# Mechanical Sympathy

Martin Thompson - @mjpt777

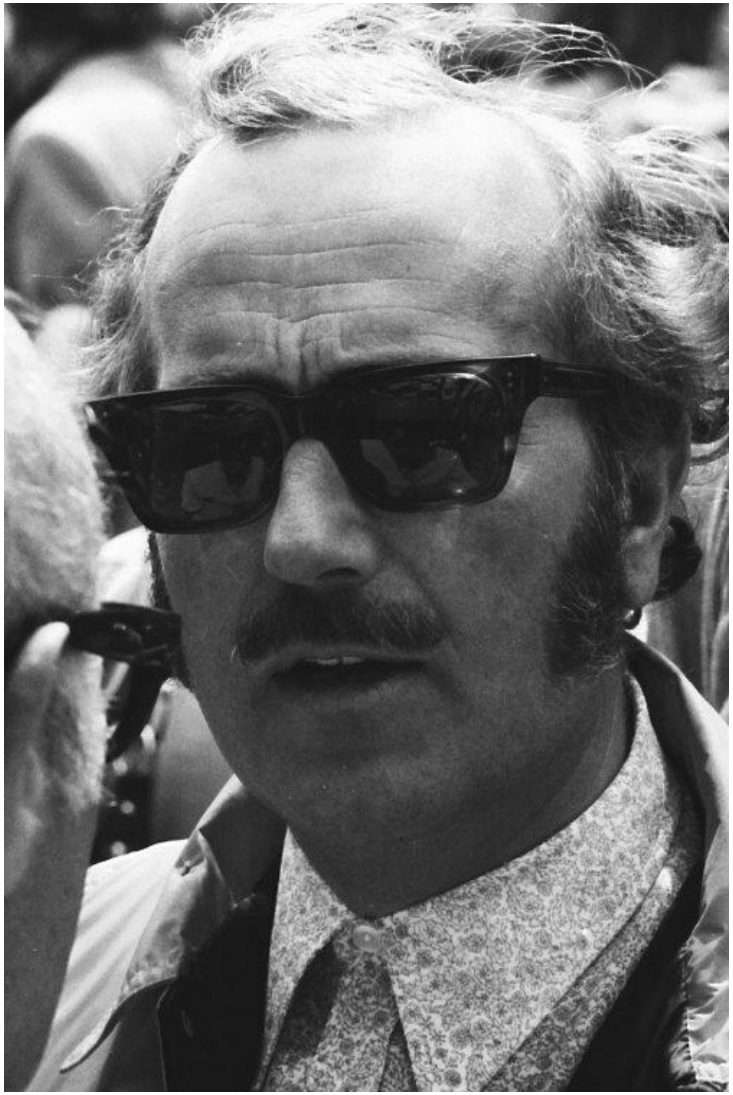
# Sir Jackie Stewart
# – 3 times World F1 Champion

# The “Flying Scot”

# *“Mechanical Sympathy”?*

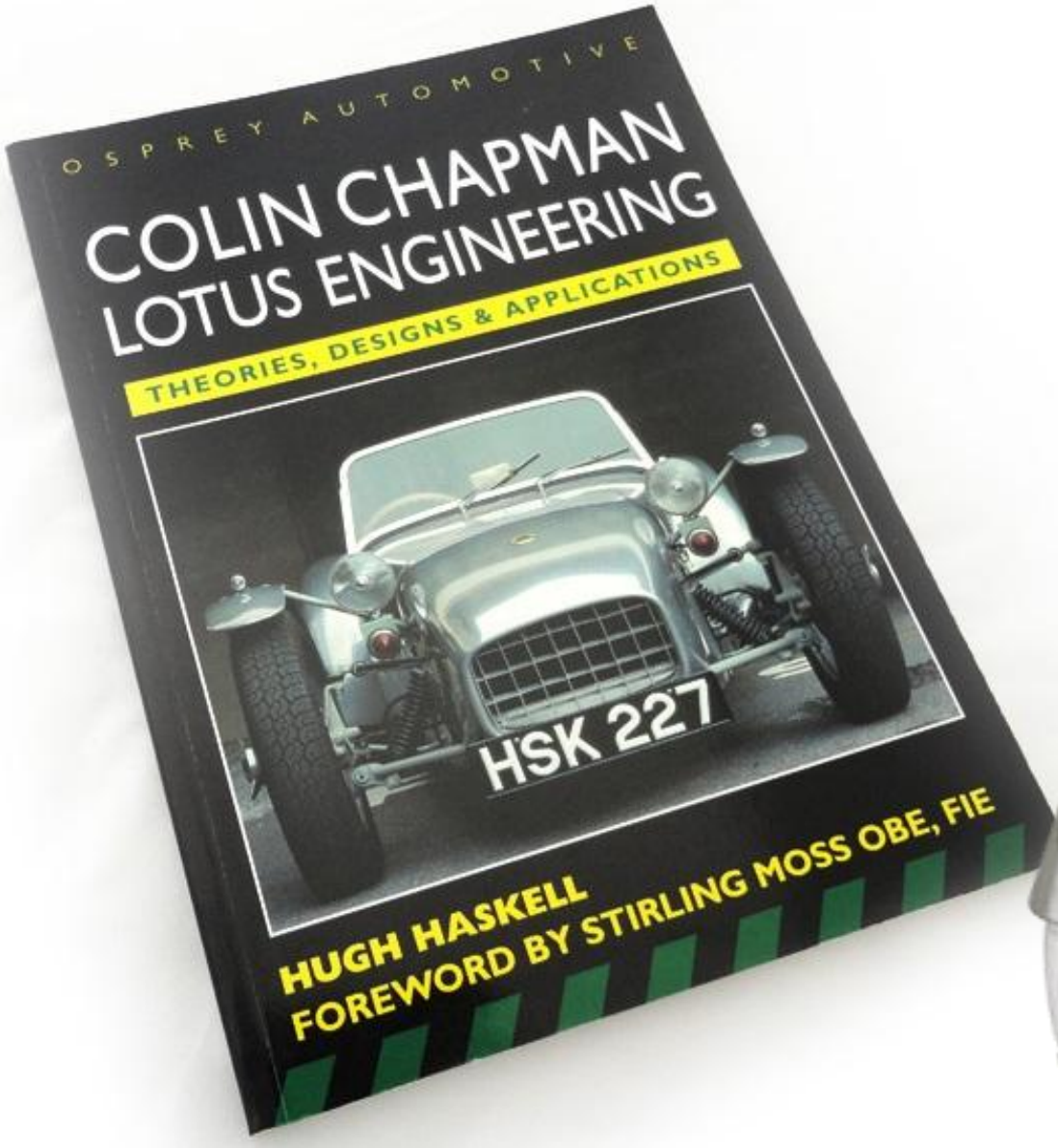
# Man and machine working together in harmony

# What does a “hardware guy” look like?



## Colin Chapman

**Lotus Founder**
**UCL Structural Eng**
**Pilot and Driver**
**Aerodynamics**


OSPREY AUTOMOTIVE
COLIN CHAPMAN
LOTUS ENGINEERING
THEORIES, DESIGNS & APPLICATIONS
HSK 227
HUGH HASKELL
FOREWORD BY STIRLING MOSS OBE, FIE

?

GP
© Reuters

***“I can think of no other field of human endeavour that allows the levels of inefficiency that we accept as normal in software.”***

**- Dave Farley (Continuous Delivery)**

# Mechanical Sympathy

1. Distilling a Model
2. Understand the Safety Features
3. Importance of Testing
4. Let Data drive Decisions
5. Mechanical Sympathy in Action

# 1.
# Distilling the Model

A **model** is a **representation** of the domain in a given **context**.

A **simplified** abstract view of a **complex** reality.

