Microservices Architecture: Building Scalable (Library) Software Solutions

CNI Spring 2016 Membership Meeting, San Antonio, TX

Jason Varghese
(New York Public Library)
@jsonlibrary

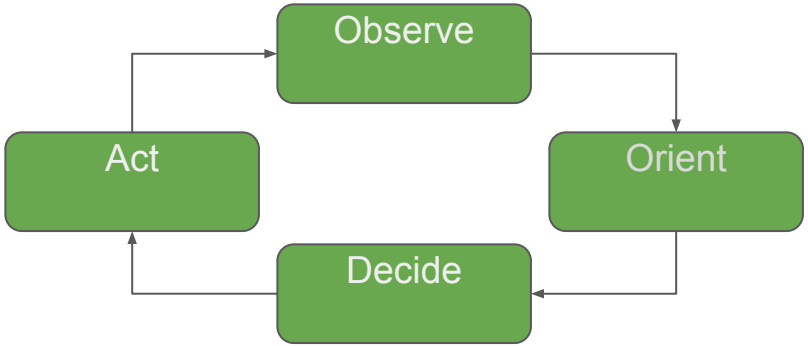
Microservices

- Buzzword compliant
- No “sales”

- Explore Principles
- Use Cases/Examples

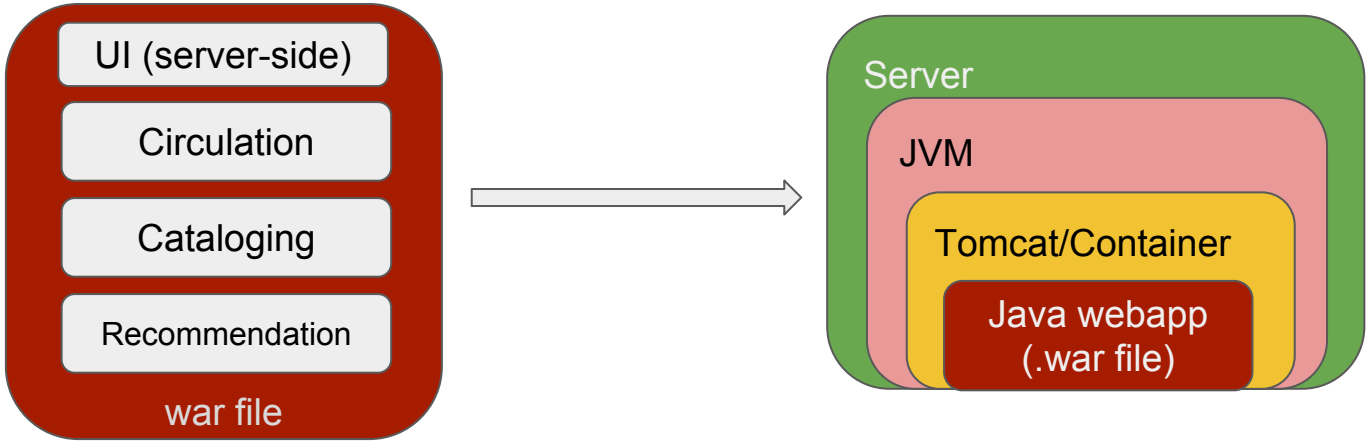
Microservice

- For Web scale only?
- Libraries = $\sum_{i=1}^{\infty}$ (present_webscale)
- Libraries = Technology Leaders
- Pace of Innovation

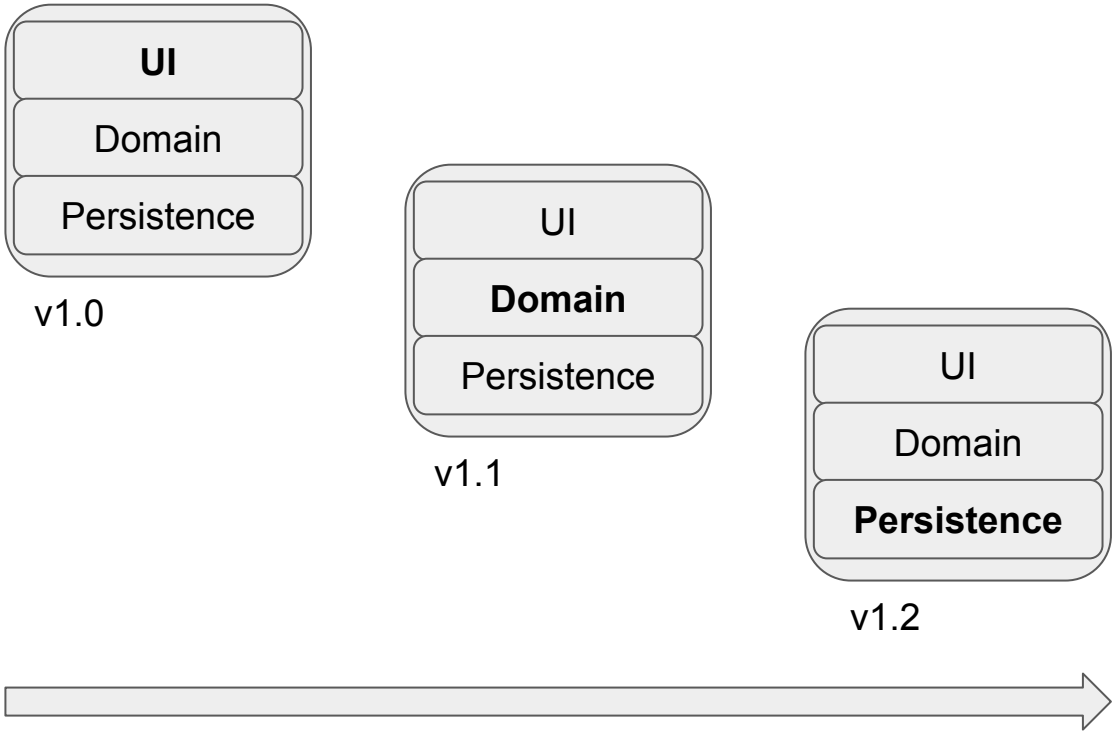


Traditional Web Applications

- Sometimes referred to as “monoliths”
- Can follow best practices in regards to architecture
- Applications packaged and deployed as single artifact or directory hierarchy

