AWS re:Invent

ARC309

From Monolithic to Microservices
Evolving Architecture Patterns in the Cloud

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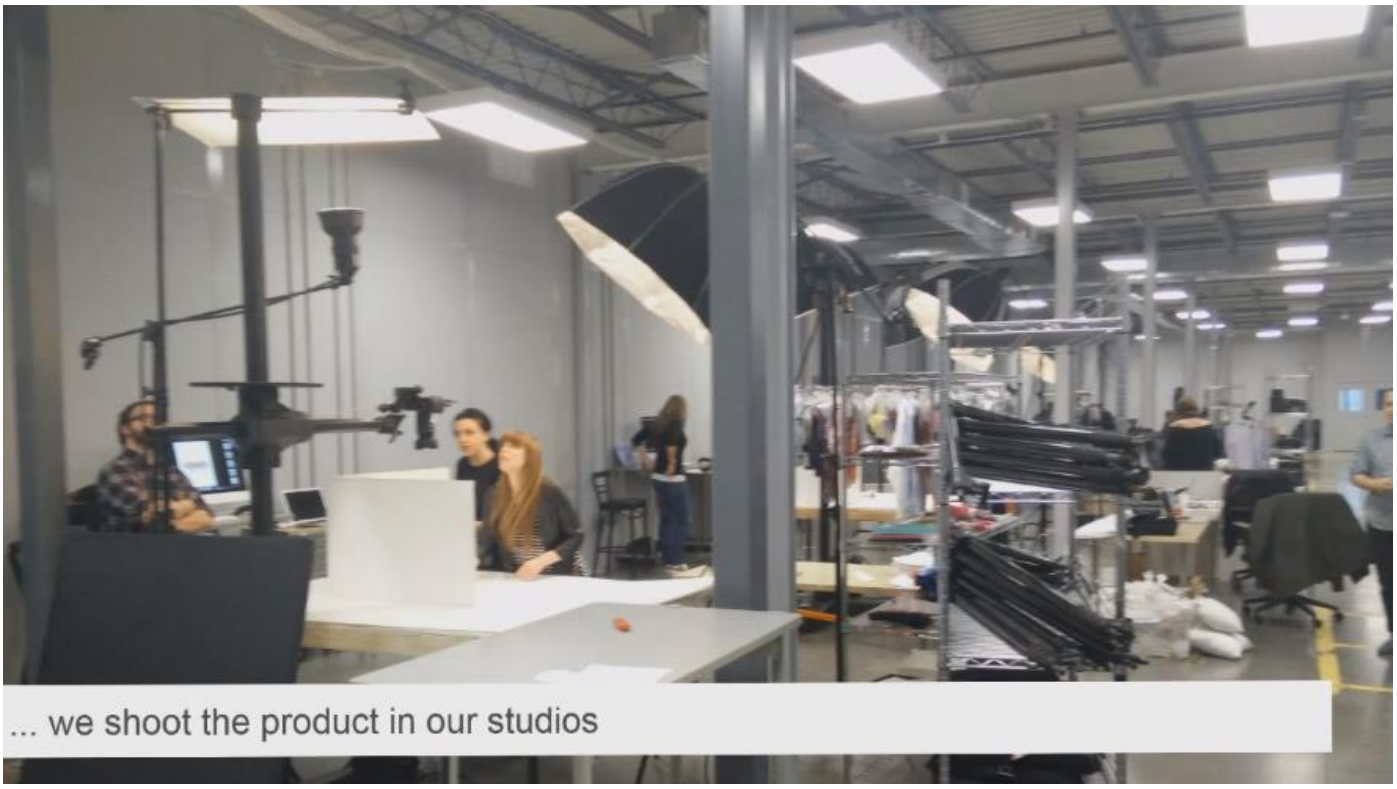
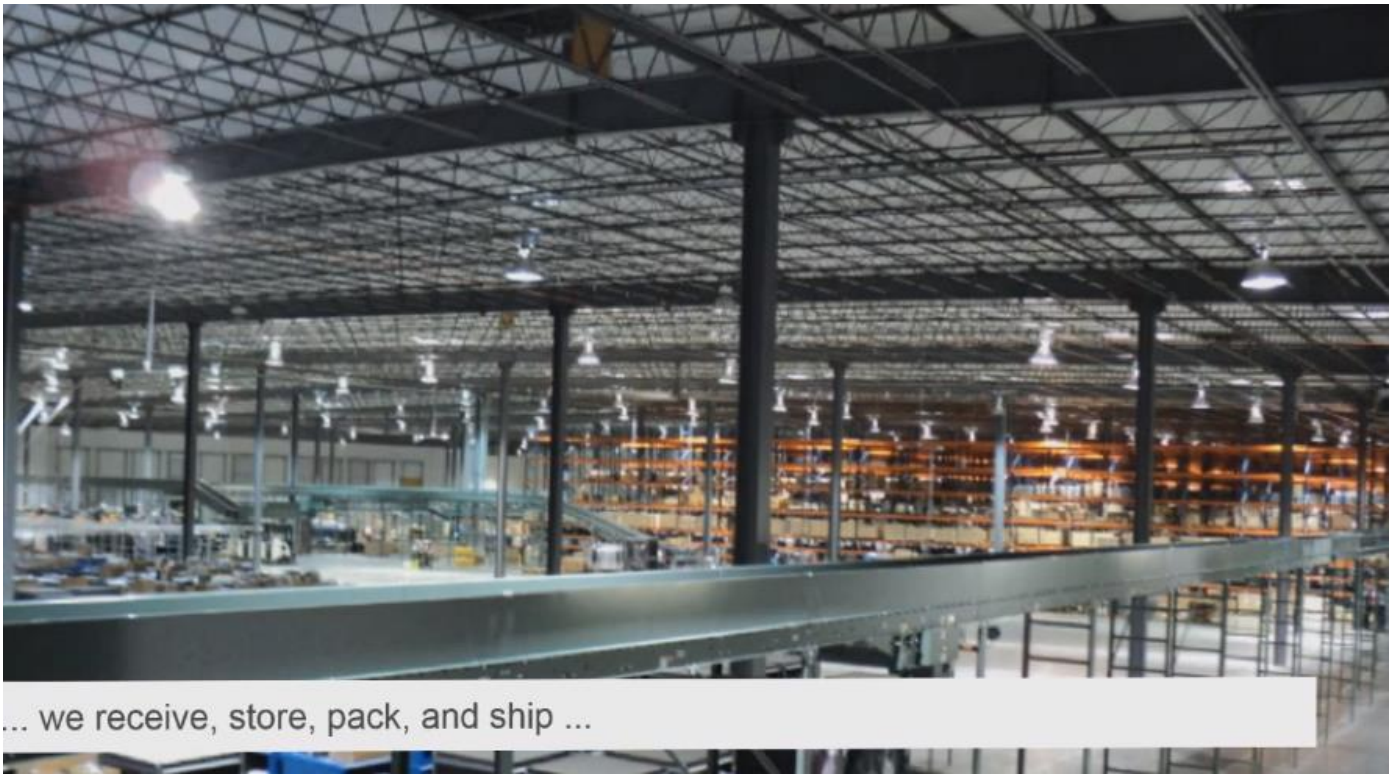
October 2015

amazon web services

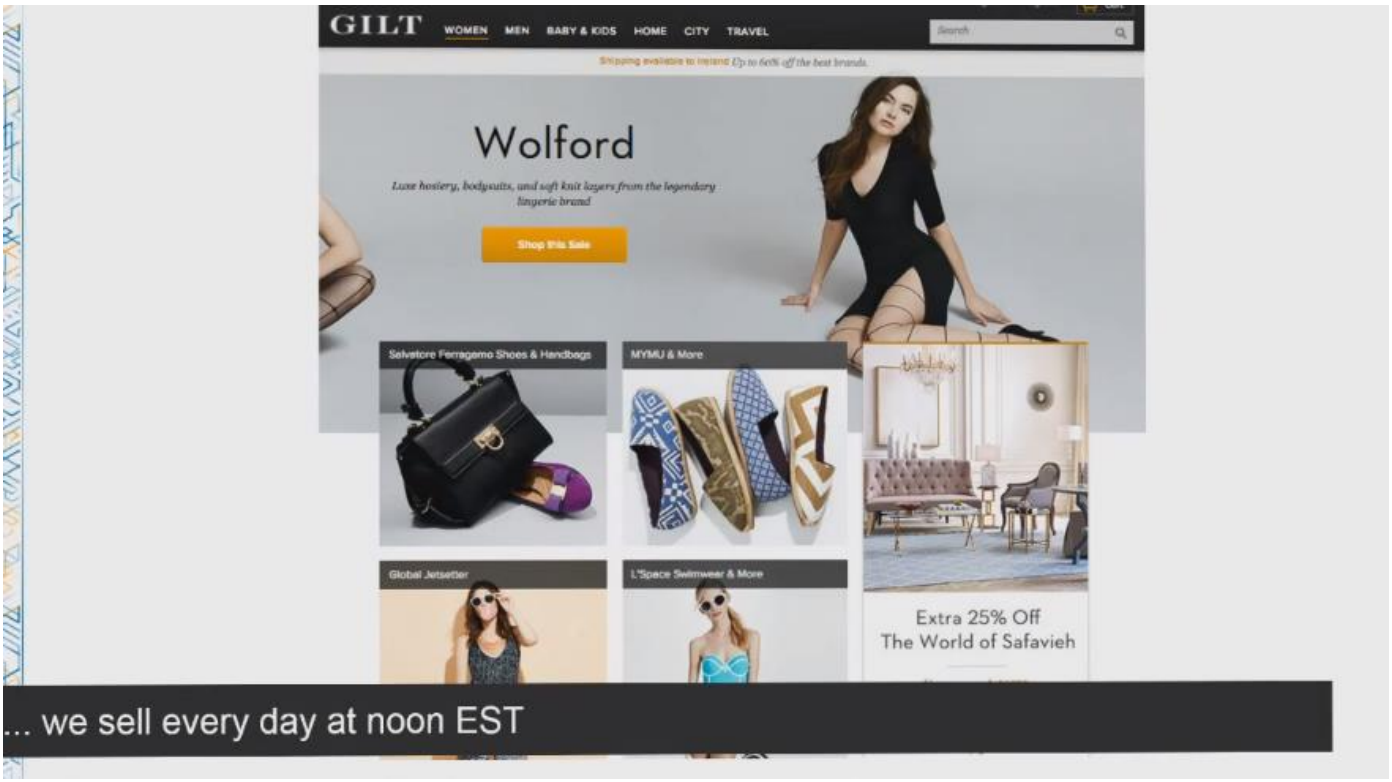
Adrian Trenaman, SVP of engineering at Gilt, shares their evolution from a single monolithic Rails application in a traditional data center to more than 300 Scala/Java microservices deployed. Learn More on AWS: http://amzn.to/2il0gry

