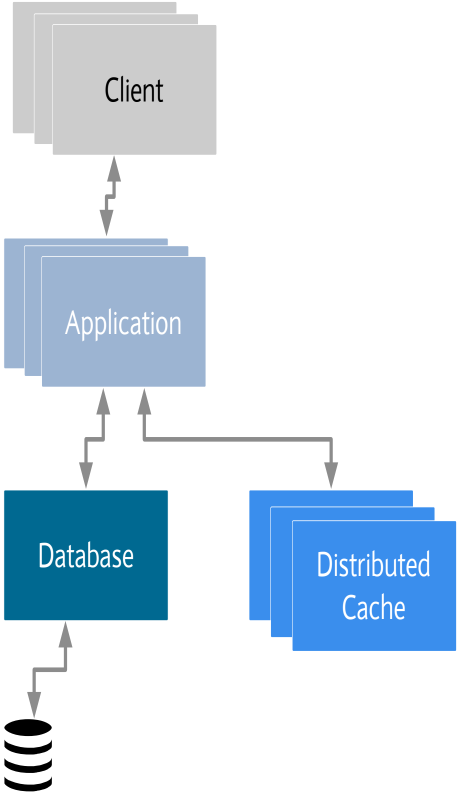
# Common Patterns [Simplistic View]



