DON'T CREATE A SERVICE MESS, USE A SERVICE MESH

Exploring microservice challenges and solutioning tips

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THE MICROSERVICES TRADEOFF

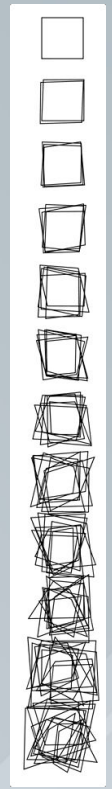
Adopting microservices means accepting architectural complexity in order to gain agility

DISTRIBUTED COMPUTING IS COMPLEX

...but it's just groups of networked computers right?

The fallacies of distributed computing

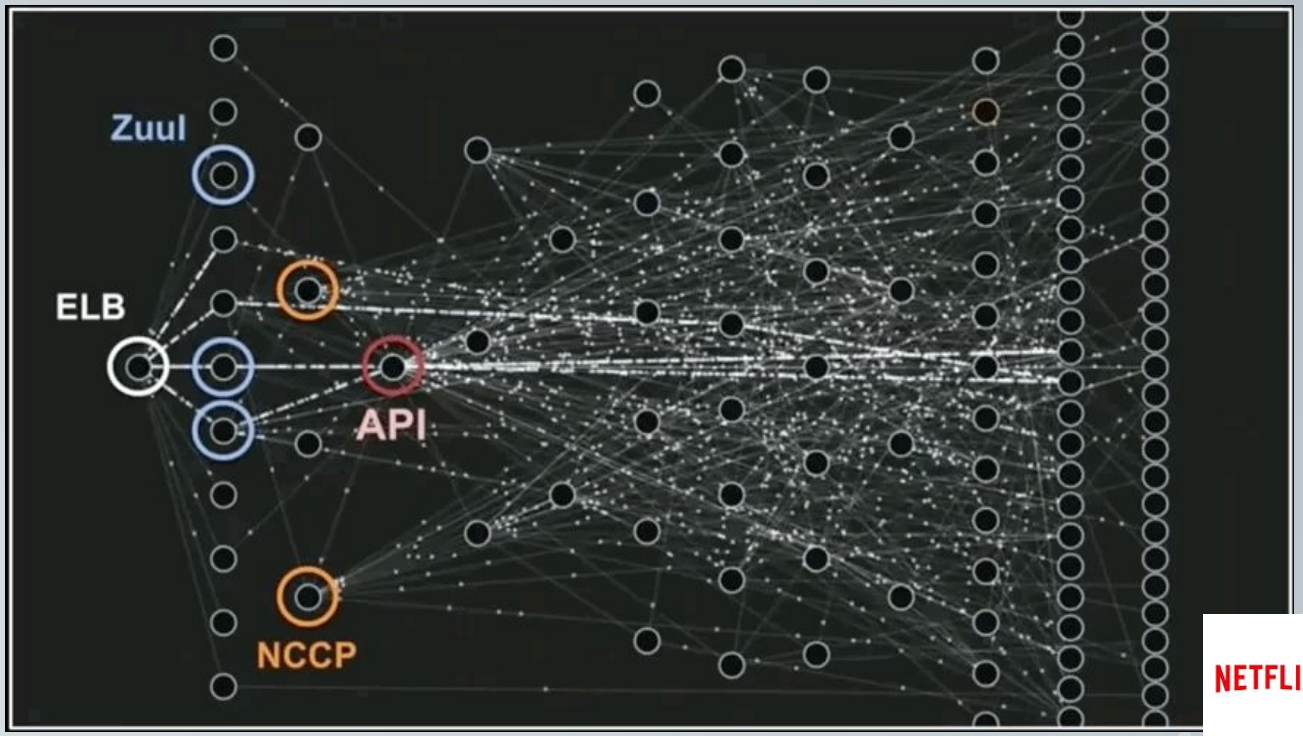
- The network is reliable.
- Latency is zero.
- Bandwidth is infinite.
- The network is secure.
- Topology doesn't change.
- There is one administrator.
- Transport cost is zero.
- The network is homogeneous.