Gilt's Journey

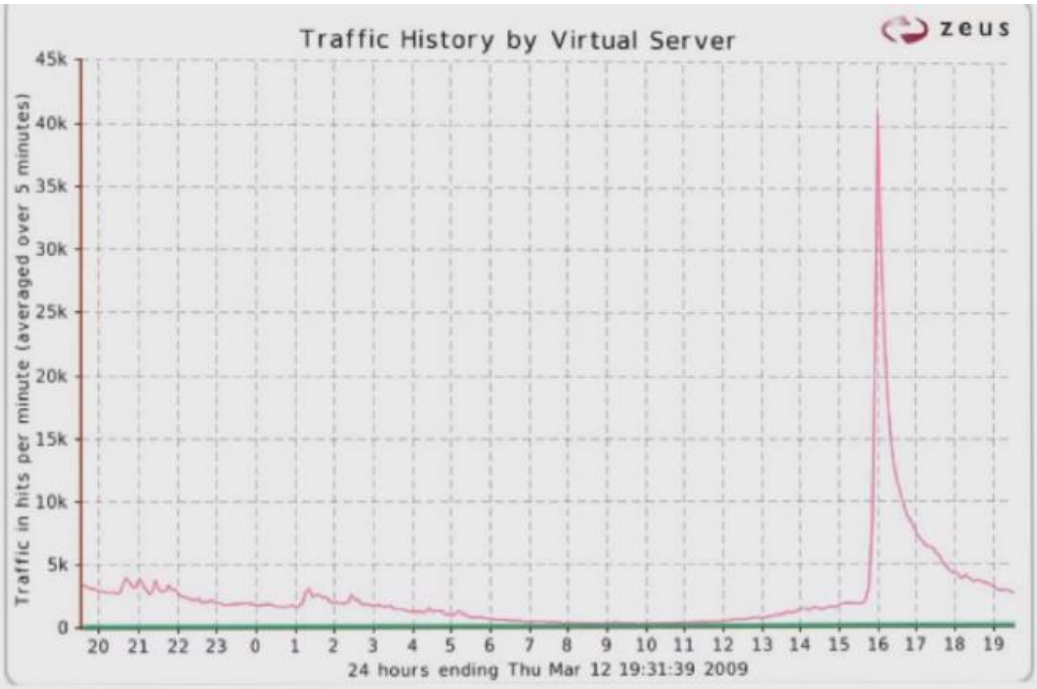




Guilt as had to build the software that helps power the different functions in the chain

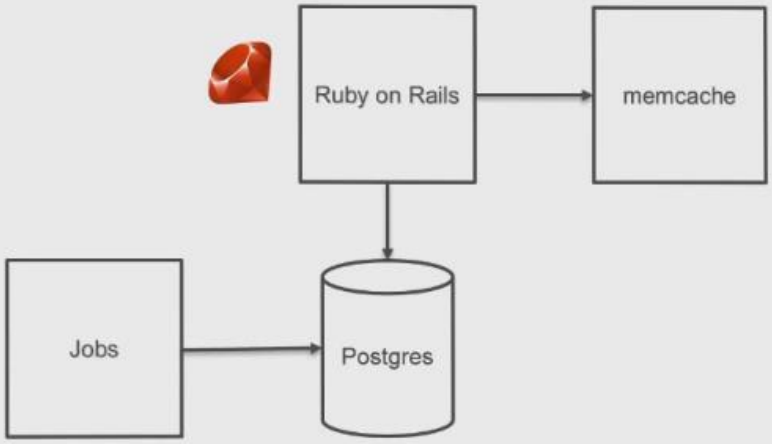

GILT
WOMEN
MEN
BABY & KIDS
HOME
CITY
TRAVEL
Wolford
Luxe hosiery, bodysuits, and soft knit layers from the legendary lingerie brand
Shop this Sale
Selvatore Ferragamo Shoes & Handbags
MYMU & More
Global Jetsetter
L*Space Swimwear & More
Extra 25% Off
The World of Safavieh
... we sell every day at noon EST


... stampede!

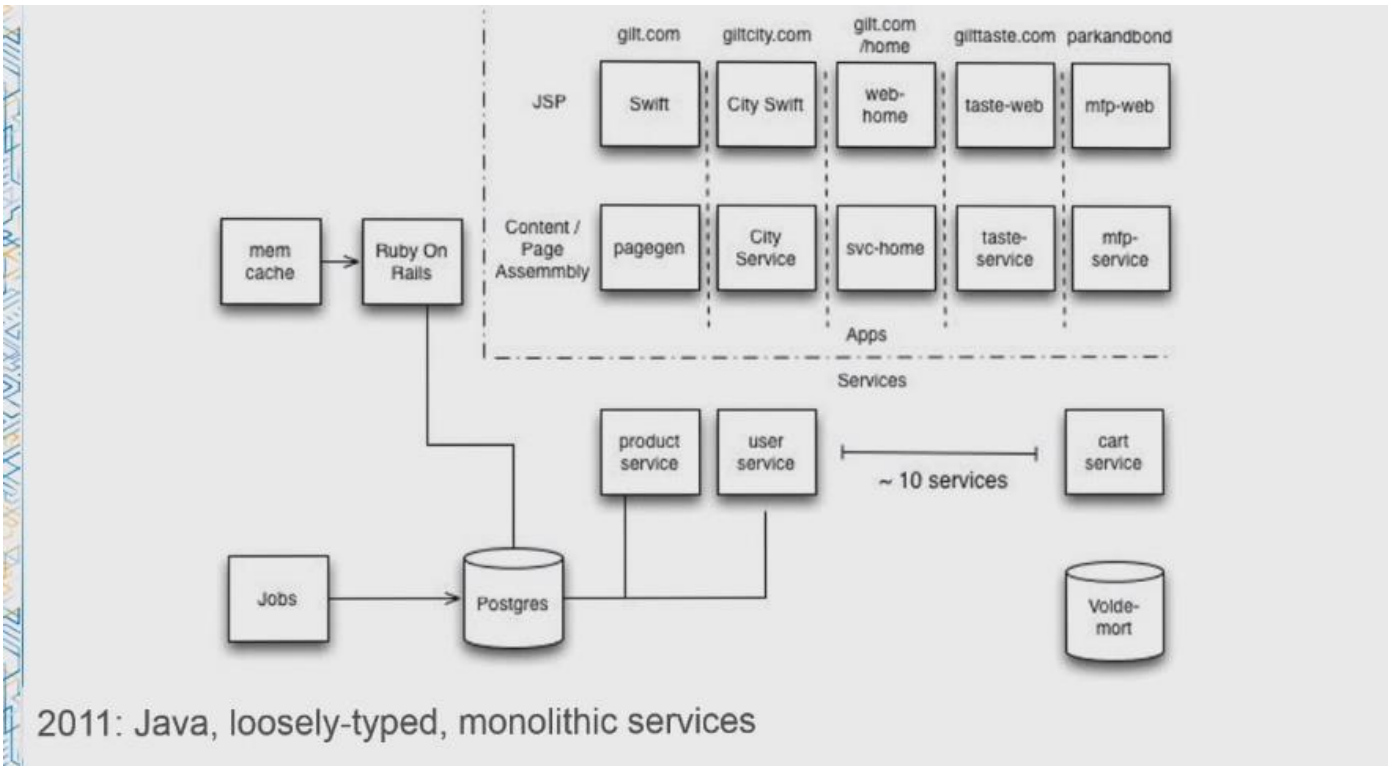


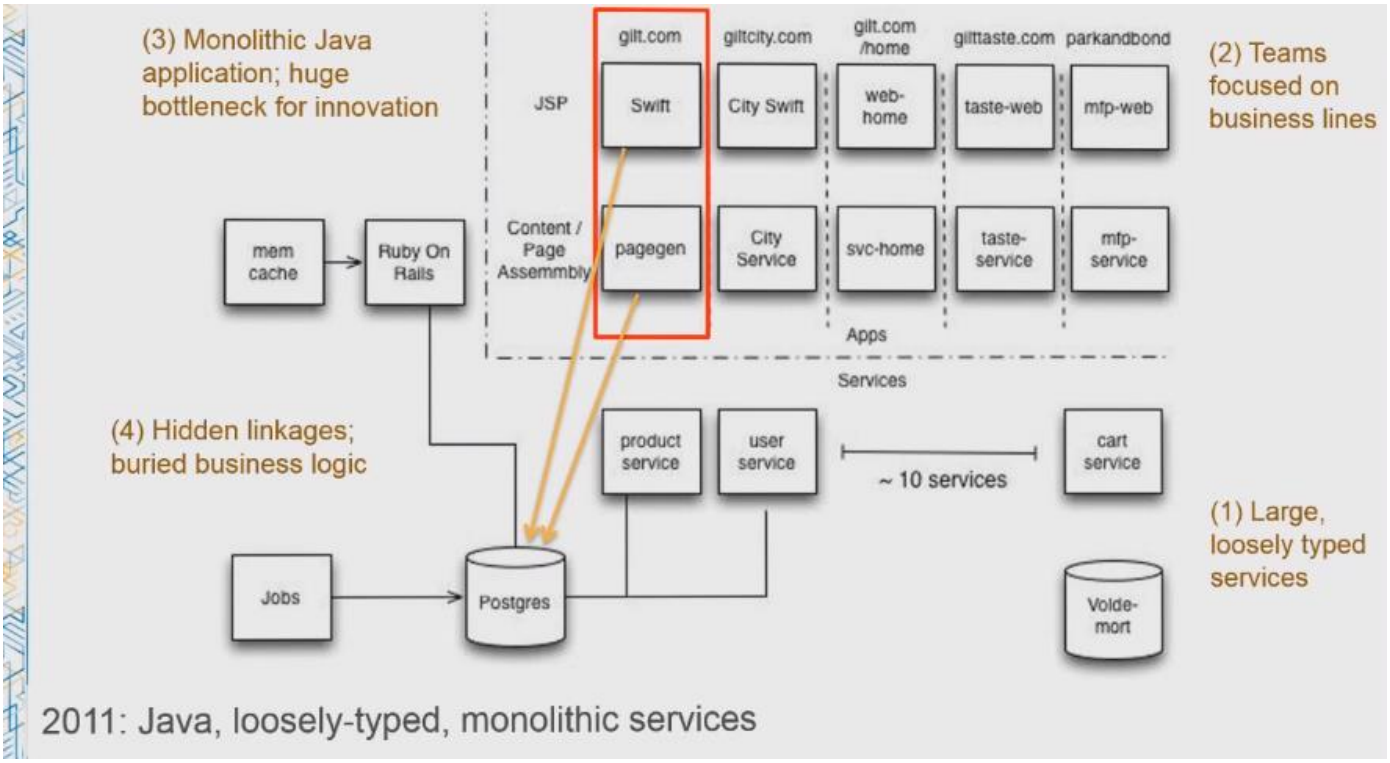
... this is what noon *really* looks like.

