App-Bisect

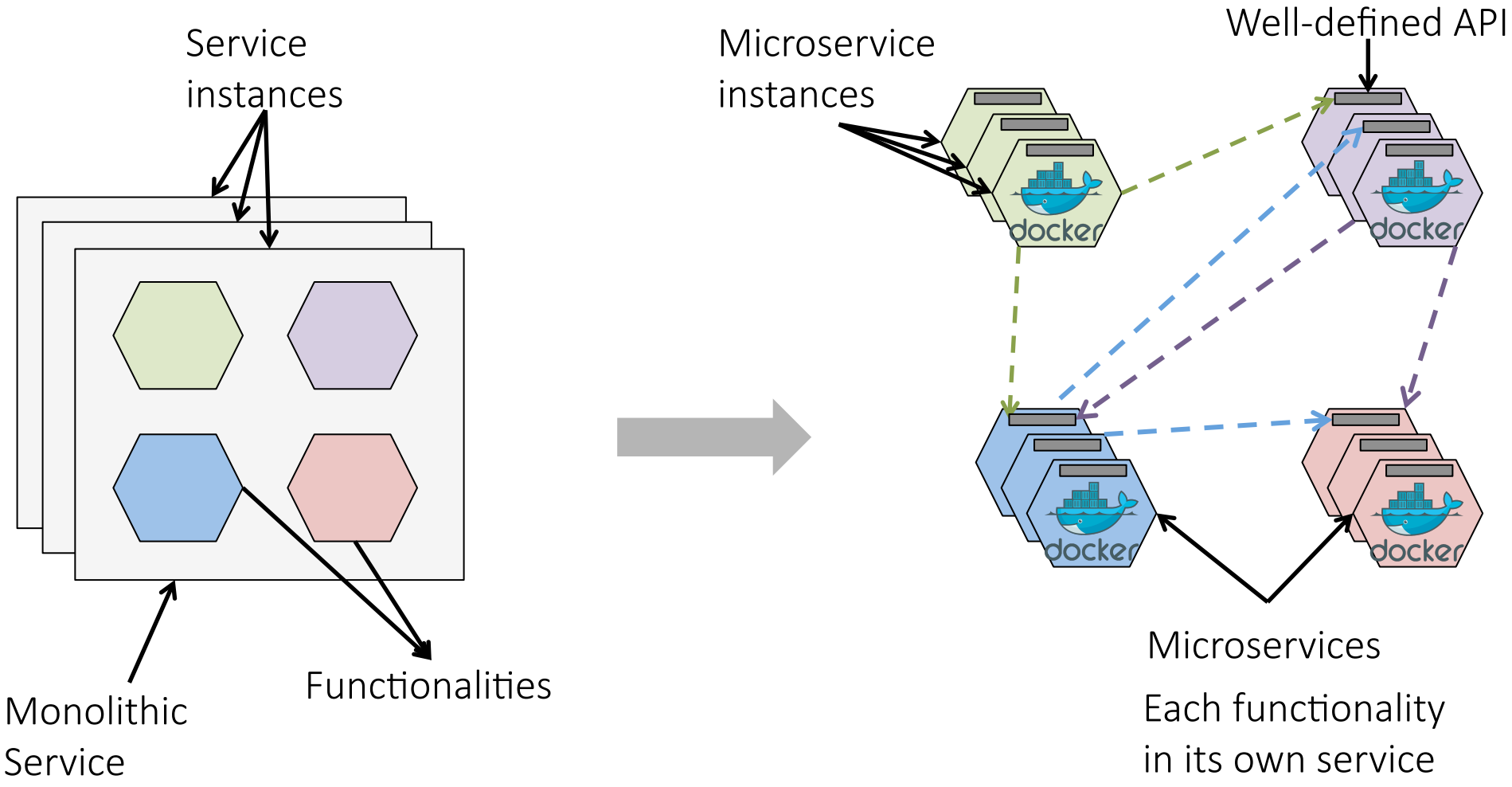
Autonomous Healing for µService-based Apps