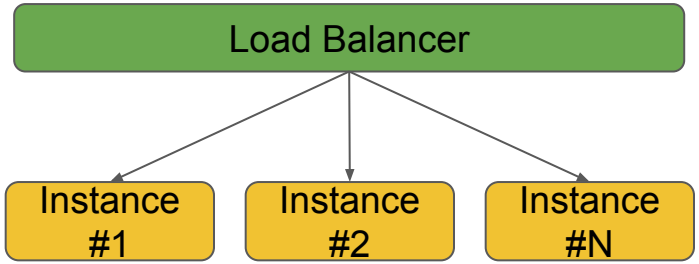


Releasing/versioning monolithic applications



Scaling Traditional Web Applications

- Horizontal Scaling

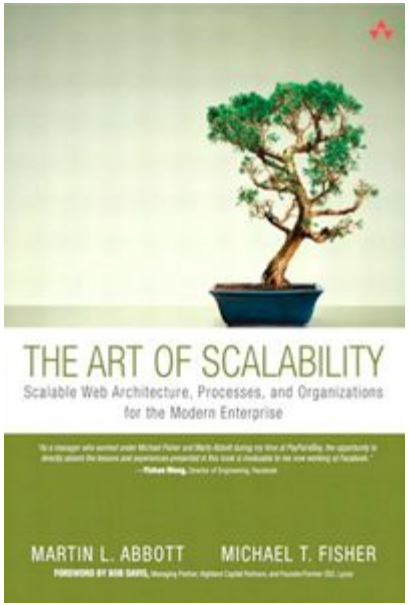


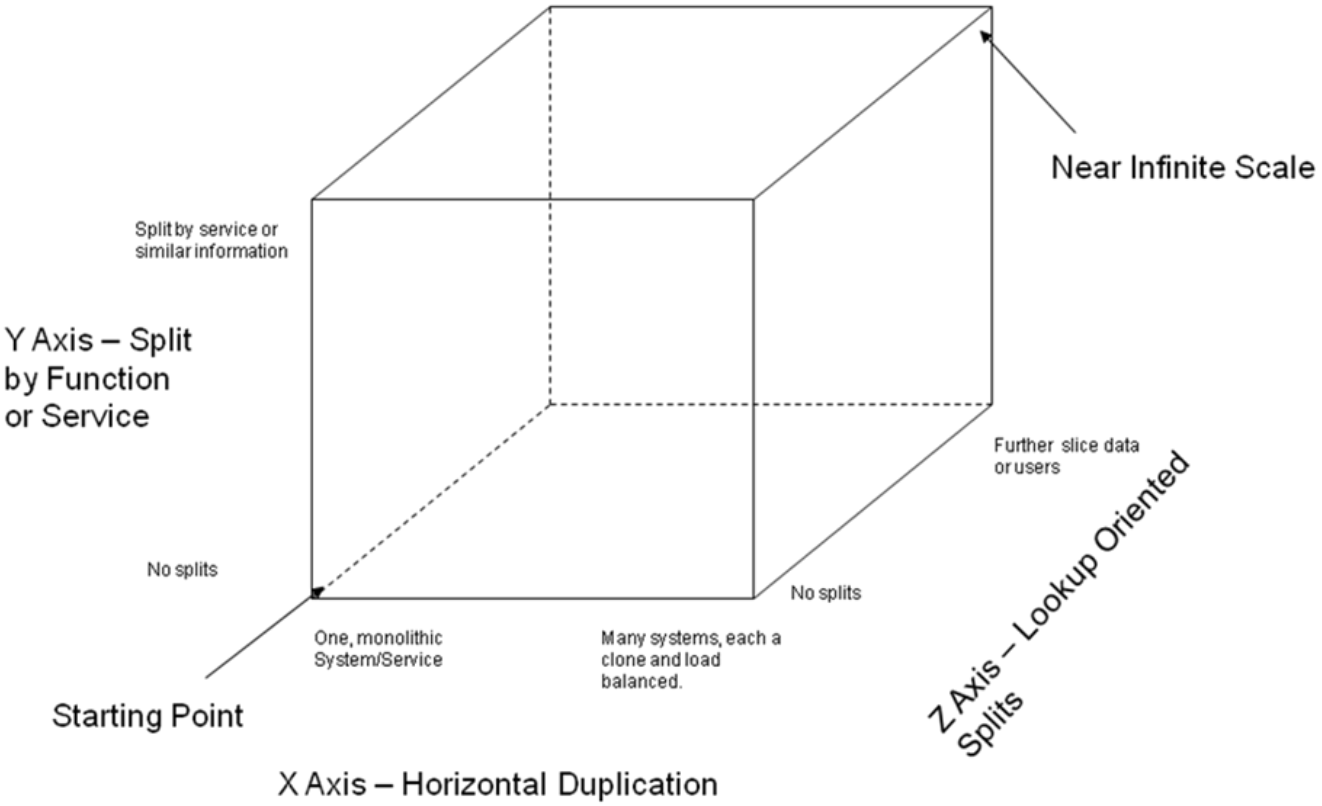
- Vertical Scaling
- Sharding

“Limitations” of monoliths

- Difficult to maintain and release over time
- Dependency management issues
- “Wholesale” scaling of apps.
- Upfront technology stack decision (lock-in).

Scaling by Functional Decomposition



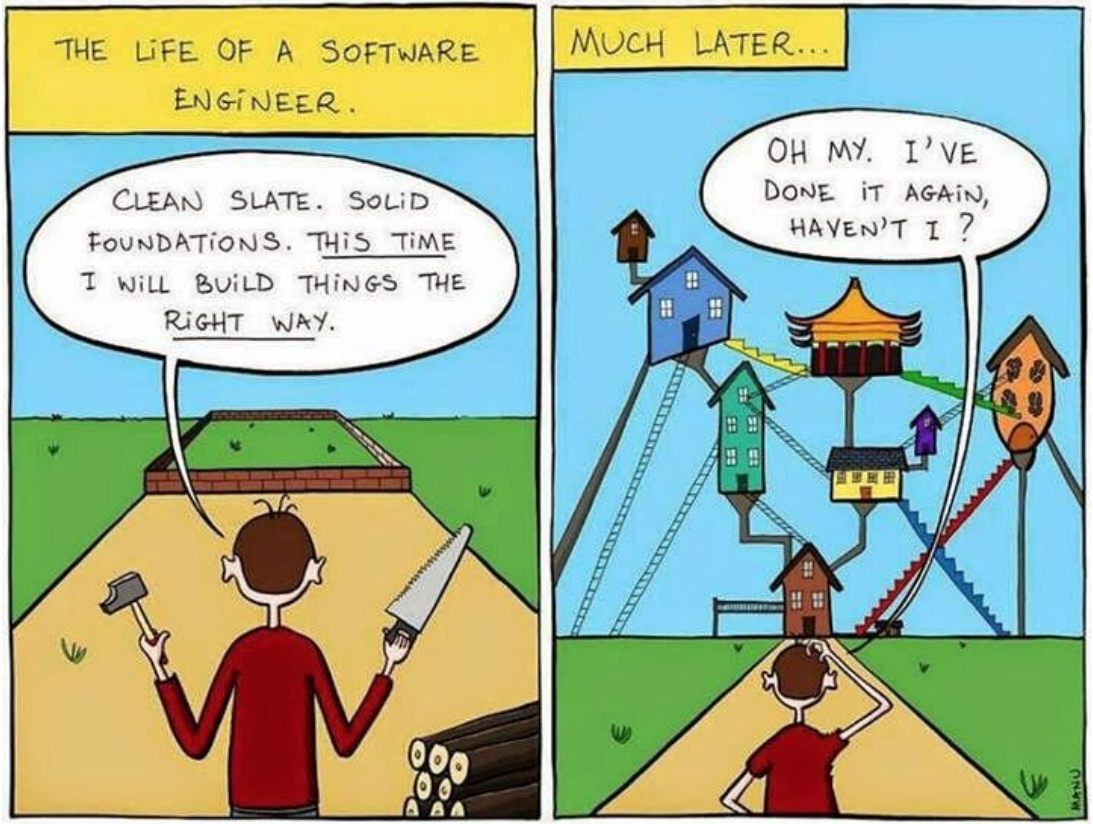


http://akfpartners.com/techblog/2008/05/08/splitting-applications-or-services-for-scale/

Microservices doesn’t solve everything

- Microservices are not a silver bullet
- “Microservices - not a free lunch”
- “If you can't build a monolith, what makes you think microservices are the answer?”