**The important s#!t**
**you need to know about**
**how stuff works!**

# How do I create a Model?

**Distil** the essence of what **represents** the domain

**What makes a really fast car?**

FREE
WITH MAX FLAVER
EVERY MONTH
IT WAS A
FIESTA

# Apply a Scientific Mindset

1. Draw on Experience

# Apply a Scientific Mindset

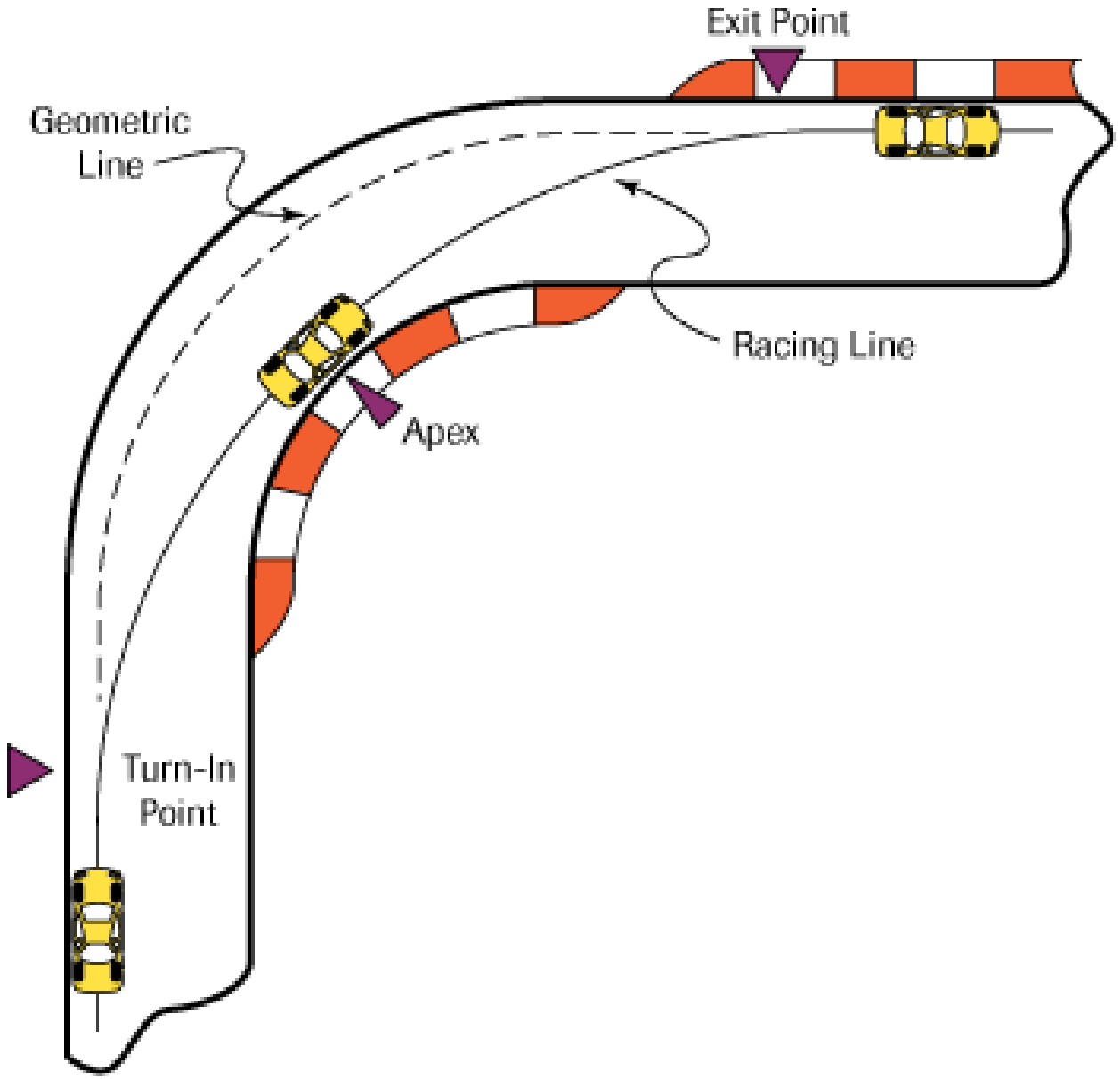
1. Draw on **Experience**
2. Do your **Research**

# Apply a Scientific Mindset

1. Draw on **Experience**
2. Do your **Research**
3. Learn by **Experimenting**

# Let’s distil models of what needs represented for two domains

# Physics Model of taking a corner



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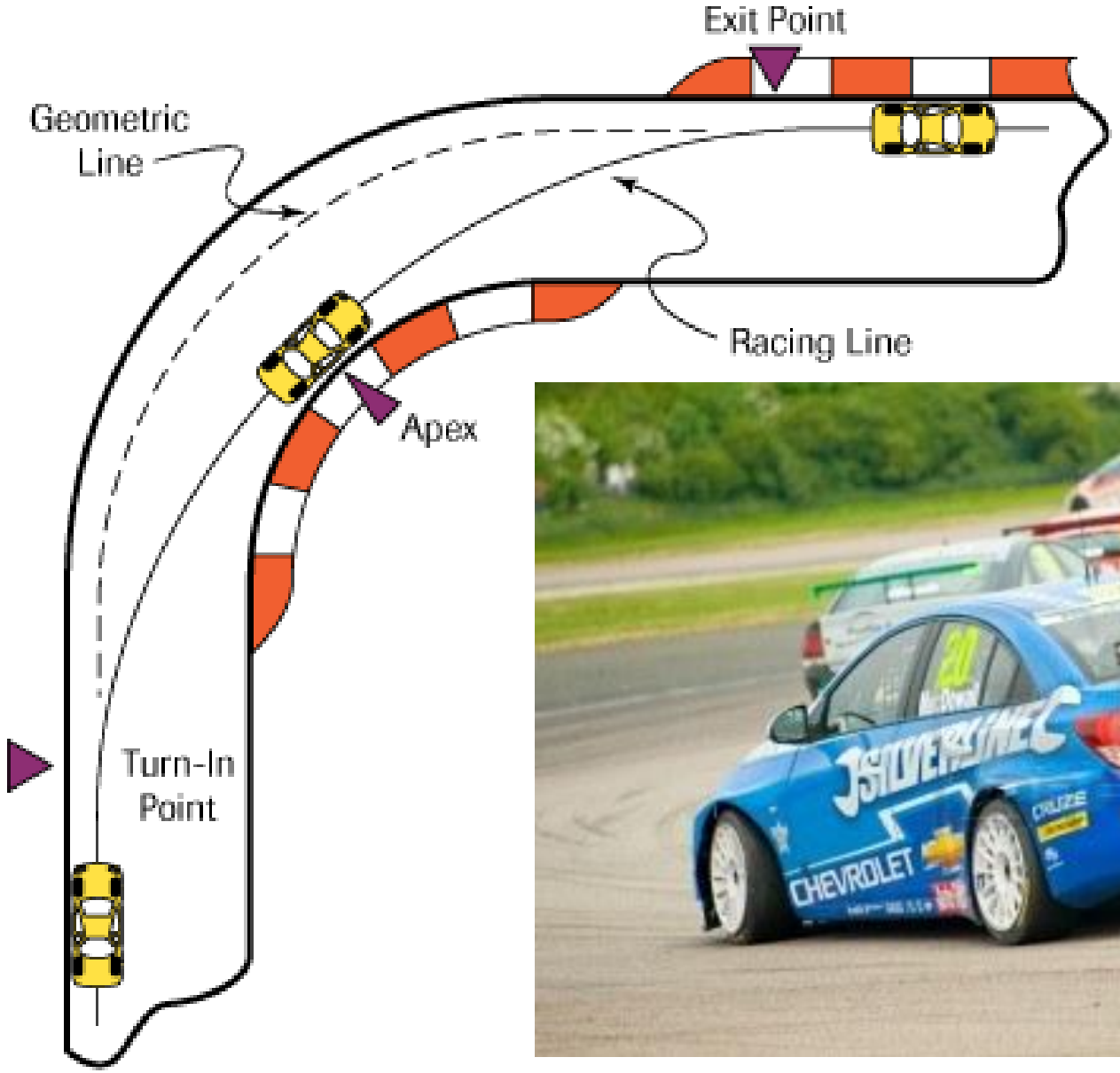


