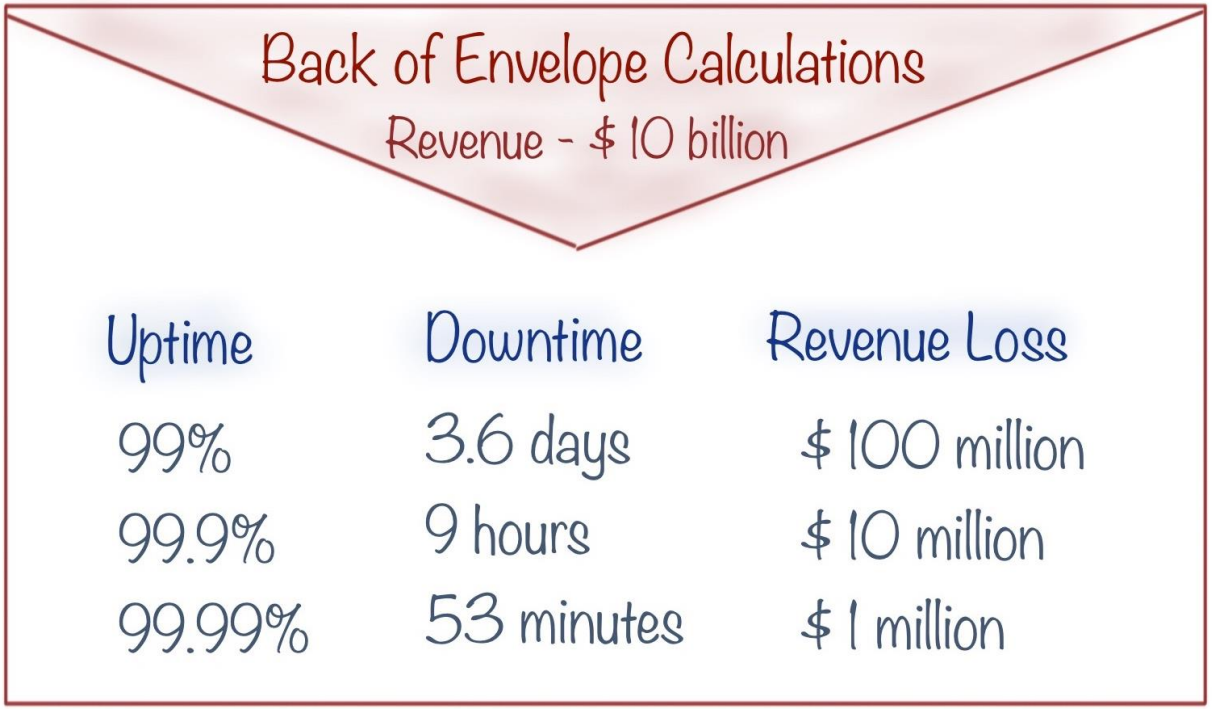
Systematically Surviving Failures In the Cloud

Manish Maheshwari, Principal Software Engineer
Expedia Group

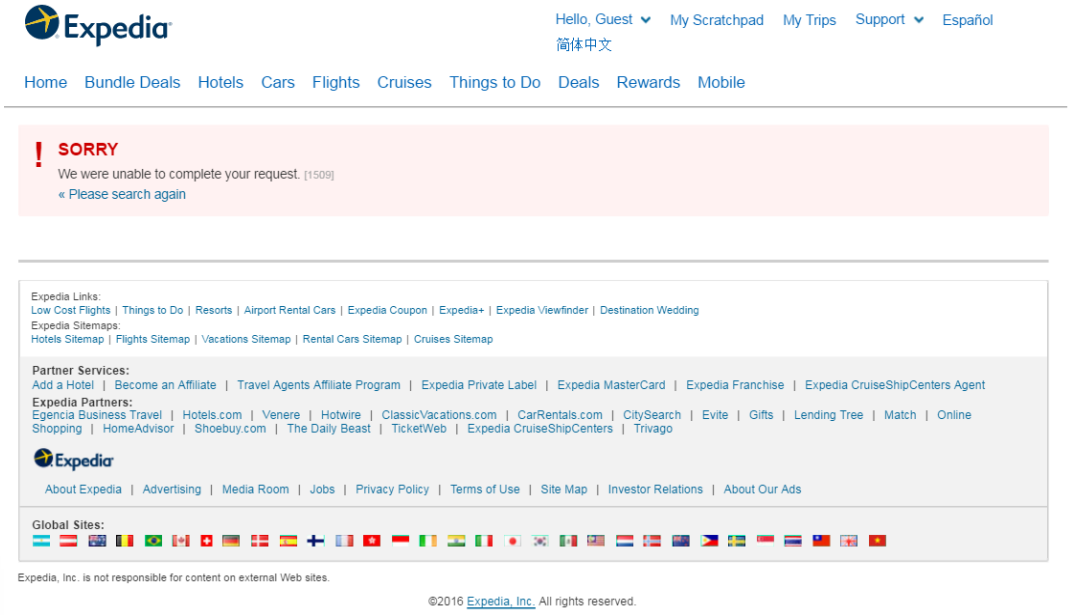
Why?

Production Stability .... Cost of Incidents



Why?

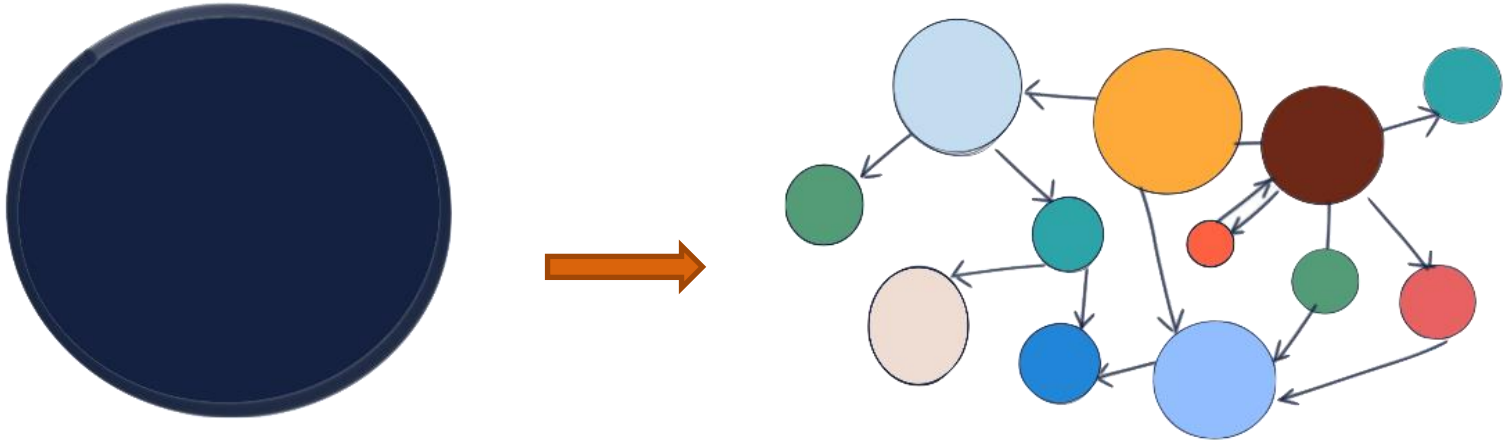
Poor User Experience … Loss of Brand Value



Why?

Sleepless Nights... Spoiled Mornings

Why Now?



... circuit-breaking...

back-pressure....deadlines....retries....backoffs....

timeouts....bulk-heading....tracing...never-ending...

Why Now?

We have embraced *velocity*

Goals

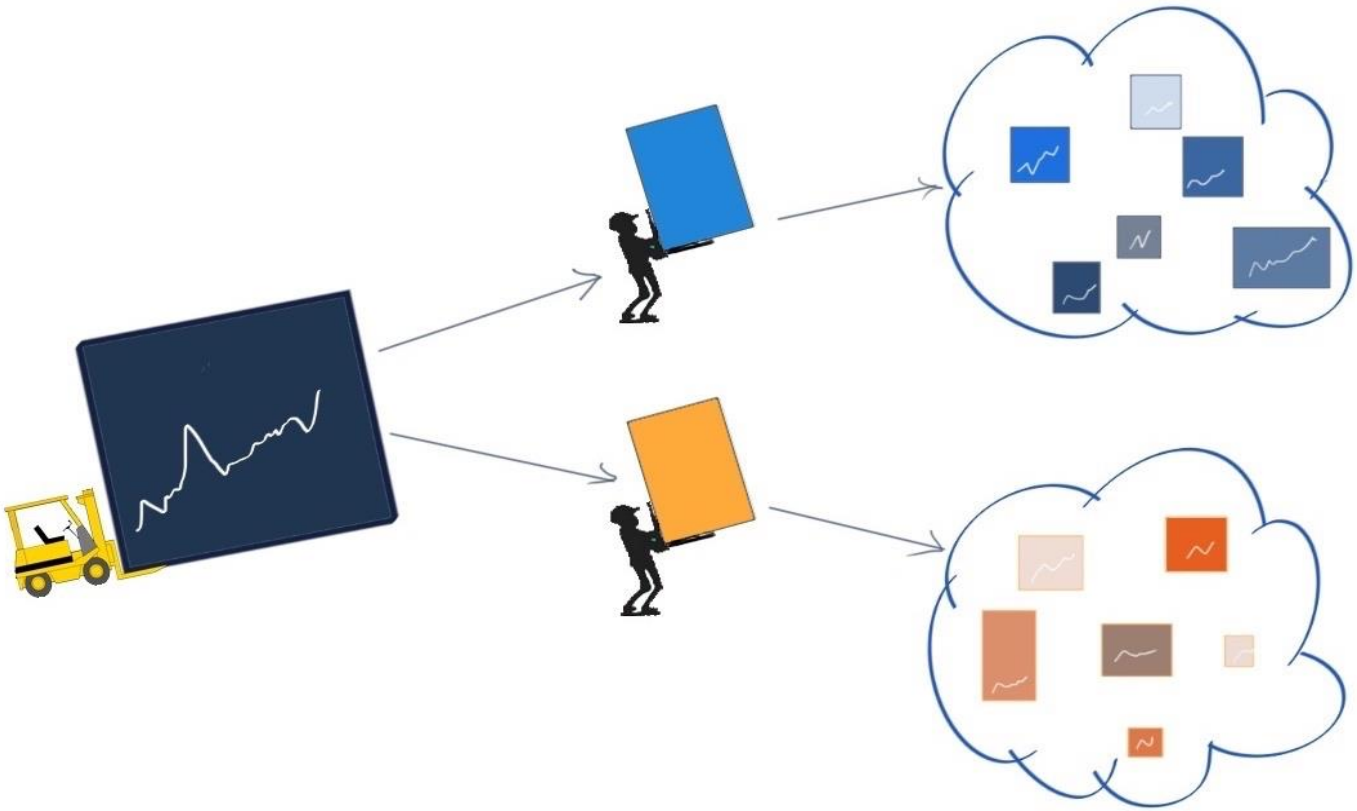
"Build the fastest, most resilient global travel platform fully in the cloud. Modernize our automation to become cloud native, and switch from DR to active resiliency."

