Microservices

Oxford University Software Engineering Programme
January 2018

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Agenda

- Why?
- History and evolution
- Architecture
- Pros and Cons
- More resources

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Microservices

- Building a single app from multiple services
  - Each service in its own process
  - Lightweight communications between each other
  - Usually HTTP but not necessarily

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Microservices Characteristics (Martin Fowler)

- **Componentization**
  - Replacability
- **Organisation**
  - around business capabilities instead of around technology.
- **Smart endpoints and dumb pipes**
  - explicitly avoiding the use of an Enterprise Service Bus (ESB)
- **Decentralised data management**
  - with one database for each service instead of one database for a whole company.
- **Infrastructure automation**
  - with continuous delivery being mandatory.

http://martinfowler.com/articles/microservices.html

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You build it you run it

Amazon story

2001

Exactly equal to Microservices!

(this isn't new!)

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Benefits of Microservices

- Independent organization makes it easier for developers
  - Separation of concern
  - Simple code
  - Simple test cases
  - Simple scaling
  - Faster to build, deploy and test

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Stuart Charlton @svrc · 16h

the next time i see a team of 4 wanting to create 63 microservices for their app, i want this posted in big neon letters to their team room

> **Andrew Clay Shafer** @littleidea
>
> The point of microservices is to unblock independent queues of work. Both in the system of services, and the system of people.

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Microservices deployment model

- Increasingly fitting with "containerisation"
  - Docker
  - CoreOS
  - Kubernetes
  - Etc
- Container model is lightweight virtualization with each "VM" running a single process

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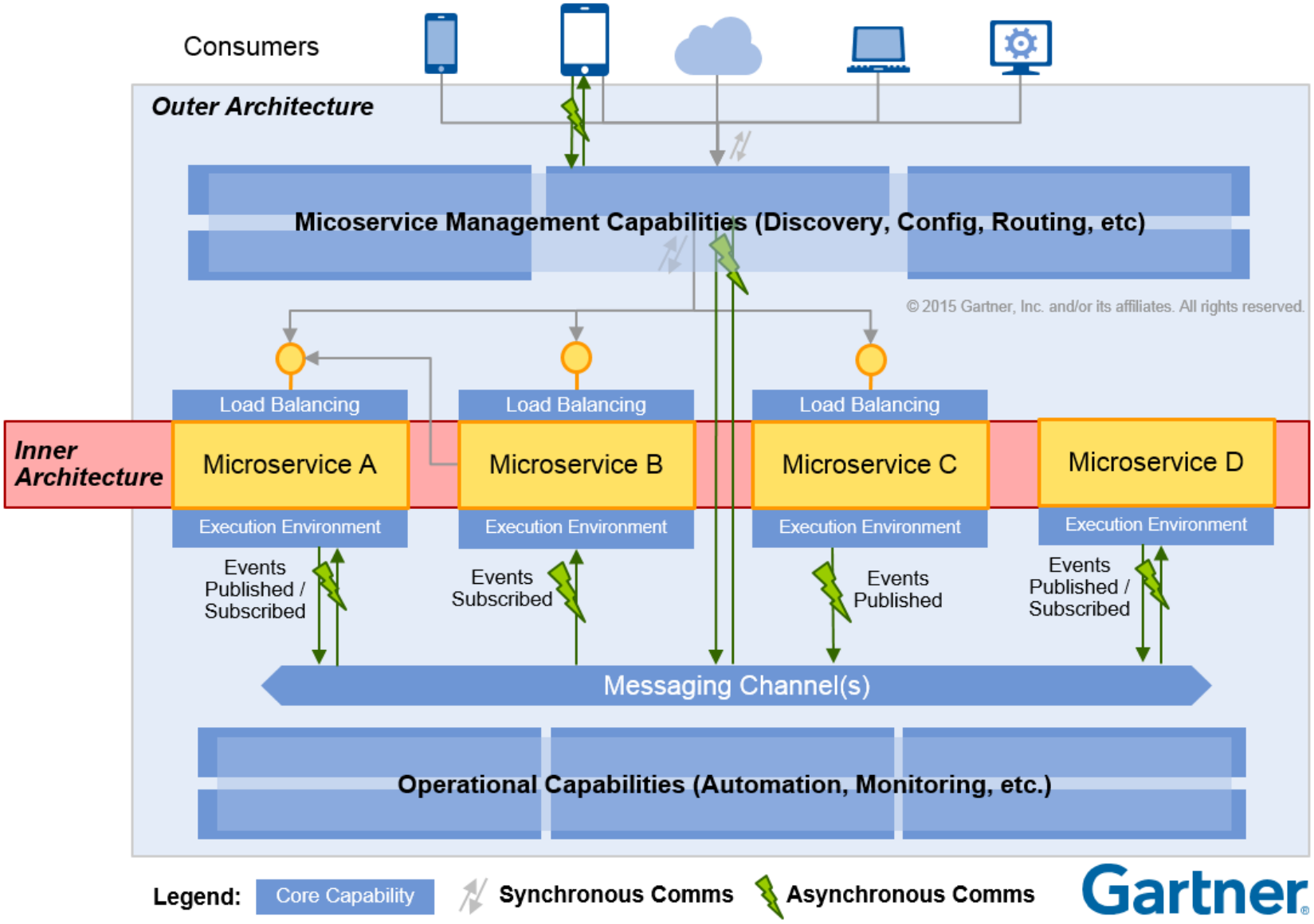