# Model of Disk Write

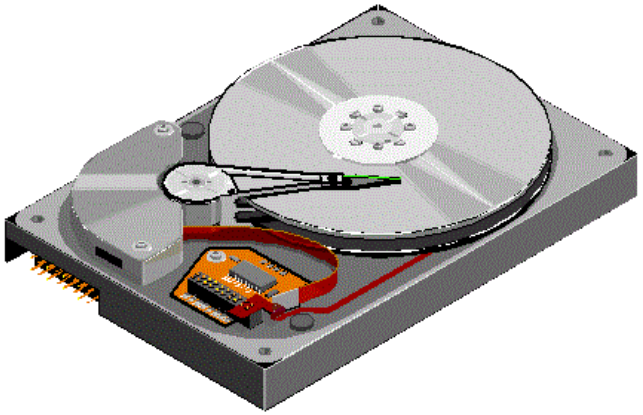
<< My Program >>

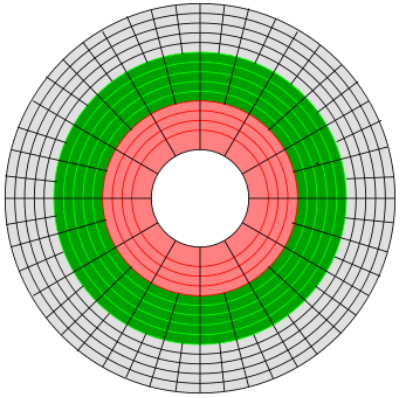
Byte Buffer

write() << syscall >>

User Space

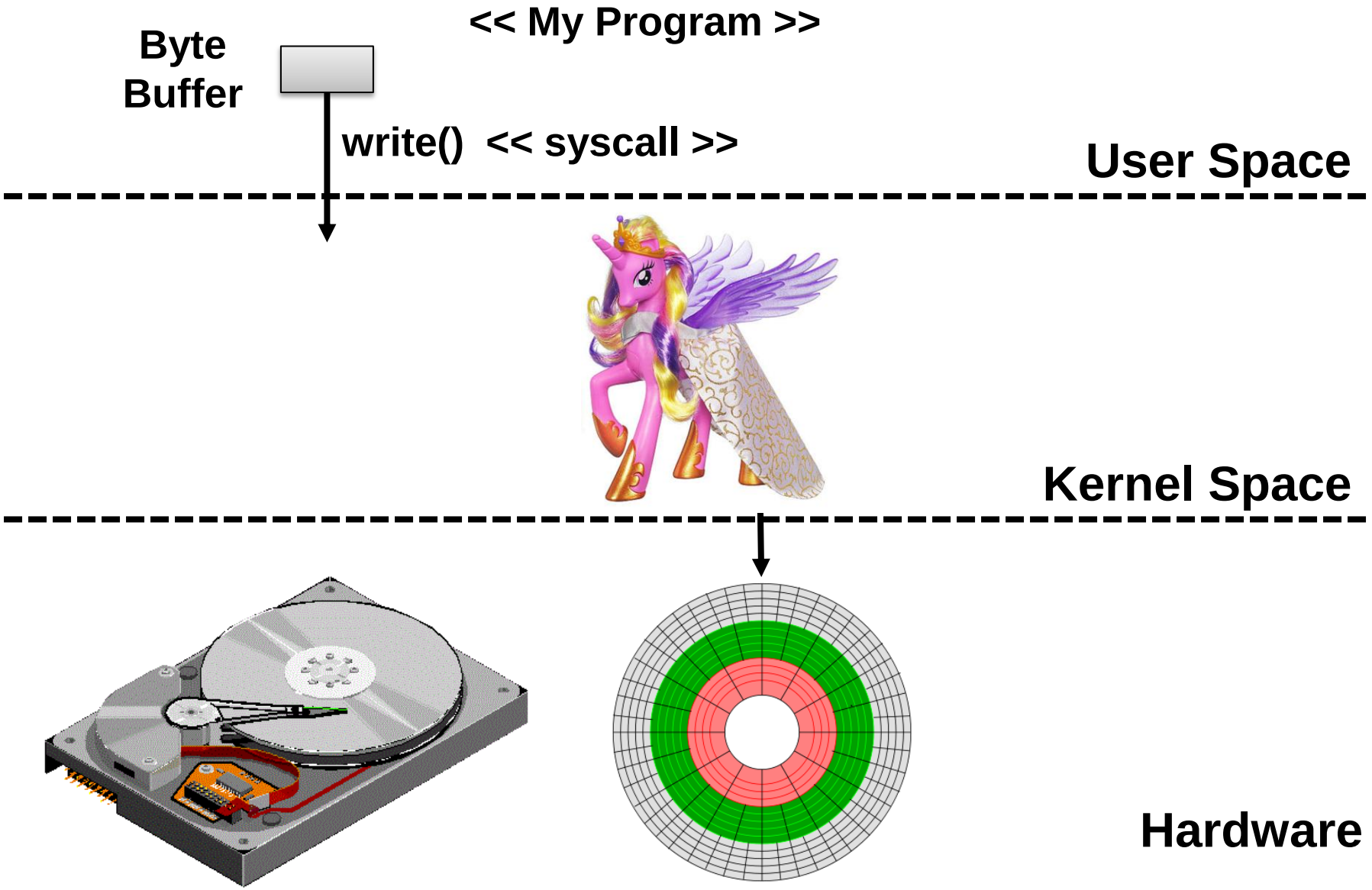
Kernel Space



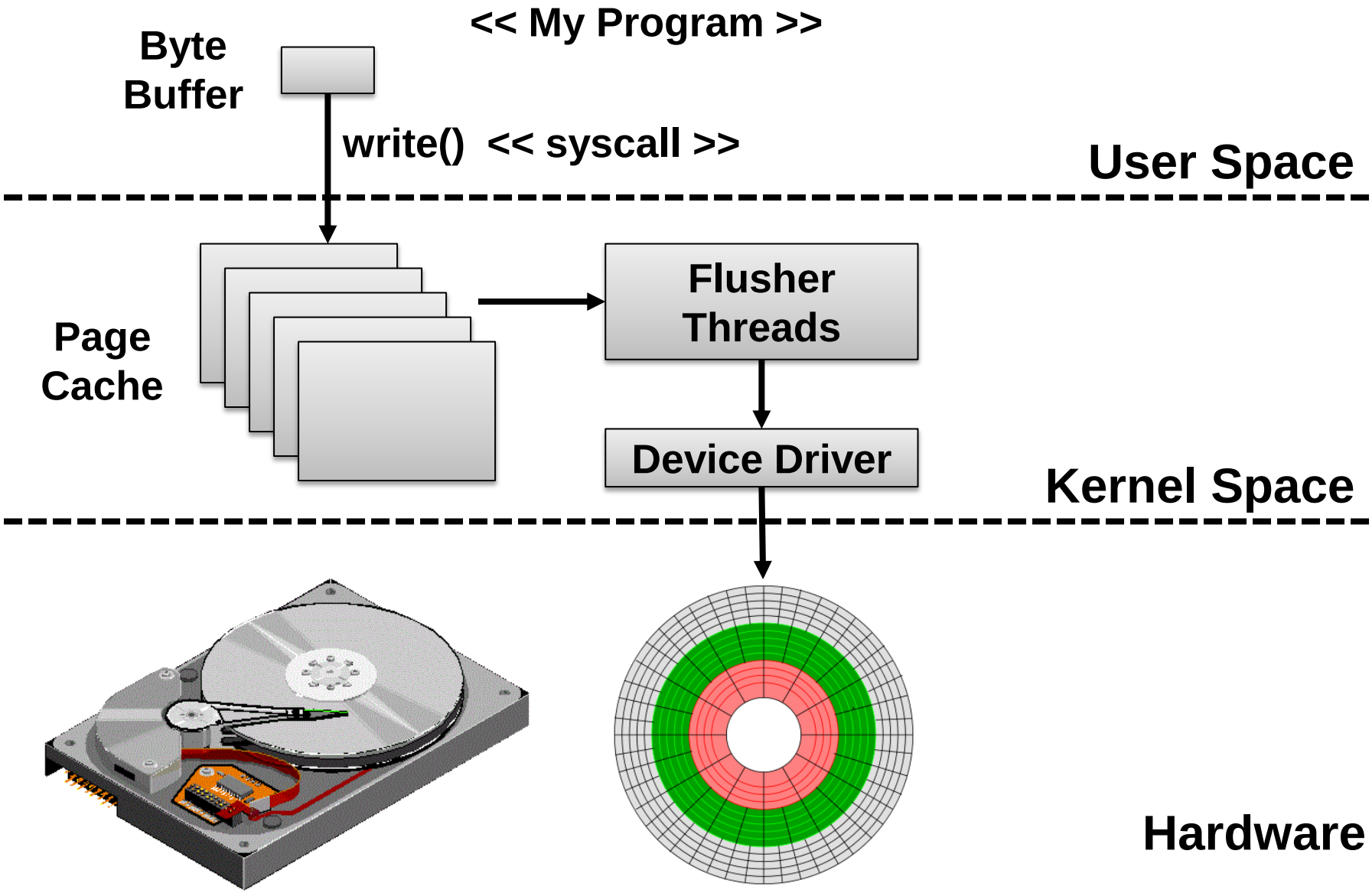


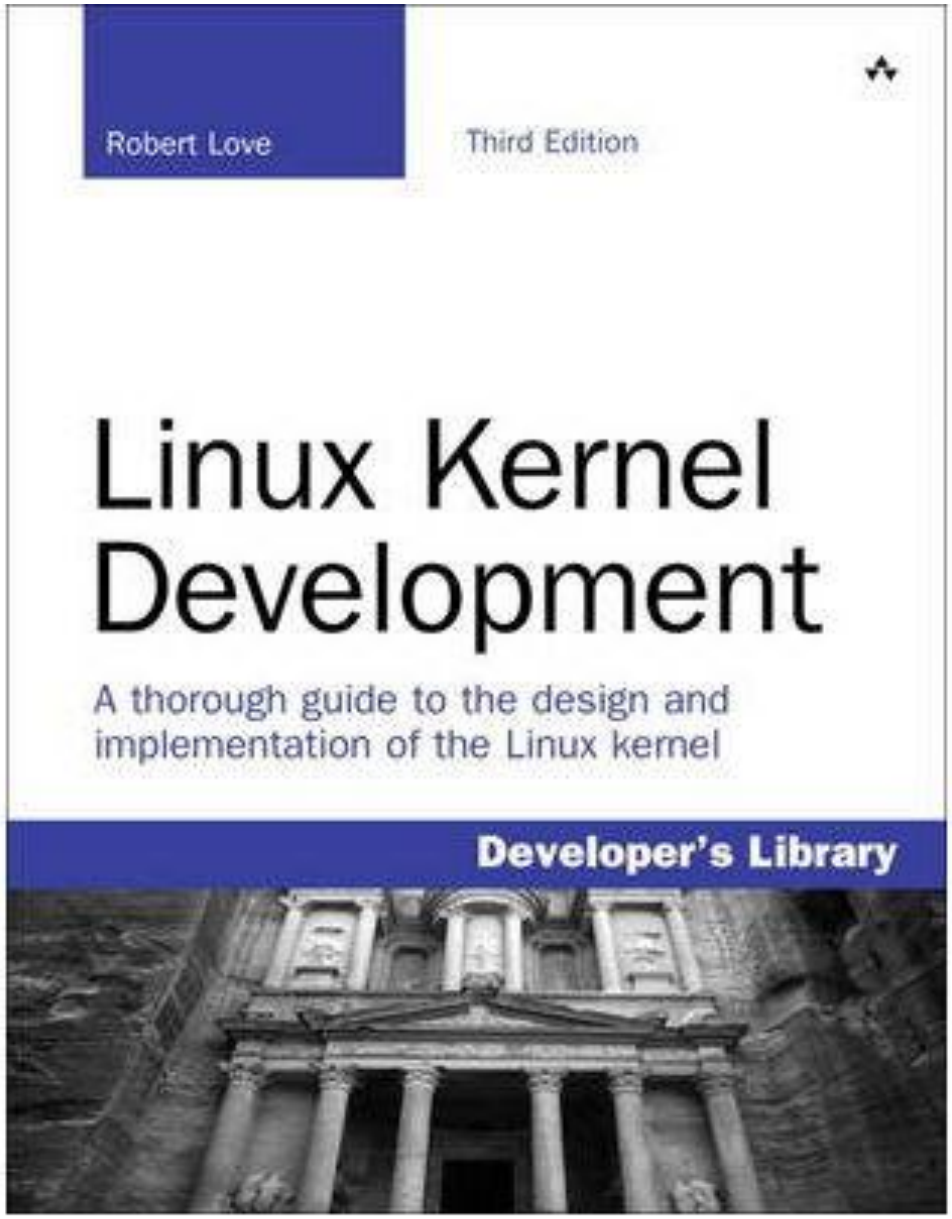
Hardware

# Model of Disk Write



# Model of Disk Write




Robert Love
Third Edition
Linux Kernel Development
A thorough guide to the design and implementation of the Linux kernel
Developer's Library

**Do what is required**

**and nothing more...**

***remember Colin Chapman...***

# *2.*
# *Understand the Safety Features*

La Source
Eau Rouge
Raidillion
Kemmel
Bus Stop
Blanchimont
Pouhon
Les Combes
Malmedy
Les
Fagnes
Rivage
Stavelot