– ad verbatim from our Cloud VP

Improve

- Resilience-at-large
- Resilience-at-small

How?



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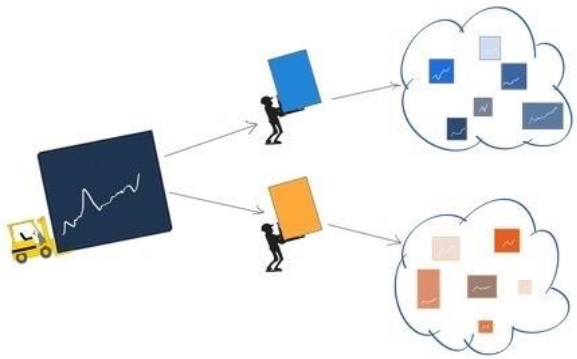

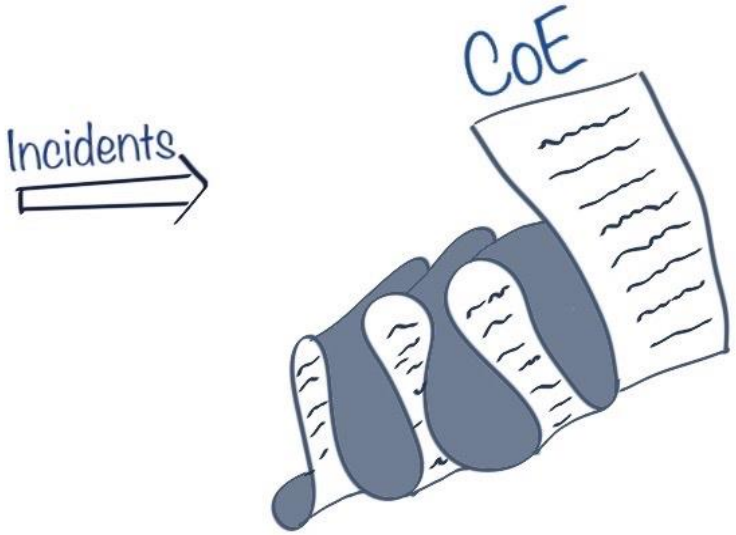

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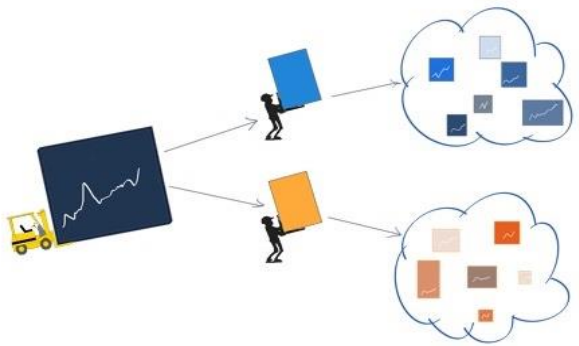

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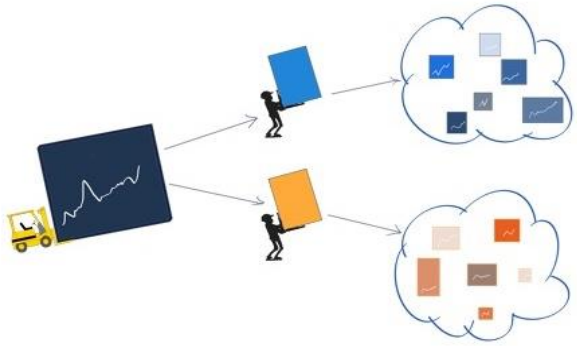
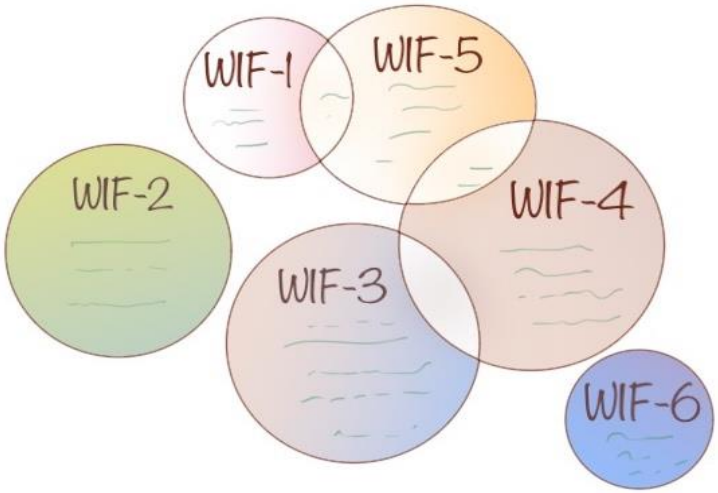
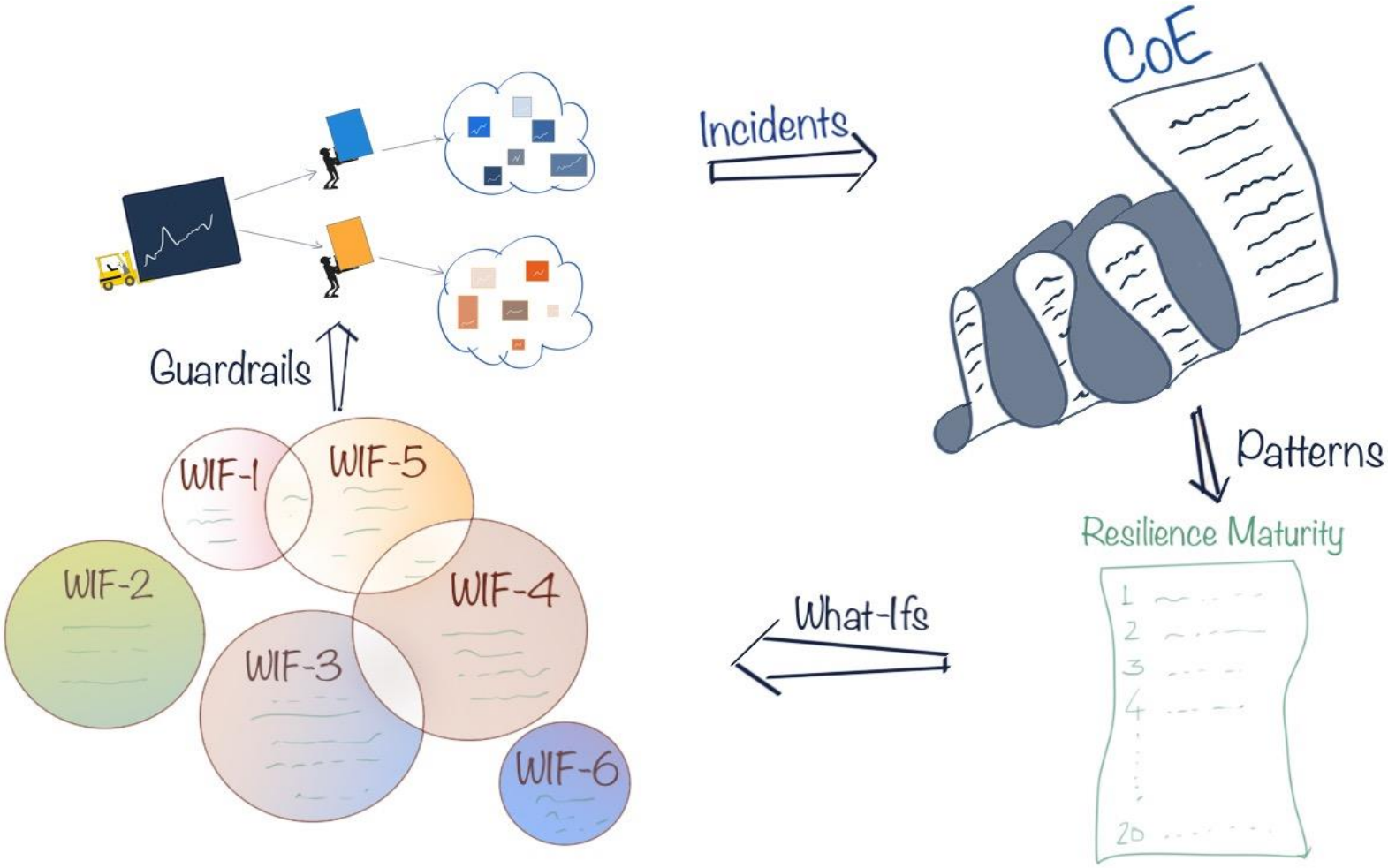



Incidents
CoE
Patterns
Resilience Maturity
What-Ifs
1
2
3
4
20

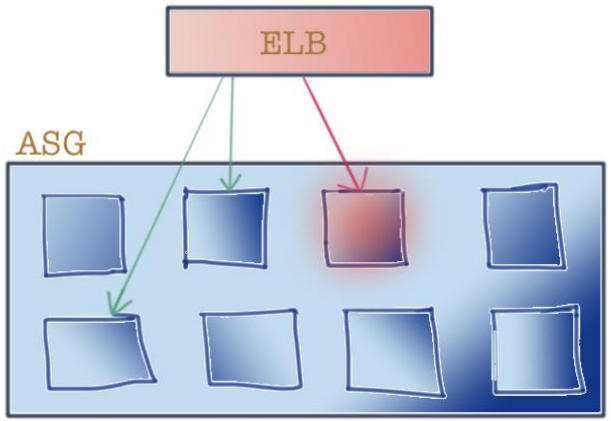

WIF-1
WIF-5
WIF-2
WIF-4
WIF-3
WIF-6

How?


Guardrails
WIF-1
WIF-5
WIF-2
WIF-4
WIF-3
WIF-6
Incidents
CoE
Patterns
Resilience Maturity
What-Ifs
1
2
3
4
20

THE SIX WHAT-IFS

What-if the VM is Unhealthy?



isHealthy

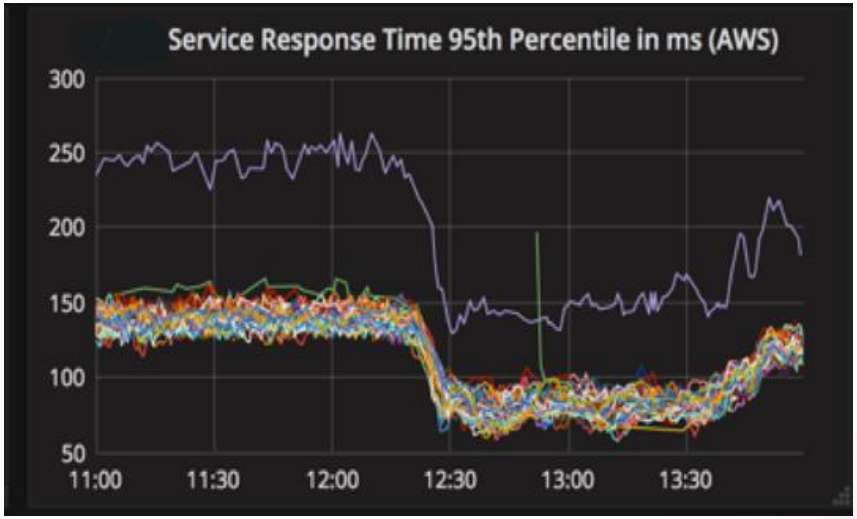
- Metrics
- Response Time
- Health Check Intervals
- Healthy Thresholds

What-if the VM is Unhealthy?