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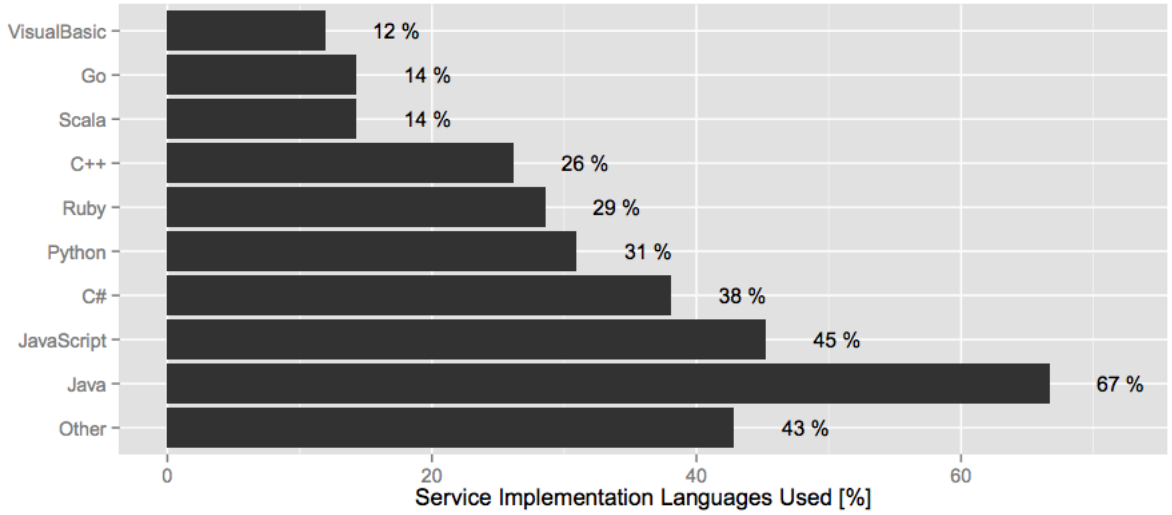
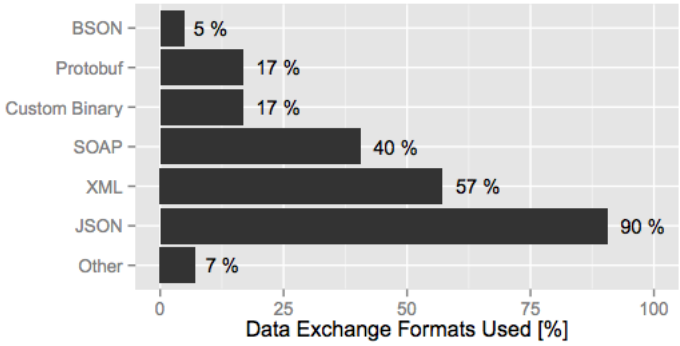
Traditional SOA versus microservices

	Traditional SOA	Microservices
Messaging type	Smart, but dependency-laden ESB	Dumb, fast messaging (as with Apache Kafka)
Programming style	Imperative model	Reactive actor programming model that echoes agent-based systems
Lines of code per service	Hundreds or thousands of lines of code	100 or fewer lines of code
State	Stateful	Stateless
Messaging type	Synchronous: wait to connect	Asynchronous: publish and subscribe
Databases	Large relational databases	NoSQL or micro-SQL databases blended with conventional databases
Code type	Procedural	Functional
Means of evolution	Each big service evolves	Each small service is immutable and can be abandoned or ignored
Means of systemic change	Modify the monolith	Create a new service
Means of scaling	Optimize the monolith	Add more powerful services and cluster by activity
System-level awareness	Less aware and event driven	More aware and event driven

What are services like in reality?