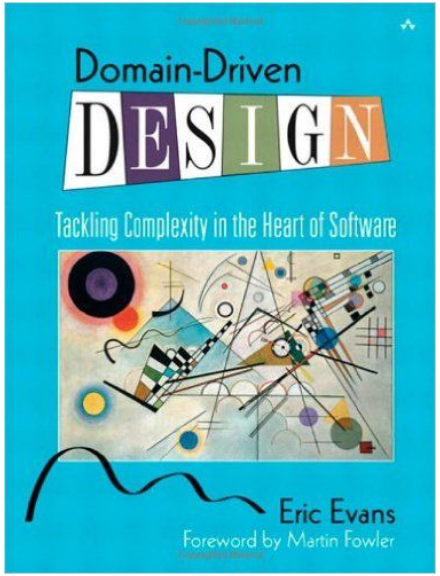
http://highscalability.com/blog/2014/4/8/microservices-not-a-free-lunch.html
http://www.codingthearchitecture.com/2014/07/06/distributed_big_balls_of_mud.html



https://plus.google.com/+ProgrammingCom/posts/LECNUgi4t6R?pid=5851335745881982002&oid=105792929719283190873

Road to microservices

- Domain Driven Design
- Bounded Context

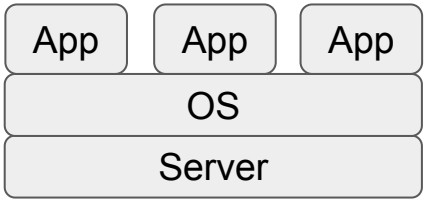


Road to microservices

- Virtualization
- IaaS
- Containerization
- Devops Practice
- PaaS

Road to microservices - Pre VM

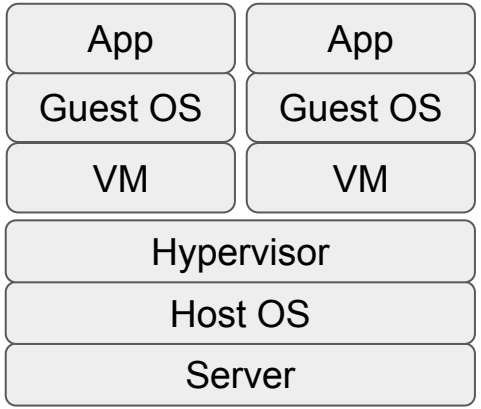
- Long lead time to stand up new server
- Special snowflake servers
  - ie. diglibdev1, diglibqa1, diglibprod1, diglibprod2, diglibprod3
- Inconsistent environments
- Package artifact and throw over wall
- Pack everything onto single machine
- But it works on my laptop!

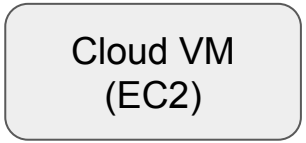


http://blog.codinghorror.com/the-works-on-my-machine-certification-program/

Road to microservices - Virtualization

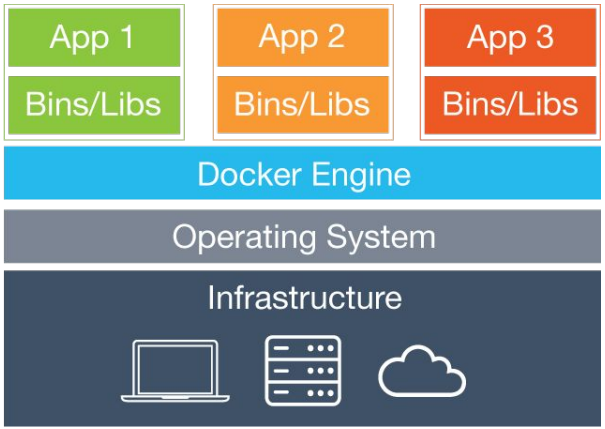
- Virtualization
- Multiple VMs per machine
- VMs still require resources
- IaaS (AWS)
- Cloud based VM’s
- Rapid elasticity

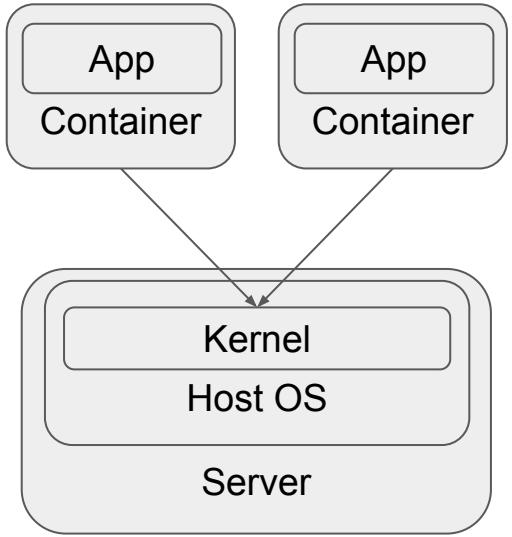




Road to microservices - Containers

- More lightweight than VMs
- No guest OS
- Docker
- Docker Hub



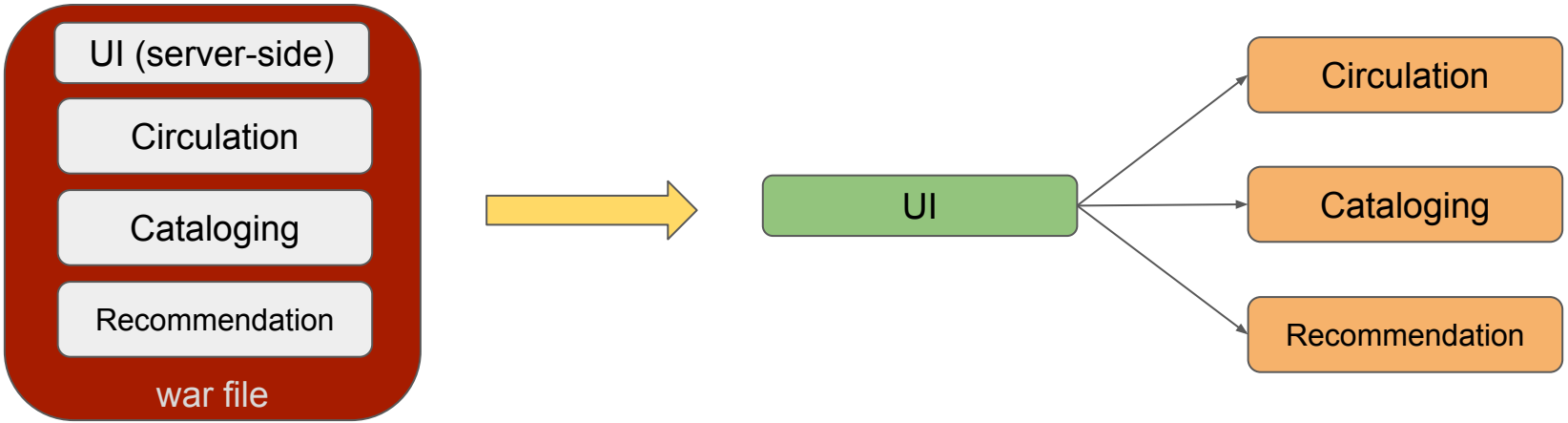


Road to microservice - Devops

- Devops is about organization culture
- Devops != {‘Chef’ || ‘Puppet’ || ‘Ansible’}
- Automation
- Getting things done
- Turn around time is minutes/days not weeks/months
- PaaS

Enter Microservices

- “An application architectural style for creating a set of loosely coupled services each with a bounded context”

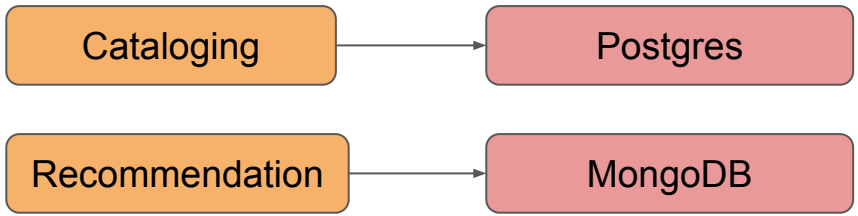


Advantages of microservices

- Allows organizations to evaluate and experiment with new technologies
- Fine grain scaling resulting in more efficient use of resources
- Faster/less risky incremental releases
- Break down complex application and problem spaces