1

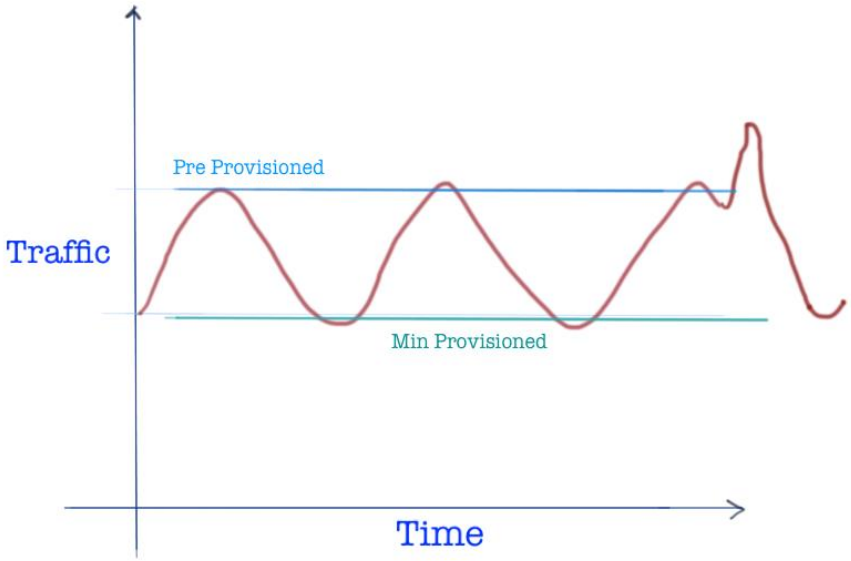
Anomaly detection for VM

Platform library
for application health



What-if the Traffic Surges?

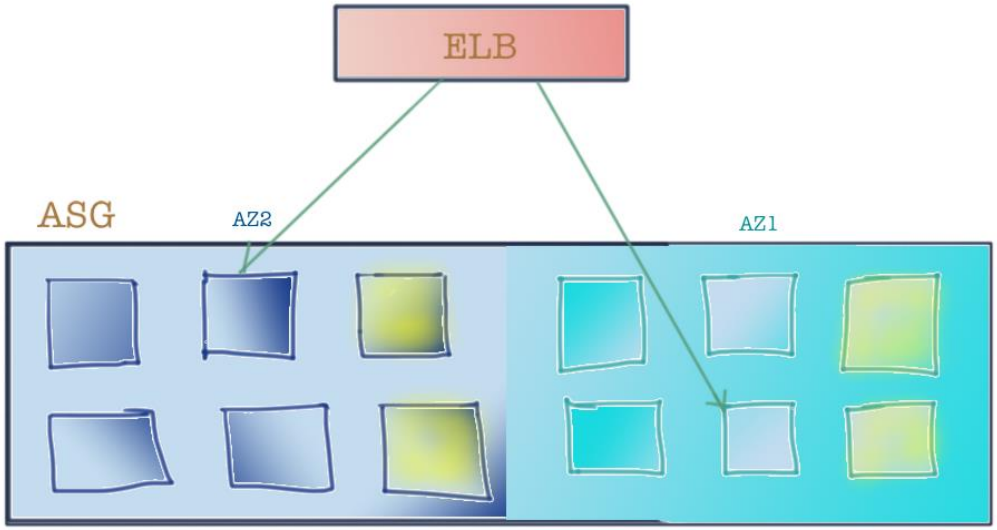
2



- Evaluate traffic pattern
  - Predictable Peaks
  - Unpredictable Peaks
- Figure out Min, Max, Desired

What-if the Traffic Surges?

2



Considerations

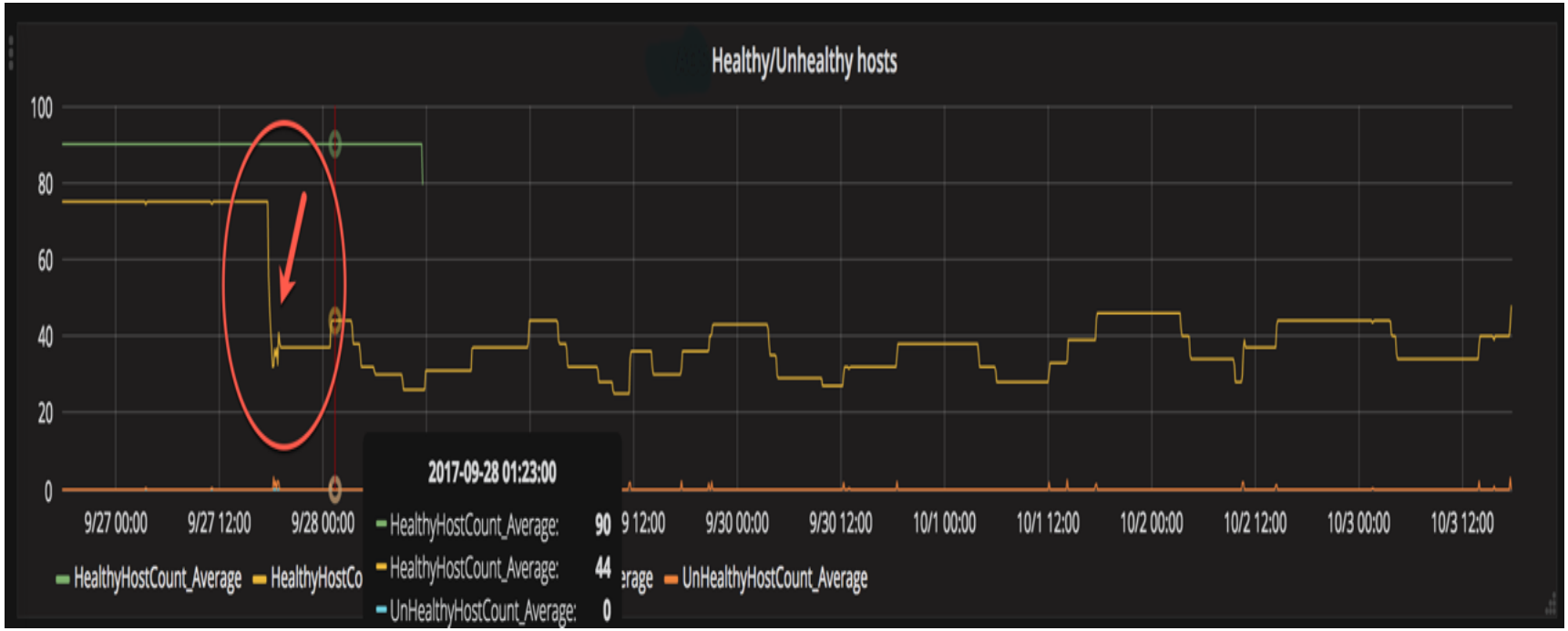
- Scale out & Scale in Policy
- Time to Launch and Run
- Right Metrics to Trigger Scaling
- Scaling Adjustment Types
- AZs to span

What-if the Traffic Surges?

2

What-if the Traffic Surges?

2



What-if the Traffic Surges?

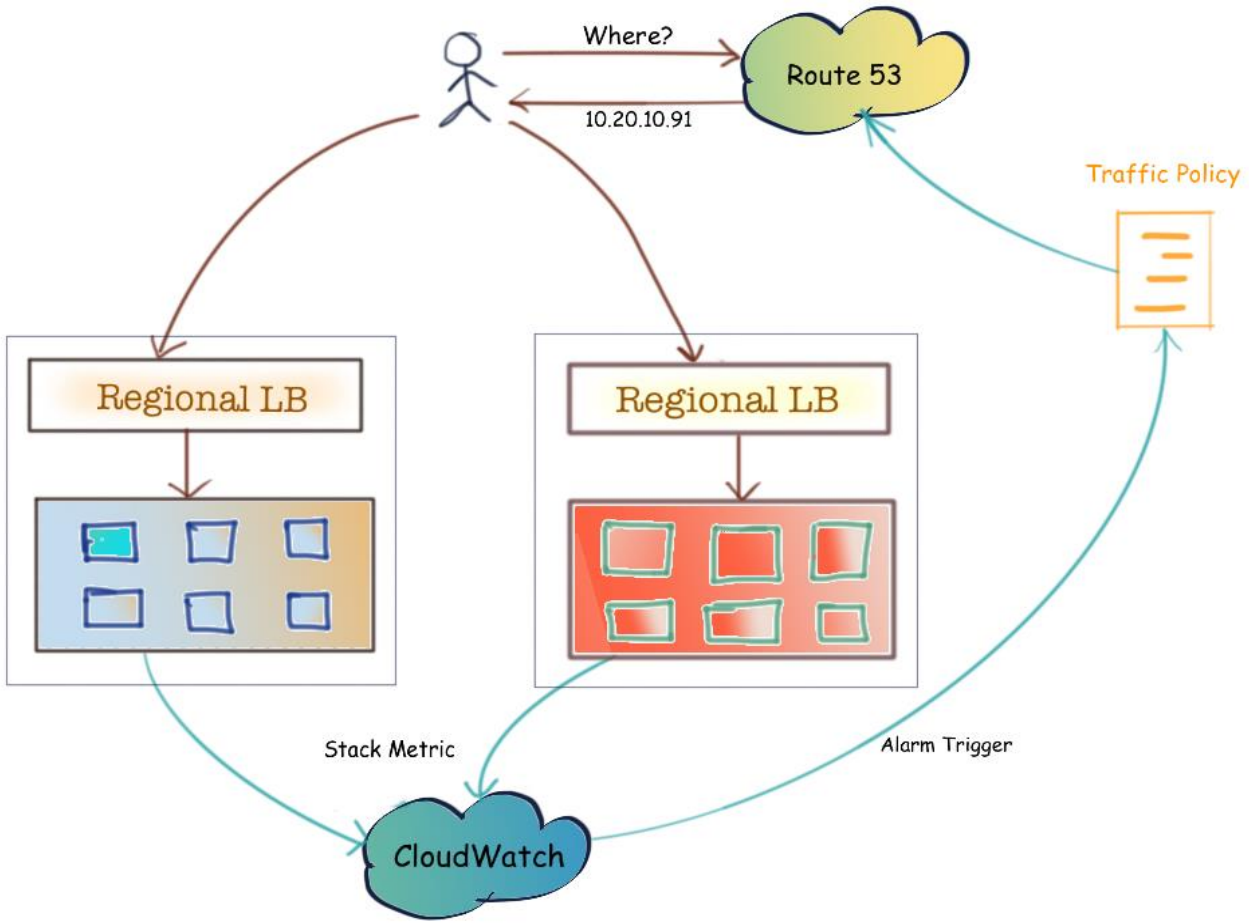
2

Some Learnings -

- CPU Based Scaling works most of the time
- Operating Band Width – 10% to 15%
- Connection Draining
- Reduced bootstrap time goes long way
- Traffic jumps from 1x to 4x in a very short span, and for very short duration are signs of bots

What-if the Service in a Region is Unhealthy?