Most services (51%) were 1,000-10,000 LoC
Only 3% of services in the survey were <100 LoC
43% 100-1,000 LoC



All the Services Large and Micro: Revisiting Industrial Practice in Services Computing
https://peerj.com/preprints/1291.pdf

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Real world examples

- The previous case studies are in many cases microservices
  - eBay, Netflix, Amazon
  - Many more out there and growing rapidly

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Polyglot

- Microservices can be built in multiple languages
  - Hackathon last year I built a simple app
  - Node, Python and MQTT
  - One day's effort
  - Microservice architecture
  - http://pzf.fremantle.org/2013/12/commshack.html

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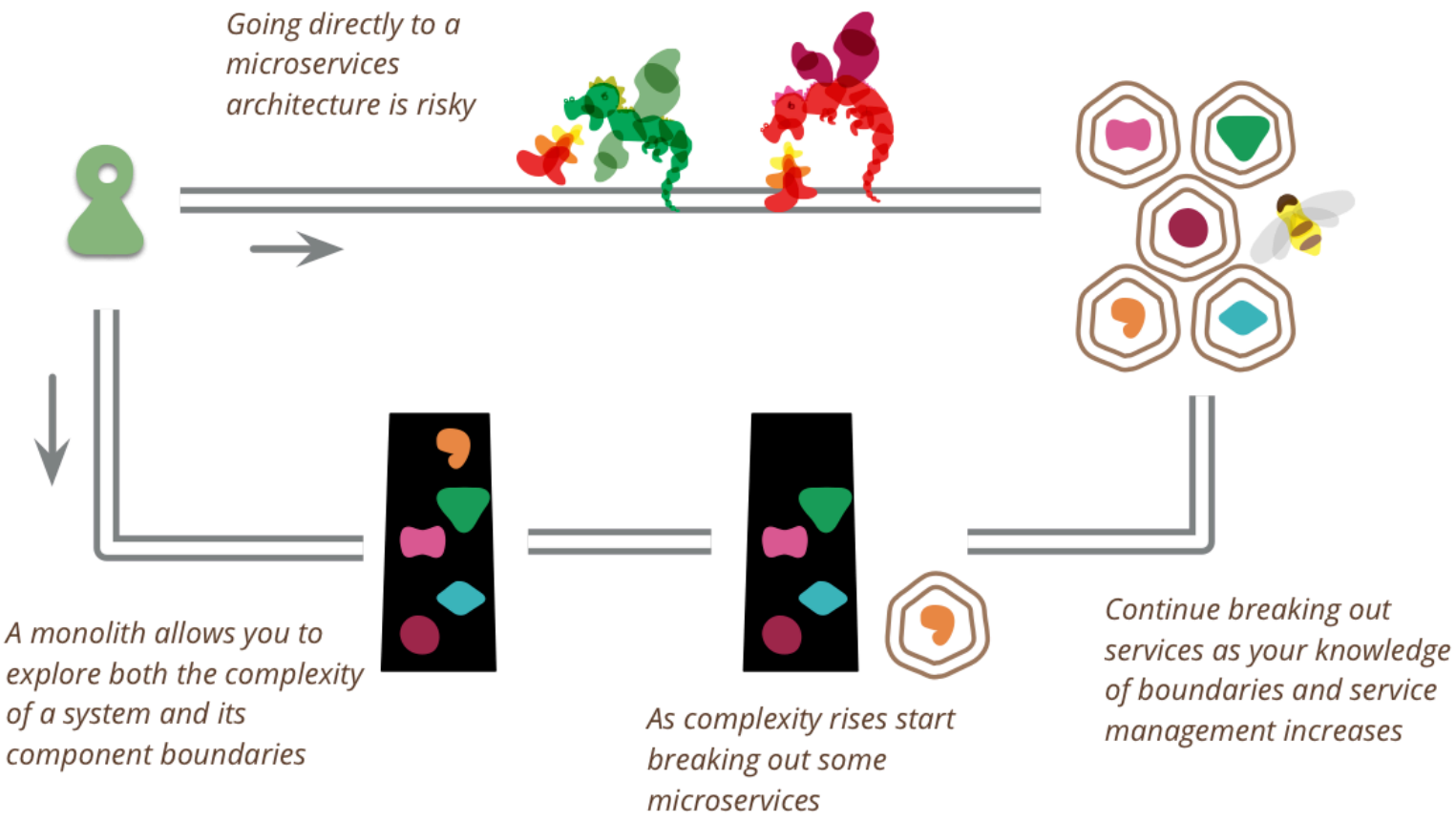
Start with a Monolith?



http://martinfowler.com/bliki/MonolithFirst.html

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Cons!