How It All Started…



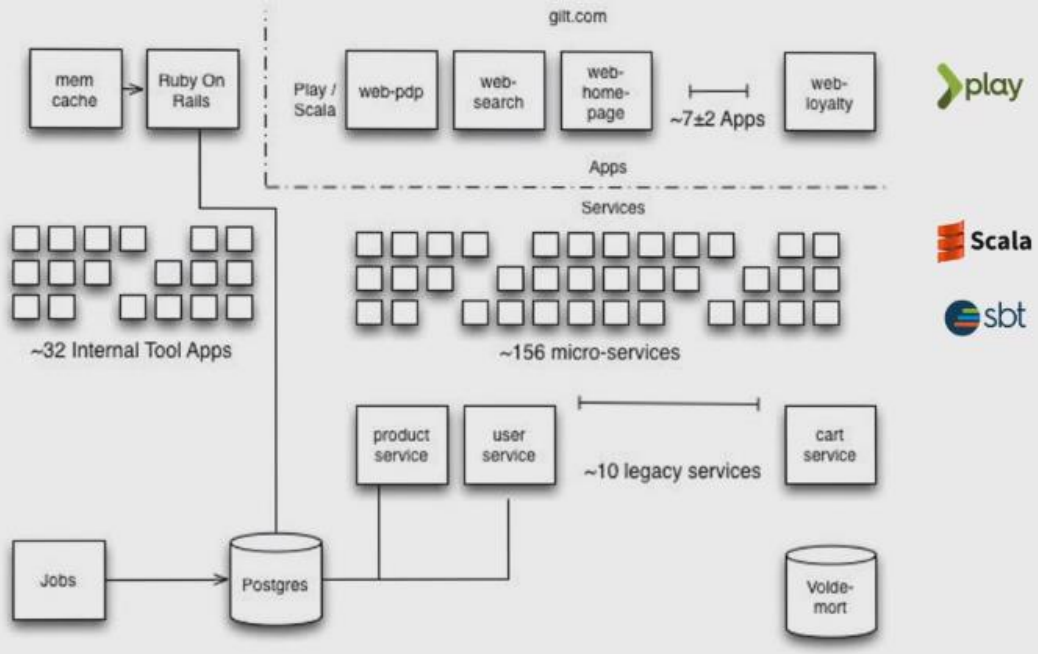
From Rails to Riches — 2007: A Ruby on Rails monolith


gilt.com
giltcity.com
gilt.com /home
gilttaste.com
parkandbond
JSP
Swift
City Swift
web-home
taste-web
mfp-web
Content / Page Assemmbly
pagegen
City Service
svc-home
taste-service
mfp-service
Apps
Services
mem cache
Ruby On Rails
product service
user service
~ 10 services
cart service
Jobs
Postgres
Volde-mort
2011: Java, loosely-typed, monolithic services


(3) Monolithic Java application; huge bottleneck for innovation
(2) Teams focused on business lines
gilt.com
giltcity.com
gilt.com /home
gilttaste.com
parkandbond
JSP
Swift
City Swift
web-home
taste-web
mfp-web
Content / Page Assemmbly
pagegen
City Service
svc-home
taste-service
mfp-service
Apps
Services
mem cache
Ruby On Rails
(4) Hidden linkages; buried business logic
product service
user service
~ 10 services
cart service
(1) Large, loosely typed services
Jobs
Postgres
Volde-mort
2011: Java, loosely-typed, monolithic services

"How can we arrange our teams around strategic initiatives? How can we make it fast and easy to get to change to production?"

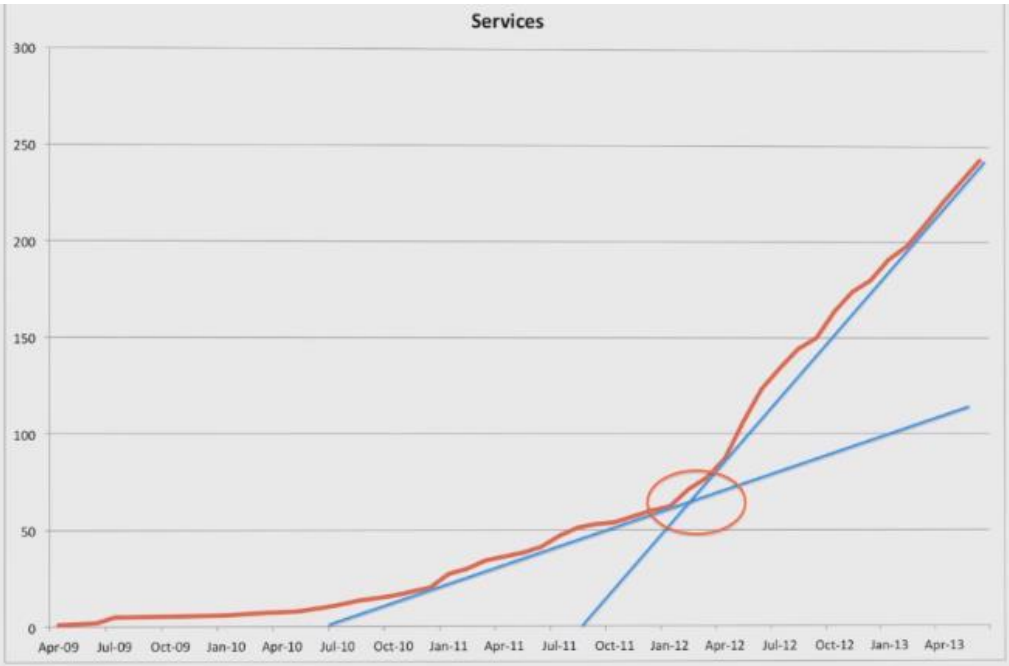
Enter: μ-services



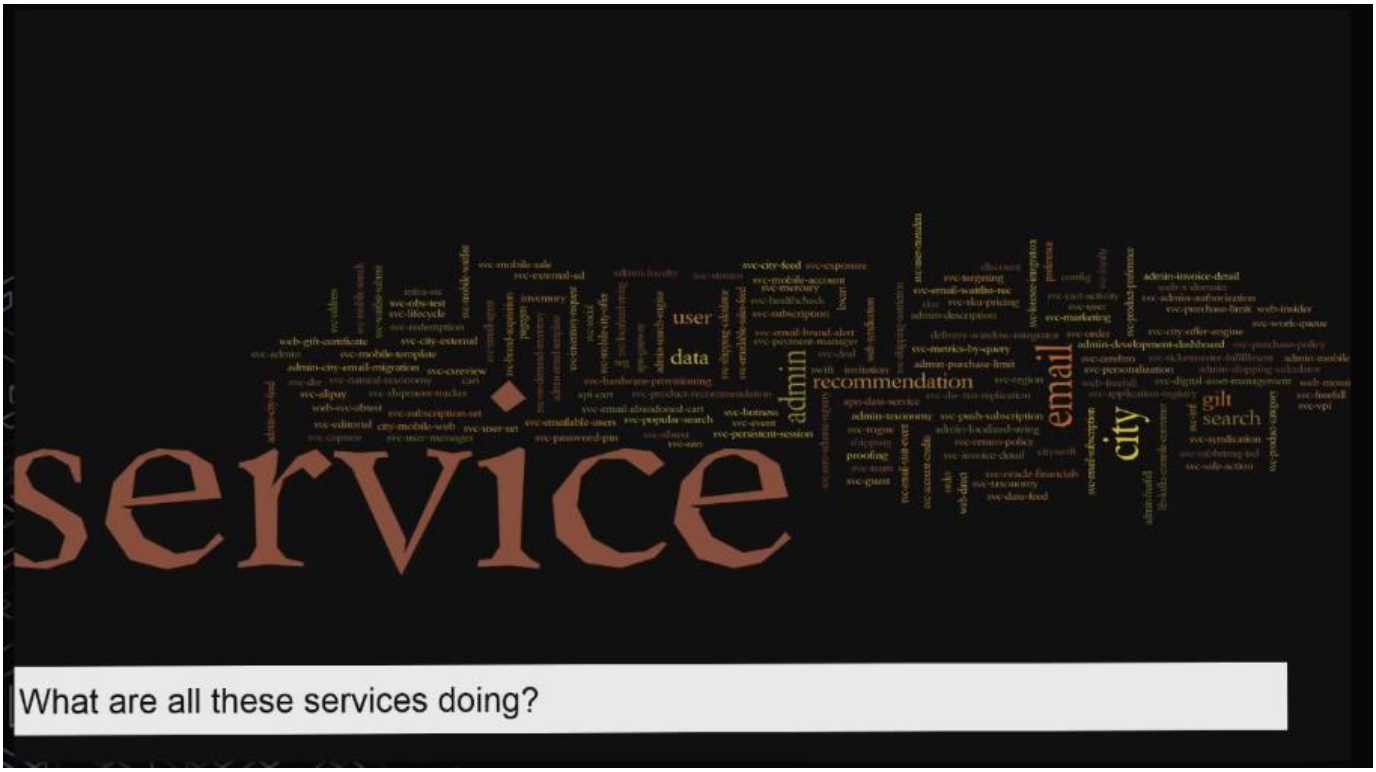
2015: LOSA (Lots of Small Apps) & Microservices

Driving Forces Behind Gilt's *Emergent* Architecture

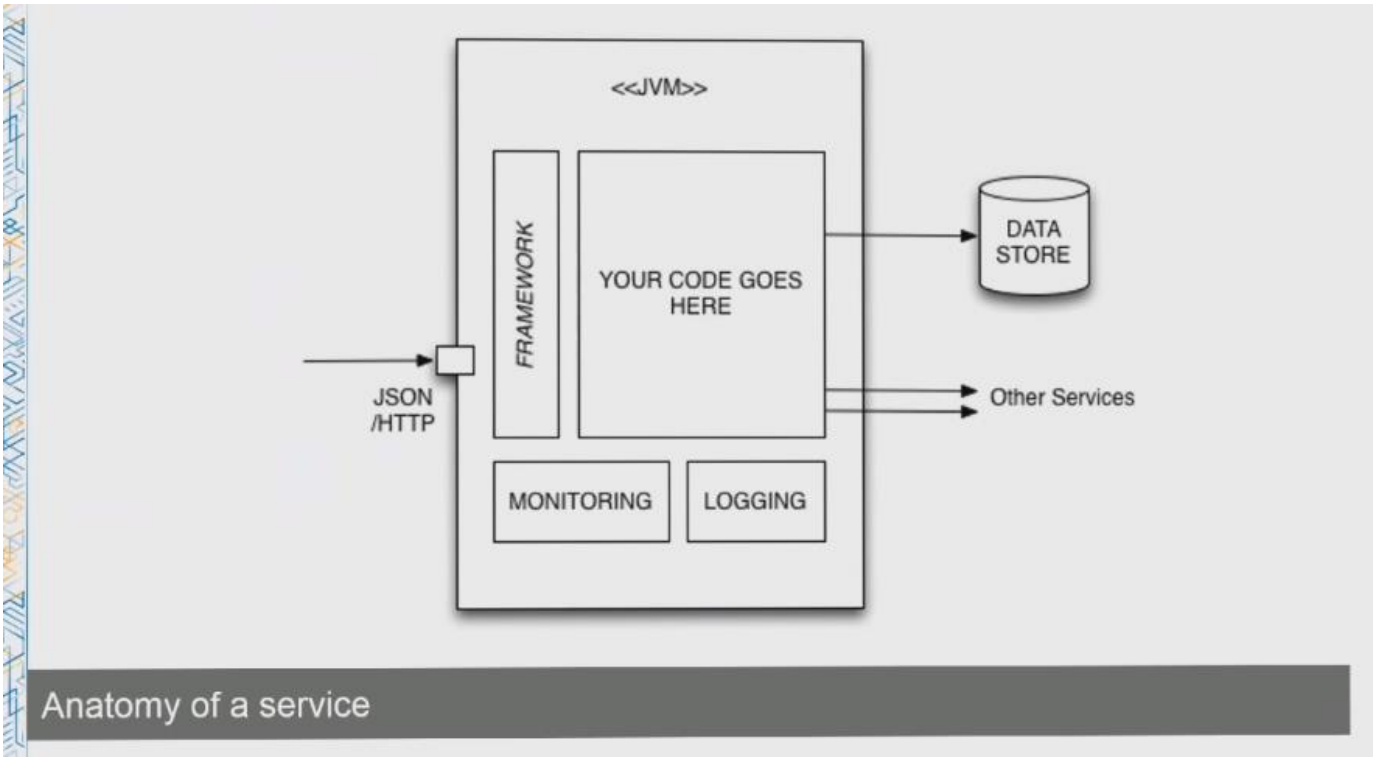
- Team autonomy
- Voluntary adoption (tools, techniques, processes)
- KPI / goal-driven initiatives
- Failing fast and openly
- Being open and honest, even when it's difficult