3



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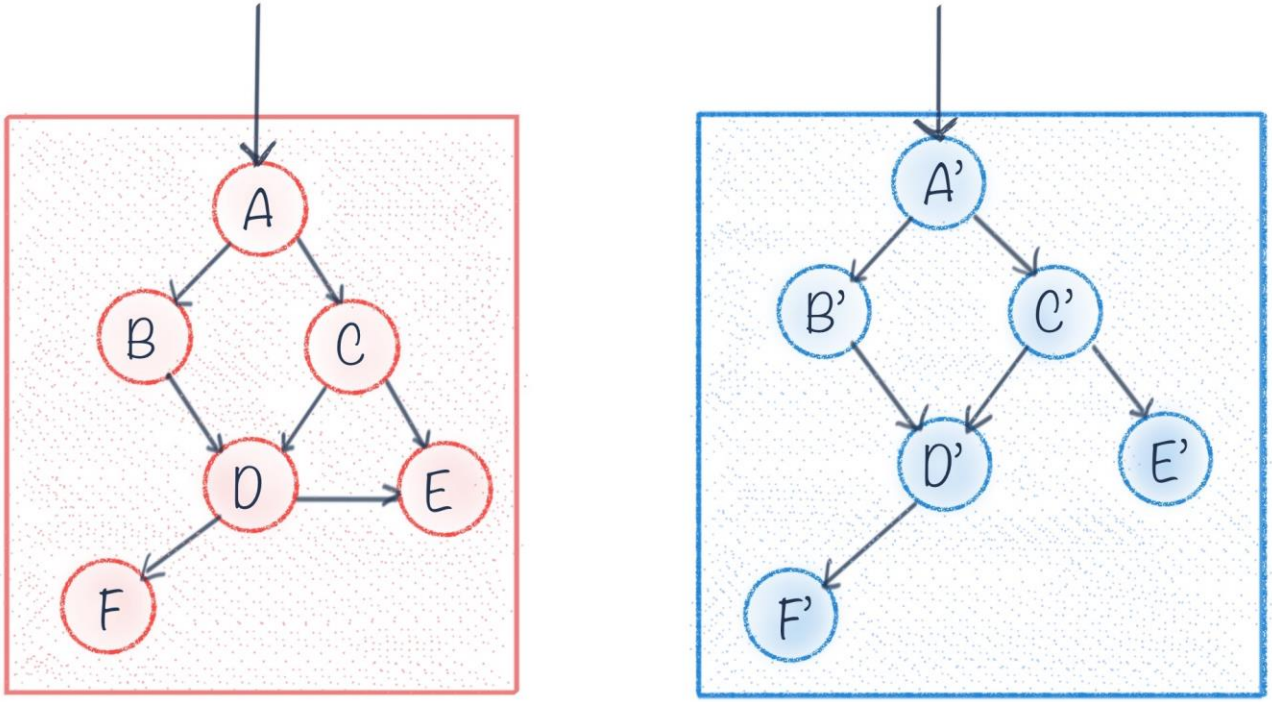
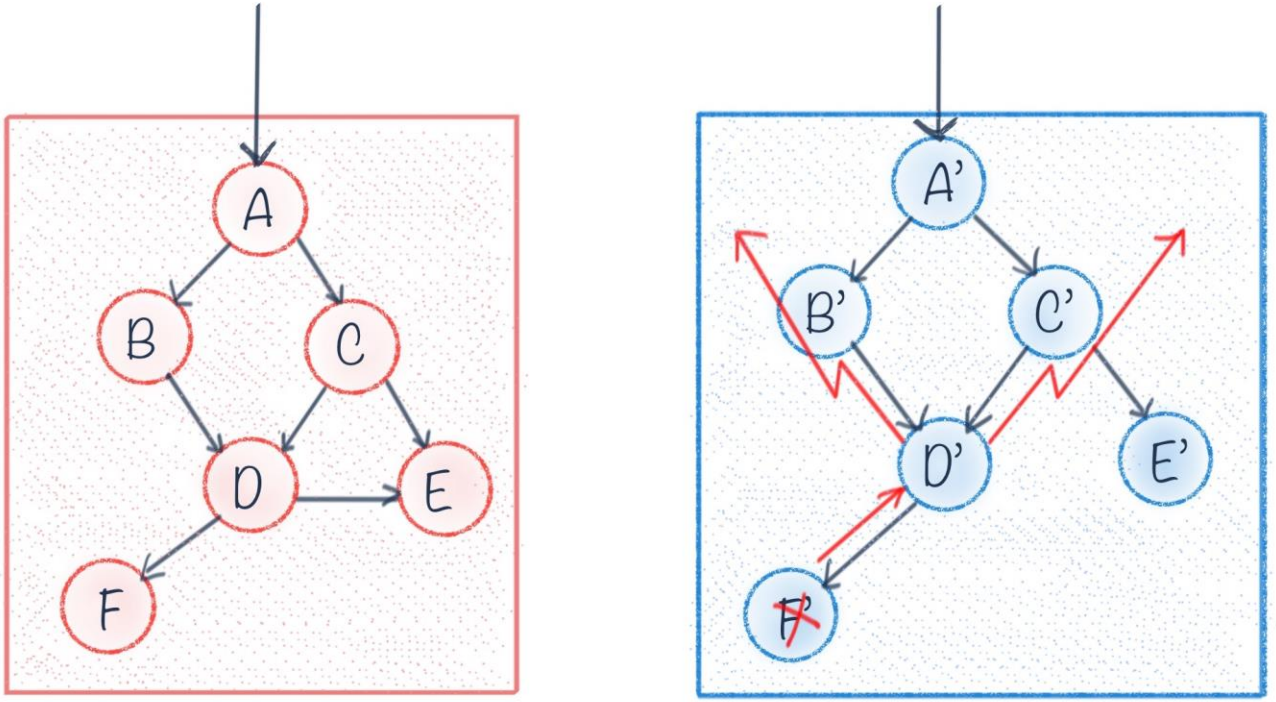


Fault Domain and the Vegas Rule

What-if the Service in a Region is Unhealthy?



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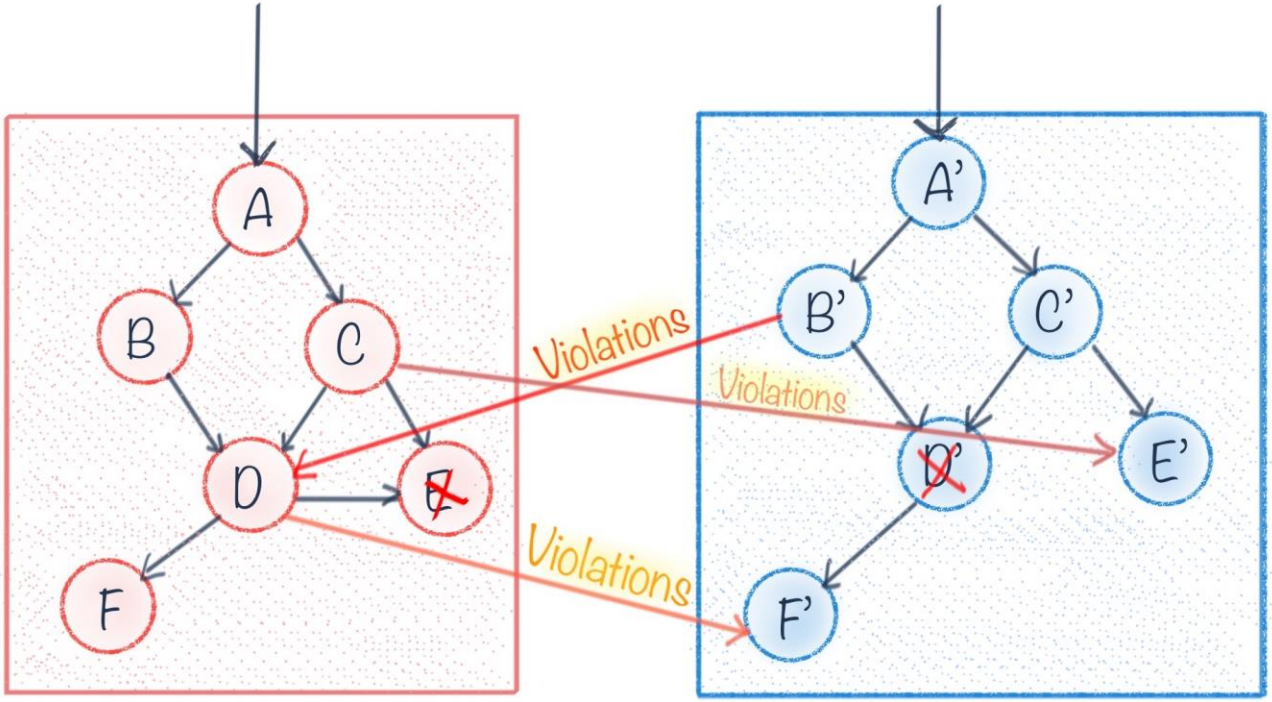


Fault Domain and the Vegas Rule

What-if the Service in a Region is Unhealthy?