# Spa
# 1966

# Close Friends Lost

**Jim Clark**

**François Cevert**

***“We are killing ourselves at a rate of one per month.***

***After 5 years in this sport you have a two out of three chance of being killed.”***

**- Jackie Stewart (1973)**

Crash Barriers

Fireproof Suits

Emergency Services

Seat Belts

Full-Face Helmets

Electric Kill Switches

Removable Steering Wheels

You have to be **brave**

when driving **change**

**Is programming a job**

**or is it a vocation?**

The **safety features** in our platforms are some the most **interesting**

Bounds Checking

Forward Error Correction

RAID

Circuit Breakers

Replication

Congestion Control

Error/Exception Handling

Automatic Memory Management

Understanding the

**safety features**

will greatly improve your

**models**

# 3.
# The Importance of Testing

**What happens when you don’t do enough**

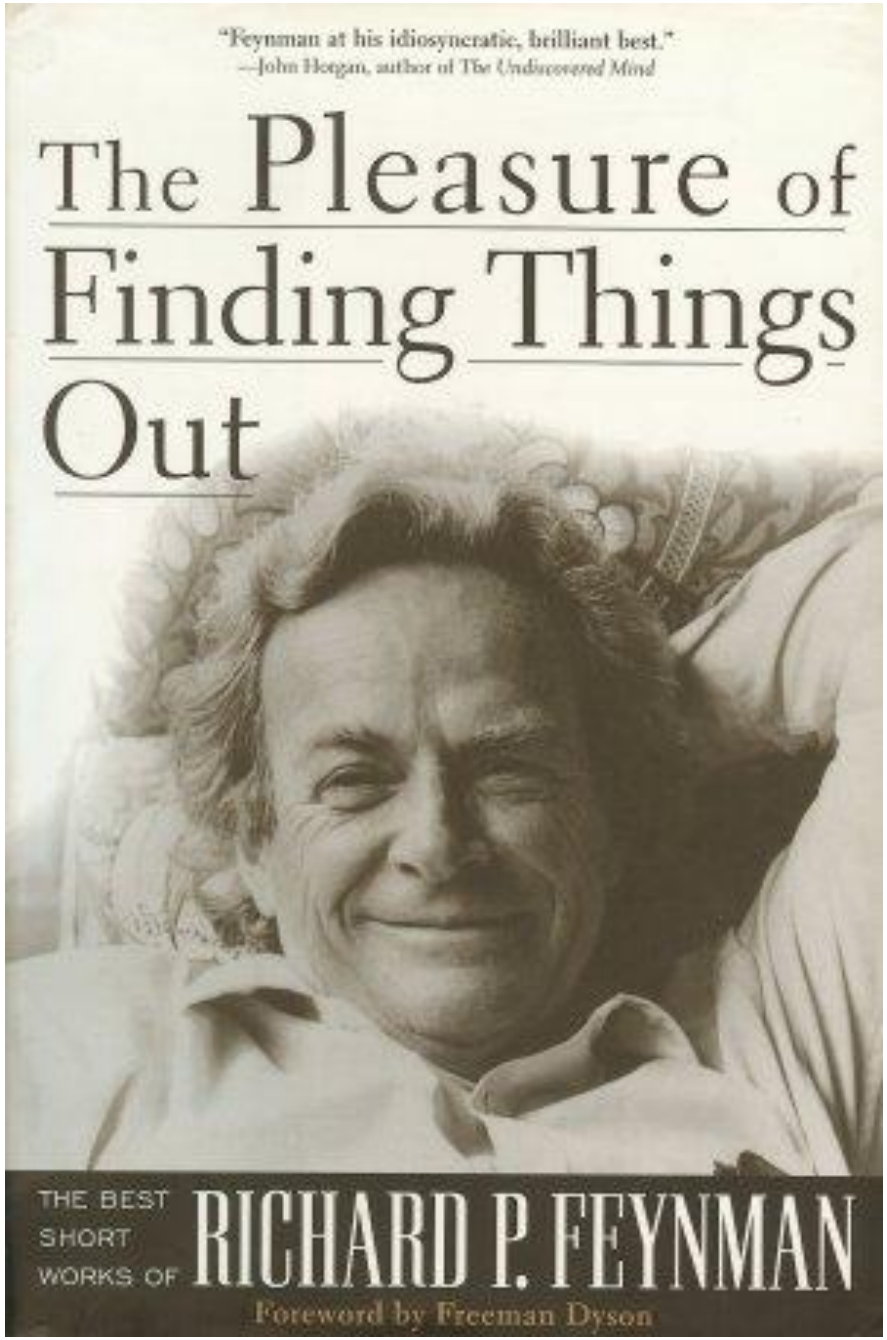
**testing?**

Mobil 1
15

REPLAY
DHL
LG
M WEBBER
RBR Renault
H KOVALAINEN
Lotus Cosworth
LG

Knight
Knight
Knight
Knight

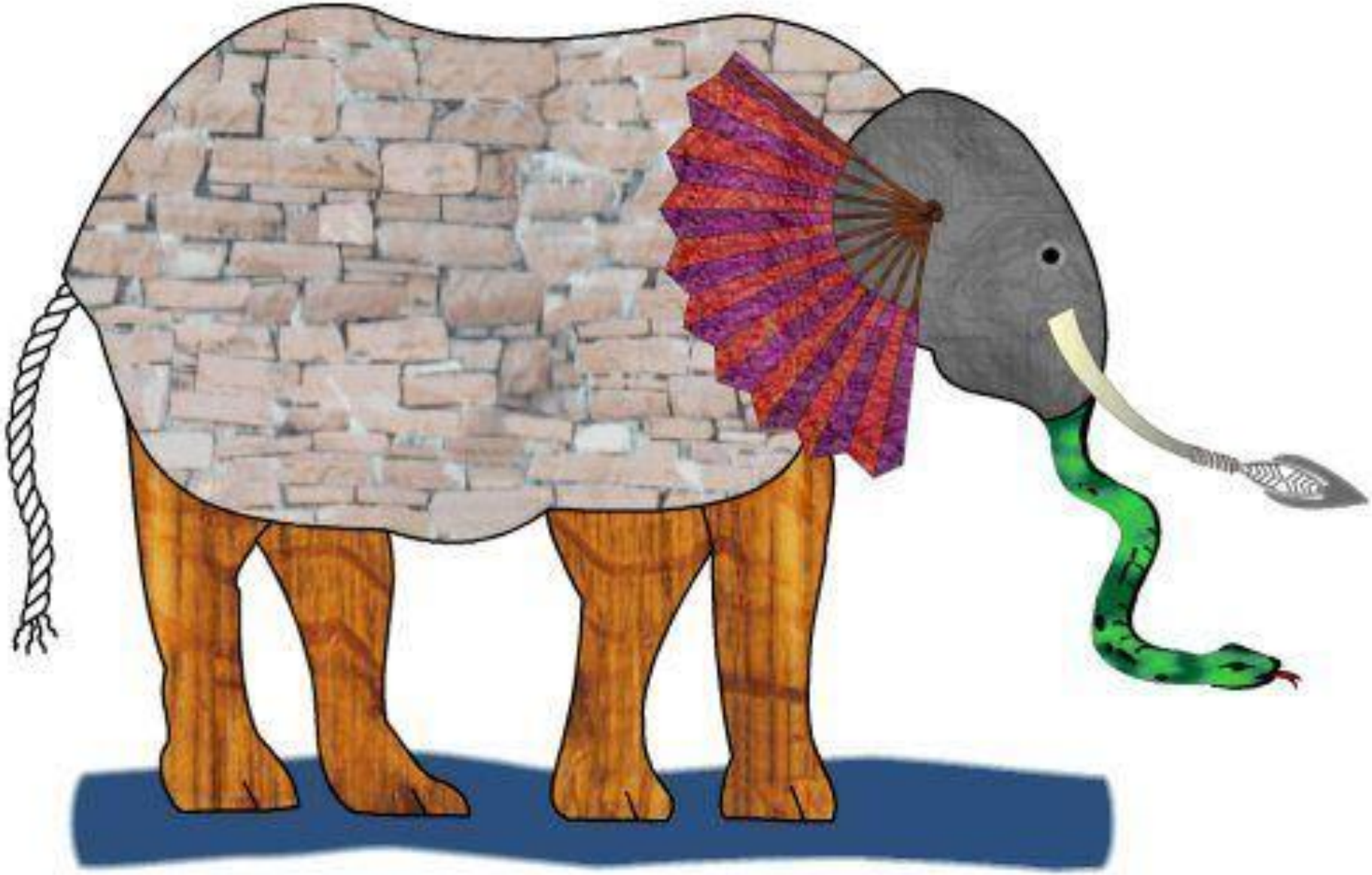
**How can you have confidence in an untested model?**


"Feynman at his idiosyncratic, brilliant best."
—John Horgan, author of The Undiscovered Mind
The Pleasure of Finding Things Out
THE BEST SHORT WORKS OF
RICHARD P. FEYNMAN
Foreword by Freeman Dyson