Properties of Microservices

- Bounded context
- Encapsulate implementation details
- One datastore per microservice/no integration database across services
- Loosely coupled
- Clear external interfaces
- Centered around product teams
- Products vs. Projects



Complexities

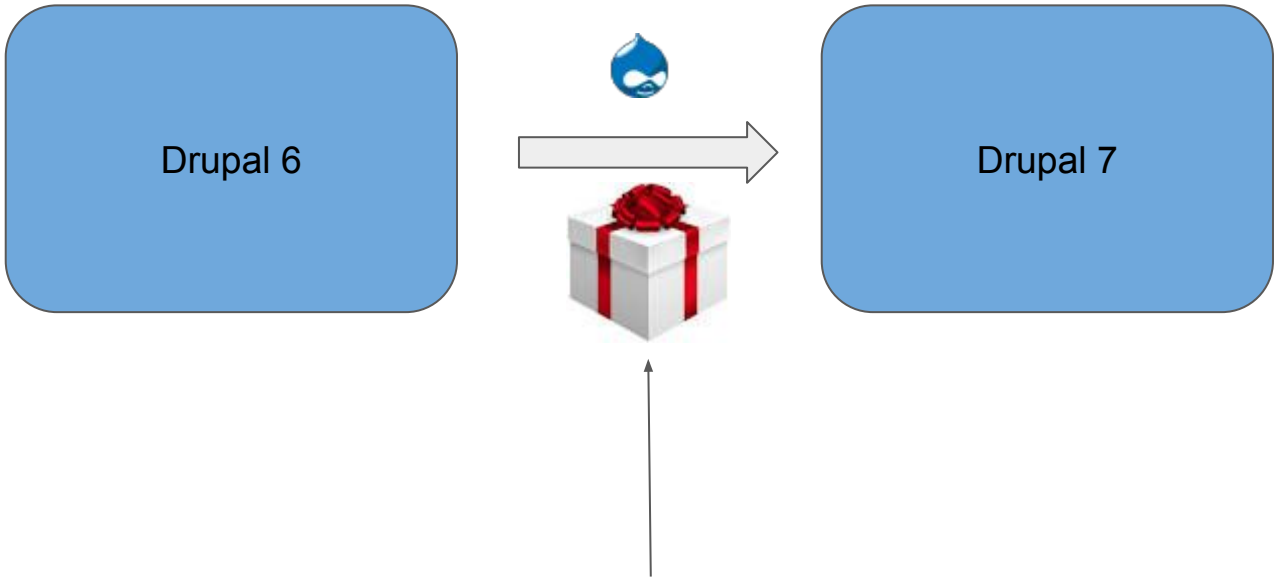
- Distributed Systems
- CAP Theorem
  - Eventually Consistent Systems

But what about SOA?

- Best of SOA Principles
- SOA 2.0
- Less emphasis on middleware (ESB, etc)
- Smart endpoints, dump pipes
- Beware of microservice-enabled middleware, “micro-service product”

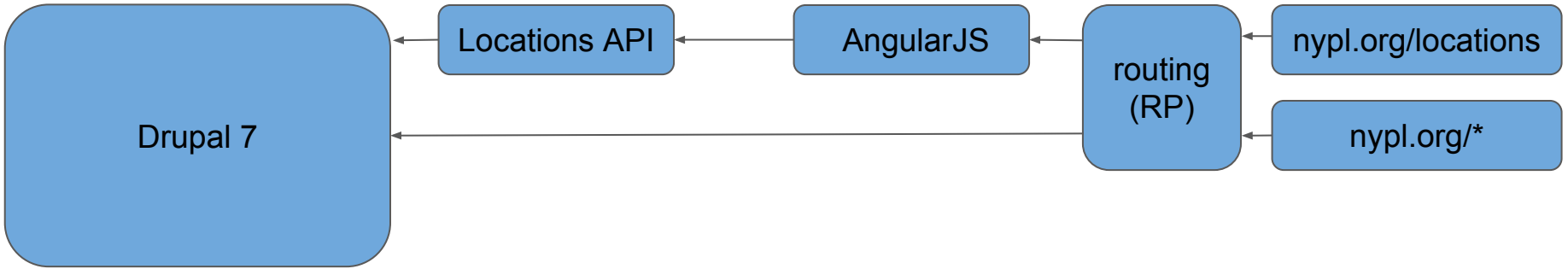
Refactoring/Integrating with existing apps

- Strategies for dealing with legacy/3rd party applications
- Case study



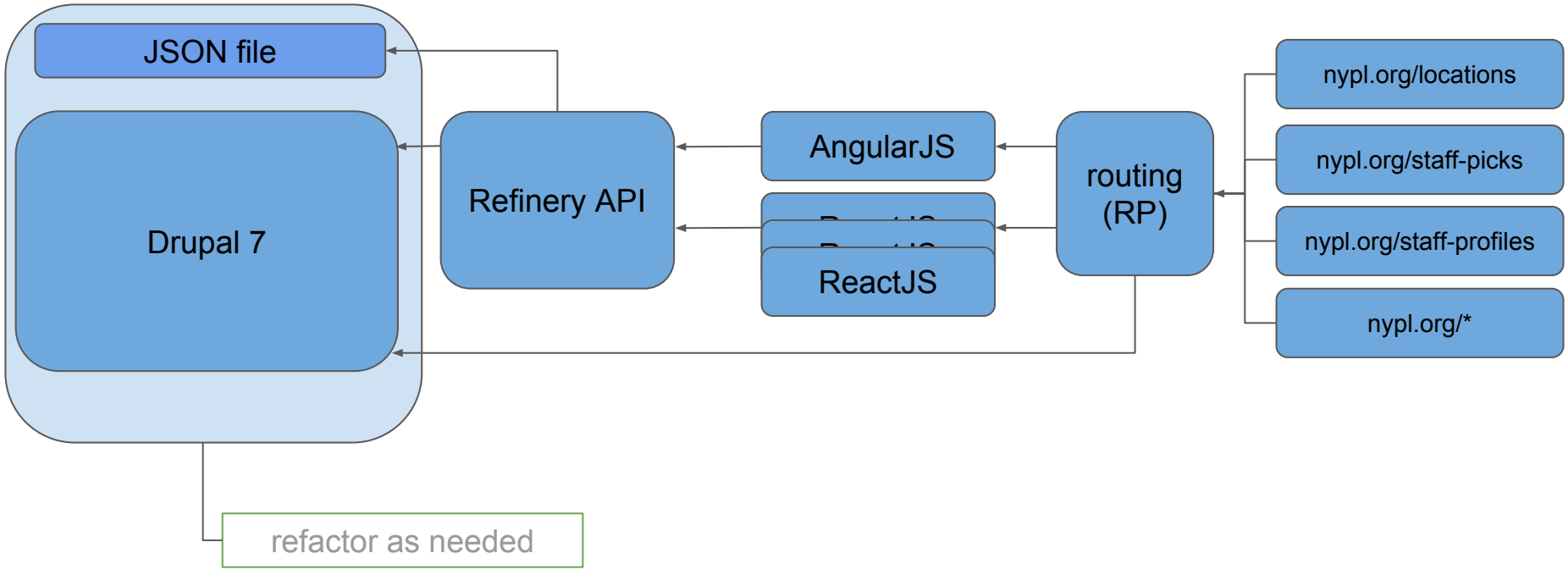
Refactoring/Integrating with existing apps