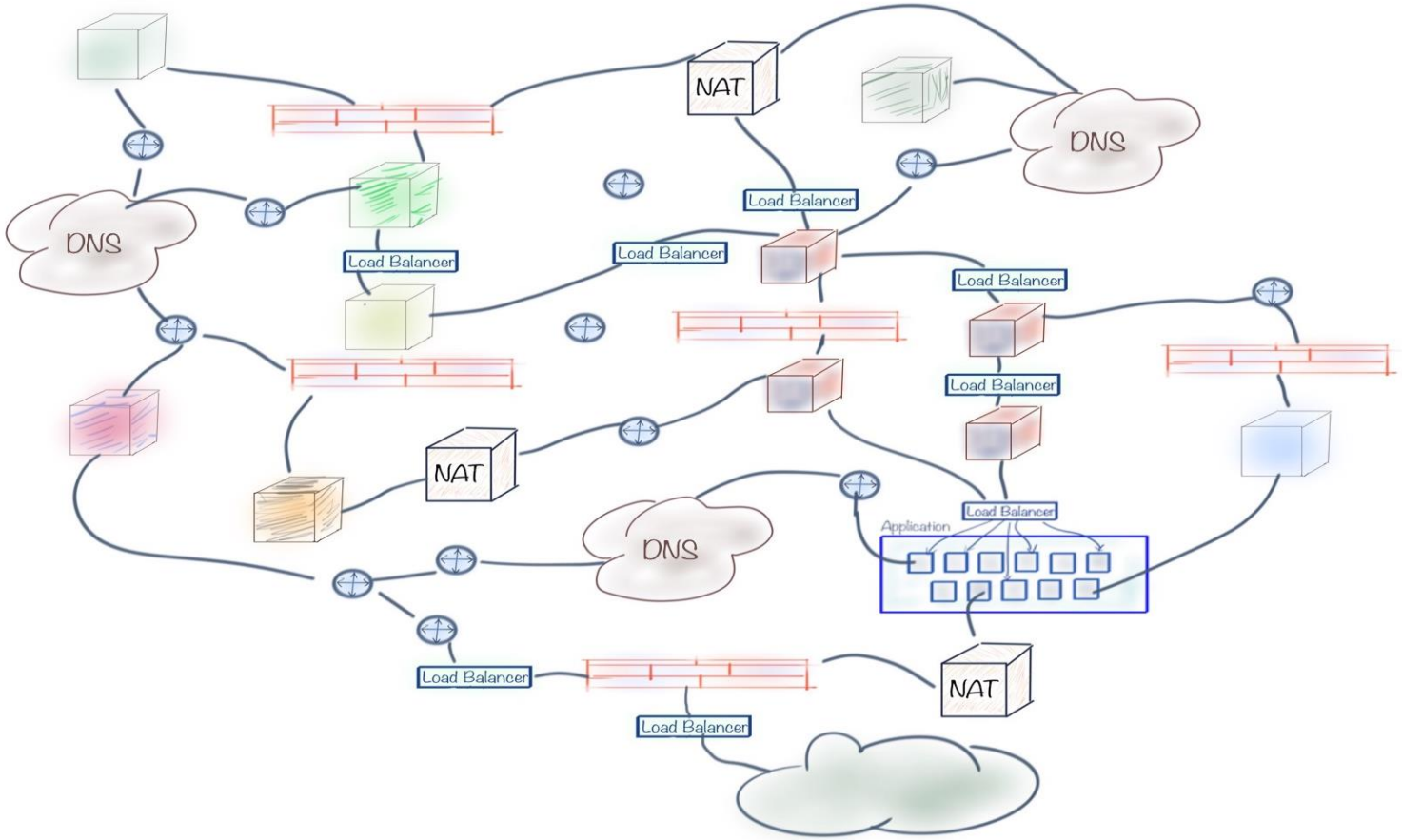
3

Considerations:

- Fault Domain and the Vegas Rule
- Minimum Failover Time
- Rule Type - Weighted RR, Primary/Failover
- State of CW Alarm
- Health Checks
- Failover Times
- Traffic Rules

What-if the Dependency goes Down?

4



What-if the Dependency goes Down?

4

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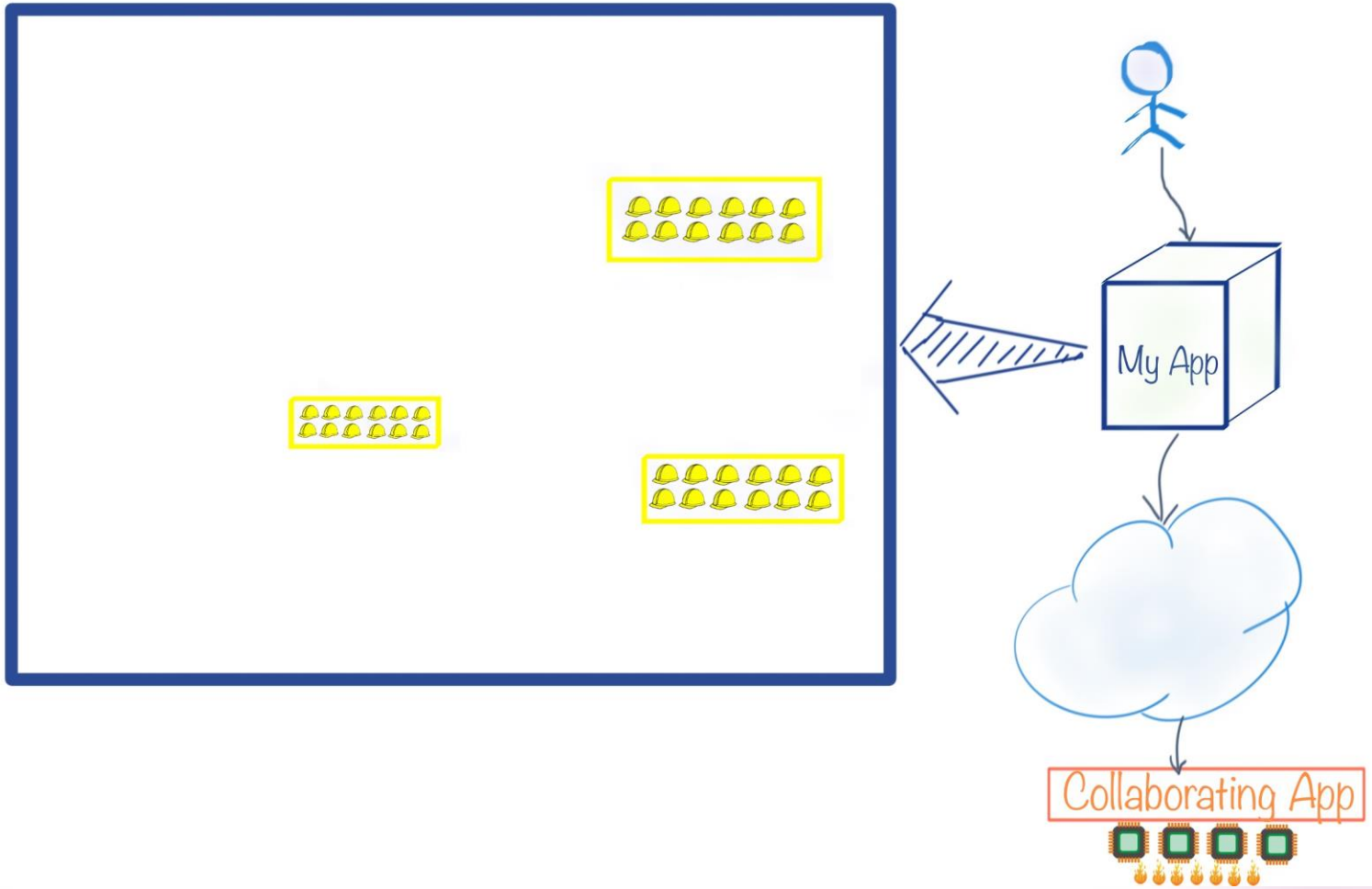

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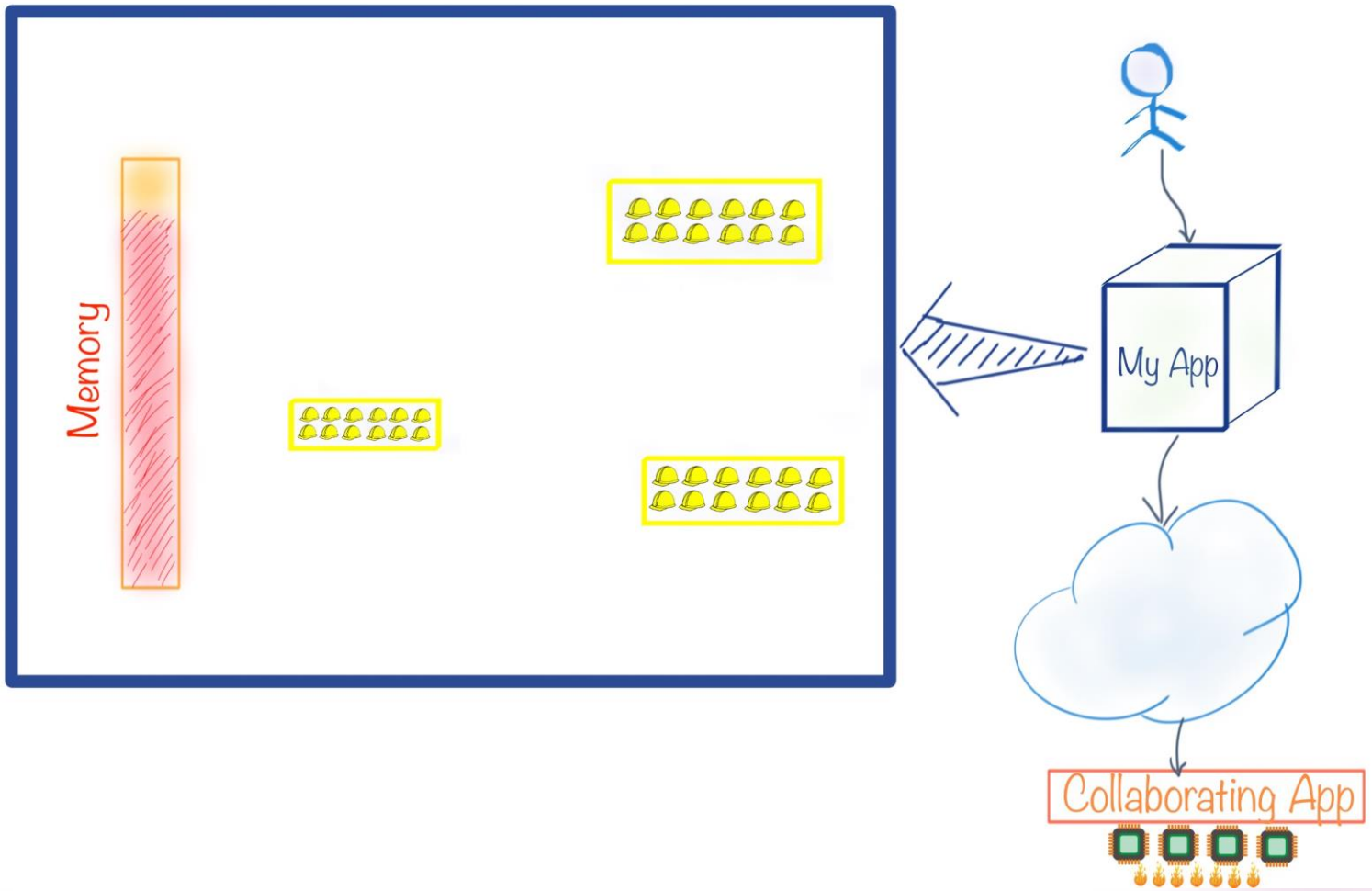