https://observablehq.com/@duncangeere/structure-de-quadrilateres

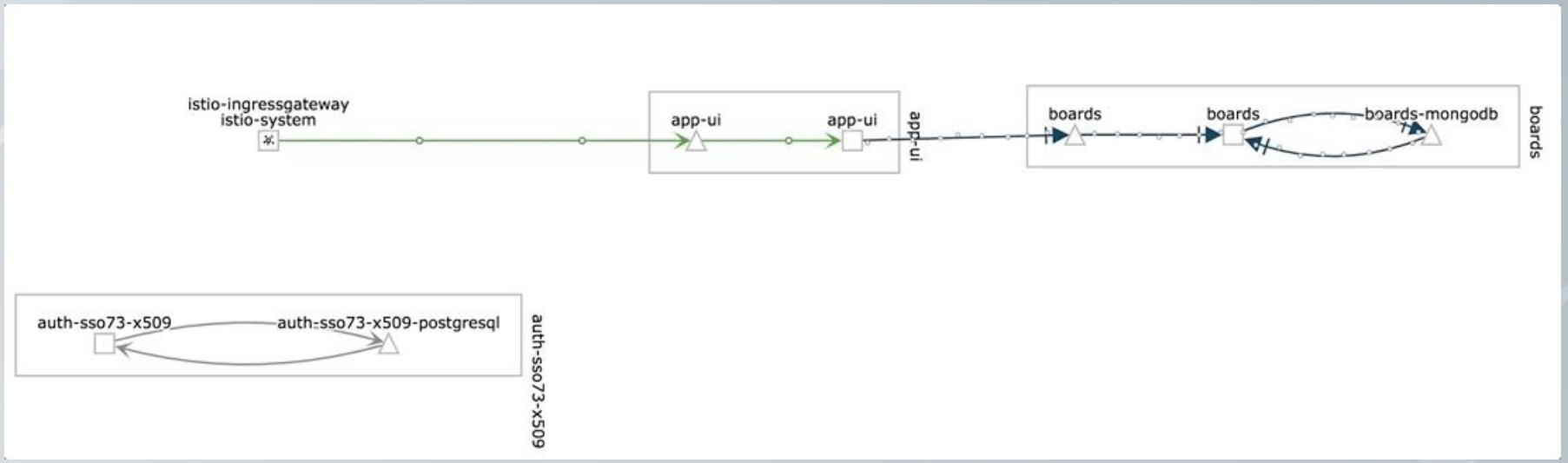
COMPLEXITY = PROBLEMS

SO IF YOU'RE BUILDING SOMETHING LIKE THIS



https://www.youtube.com/watch?v=CZ3wIuvmHeM

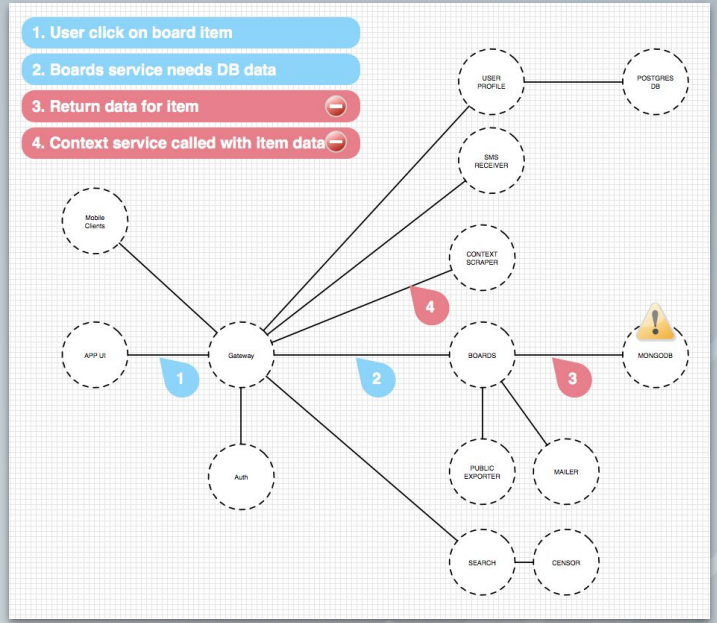
…OR SOMETHING LIKE THIS



YOU HAVE SIMILAR CHALLENGES

PARTIAL OUTAGES & CASCADING FAILURES

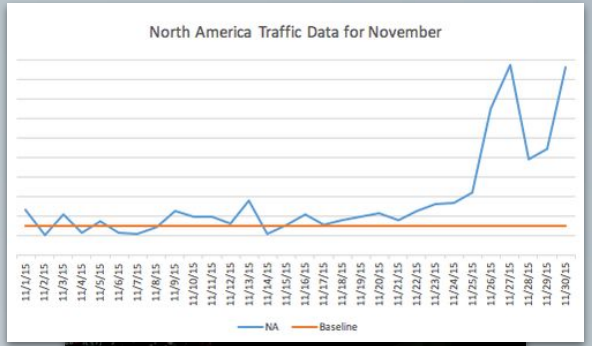
- Functionality can require a chain of services
- Any of these services can fail individually
  - permanently or temporarily
- Calling code should handle failures
  - Failures aren't instantaneous
- Failures can cascade through services

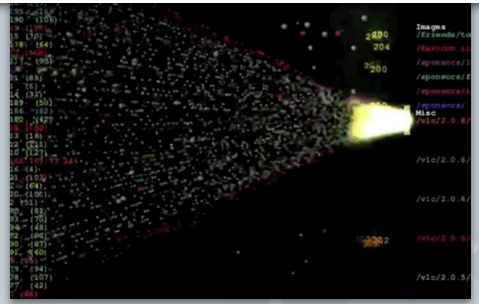


Typically result in hanging and unresponsive app user interfaces

TRAFFIC SPIKES

- Traffic spikes are unpredictable increased load
- User demand or malicious attacks
- These spikes can be hard on specific services
- API gateways regulate at ingress only





Typically result in service failures

https://blogs.akamai.com/2015/12/2015-black-friday-traffic-spikes-109-percent-over-average-pre-holiday-activity.html
https://www.youtube.com/watch?v=hNjdBSola8k

COMPLEX DEPLOYMENTS & FAILURES

- Deploying changes are often a failure point
- Untracked deployments is a problem
  - “Our process docs” shouldn’t be the solution
- Service versioning adds complexity
  - SvcX:v1 isn’t compatible with SvcY:v2
- Problems can show up only after release

This site can’t be reached

Typically result in downtime or degraded functionality