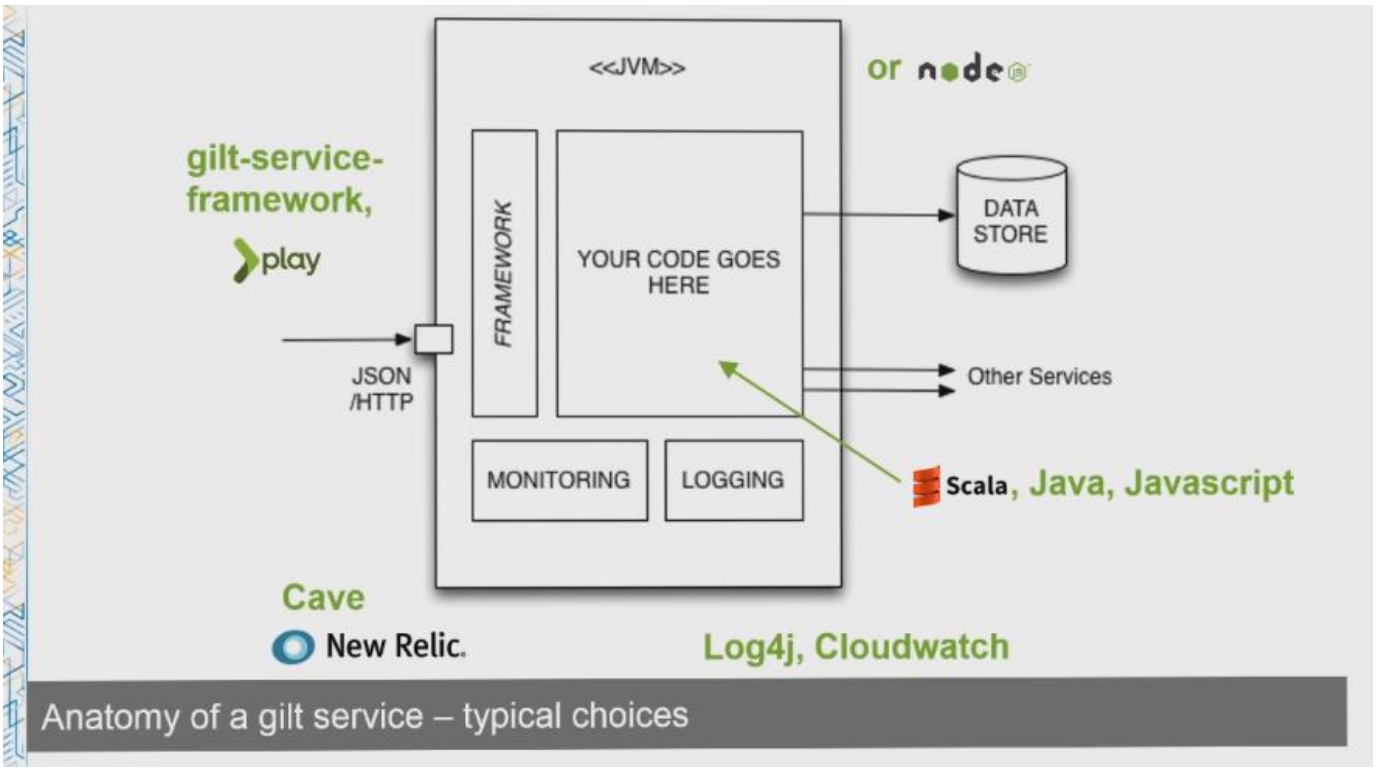
Service growth over time: point of inflexion === Scala.



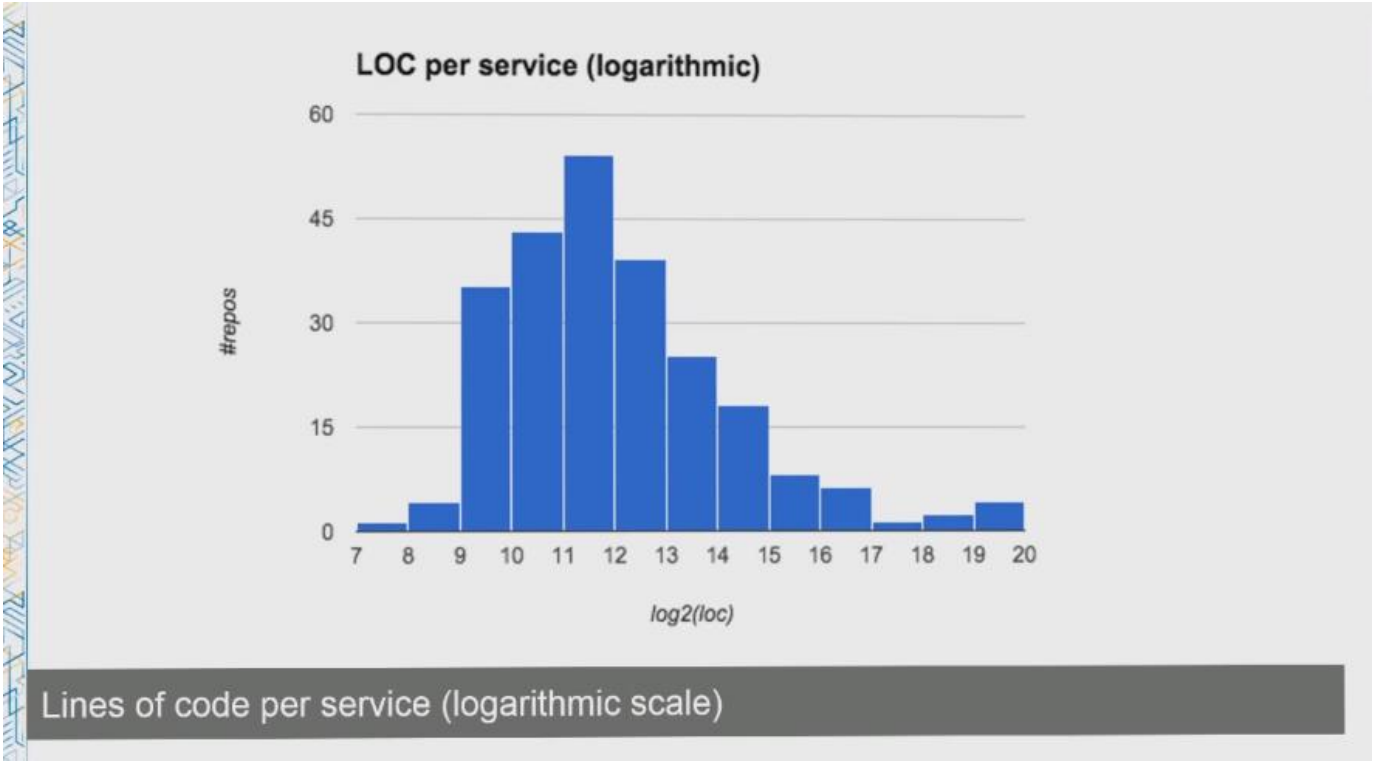
What are all these services doing?



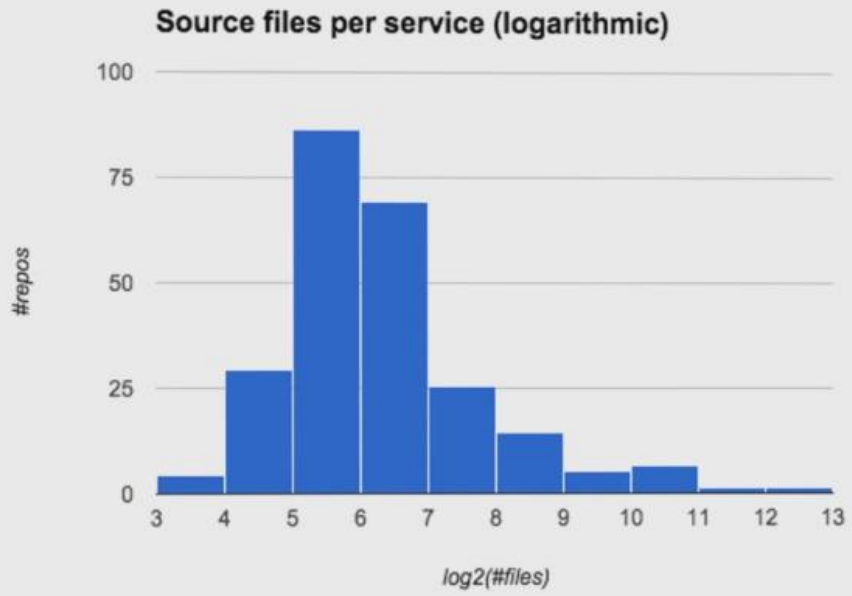
Anatomy of a service



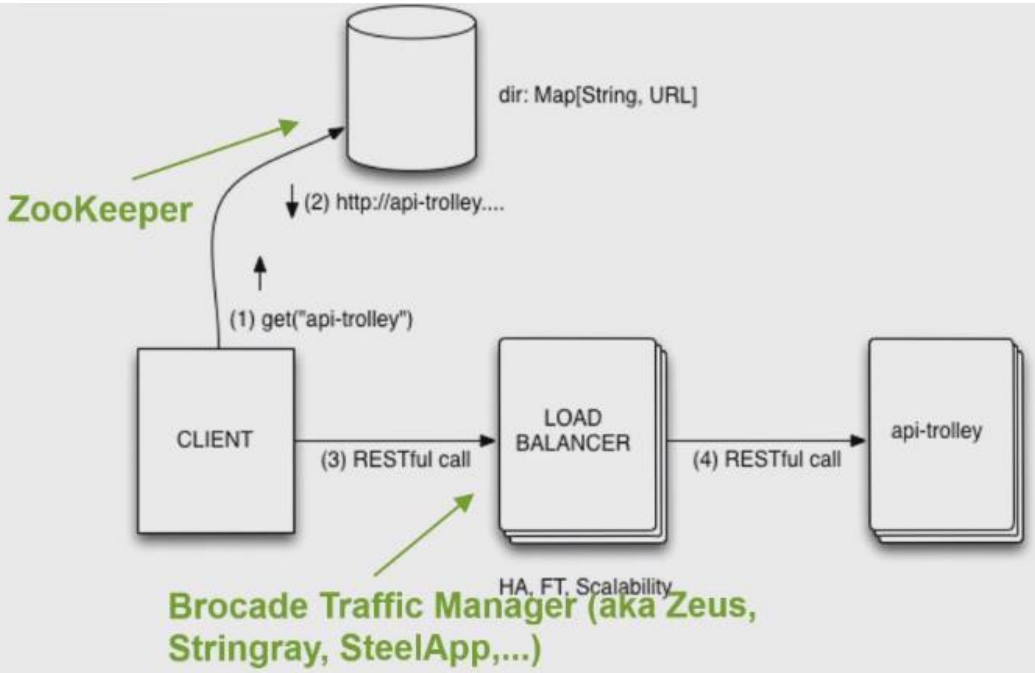
Anatomy of a gilt service – typical choices