- Migrated D6--->D7 instance
- “Locations” experiment



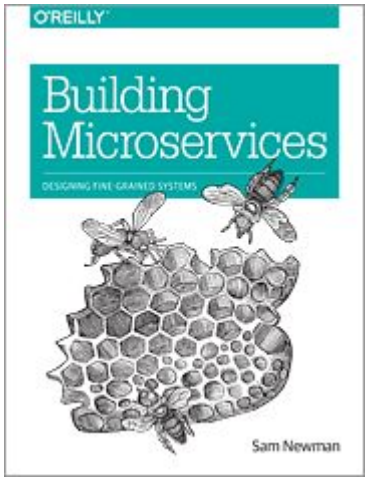
Refactoring/Integrating with existing apps

- Iterate and expand on architecture



Best practices/Emerging Trends

- Providing CMS content as service is appearing to be a best practice
- Building Microservice book describes “CMS as a Service”
- Drupal 8 describes “Content as a Service”



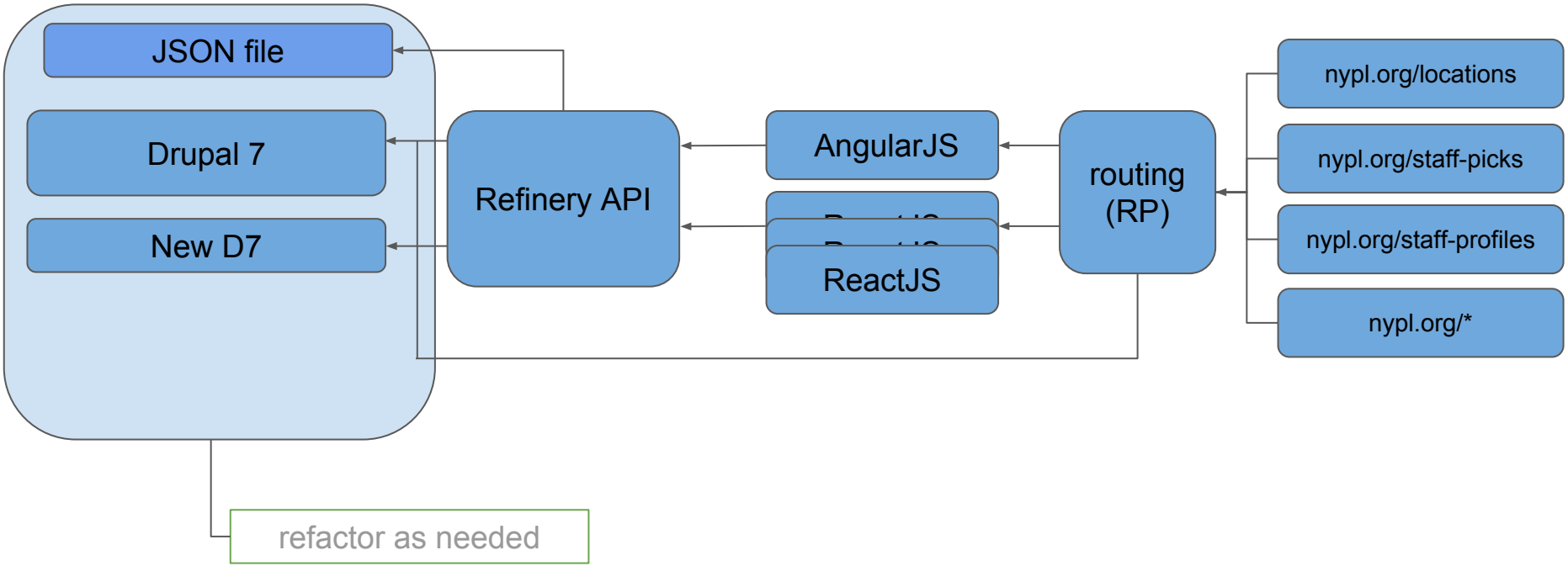
Drupal Feature

Content as a Service

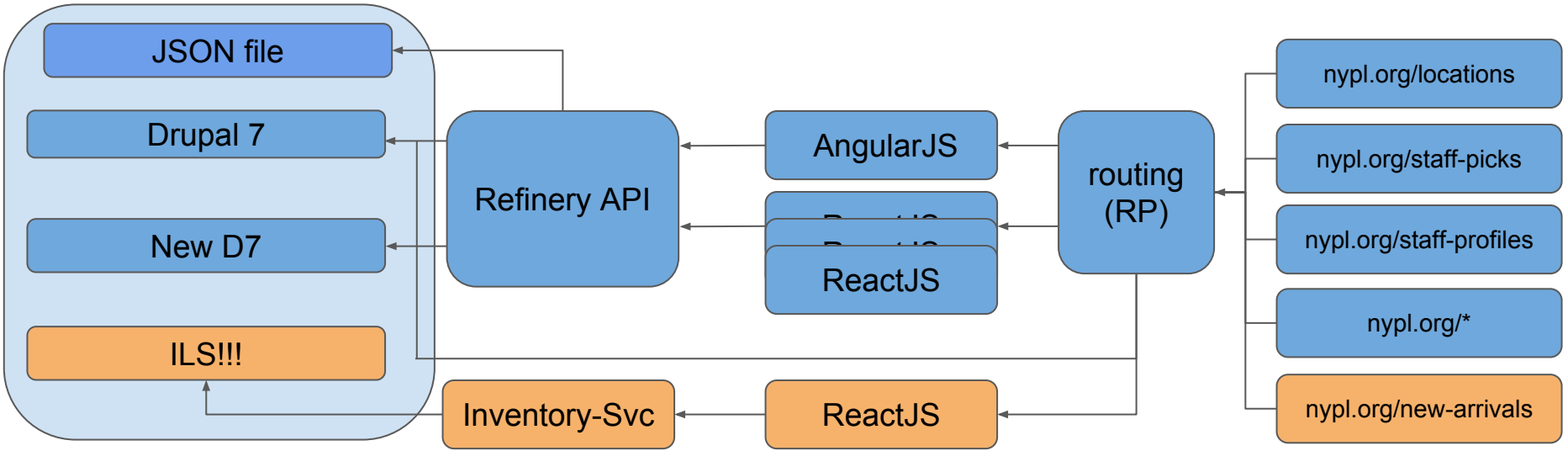
Web content used to have one purpose in life: to get pushed to a web page viewed through a desktop browser. But content now must flow freely to sites, native apps, connected devices and show up on third-party sites and social networks too. Digital experiences demand content flexibility. Drupal’s content-as-a-service approach opens the door to ultimate flexibility.