- Debugging
- Deployment and devops
- Operations overhead
- Implicit interfaces and contracts
- Latency
- Transactions
- Etc.!

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Smart endpoints and dumb pipes

- Microservices are based on the idea of simple RESTful APIs directly implemented
- Need to manage contracts cleanly and carefully
- ESB is not part of this architecture
  - But an API Gateway might be
  - Don't confuse the application architecture with the Enterprise architecture

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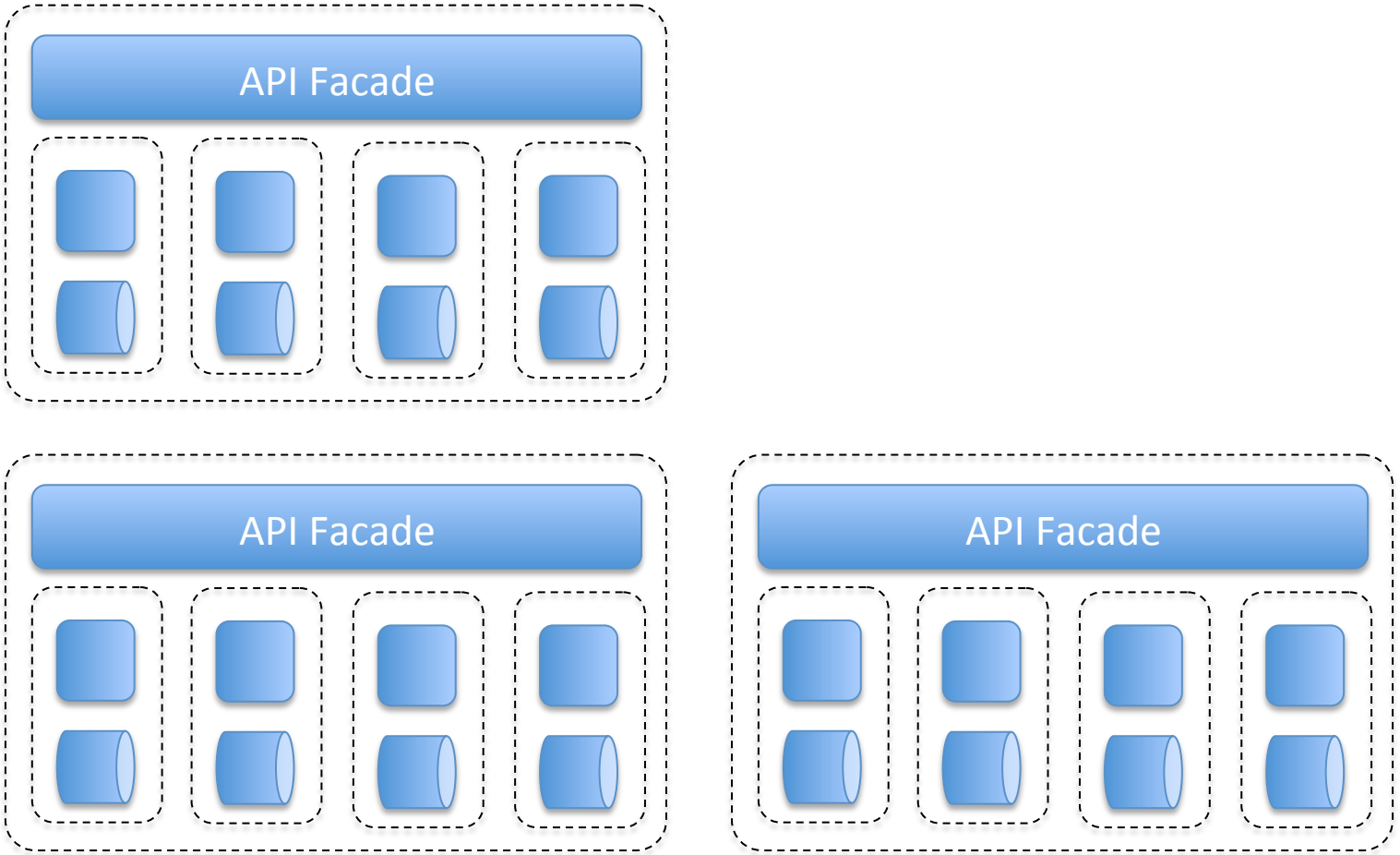
Micro and Macro Services