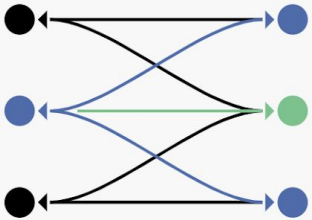
MORE PROBLEMS

1. Overloaded services
2. Anemic domain models
3. Usage limiting for limited resources
4. Versioning and version specific traffic
5. Lack of service discovery
6. Integration testing
7. Malicious requests
8. Dealing with stateful services
9. Finding data from 100s of logs files
10. Services coupling leading to a Death Star
11. Inability to measure/monitor performance
12. New client libs force rebuild/test of services
13. Network Latency
14. Migration from a monolith
15. Identifying unhealthy services
16. Heterogeneous communication protocols
17. Managing retry logic
18. Testing failure conditions
19. Validation of users across services

84. Sneaky bugs that only rear their head in prod
85. Microservice libs unavailable for my language
86. Increased complexity for operations team
87. Code pipelines for 100s of services
88. Finding root cause of a failure
89. Controlling access to service APIs
90. Increased complexity for developers
91. Deployment failures
92. Distributed transactions
93. Insecure communication of data in-transit
94. Legacy data sources
95. Service level security auditing
96. Multi-region deployments
97. Tracing service call chains
98. Lack of role based access control
99. Data consistency

I GOT 99 PROBLEMS, BUT A MESH AIN'T ONE

ISTIO - A SERVICE MESH

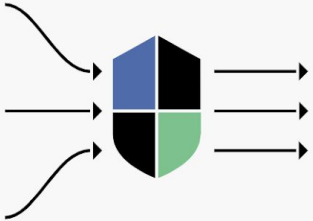


Connect

Intelligently control the flow of traffic and API calls between services, conduct a range of tests, and upgrade gradually with red/black deployments.