https://www.drupal.com/feature/content-as-a-service

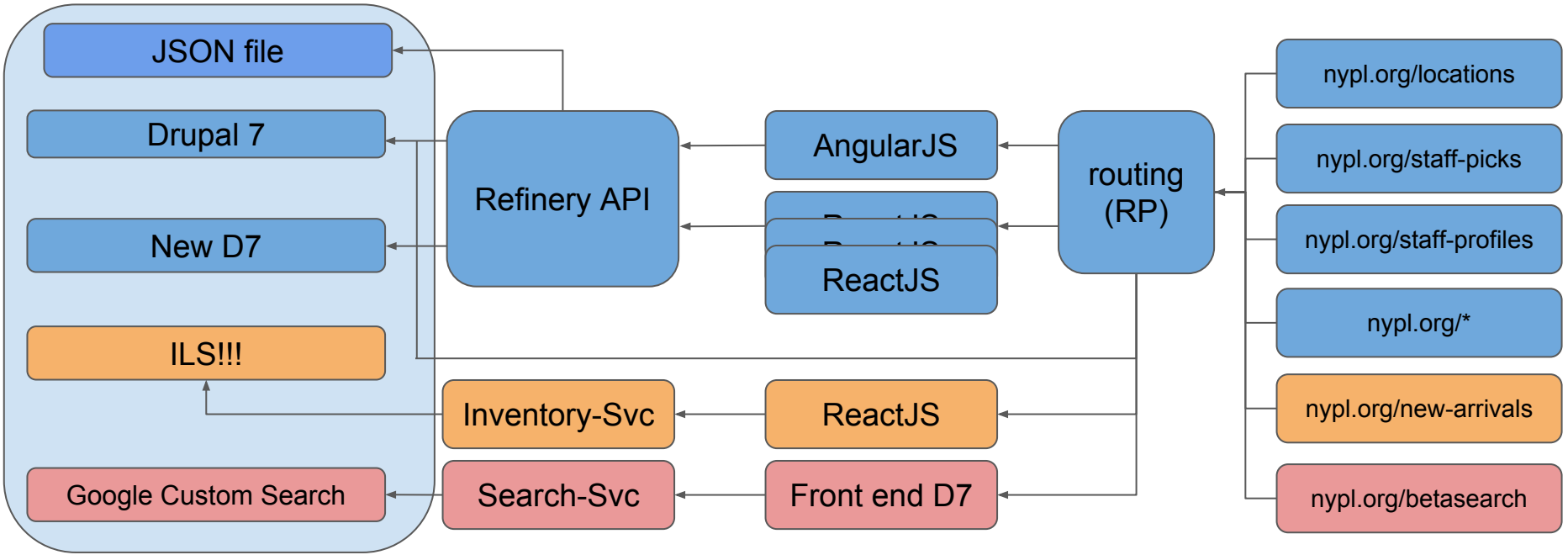
Refactoring/Integrating with existing apps



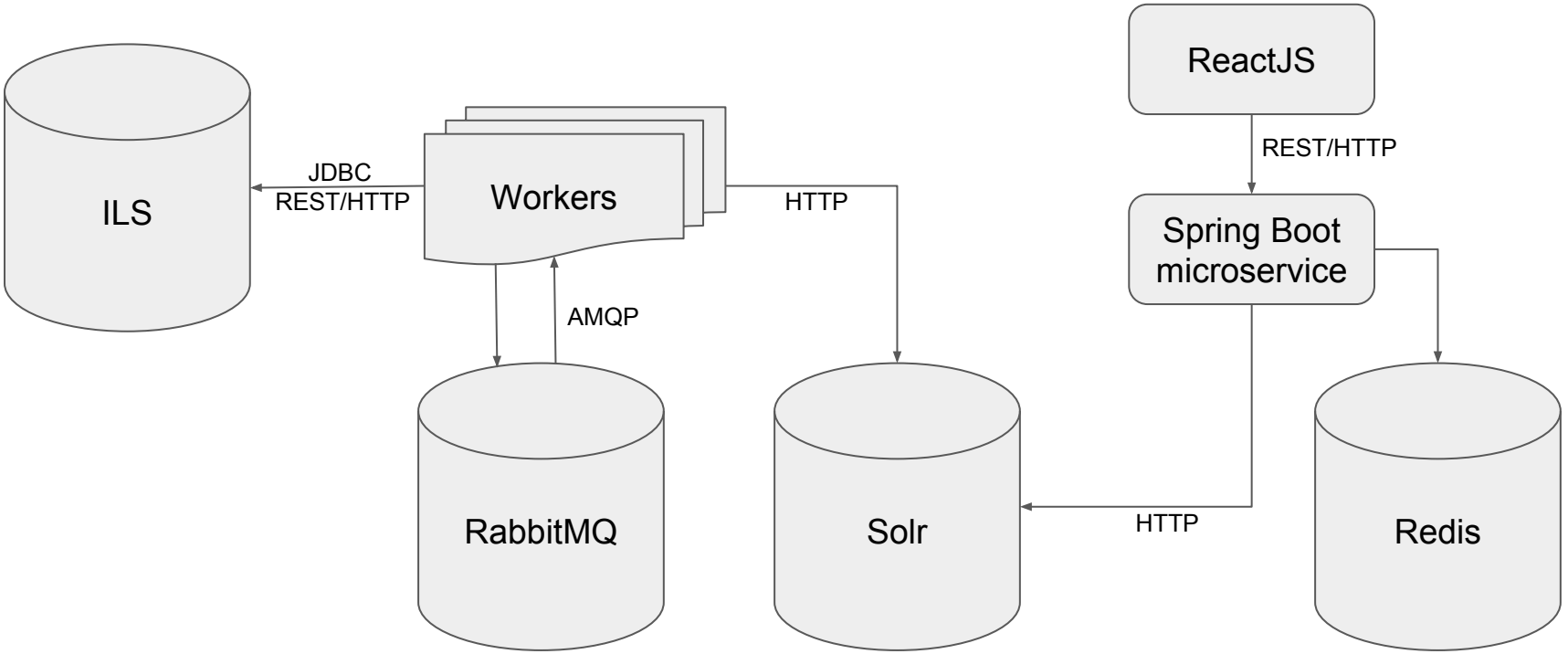
Refactoring/Integrating with existing apps



Refactoring/Integrating with existing apps



Inventory Service - closer look

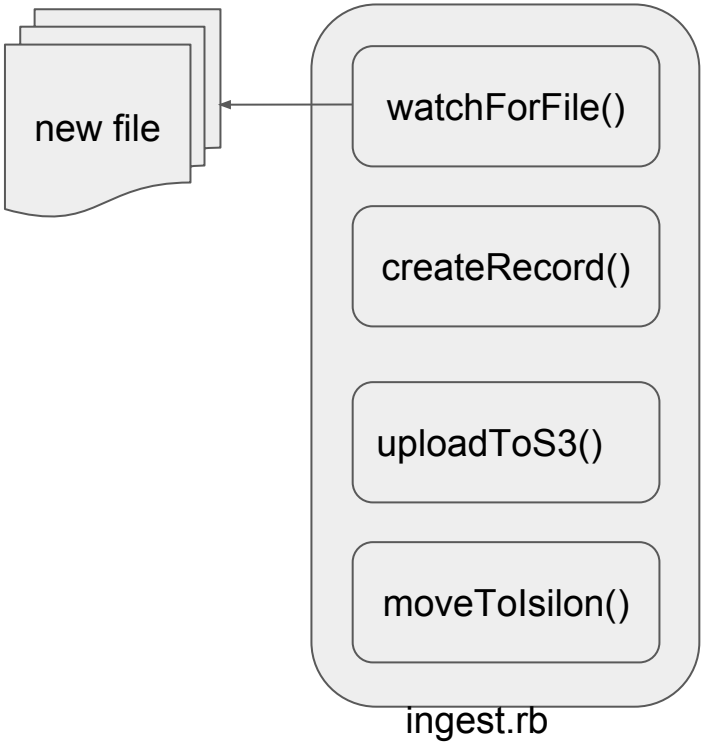


Microservices for complex workflow

- Orchestration
- Choreography
- NYPL A/V ingest use case
  - Have an idea of end state
  - current state and workflows unclear
  - Spreadsheets
  - “Parking lot” storage (backlog > 600+TB)
  - **Bag created as result of current process**
- Initial known steps
  - Watch for file/bag
  - Create entry in metadata system
  - Transcode the video
  - Place preservation master in Isilon storage