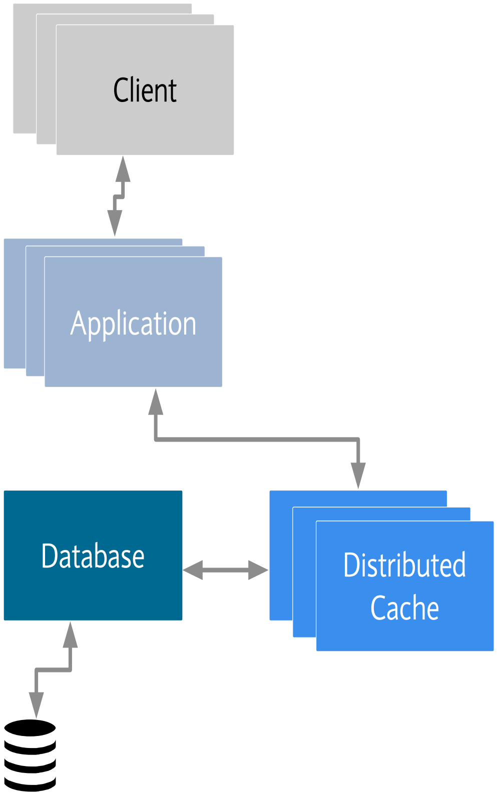
Basic Caching



DB Clustering



Cache Aside

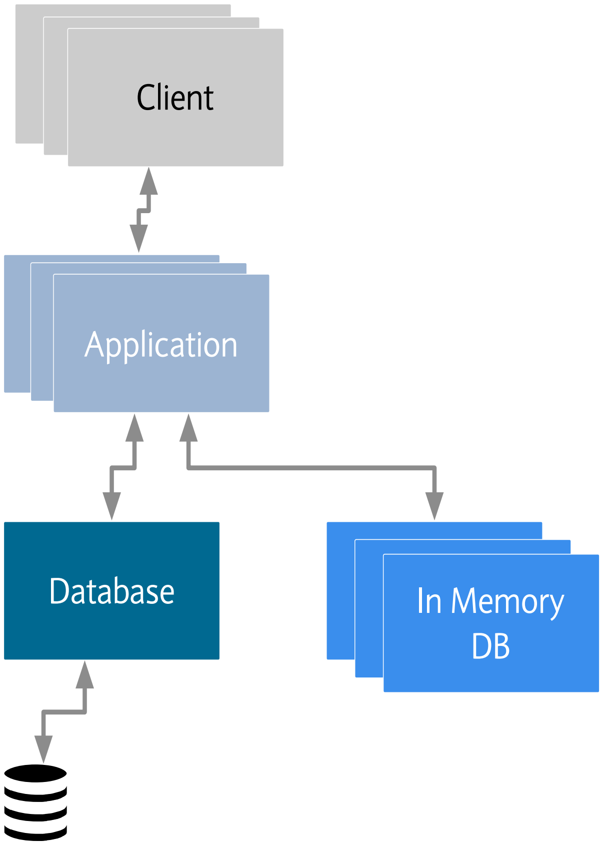


Cache Through*

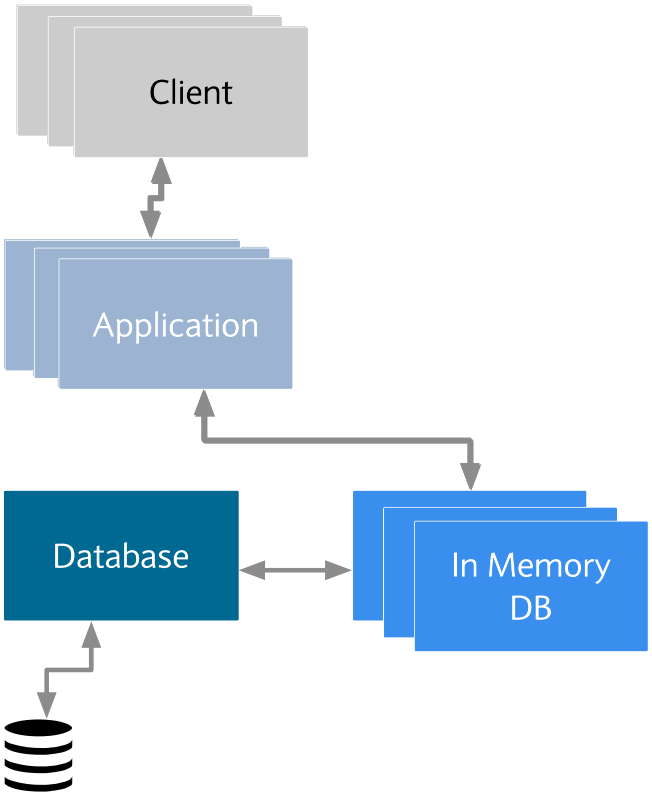
* Other variations also exists

# Common Patterns [Simplistic View]

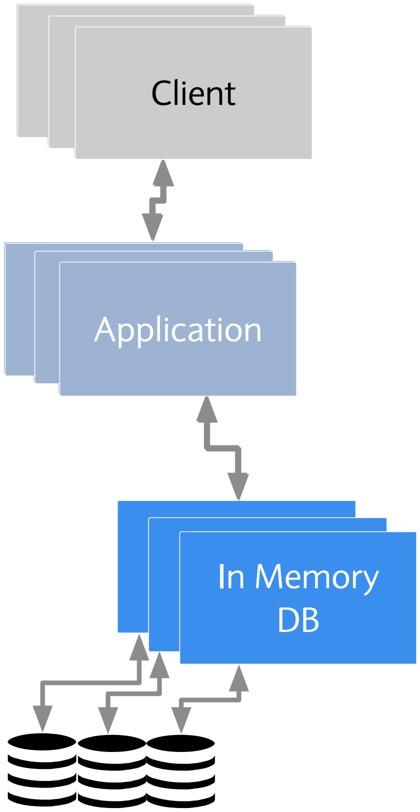
2 of 3



In-Memory DB aside

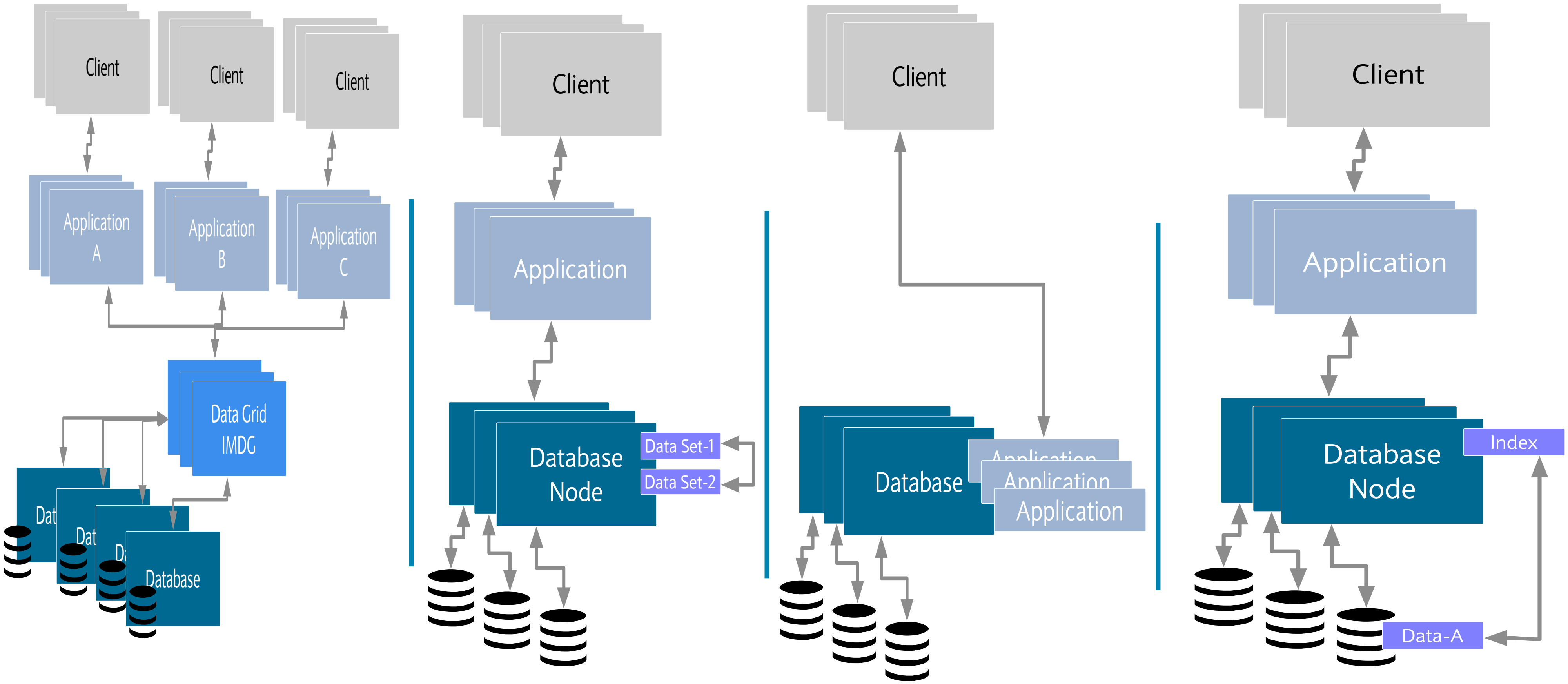


In-Memory DB- through



In-Memory DB with Persistence

# Common Patterns [Simplistic View]



In-Memory Data Grid

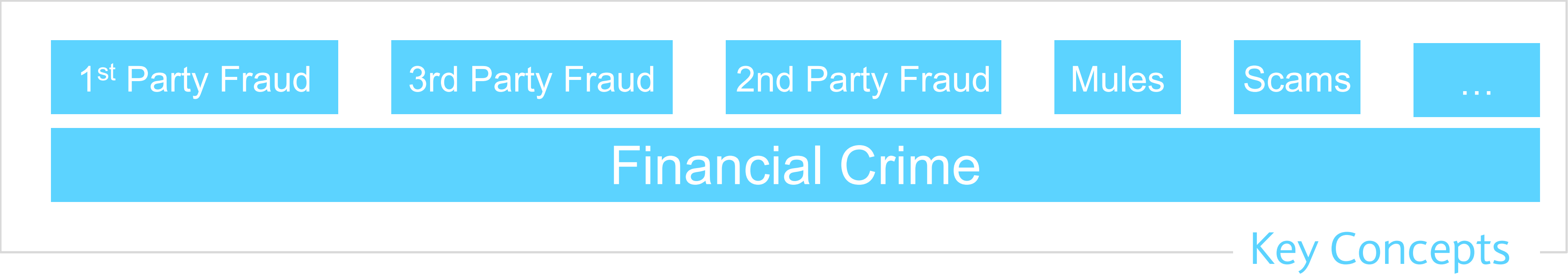
Data Co-location

Compute Co-location *

Hybrid Memory

* Deploying application in database is roughly similar

# Complexity of Financial Fraud



1st Party Fraud

3rd Party Fraud

2nd Party Fraud

Mules

Scams

…

Financial Crime

Key Concepts

- Card Fraud
- Account Takeovers
- Cheque Fraud
- Payment Fraud
- Invoice Fraud
- Bank Account Fraud
- Cyber Fraud
- Cash Point Fraud
- Identity Fraud
- Plastic Fraud
- Mandate Fraud
- ….

Fraud Types

## Extending use-case: Implications?

- Complexity & Criticality
- Additional data needs
- Scale, throughput and other NFRs…

# Regulatory requirements

- Strong Customer Authentication (SCA)
- Transaction Risk Assessment (TRA)
- Confirmation of Payee
- Payment Validations
- Contingency Reimbursement Model (CRM)
- …

- Impact on the use-case ?
- Impact on Architecture ?