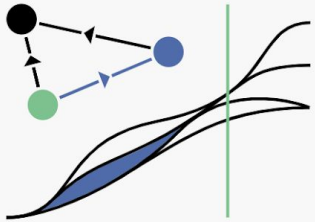
Secure

Automatically secure your services through managed authentication, authorization, and encryption of communication between services.



Control

Apply policies and ensure that they're enforced, and that resources are fairly distributed among consumers.

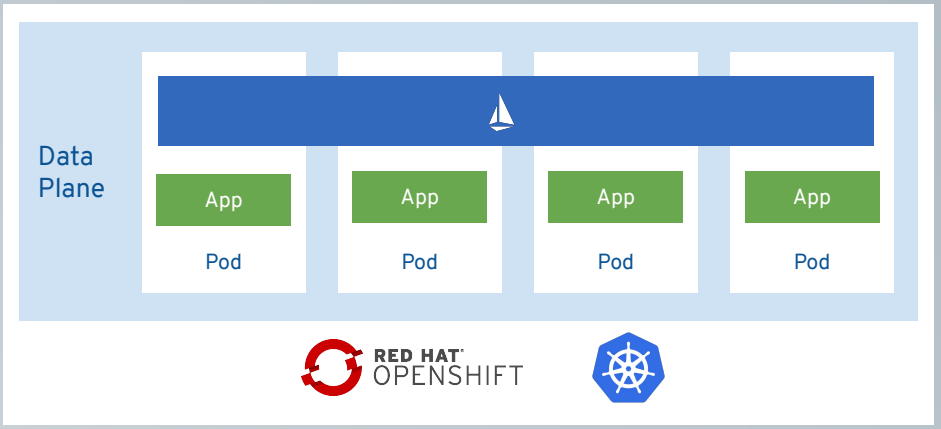


Observe

See what's happening with rich automatic tracing, monitoring, and logging of all your services.

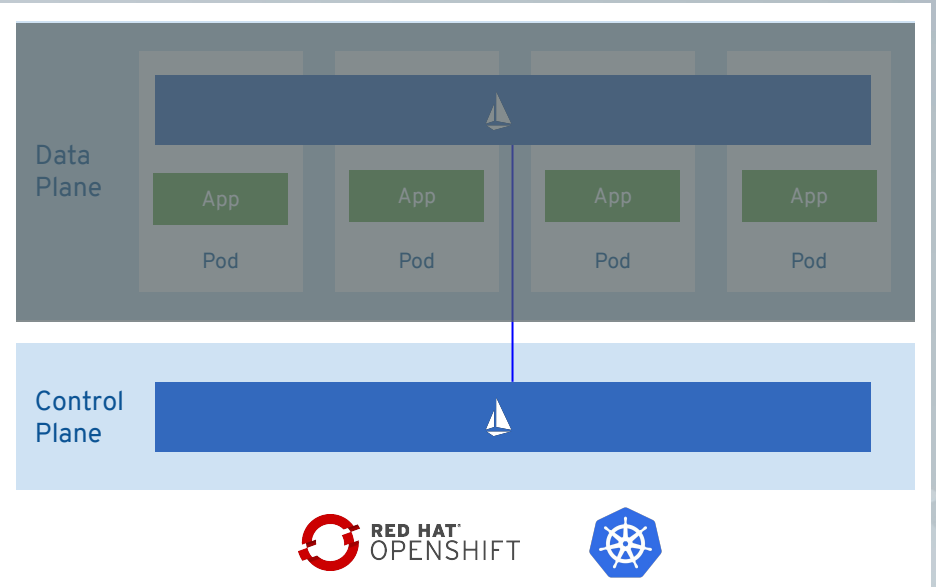
YOUR SERVICES ARE IN A DATA PLANE

The **data plane** is composed of a set of intelligent proxies (Envoy) deployed as sidecars that mediate and control all network communication between microservices.