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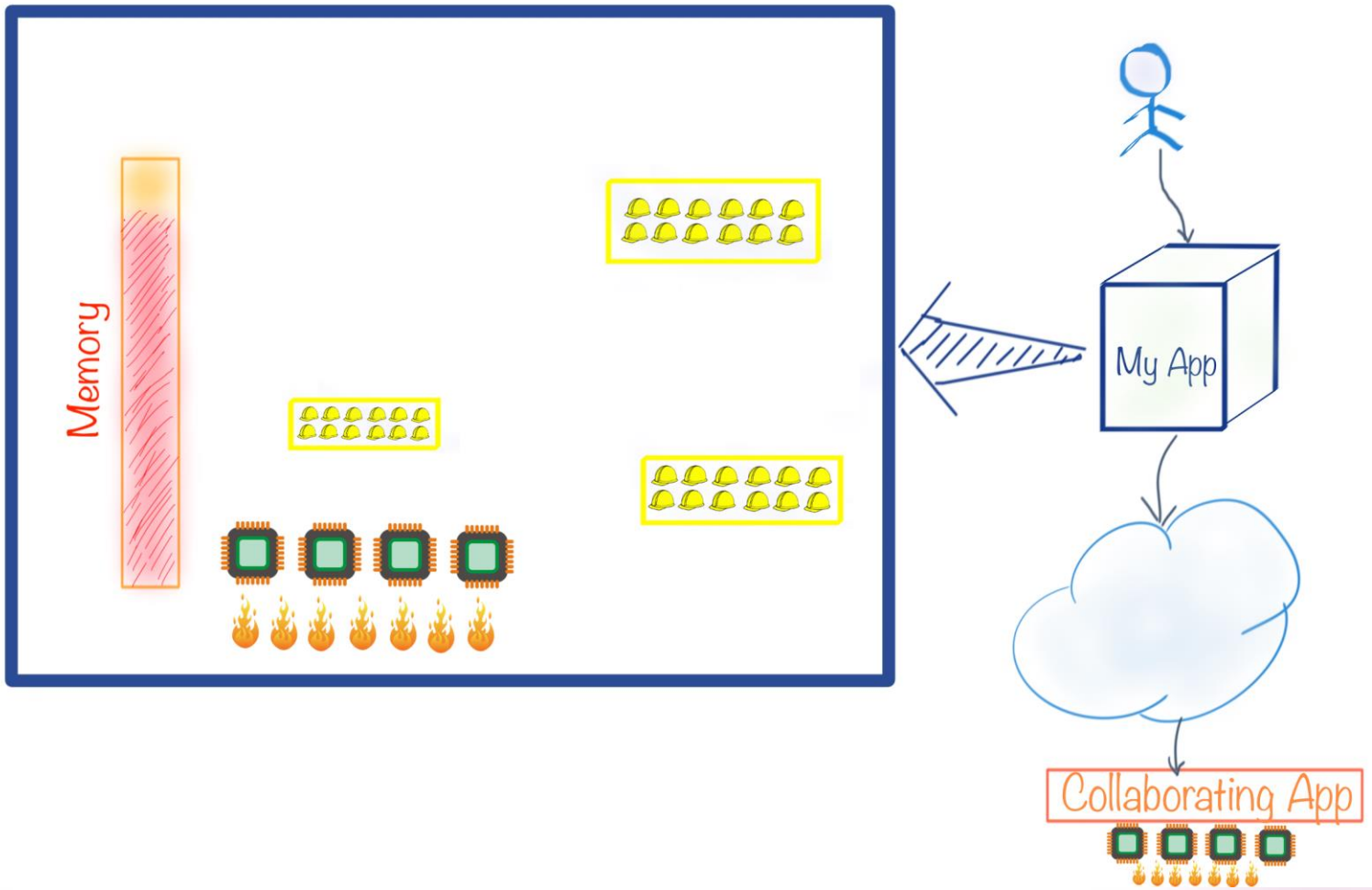

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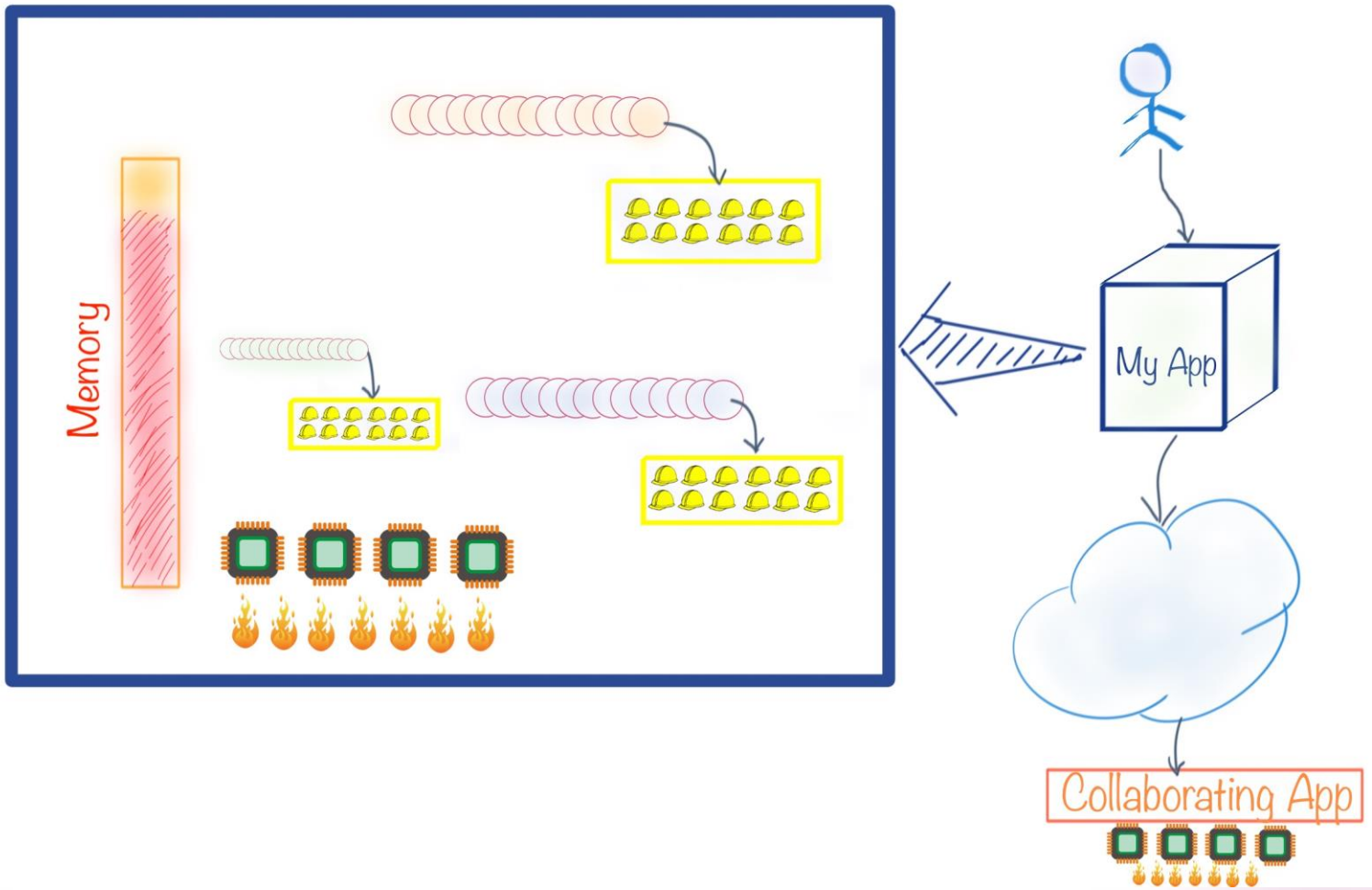

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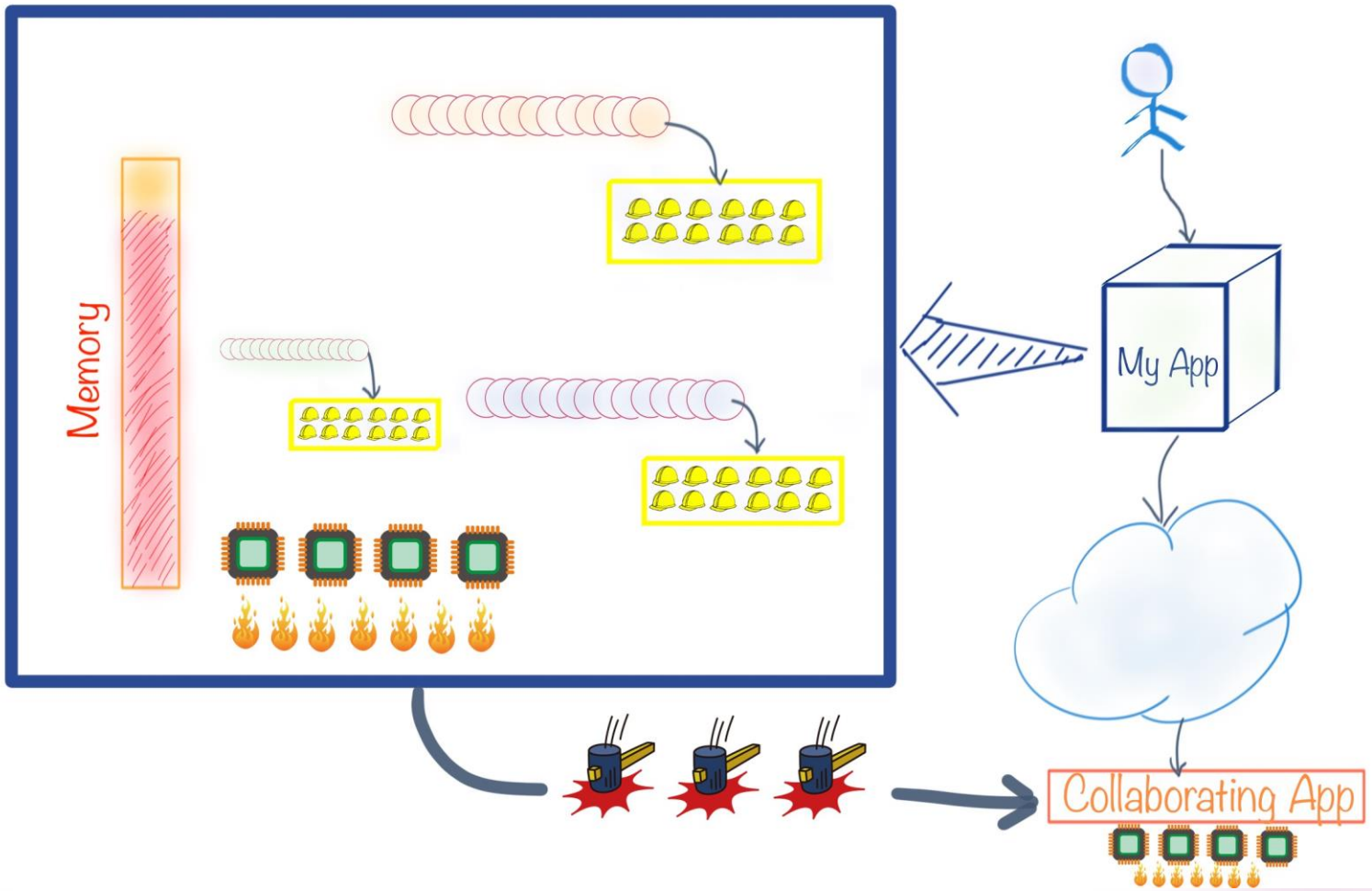