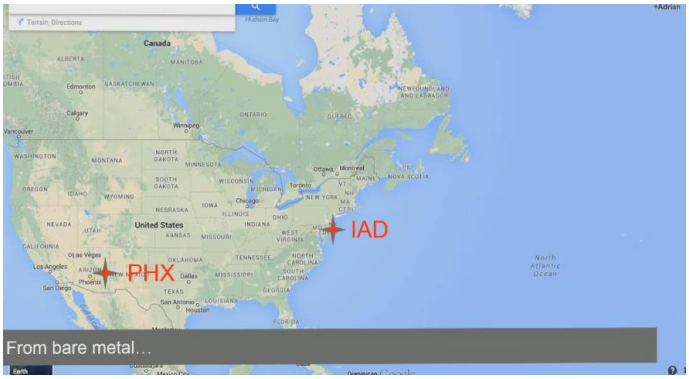
Lines of code per service (logarithmic scale)

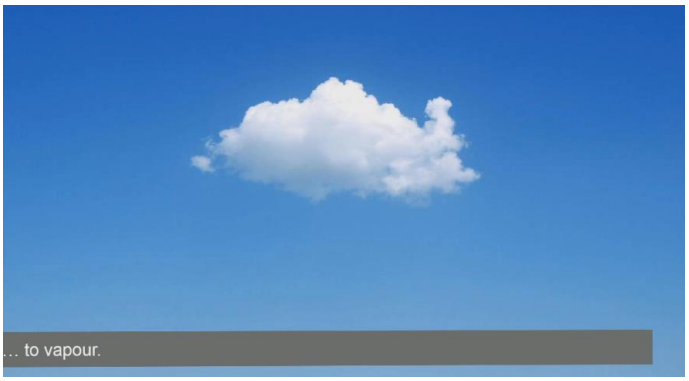


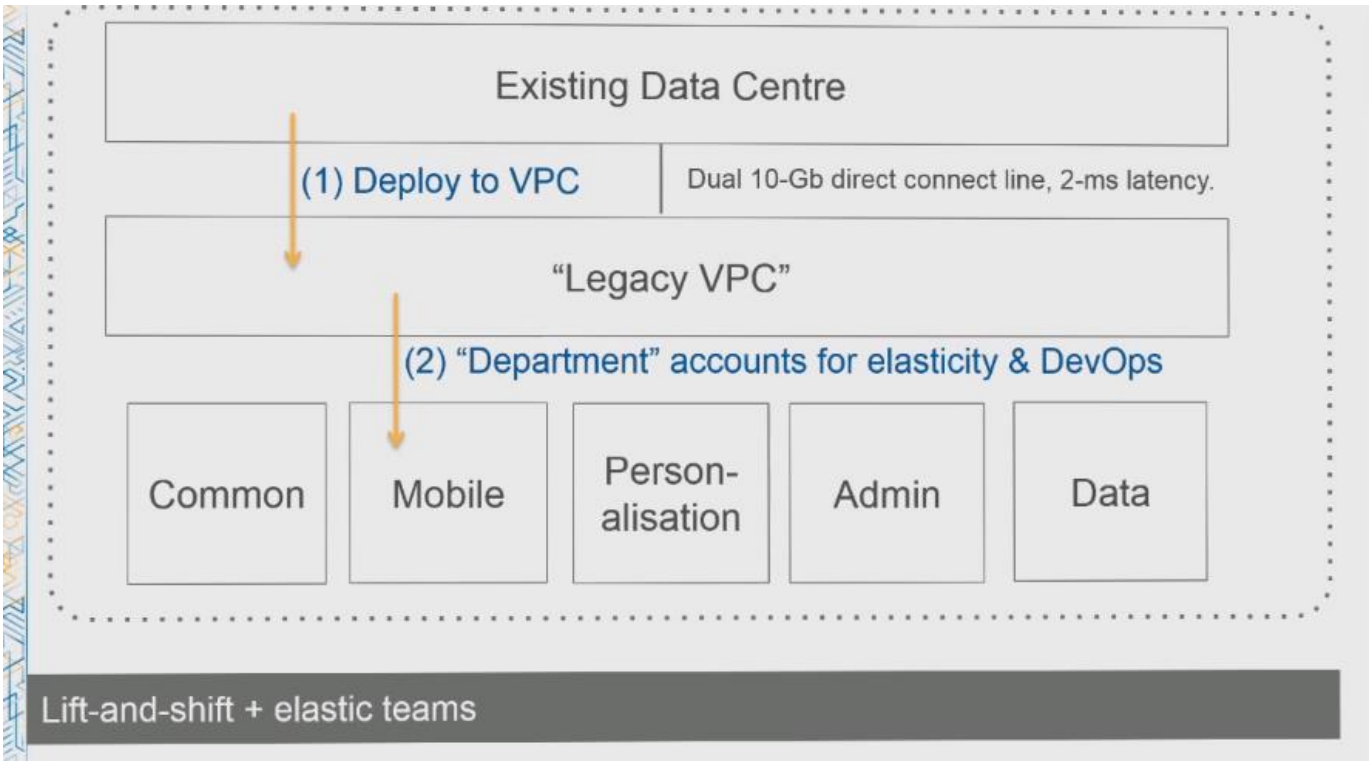
source files per service (includes build, config, xml, Java, Scala, Ruby...)

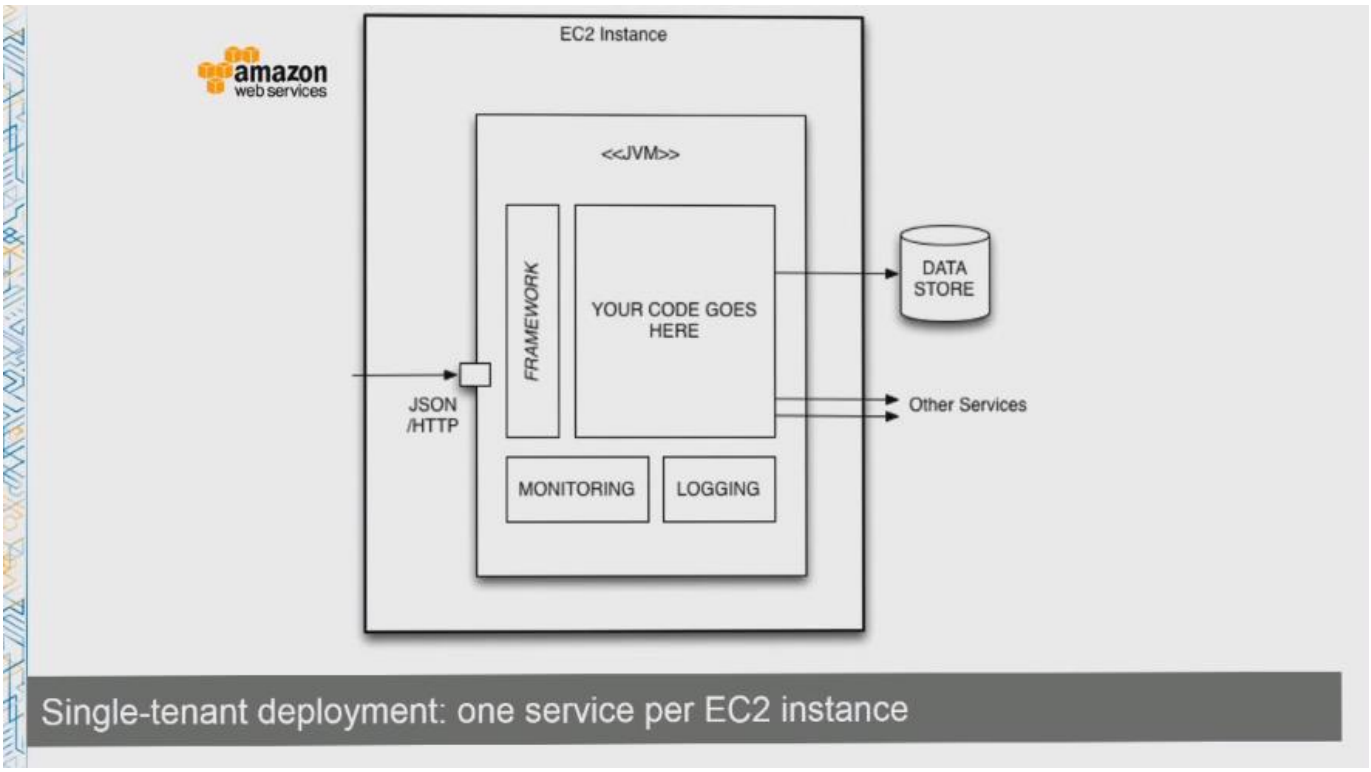


Service discovery: straightforward

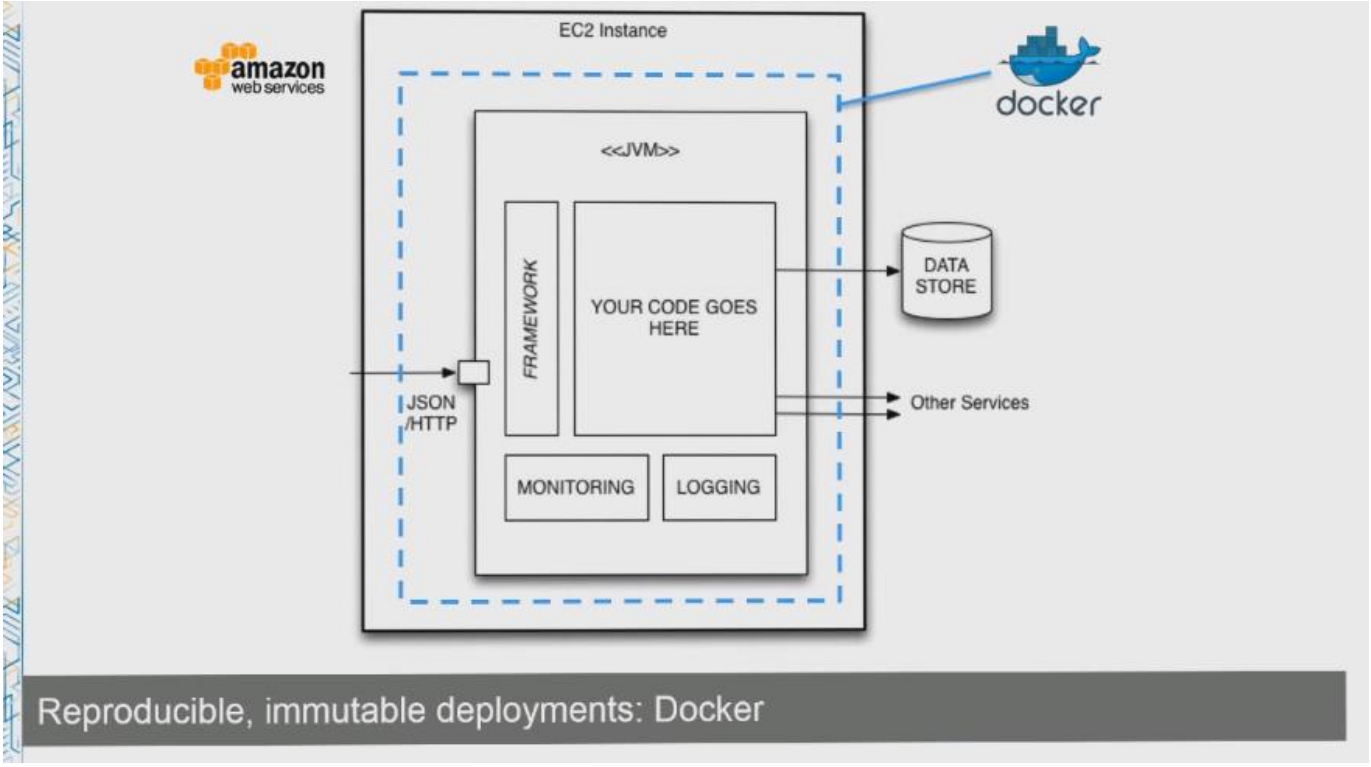

IAD
PHX
From bare metal…


… to vapour.