YOUR POLICY MAKES UP A CONTROL PLANE

The **control plane** is responsible for managing and configuring proxies to route traffic, as well as enforcing policies at runtime.

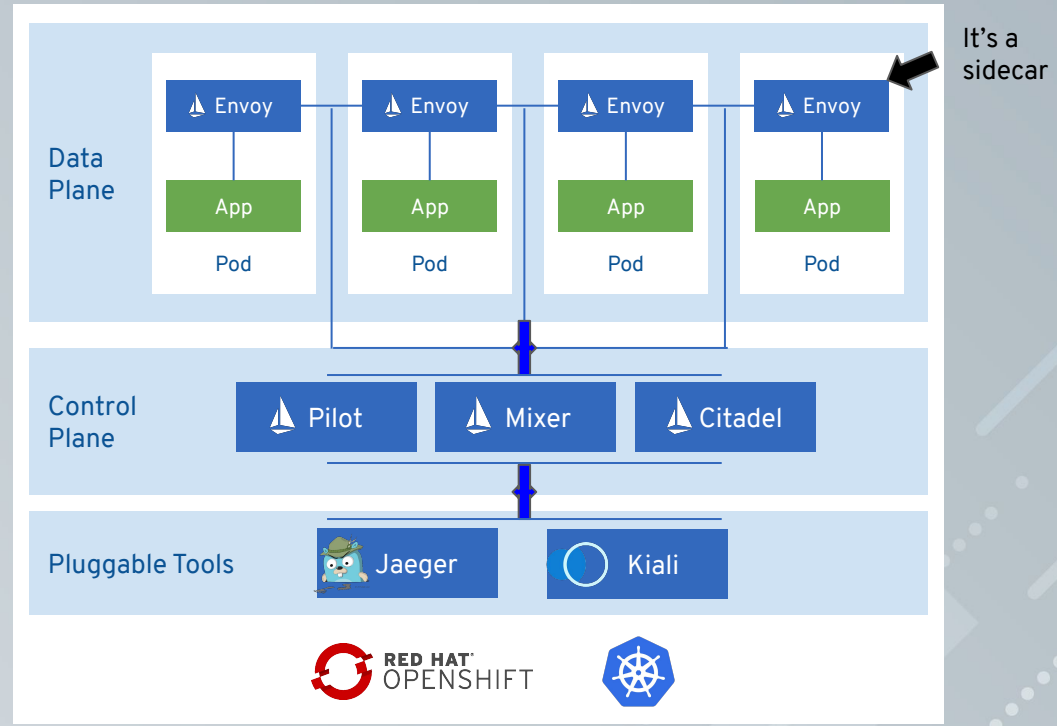


THIS IS THE ISTIO SERVICE MESH

A network of deployed services with load balancing, service to service authentication, monitoring, (and more), requiring

few or no code changes to you services source code.

This is possible due to data plane sidecars and control plane components.



ADDRESSING COMMON PROBLEMS BY...

CIRCUIT BREAKING AND BULKHEADS

- Fail FAST - prevent requests to failed services
- Configure via Istio's "`DestinationRule`"
- `outlierDetection`
  - Check for consecutive errors
  - Applied to HTTP and TCP traffic
- `connectionPool`
  - Can use HTTP or TCP
- You get immediate 503s when tripped

```yaml
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: reviews-cb-policy
spec:
  host: reviews.prod.svc.cluster.local
  trafficPolicy:
    connectionPool:
      tcp:
        maxConnections: 100
      http:
        http2MaxRequests: 1000
        maxRequestsPerConnection: 10
    outlierDetection:
      consecutiveErrors: 7
      interval: 5m
      baseEjectionTime: 15m
```