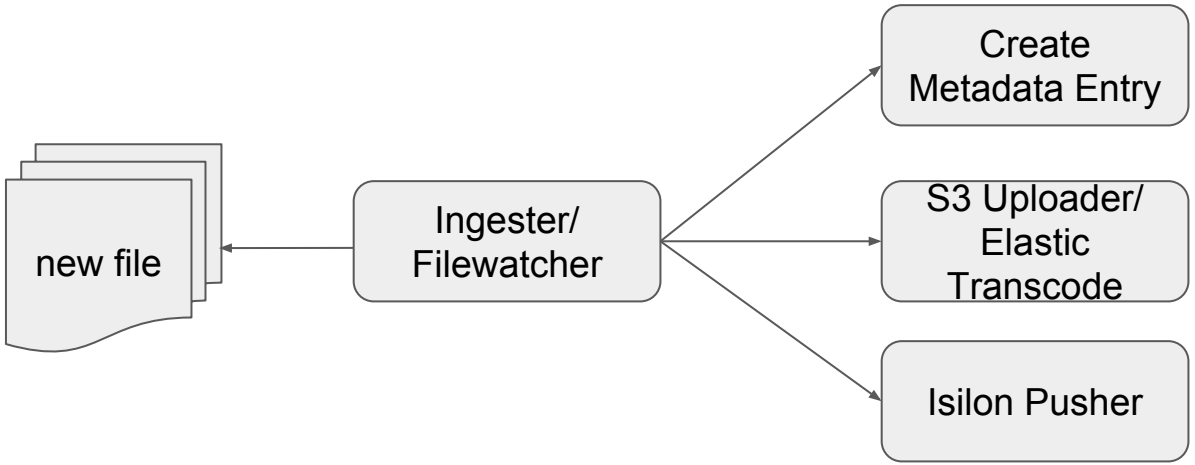
Audio/Video Ingest

- Not service based
- Ingest Script



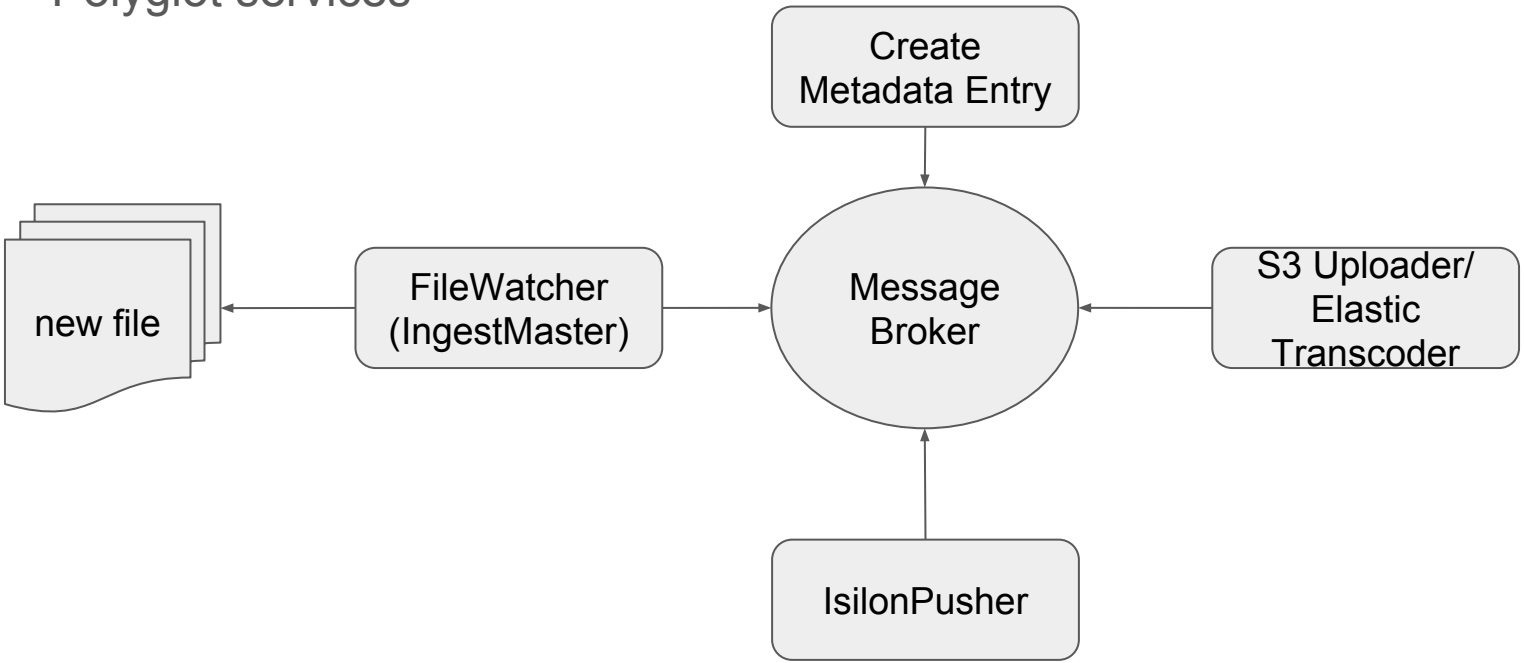
Audio/Video Ingest

- Make it service based
- Orchestrated Approach Example



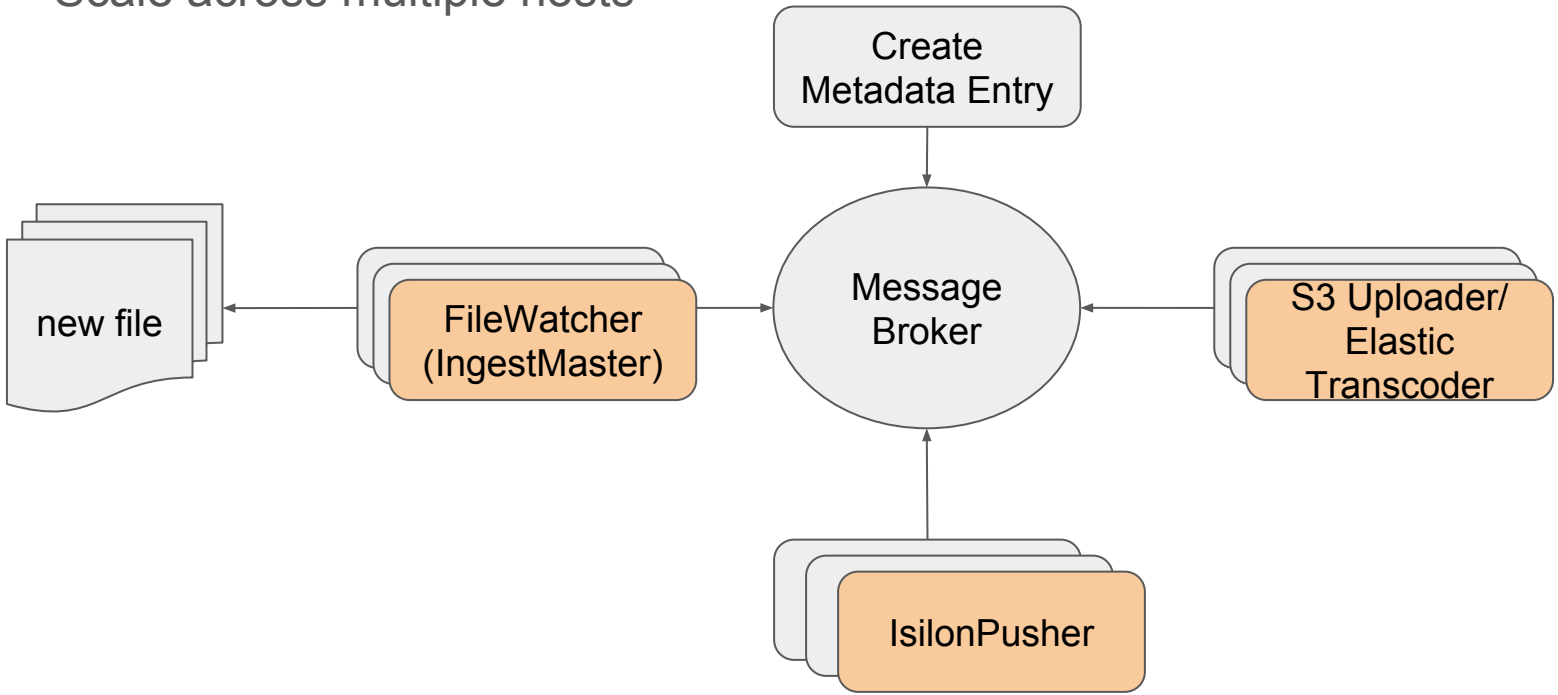
Audio/Video Ingest

- Choreographed Approach Example
- Polyglot services



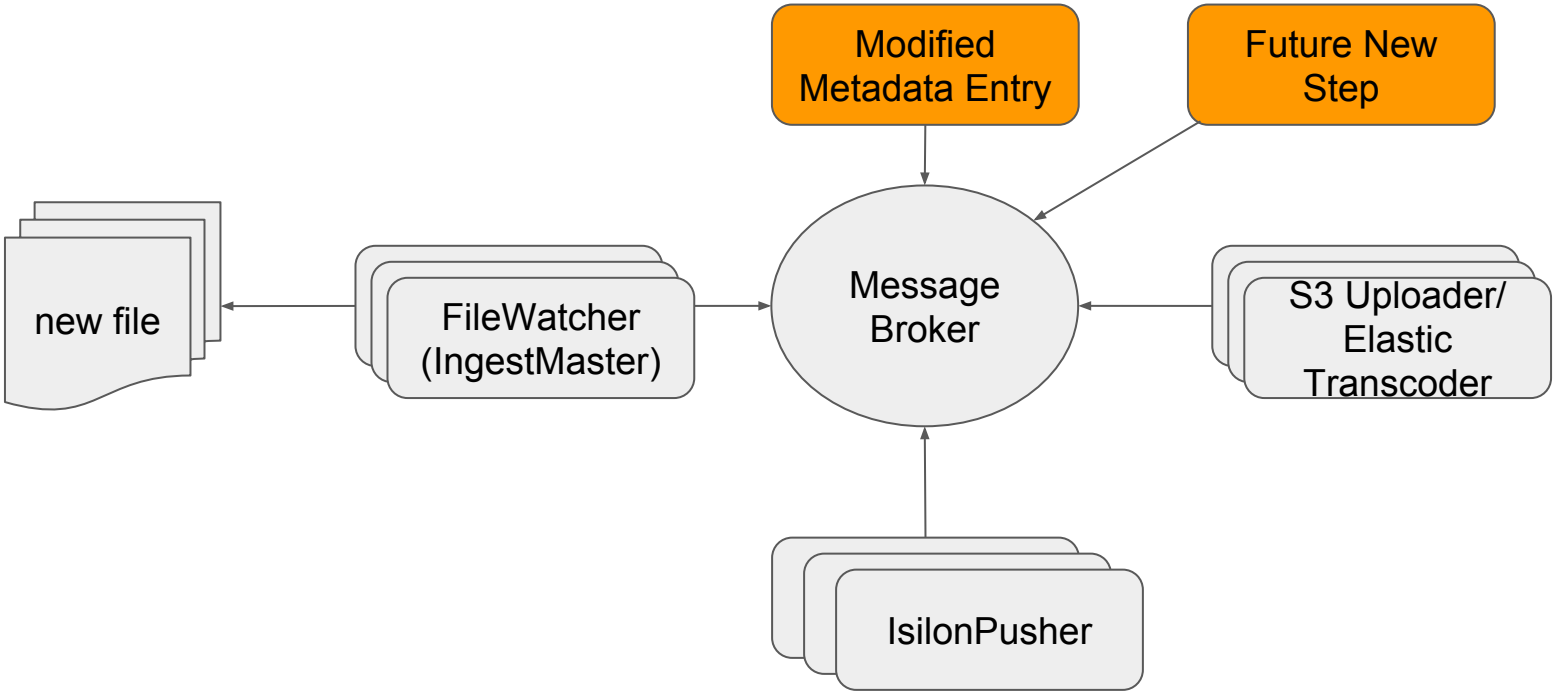
Audio/Video Ingest

- Scale out services as needed
- Scale across multiple hosts



Audio/Video Ingest

- Modify and extend

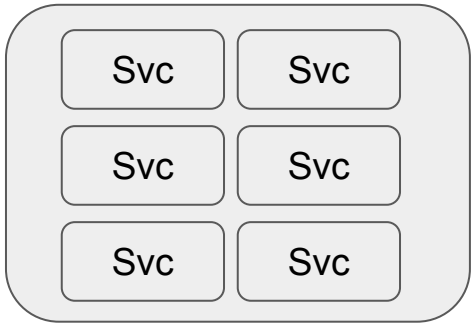


A/V ingest workflow

- Tracking status
- Use Correlation ids (uuid-based)
- View status in log aggregation tool

Deployment Strategies

- Multiple services per host



- Definition of host
- Service per host

- Docker/Kubernetes

Microservice Requirements