Shriram Rajagopalan

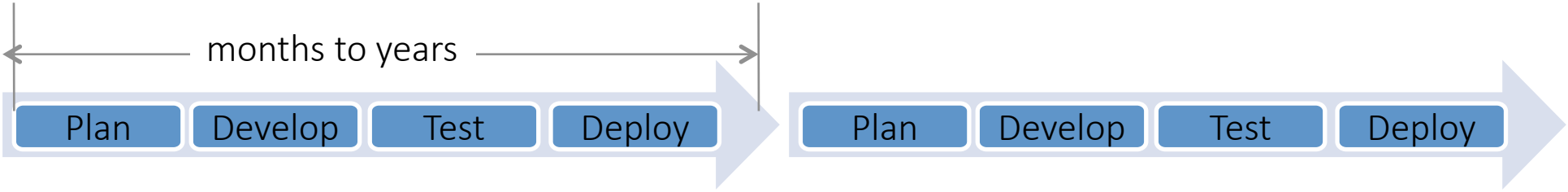
Hani Jamjoom

IBM T. J. Watson Research

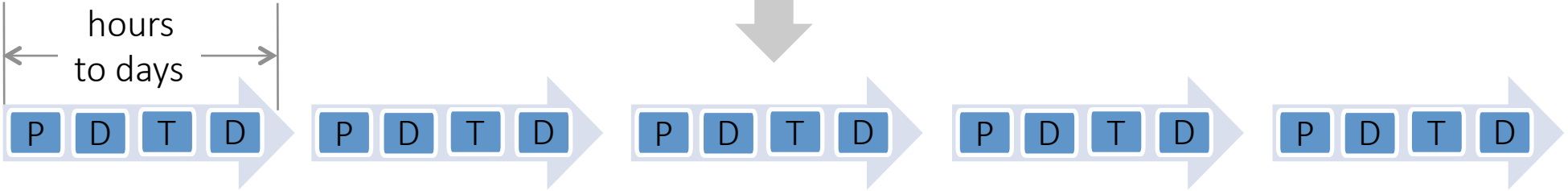
From Monoliths to Microservices



From Waterfall to DevOps



Features, performance improvements, bug fixes, etc., are periodically delivered as one big update

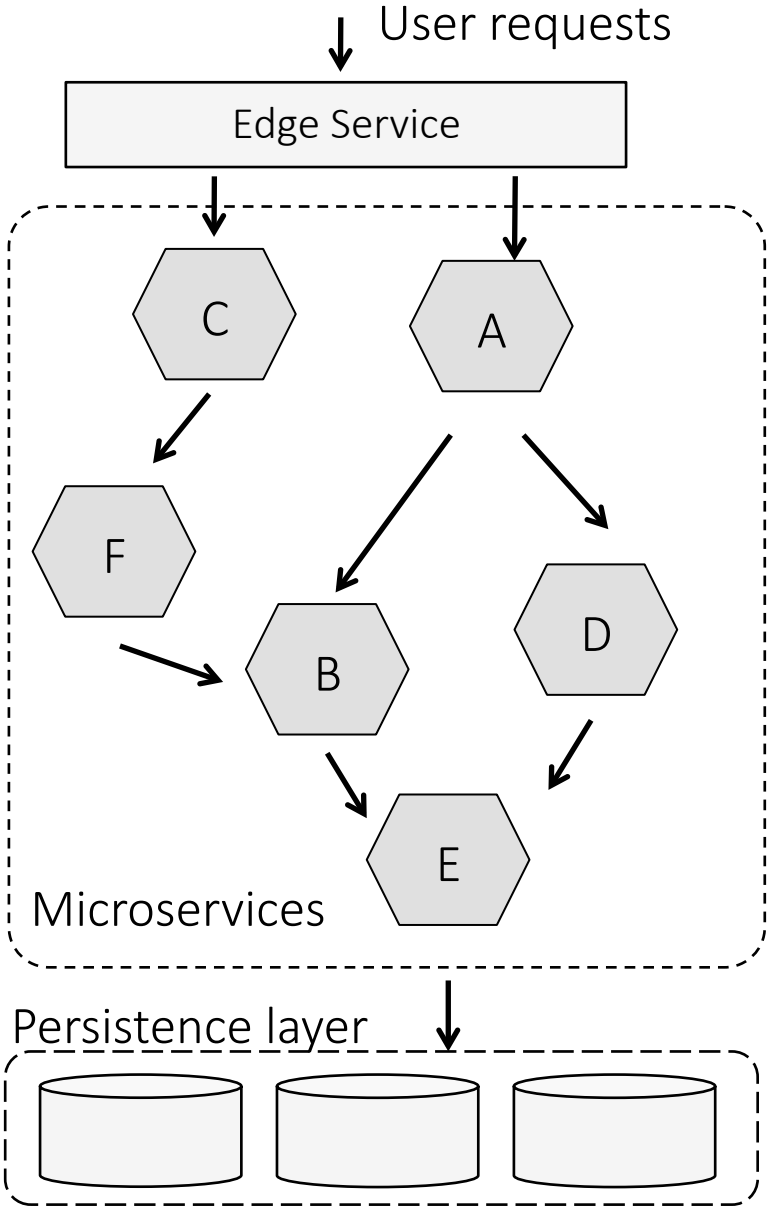


Continuous delivery of incremental updates. User feedback is constantly monitored and incorporated.

grubHub happy eating — Deploys 100 a day!