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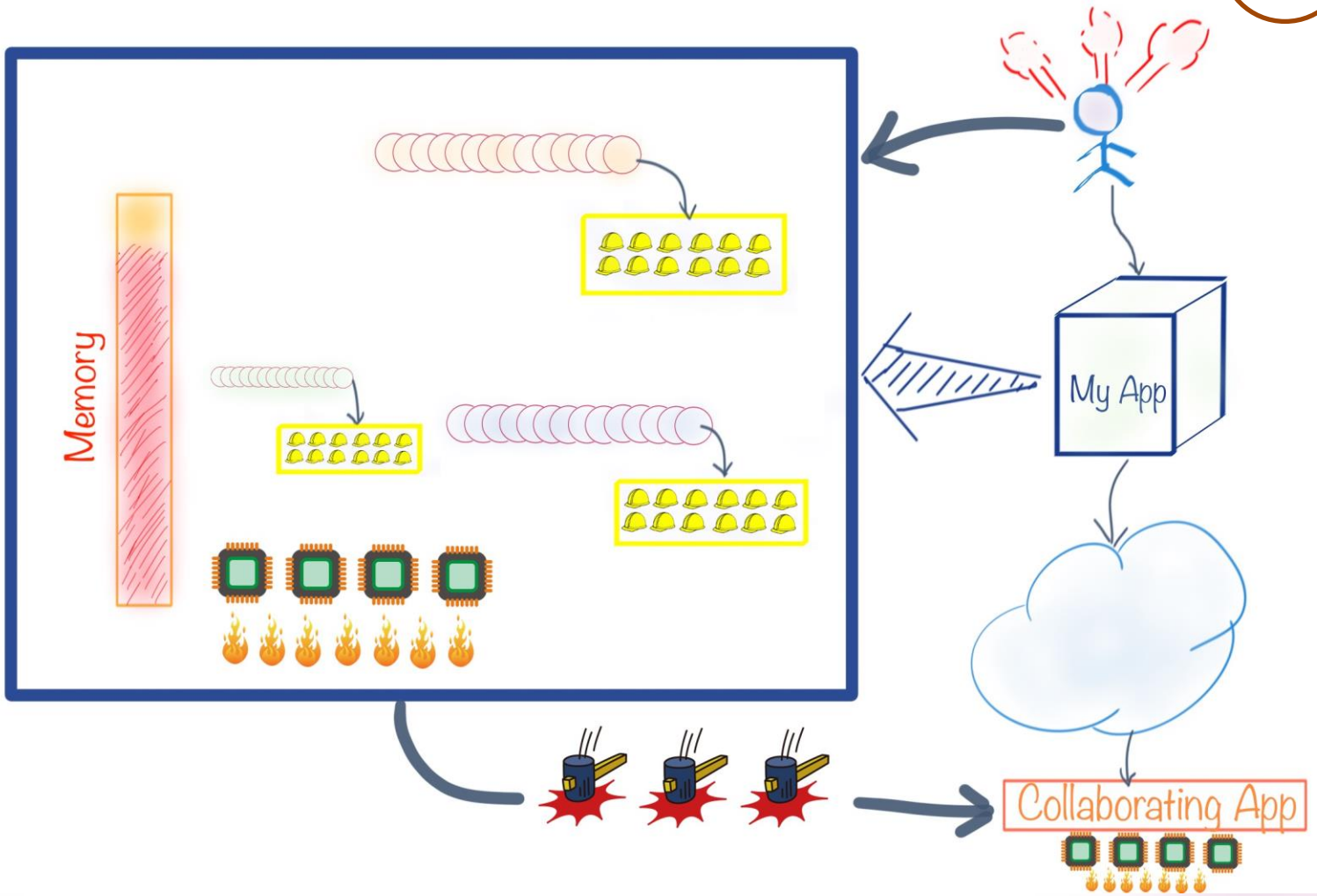

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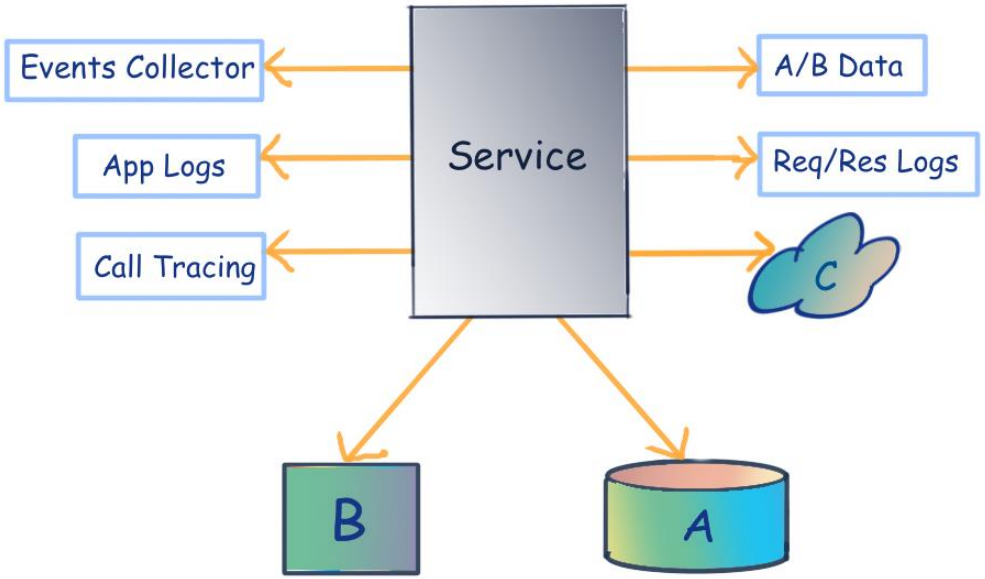
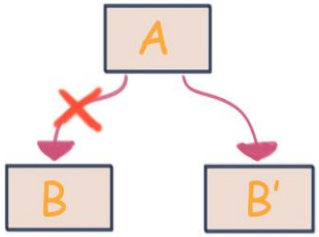


Analyzing Dependencies

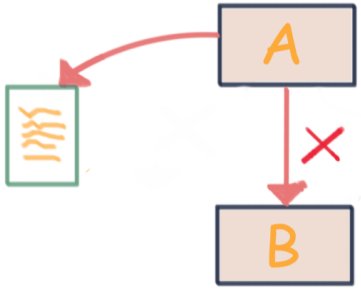
- Downstream
- Cross-cutting

What-if the Dependency goes Down?

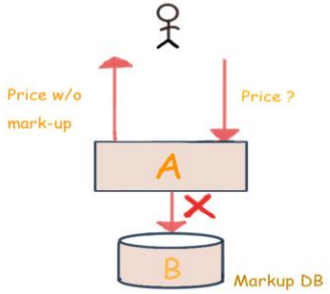
Failover to Alternate



Use Offline Data



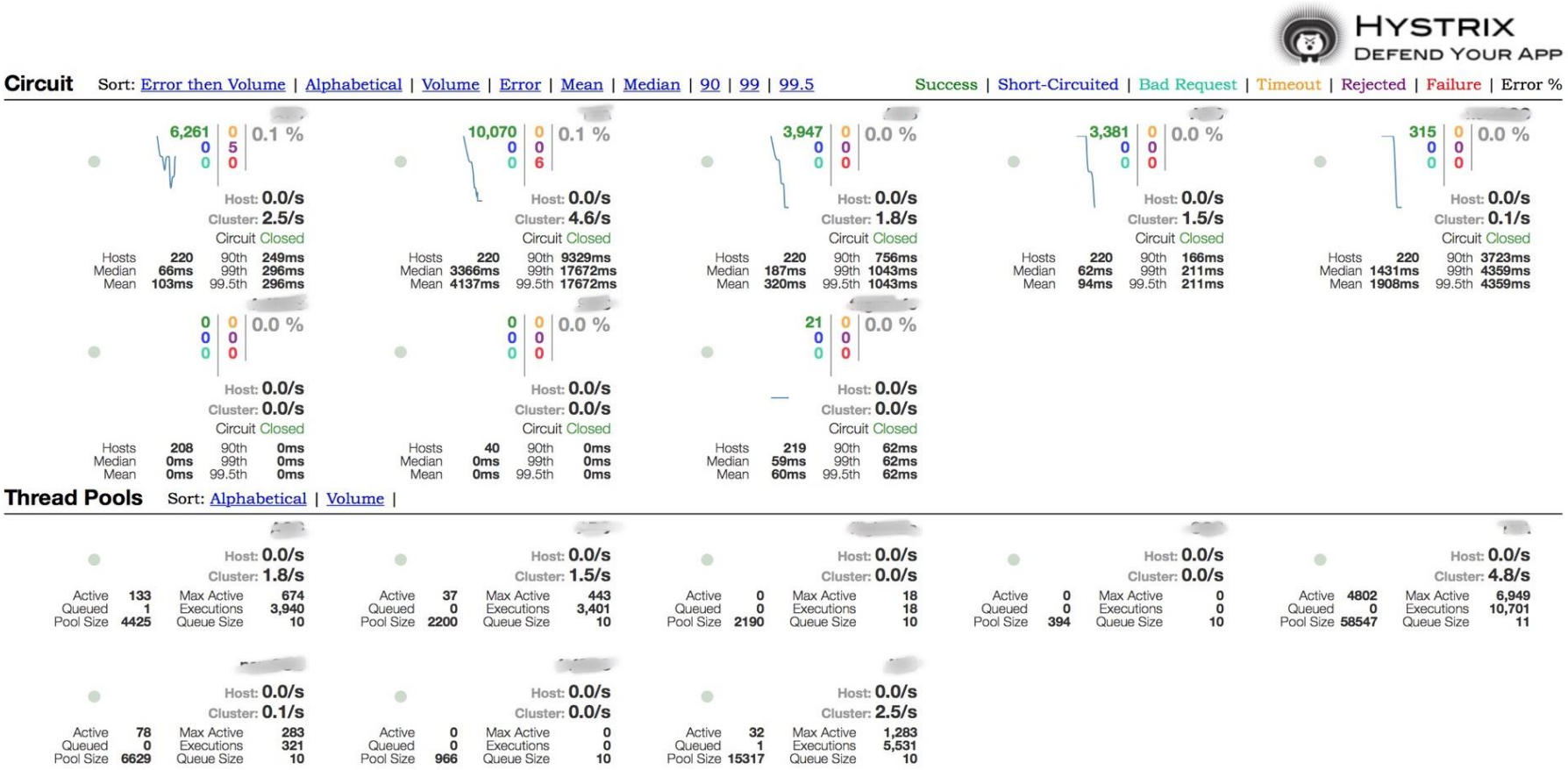
Degrade Gracefully



Think Creatively

What-if the Dependency goes Down?

4



You need to restart your computer. Hold down the Power button until it turns off, then press the Power button again.

Redémarrez l'ordinateur. Enfoncez le bouton de démarrage jusqu'à l'extinction, puis appuyez dessus une nouvelle fois.

Debe reiniciar el ordenador. Mantenga pulsado el botón de arranque hasta que se apague y luego vuelva a pulsarlo.

Sie müssen den Computer neu starten. Halten Sie den Ein-/Ausschalter gedrückt bis das Gerät ausgeschaltet ist und drücken Sie ihn dann erneut.