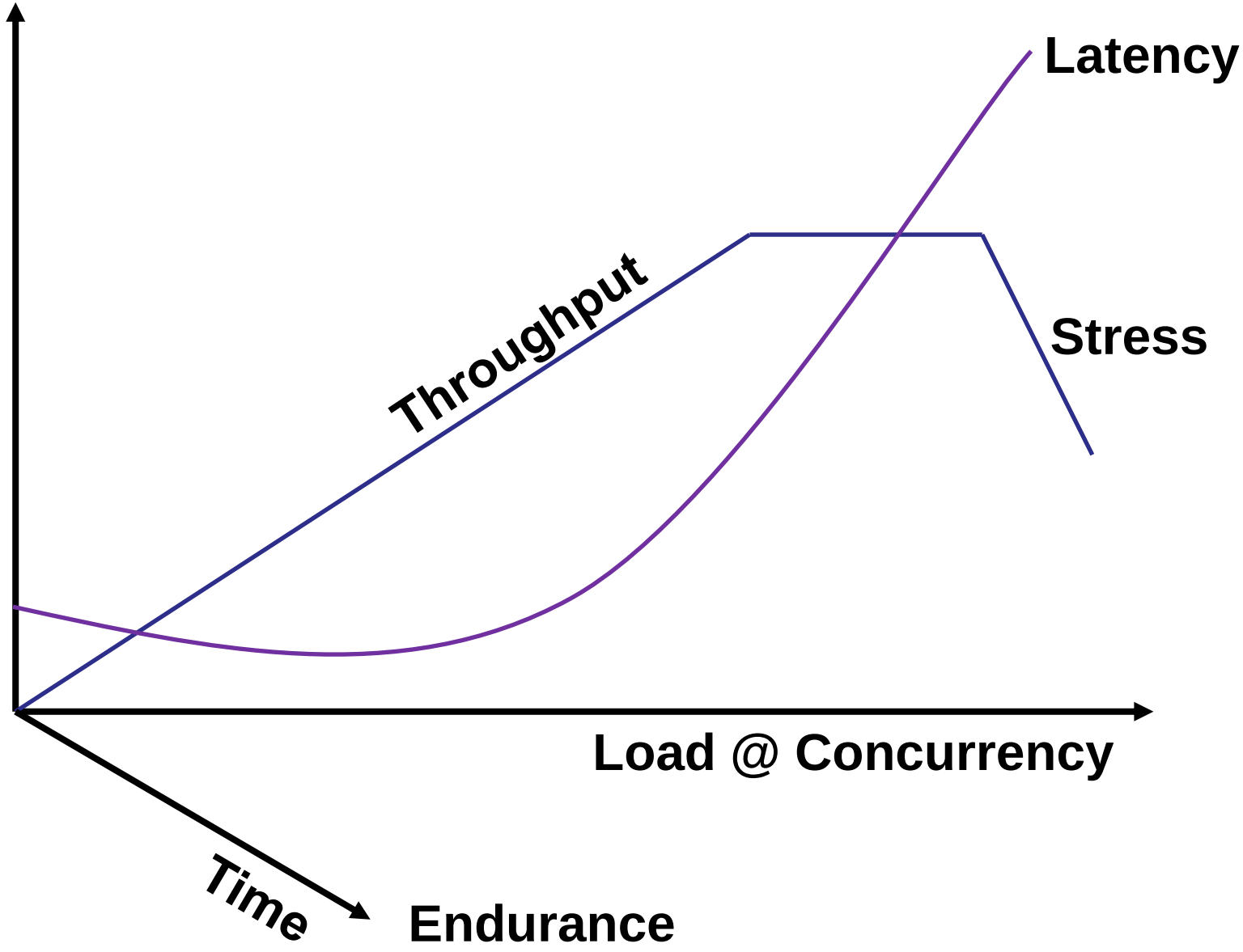
Testing is about gaining

**experimental evidence**

to prove a **model**



# Performance Testing



# What about Macro benchmarking?

*“Build on the shoulders of giants.”*

**- Sir Isaac Newton**

# HdrHistogram

# JMH

## Java Microbencmark Harness

# *4.*
# *Let Data drive Decisions*

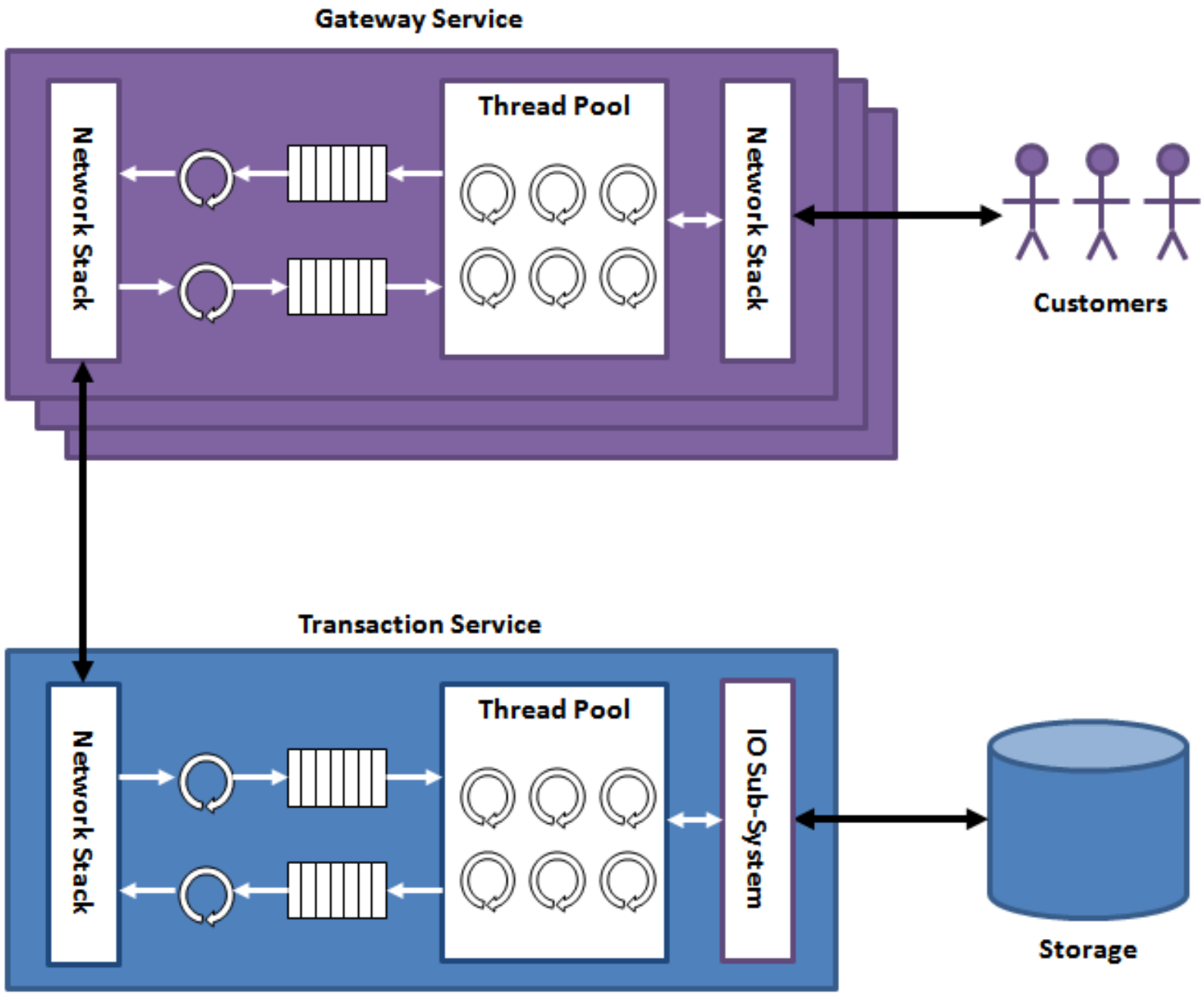
Marlboro
Marlboro
Marlboro
Marlboro
OMP
motorsport.com

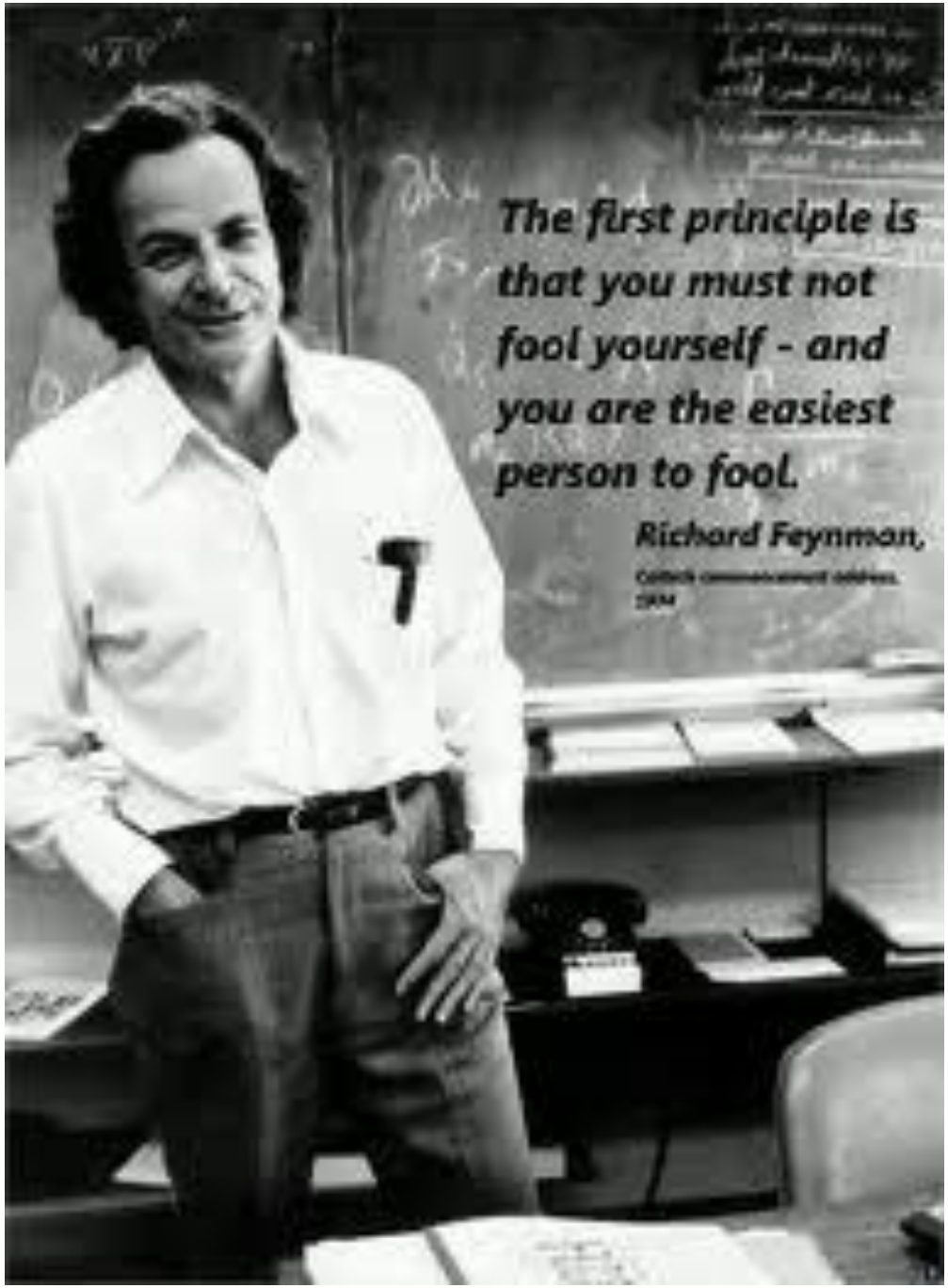
INFINITI
RedBull
RACING
Pepe Jeans
LONDON
RedBull
TOTAL
RedBull
INFINITI