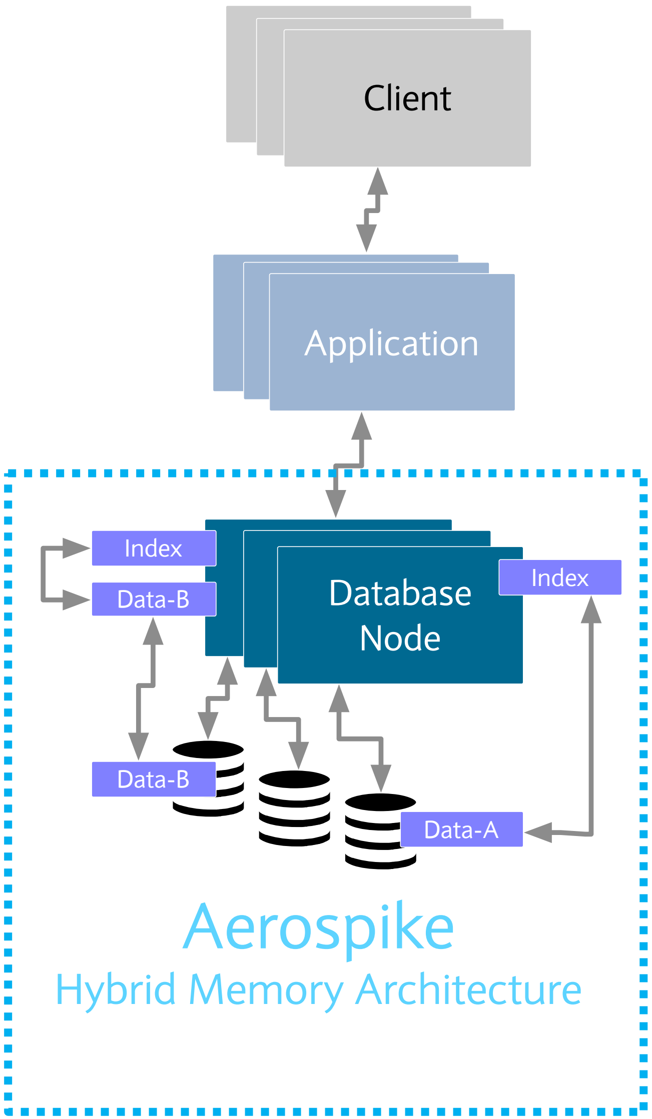
- Impact on the Data handling ?
- Impact on DB technology choice ?

# Summary

- Database Matters in Fraud use-case
    - It’s extremely important component in the Fraud detection process
- Each DB Technology
    - Has its pros and cons
    - Scale differently to others
    - Each technology may offer unique feature as its core strength but may have weakness in other areas
- No Silver Bullet in selecting a DB
    - 80% use-cases may fall into general purpose where selection may be relatively easy
    - Remaining 10 - 20% use-case are more complex and difficult

- Functionally similar use-cases
    - May only be functionally alike but
    - Additional use-cases may increase complexity and scale exponentially
    - NFRs may completely warrant changing the solution
    - Operational Environment can change / dictate solution
- What may work
    - Deep understanding of use-case
    - Understanding Data itself
    - Meticulously matching detailed use-case requirements with product features

# Barclays Fraud Use-Case



Aerospike

Hybrid Memory Architecture

- Performance – Quick access to large data sets
  - One hop to the data from client
  - Fast disk access [Secret sauce - Patented Technology]
  - No cache misses
  - Supports IMDB
  - Parallel Fetch
- Predictability - Helps utilizing set 'Time Budget' effectively
  - Known path of data retrieval
  - No cache miss
  - Reduced Jitter [written in C]
- Simple Architecture – Help TCO & Extensibility
  - No caching layer to setup and manage
  - Reduced RAM footprint & Cluster size
- Supported – The use-case's
  - Scaling needs
  - Strong consistency & durability
  - Standard security features

- Non Relational - Key Value pair only with Maps & List feature
- Does not support SQL, has its own API like most NO-SQL DBMS
- Has bit of a learning curve
- Not a general purpose DB, may not be the best investment for all use-cases

# DB Selection – Lessons / Suggestions

1 of 2

- Choosing right DB technology is more difficult (for extreme 10-20% use-cases)
- Aspects frequently misunderstood or often taken lightly
  - ➢ Scale & Throughput requirements
  - ➢ Sensitivity towards Latency
  - ➢ Jitter in DB operations and its Implication on overall application behaviour
  - ➢ Matching CAP theorem aspects with use-case
  - ➢ Data characteristics and usage [Hot /Cold, All Hot, volume, variety etc.]
  - ➢ TCO calculation considering all factors and environments
- Key aspects to consider to narrow down choices
  - ➢ Pedigree – One specific problem the product was originally designed to solve i.e. product’s core competence and matching with the use-case
  - ➢ Jepsen Report – If consistency is important; wonderful resource for DB community
  - ➢ References - Drawing comparable from industry use-cases

# DB Selection – Lessons / Suggestions

2 of 2

- Operational aspects
  - ➢ Knowing your operational environment and constraints imposed by overall landscape, wider architecture, practices, pipelines etc.
  - ➢ Security & Monitoring
  - ➢ Patching strategy of DB and its alignment with the UNIX node patching
  - ➢ Vendor Support & SLAs
  - ➢ Other standard aspect such as Resilience, Cloud/On-Premise, DR, Active – Active, Rolling Upgrades, Backup, Accessibility to data/API etc.
- Investment in following pays off
  - ➢ PoC/s for right DB selection
  - ➢ Training the Build & Operational teams on product
  - ➢ Right Data-Modelling for the application/s
- Things change
  - ➢ Better products to support your use-case may be available tomorrow, so keep eyes open and be aware of Vendor-Lock-In

# Thank you

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