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API Gateway and Microservices

- Versioning
- Single URI structure out of many independent backends
- Contracts and documentation
- More discussion later

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Service Mesh

- How do I guarantee resilience in a microservices environment?
- Load-balancing, failover, discovery
- Building it into code is complex
  - Libraries such as Hystrix help
- But inhibits polyglot
  - Each language needs its own approach

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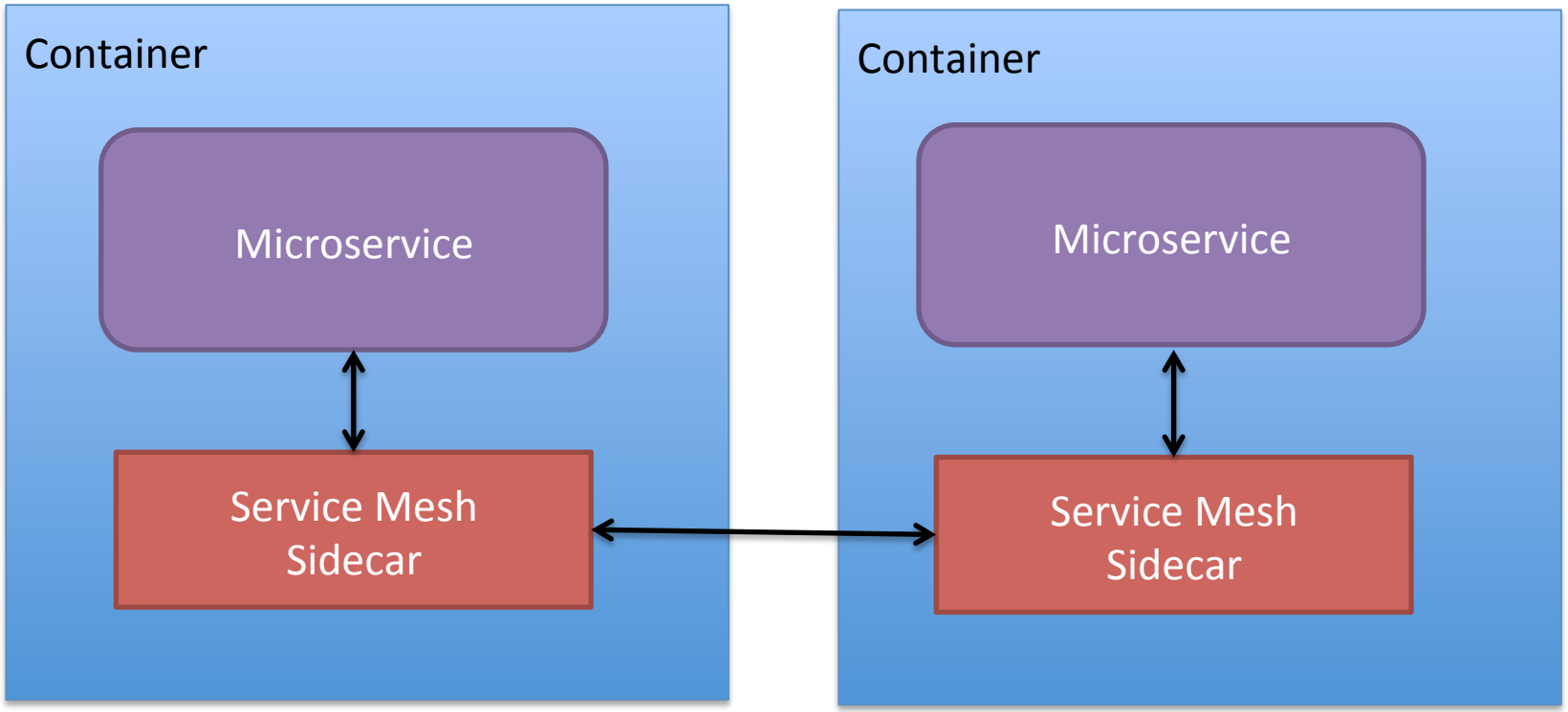
Service Mesh

Sidecar architecture



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Service Mesh

- Load-balancing, circuit breakers
- Discovery / Naming
- Traffic control
- Per-request/content-based routing
- Timeouts and deadlines
- Mutual TLS
- Observability