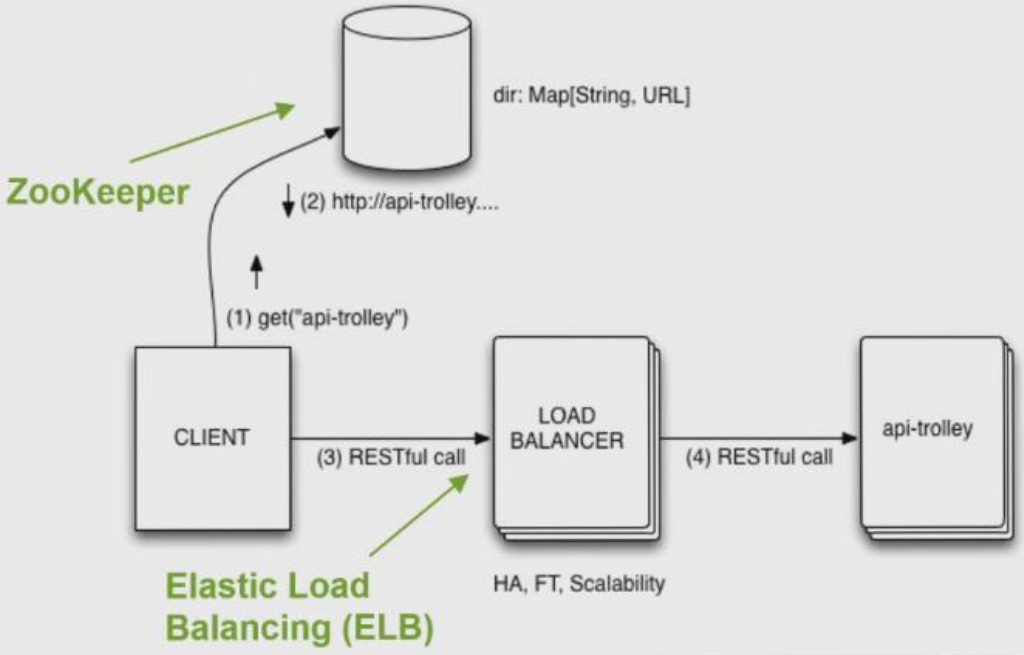

Existing Data Centre
(1) Deploy to VPC
Dual 10-Gb direct connect line, 2-ms latency.
"Legacy VPC"
(2) "Department" accounts for elasticity & DevOps
Common
Mobile
Person-alisation
Admin
Data
Lift-and-shift + elastic teams



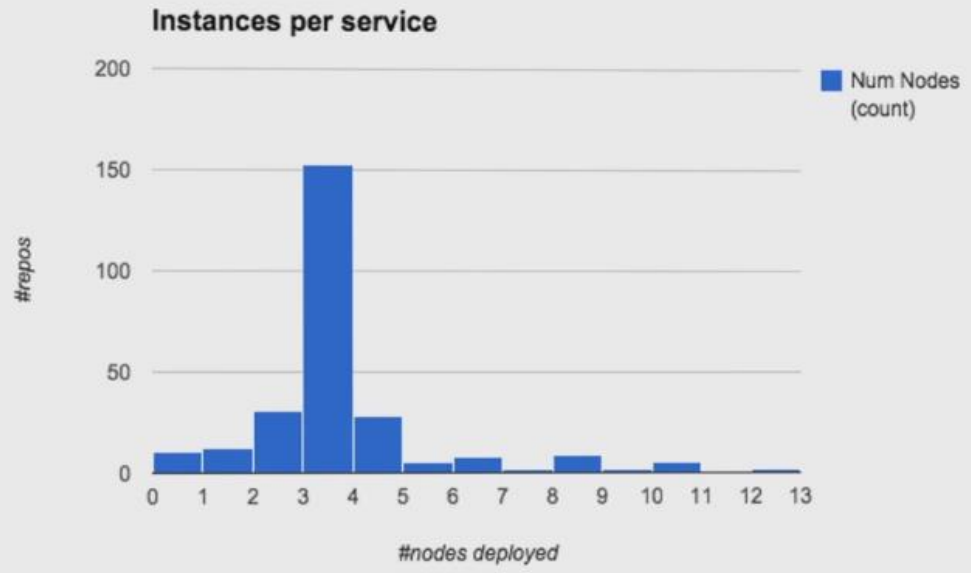
Single-tenant deployment: one service per EC2 instance



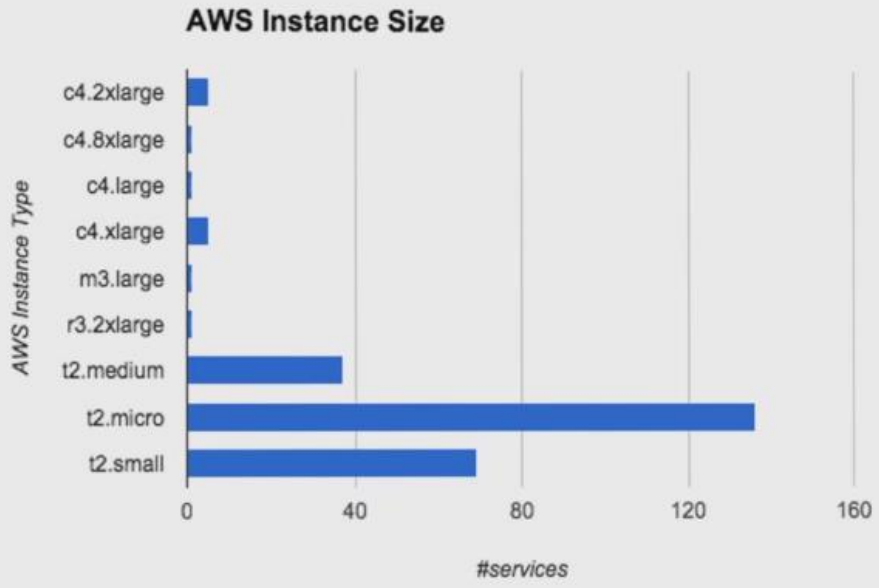
Reproducible, immutable deployments: Docker



Service discovery: new services use ELB

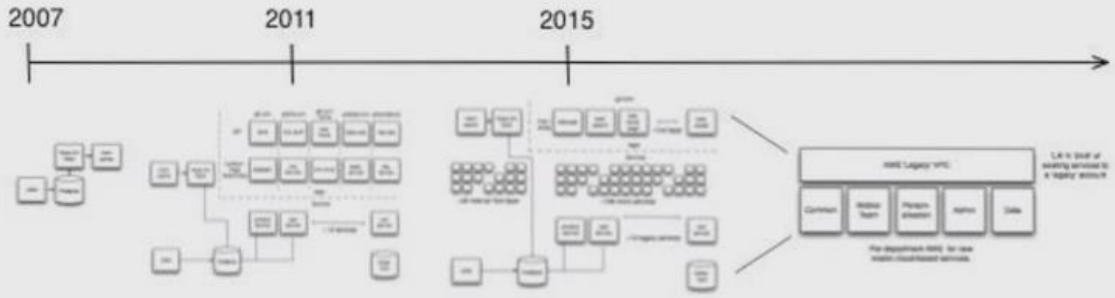


running instances per service: “rule of three” (previously “rule of four”)



EC2 instance sizing: lots of small instances

GILT: Evolution of a Micro-Services Architecture in a $1B startup



RoR Monolith	Java,Scala Loosely Typed Services	Lots of Small Apps (LOSA) Lots of Micro Services	Get thee to the cloud.
A few big teams	Team-per-business.	Team-per-initiative. Lots of initiatives. Team & Individual autonomy. Individual autonomy. KPIs	Teams of Teams (Depts.) Self-service Infrastructure by Dept. Lots of Initiatives. Lots of Autonomy.

Evolution of architecture and tech organization

We (heart) µ-services

- Lessen dependencies between teams: faster code-to-prod
- Lots of initiatives in parallel
- Your favourite <tech/language/framework> here
- Graceful degradation of service
- Disposable code: easy to innovate, easy to fail and move on.