RATE LIMITING

- Stop traffic from overloading services
- Define quotas to limit routing
  - Tune for individual services
  - e.g. Requests per second
- Apply rules for more control
  - e.g. Quota only apply anon users
- Add autoscaling to help meet demand

```
quotas:
- name: requestcountquota.instance.istio-system
  maxAmount: 500
  validDuration: 1s
  overrides:
  - dimensions:
      destination: serviceA
    maxAmount: 1
    validDuration: 5s
  - dimensions:
      destination: serviceB
      source: "10.28.11.20"
    maxAmount: 500
    validDuration: 1s
  - dimensions:
      destination: serviceB
    maxAmount: 2
    validDuration: 5s
```

MIRRORING / TRAFFIC SHIFTING

- Mirror traffic to new and old for prod. env tests
  - Get real data into the new version to test
- Slowly shift traffic to new service versions
  - Minimal load reduces impact of issues
  - Shift back if needed
- Configure via Istio's "`VirtualService`"

```
apiVersion: networking.istio.io/v1alpha3
kind: VirtualService
metadata:
  name: reviews
  ...
spec:
  hosts:
  - reviews
  http:
  - route:
    - destination:
        host: reviews
        subset: v1
      weight: 50
    - destination:
        host: reviews
        subset: v3
      weight: 50
```

VERSION BASED ROUTING

AUTOSCALING

STAGED ROLLOUTS

CANARY DEPLOYMENTS

BLUE/GREEN DEPLOYMENTS

DISTRIBUTED TRACING (JAEGER)

VISUAL SERVICE HEALTH (KIALI)

DISTRIBUTED LOGGING

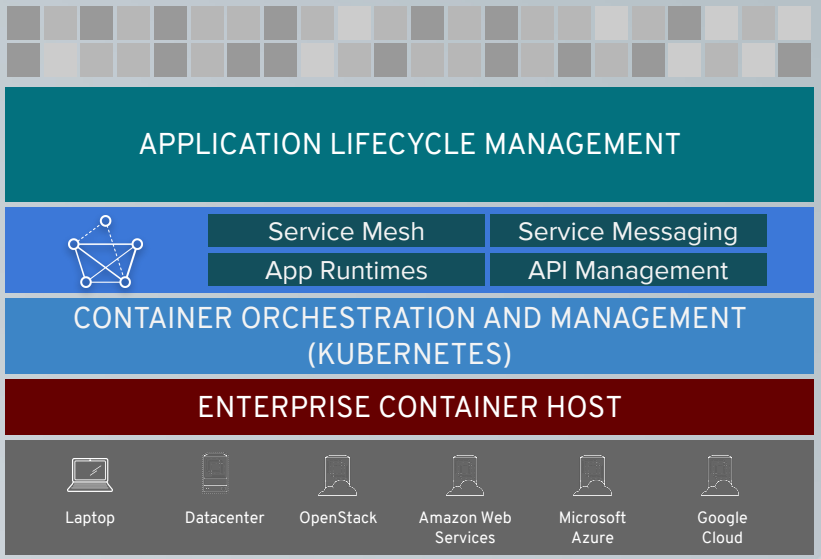
COLLECTING AND VISUALIZING METRICS

AND MORE...

WHY IS THIS EXCITING?

- It's a lot of capability
- It's dynamic
- It's automatic
- It's configurable
- It's not in the code
- It's polyglot

And it's bundled as an installable platform for OpenShift / Kubernetes!



ANY CONTAINER

RED HAT® OPENSHIFT

ANY INFRASTRUCTURE

TODAY I LEARNED...

TODAY I LEARNED

- Adopting microservices comes with new challenges
- Don’t force those challenges onto developers
- Follow best practices and leverage
  - Circuit breaking and bulkheads
  - Advanced traffic management
  - Distributed tracing, logging, and metrics
  - Load balancing and autoscaling

Istio can take operational burden off a team by addressing common challenges with little to no code change

Art from ClipArt ETC: https://etc.usf.edu/clipart/

FIND OUT MORE
AND TRY IT YOURSELF

https://learn.openshift.com/servicemesh

https://developers.redhat.com/topics/service-mesh/
https://developers.redhat.com/topics/microservices/

https://github.com/dudash/openshift-microservices

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