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Service Mesh implementations

- Envoy
  - And hence Istio
- Linkerd
- Conduit

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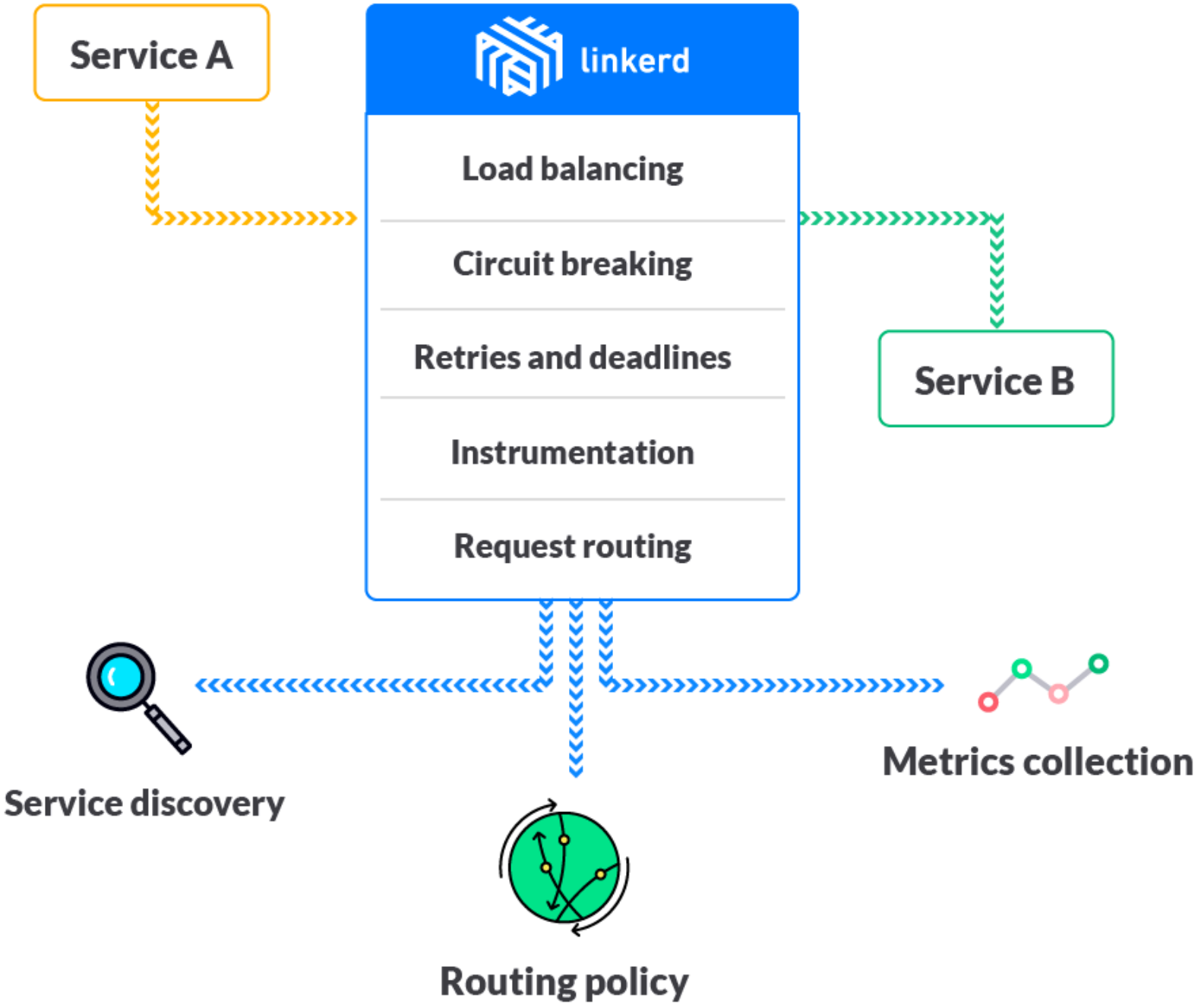
Service A
linkerd
Load balancing
Circuit breaking
Retries and deadlines
Instrumentation
Request routing
Service B
Service discovery
Metrics collection
Routing policy

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Resources

- http://www.slideshare.net/chris.e.richardson
- http://martinfowler.com/articles/microservices.html
- http://www.thoughtworks.com/insights/blog/microservices-nutshell

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