We (heart) cloud

- Do DevOps in a *meaningful* way.
- Low barrier of entry for new tech (Amazon DynamoDB, Amazon Kinesis,...)
- Isolation
- Cost visibility
- Security tools (IAM)
- Well documented
- Resilience is easy
- Hybrid is easy
- Performance is great

Common Challenges and Patterns

Monolithic

- Simple deployments
- Binary failure modes
- Inter-module refactoring
- Technology monoculture
- Vertical scaling

Microservices

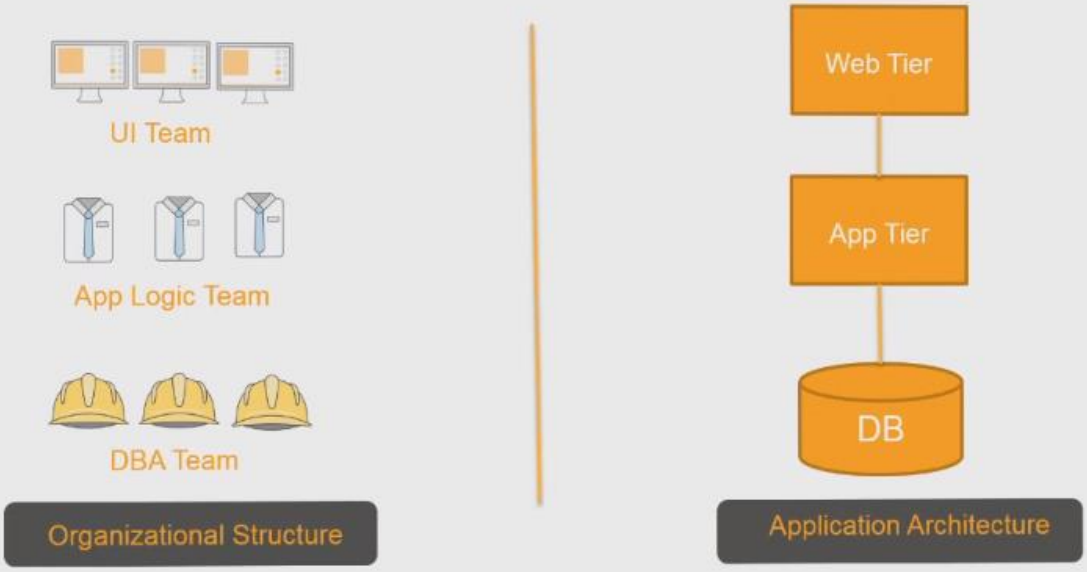
- Partial deployments
- Graceful degradation
- Strong module boundaries
- Technology diversity
- Horizontal scaling

Common Challenges and Patterns

- Organization
- Discovery
- Data management
- Deployment
- I/O explosion
- Monitoring

Monolithic Ownership

Organized on technology capabilities



Microservices Ownership

Organized on business responsibilities

Microservices Ownership

- Requirements
- Technology selection
- Development
- Quality
- Deployment
- Support

How to Be a Good Citizen (Service Consumer)

- Design for failure
- Expect to be throttled
- Retry w/ exponential backoff
- Degrade gracefully
- Cache when appropriate

How to Be a Good Citizen (Service Provider)

- Publish your metrics
- Protect yourself
- Keep your implementation details private
- Maintain backwards compatibility

Amazon API Gateway

- Throttling (global and per-method)
- Caching (with TTLs and invalidation)
- Monitoring (RPS, latency, error rate)
- Versioning
- Authentication

Discovery

Use DNS

Convention-based naming

<service-name>-<environment>.domain.com

shoppingcart-gamma.example.com

<service-name>.<environment>.domain.com

shoppingcart.gamma.example.com

Use a Dynamic Service Registry

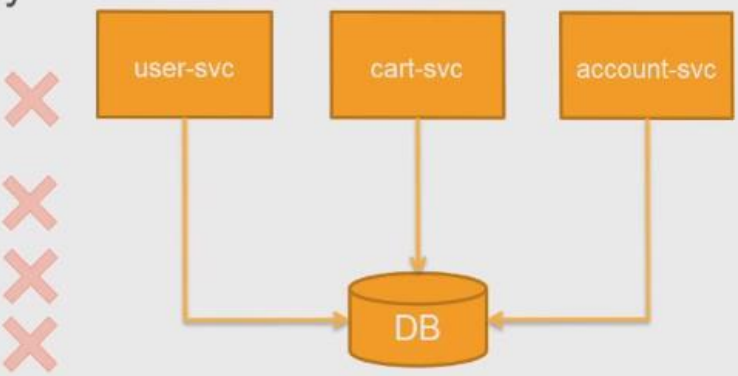
- Avoids the DNS TTL issue
- More than service registry & discovery
  - Configuration management
  - Health checks
- Plenty of options
  - ZooKeeper (Apache)
  - Eureka (Netflix)
  - Consul (HashiCorp)
  - SmartStack (Airbnb)

Data management

Challenge: Centralized Database

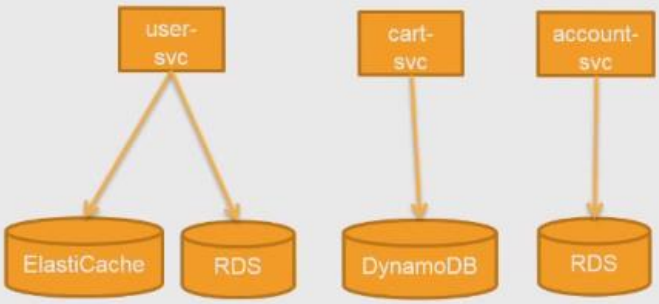
Monolithic applications typically have a monolithic data store:

- Difficult to make schema changes
- Technology lock-in
- Vertical scaling
- Single point of failure



Decentralized Data Stores

- Each service chooses its data store technologies
- Low impact schema changes
- Independent scalability
- Data is gated through the service API

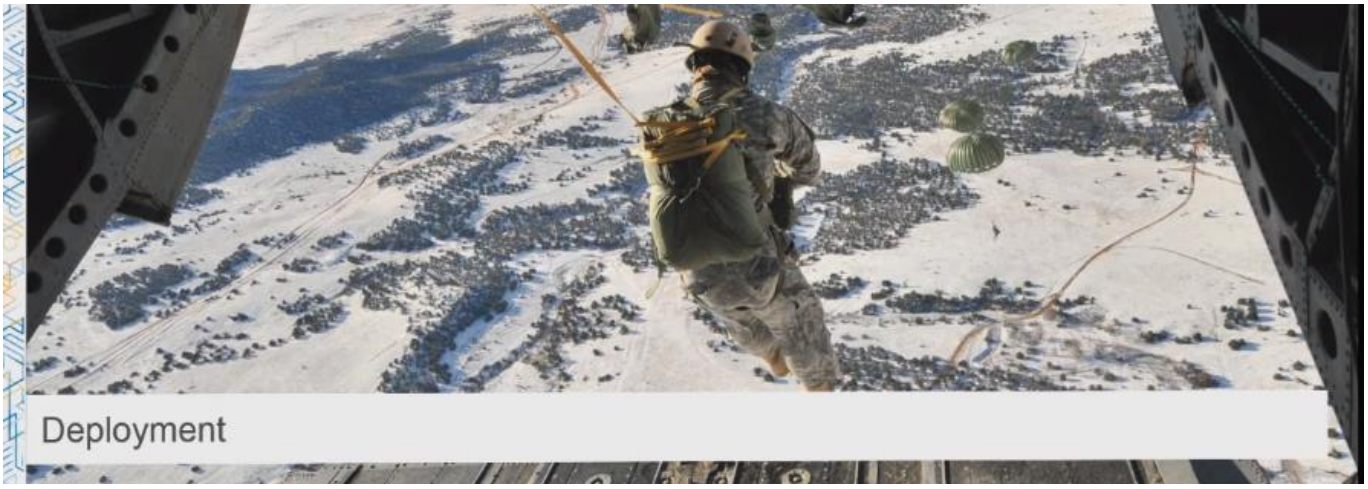


Challenge: Transactional Integrity

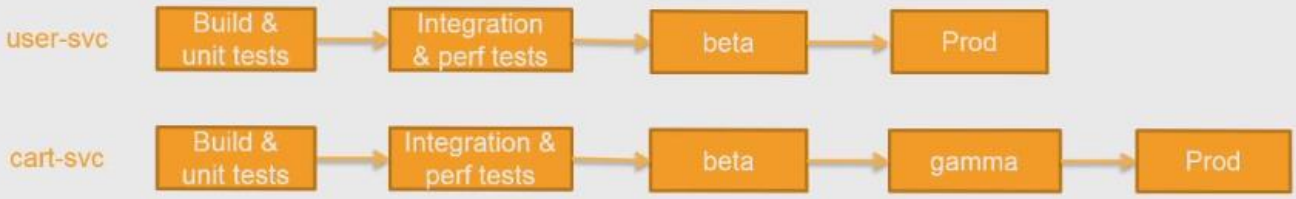
- Use a pessimistic model
  - Handle it in the client
  - Add a transaction manager / distributed locking service
  - Rethink your design
- Use an optimistic model
  - Accept eventual consistency
  - Retry (if idempotent)
  - Fix it later
  - Write it off

Challenge: Aggregation

- **Pull:** Make the data available via your service API
- **Push:** To Amazon S3, Amazon CloudWatch, or another service you create
- **Pub/sub:** Via Amazon Kinesis or Amazon SQS



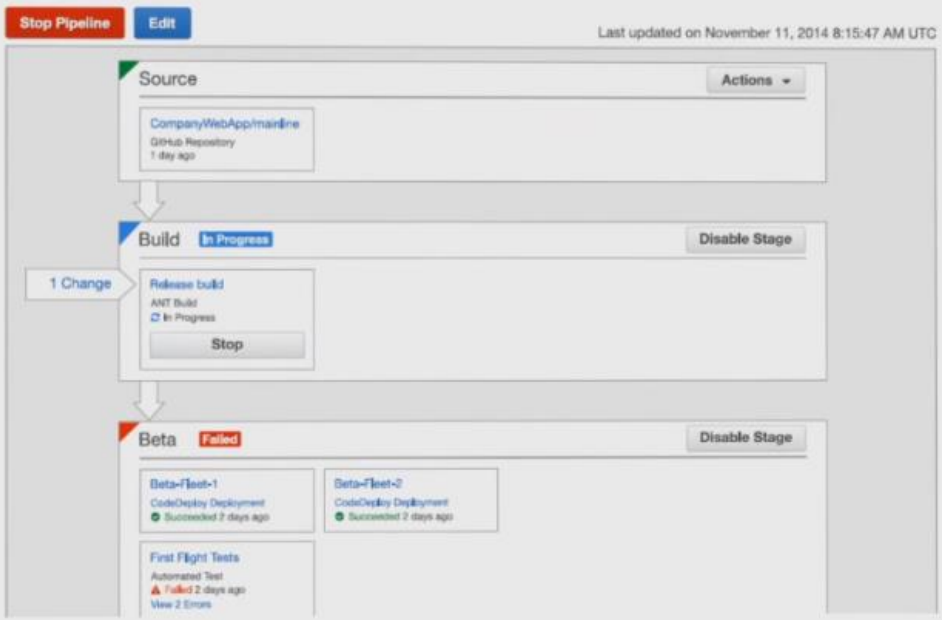
Continuous Delivery & Continuous Deployment



Create the right build pipeline for each service

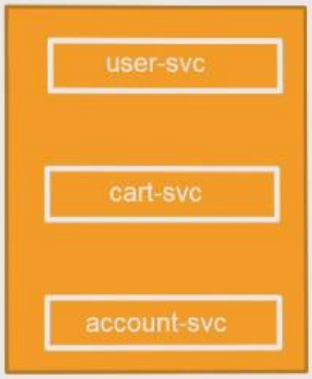
- AWS CodeDeploy
- AWS Elastic Beanstalk
- Jenkins, CircleCI, Travis,…

AWS CodePipeline



Multiple Services per Container/Instance

- Independent monitoring
- Independent scaling
- Clear ownership
- Immutable deployments