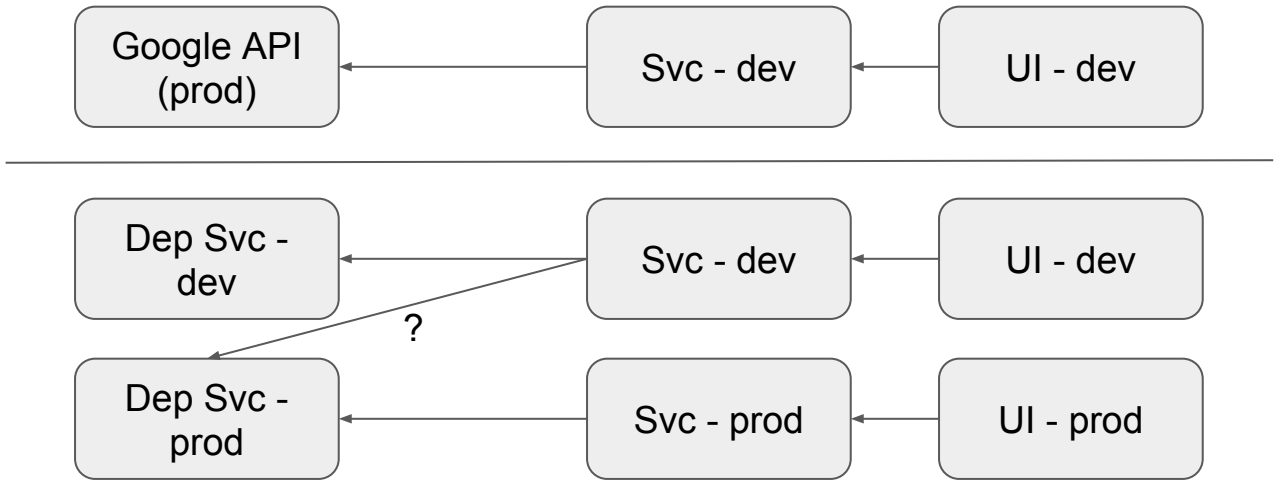
- Automation
  - Provisioning
  - Automated testing
  - CI/CD
  - Rollback
- Monitoring
  - APM
  - Log aggregation
  - Checkpoints (queue-in, queue-out)
  - Correlation IDs
- Service Discovery
- Design for Failure
  - Any node can go down
  - Network failure
  - Degrade functionality without taking down system

Security

- OAuth2.0
- Parties
  - Resource Owner
  - Resource Server
  - Client
  - Authorization Server (can be same as resource server sometimes)
- Authorization Grant Types
  - Authorization Code
  - Client Credentials
  - Implicit Resource Owner
  - Password Credentials
- Open ID Connect
  - Open ID providers
  - Relying Party
- JSON Web Tokens (JWT)

Testing

- Integration Environments
- End to End tests?



Thank You