Apply **telemetry** and perform real-time **monitoring** on the data

Requires efficient **collection**, centralised **aggregation**, **analysis**, and **alerting**

Without telemetry and good profiling you might as well be using witchcraft


Gateway Service
Network Stack
Thread Pool
Network Stack
Customers
Transaction Service
Network Stack
Thread Pool
IO Sub-System
Storage


The first principle is that you must not fool yourself - and you are the easiest person to fool.
Richard Feynman,

# Do Profilers lie?

# *5.*
# *Mechanical Sympathy in Action*

It is all about **experience**

and **understanding**

executed with **finesse**

**What are the highlights**
**we need to consider**
**when putting this into action?**

**Do you have appropriate**

**leadership and**

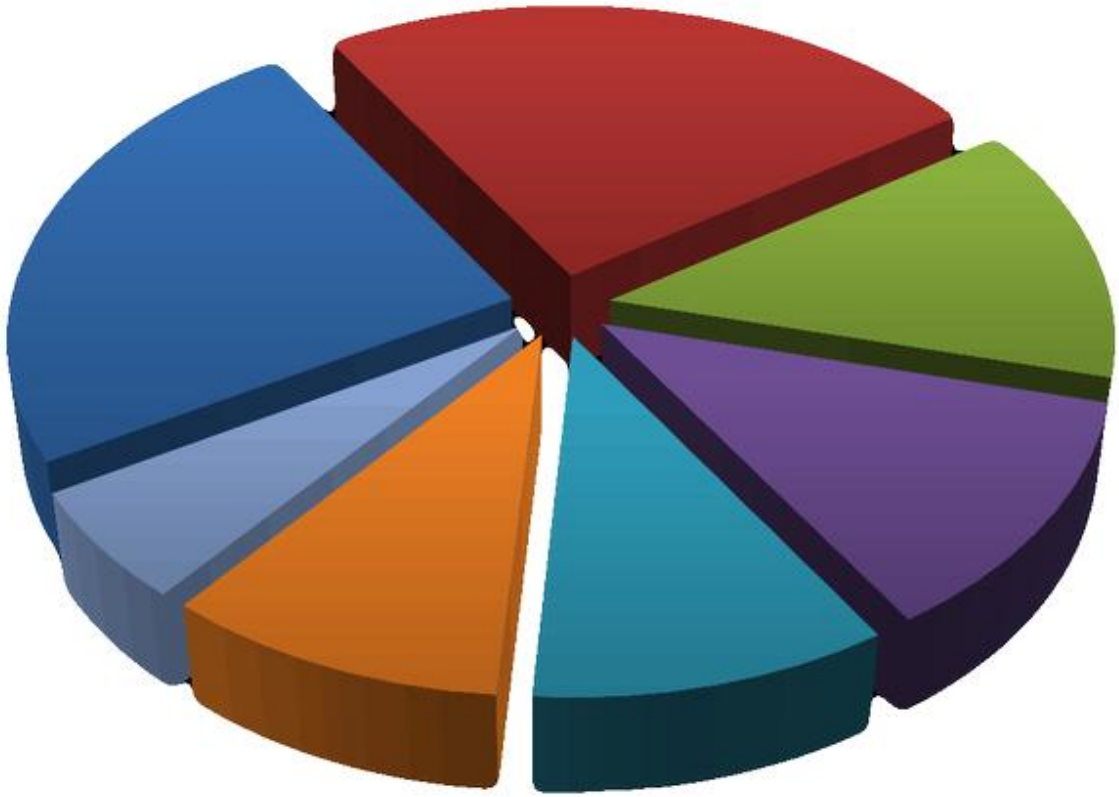
**management in place?**

FOST
SAN
200

**You have finite resources**

**you use them wisely**

# Transaction Budget



**React** appropriately

to spikes in **load**...

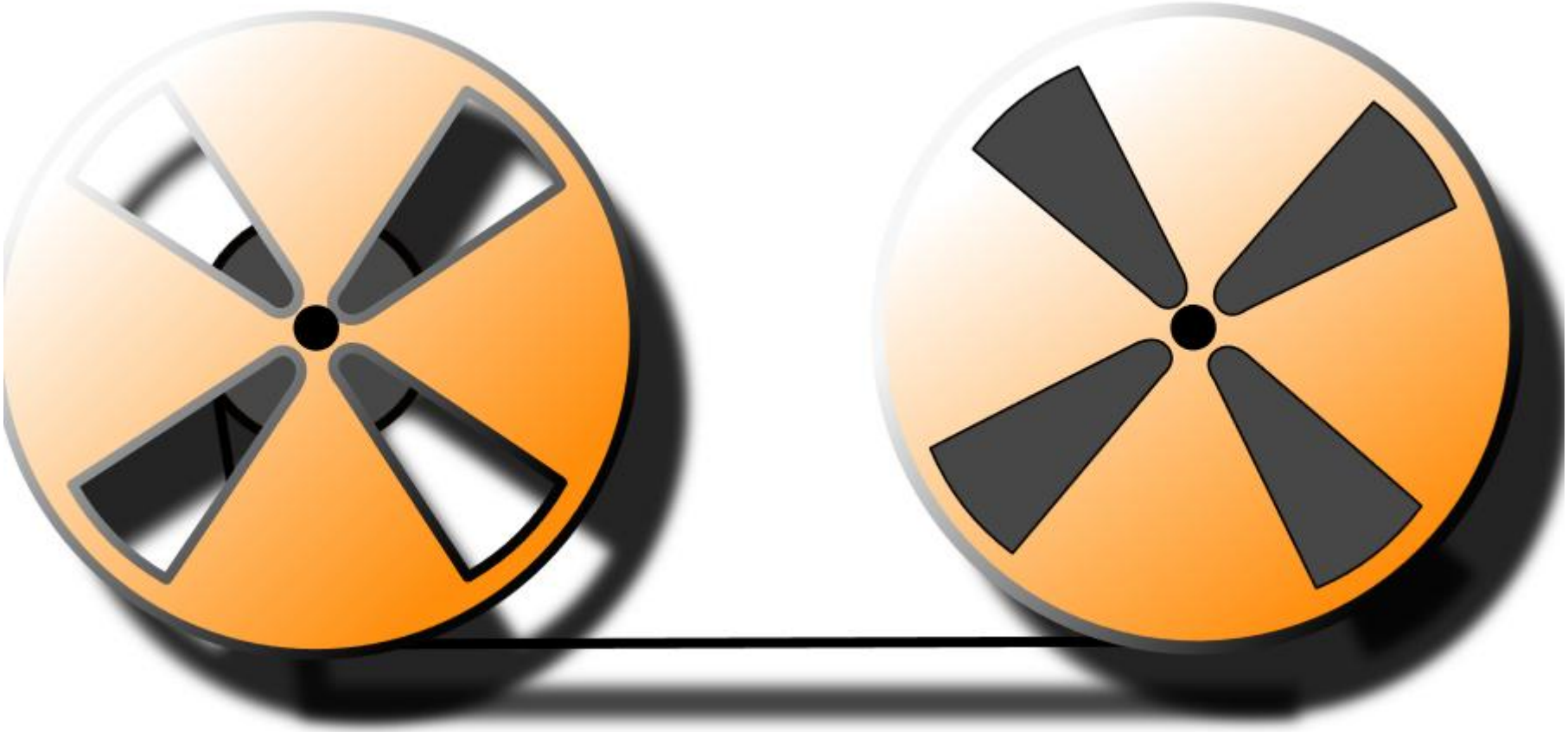
Apply **batching**
to amortise expensive costs
and **back-off**
strategies to prevent failure