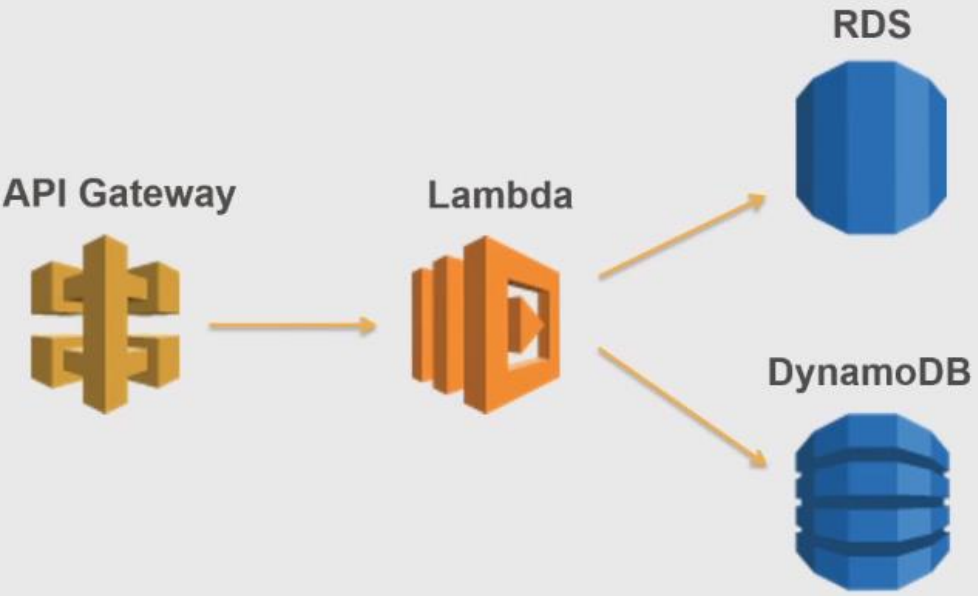


Container or instance

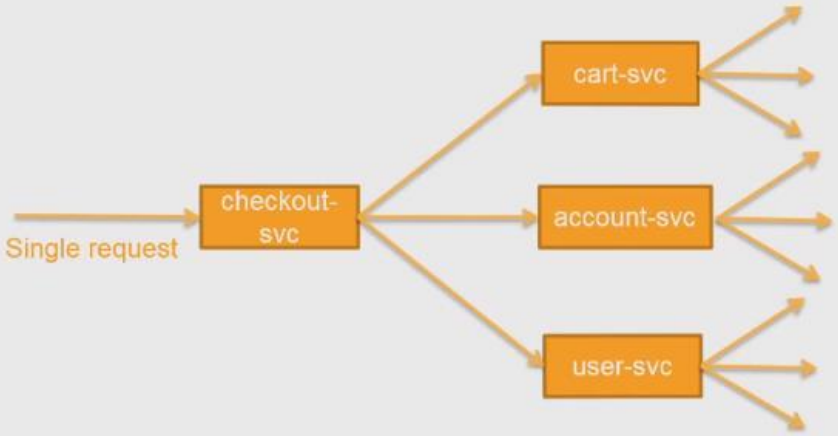
Single Service per Container/Instance

- Independent monitoring
- Independent scaling
- Clear ownership
- Immutable deployments

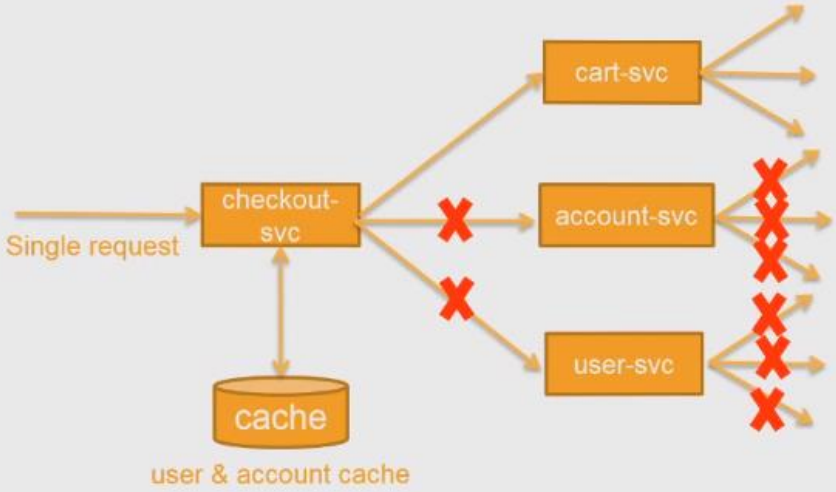
…Or Just Use AWS Lambda



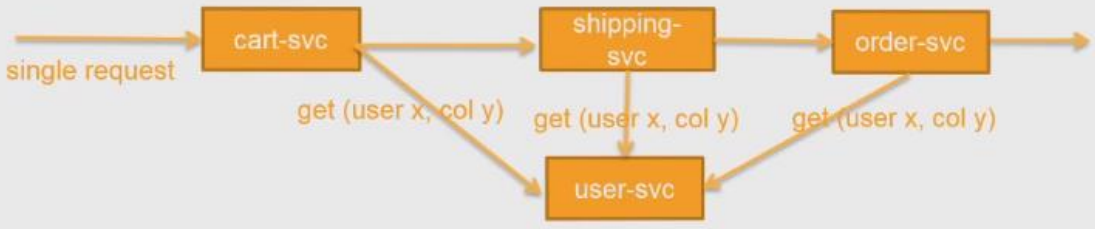
Challenge: Request Multiplication



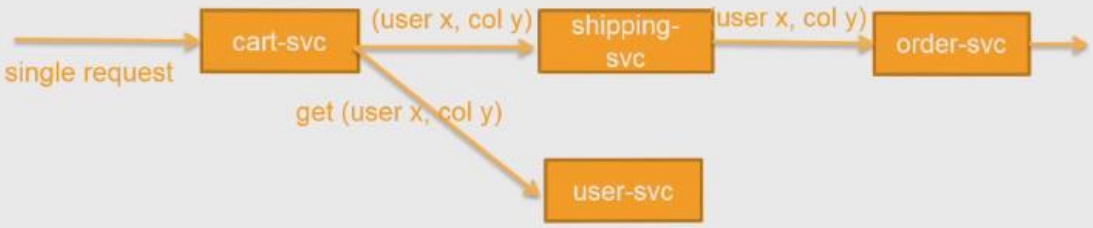
Add Client Caching

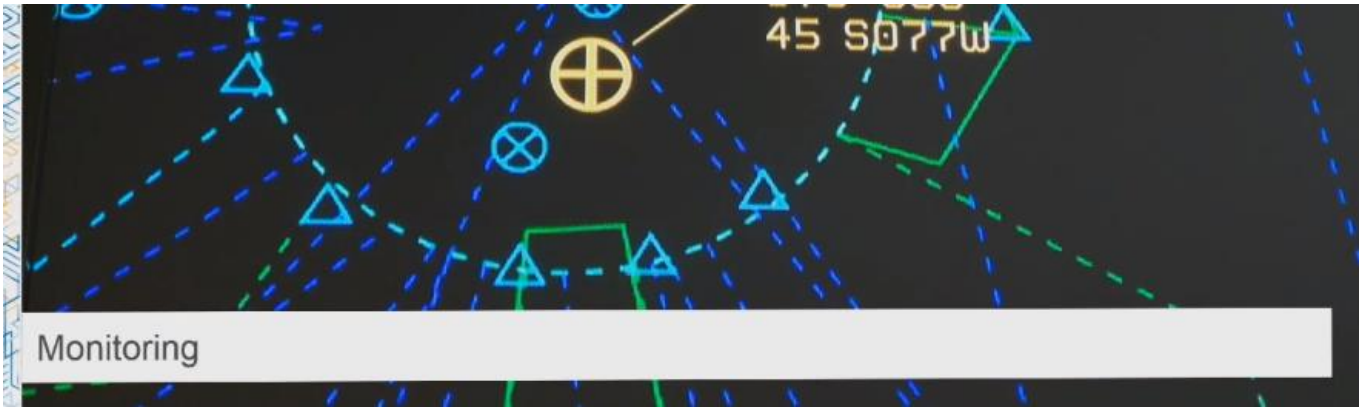


Challenge: Hotspots



Use Dependency Injection





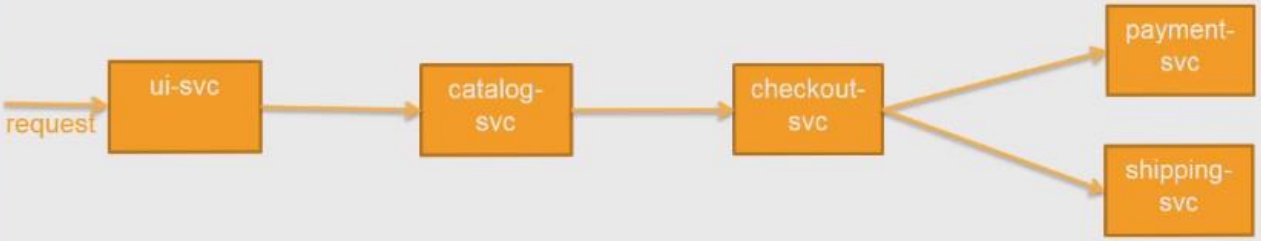
Challenge: monitoring

- *Publish* externally relevant metrics
  - Latency
  - RPS
  - Error rate
- *Understand* internally relevant metrics
  - Basic – CloudWatch
  - OS
  - Application

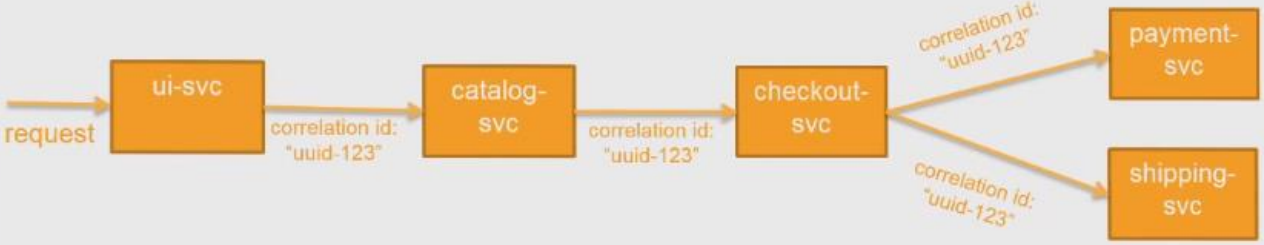
Challenge: Logging

- Pick a common log aggregation solution
- Agree on log entry formats
- Use naming conventions
- Agree on correlation strategy

Challenge: Correlating Requests



Use Correlation IDs




```
09-02-2015 15:03:24 ui-svc INFO [uuid-123] ……
09-02-2015 15:03:25 catalog-svc INFO [uuid-123] ……
09-02-2015 15:03:26 checkout-svc ERROR [uuid-123] ……
09-02-2015 15:03:27 payment-svc INFO [uuid-123] ……
09-02-2015 15:03:27 shipping-svc INFO [uuid-123] ……
```

What did we cover?

- Ownership
- Discovery
- Data management
- Deployment
- I/O explosion
- Monitoring

Related Sessions

- ARC201 - Microservices Architecture for Digital Platforms with AWS Lambda, Amazon CloudFront and Amazon DynamoDB
- CMP302 - Amazon EC2 Container Service: Distributed Applications at Scale
- DEV203 - Using Amazon API Gateway with AWS Lambda to Build Secure and Scalable APIs
- DVO401 - Deep Dive into Blue/Green Deployments on AWS
- SPOT304 - Faster, Cheaper, Safer Products with AWS: Adrian Cockcroft Shares Experiences Helping Customers Move to the Cloud

Remember to complete your evaluations!

Thank you!

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