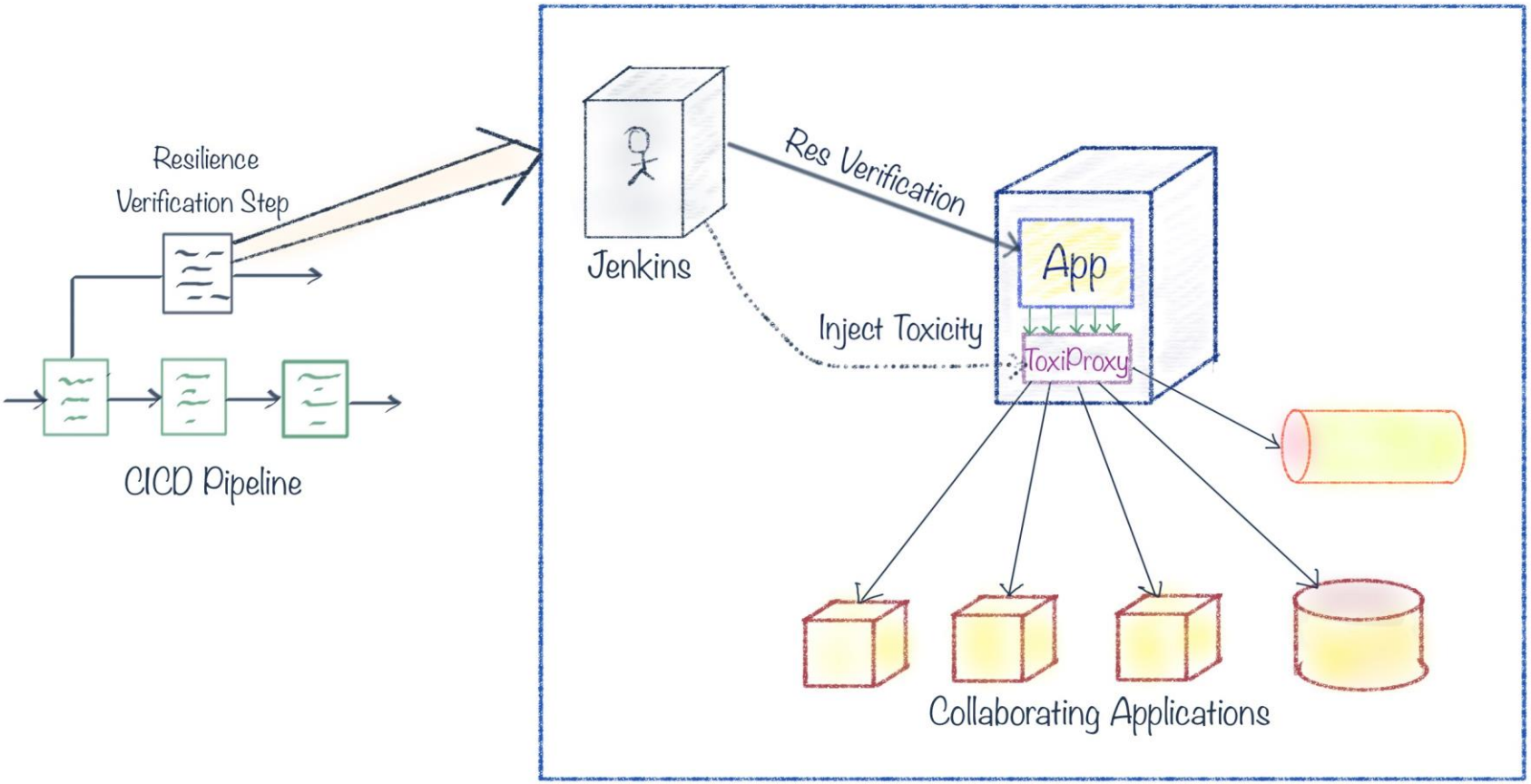
コンピュータの再起動が必要です。電源が切れるまでパワーボタンを押し続けてから、もう一度パワーボタンを押します。

What-if the Dependency Behaves Bad?

"Be *Conservative* in what we send to a service and *Liberal* in what we accept"

- Bad Behaviors
  - packet-drops…connection-resets…slow-readers…
  - time-outs…increased-latency...
- Considerations
  - Software Resiliency Patterns - ... circuit-breaking... retries....backoffs....
  - Test the Resiliency – Simian Army, Gremlin, et al

What-if the Dependency Behaves Bad?



What-if the Dependency Behaves Bad?

5

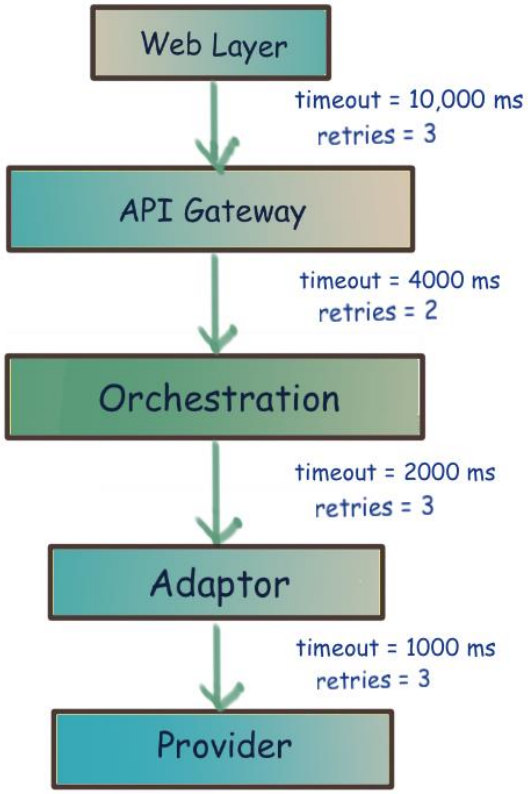
```
Feature: Resilience Verification of Search Service

  Background: Ensure that the service is up and running
      Given There are no proxies
        And Proxy named pricingServiceProxy is created from <localhost:21001> to <faresearch.internal.expedia.com:443>
        And Proxy named collectorProxy is created from <localhost:31001> to <collector.internal.expedia.com:443>
        And Proxy named databaseProxy is created from <localhost:31002> to <offermaster.expedia.com:3306>
        And Proxy named fareSearchProxy is created from <localhost:31003> to <fareservice.internal.expedia.com:443>

  Scenario: Pricing service downstream latency of 2+3 seconds
    Given The pricingServiceProxy has downstream latency of 6000 ms with jitter of 1000 ms
      And The pricingServiceProxy has upstream latency of 5000 ms with jitter of 1000 ms
    When The /restservice endpoint is hit with POST request from resource xmls/carssearch1.xml and below headers
      | accept        | application/xml |
      | content-type  | application/xml |
      | cache-control | no-cache        |
    Then Response code is 200
      And Response received has </ns4:CarProduct> text
      And Response received has vendor text
      And Delay in response is more than 5000 ms
      And Delay in response is less than 90000 ms

  Scenario: Pricing service downstream slice
    Given The pricingServiceProxy has downstream slicing of 3000 byte packets delayed by 10000 microseconds
    Given The pricingServiceProxy has upstream slicing of 3000 byte packets delayed by 10000 microseconds
    When The /restservice endpoint is hit with POST request from resource xmls/carssearch1.xml and below headers
      | accept        | application/xml |
      | content-type  | application/xml |
      | cache-control | no-cache        |
    Then Response code is 200
      And Response received has </ns4:CarProduct> text
      And Responses received have vendor text
```

What-if the Dependency Behaves Bad?

Chaos Engineering

- VM Termination
- Health Check integration
- New attacks

What-if the Service gives up too early?



Time Grading

- SLA Definition
- Right Alarm Thresholds
- Deadlines

What-if the Service gives up too early?

Classifying HTTP Responses

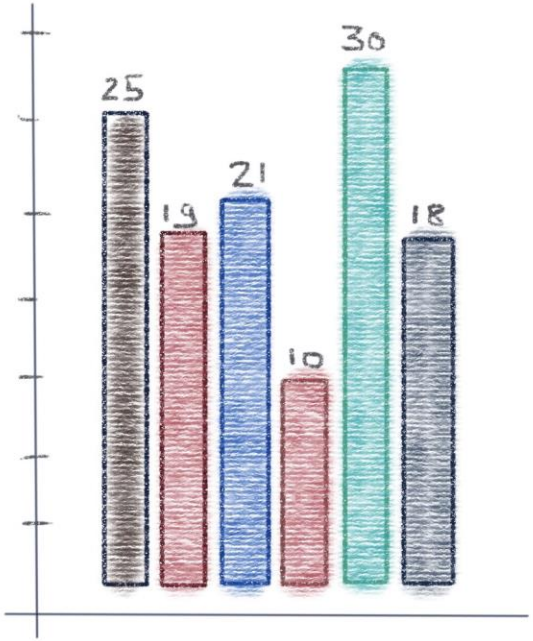
- Non-Retryable Failures
- Retryable Failures

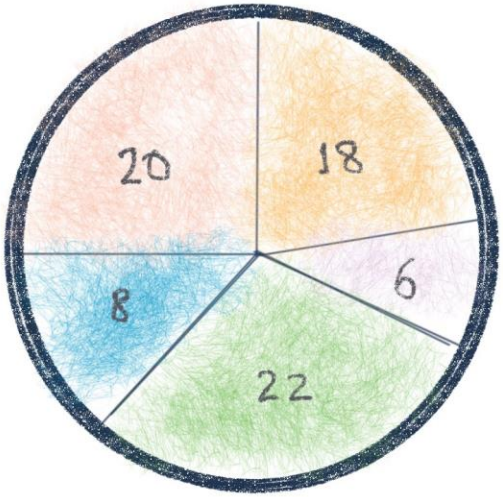
TACTICAL LEARNINGS

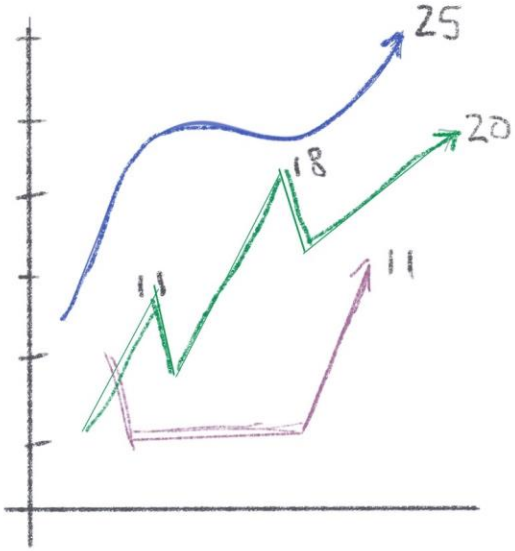
What Helps

1. Translating the Black Book into Small, Actionable Items
2. Simplest things give the Largest Gains *(just take the first step)*
3. State the Problem (what-ifs) *(but do not prescribe a solution)*
4. Unblock by filling in Tech Gaps
5. A good Program Manager

Tracking







Acknowledgements

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Nitish Sabharwal *(building scaling using non-traditional metrics)*

Sunil Singhal *(platform library for health checks)*

Willie Wheeler *(building confidence and running Chaos Monkey on Production)*

Conclusion

1. What-if the VM is Unhealthy?
2. What-if the Traffic Surges?
3. What-if the Region is Unhealthy?
4. What-if the Dependency is Down?
5. What-if the Dependency Behaves Bad?
6. What-if the Service gives up too early?


Thank you
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