Do you know the

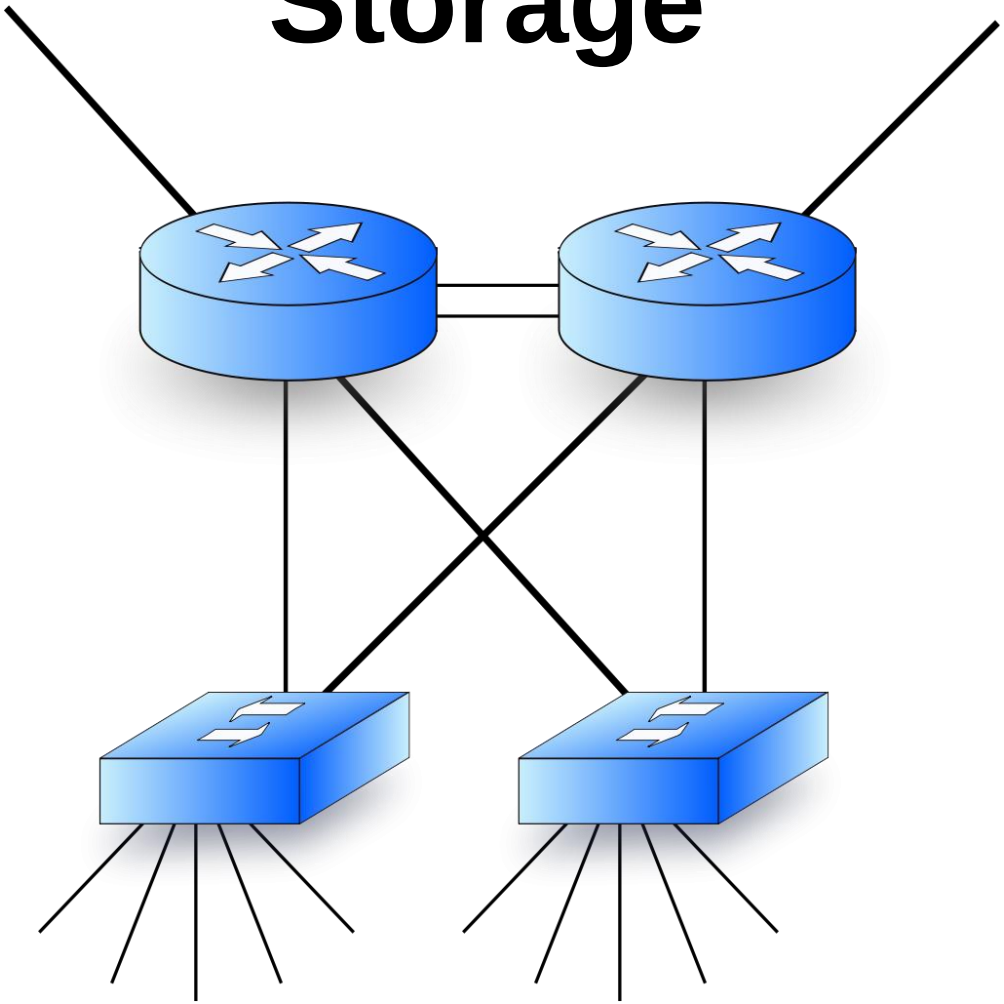
**fundamentals** of how your

platform **works**?

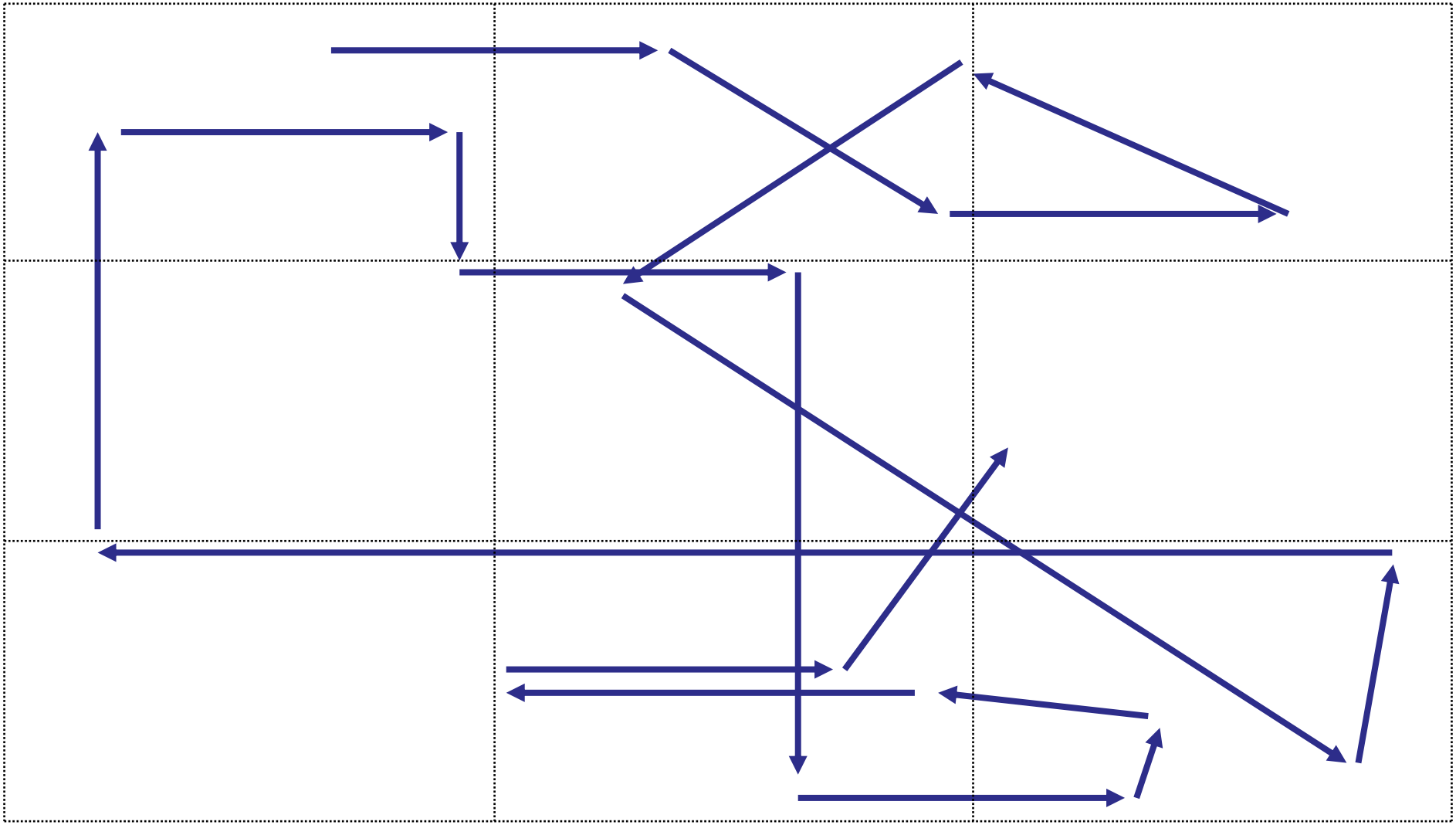
# All Storage is Tape



# Networks are faster than Storage



# Memory Access Patterns Matter



**We are never done learning**

**make learning an active part of your approach**

Blog: http://mechanical-sympathy.blogspot.com/

Twitter: @mjpt777

***“Winning is not enough. --***
***I’d have pushed harder on safety.***
***I’d have carried it to the next dimension.”***

**- Sir Jackie Stewart**