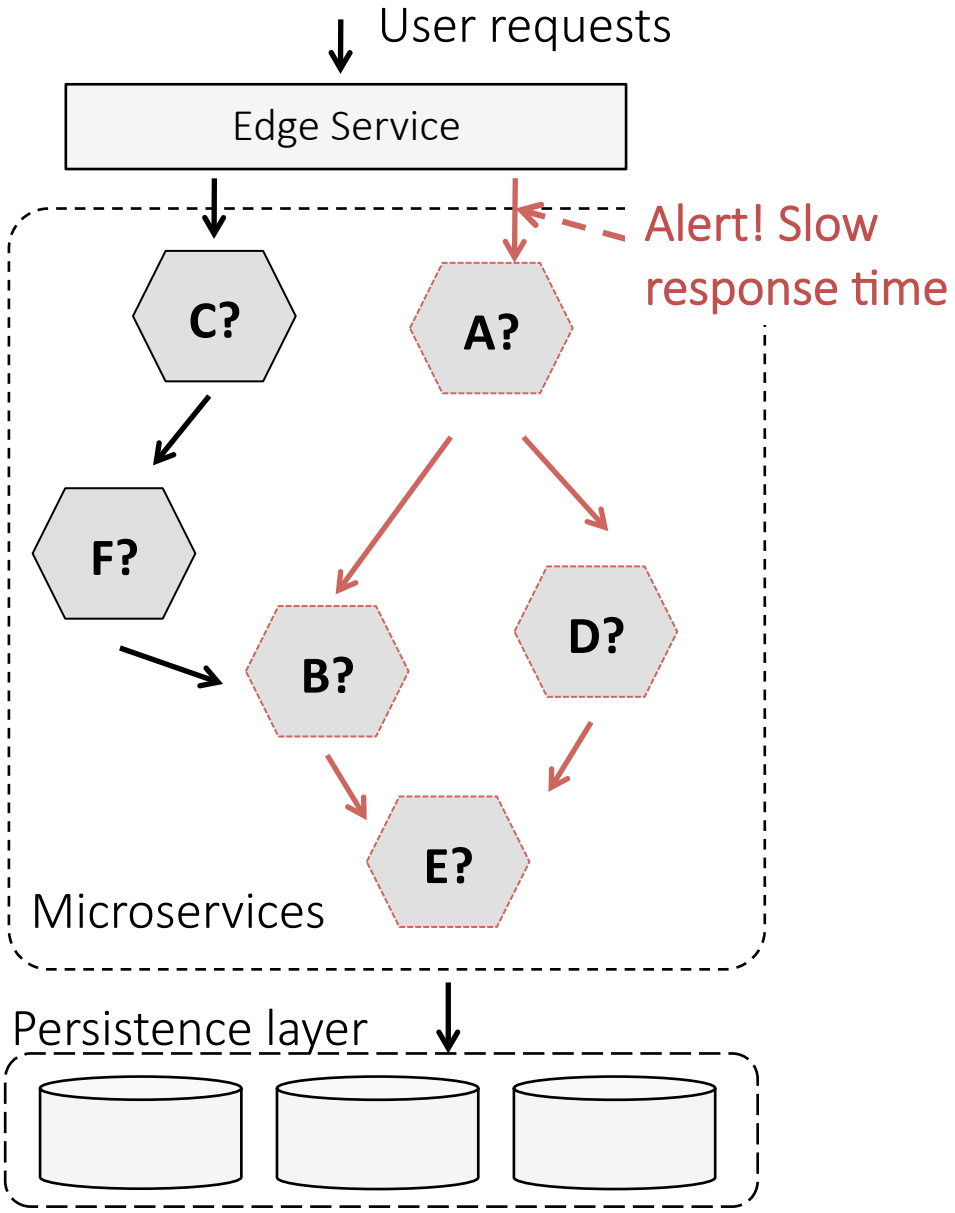
HubSpot — Deploys 300 a day!

Microservices + DevOps



- Application is now a composition of loosely coupled microservices
- Individual microservices are owned and operated by independent teams
- Services are updated frequently, independent of other services, while maintaining compatibility

The Availability Problem



- Frequent performance issues due to insufficient testing
- High MTTR
  - Triaging is time consuming as knowledge base is spread across teams
- End user experience is impacted until the issue is fixed

An Interim Measure

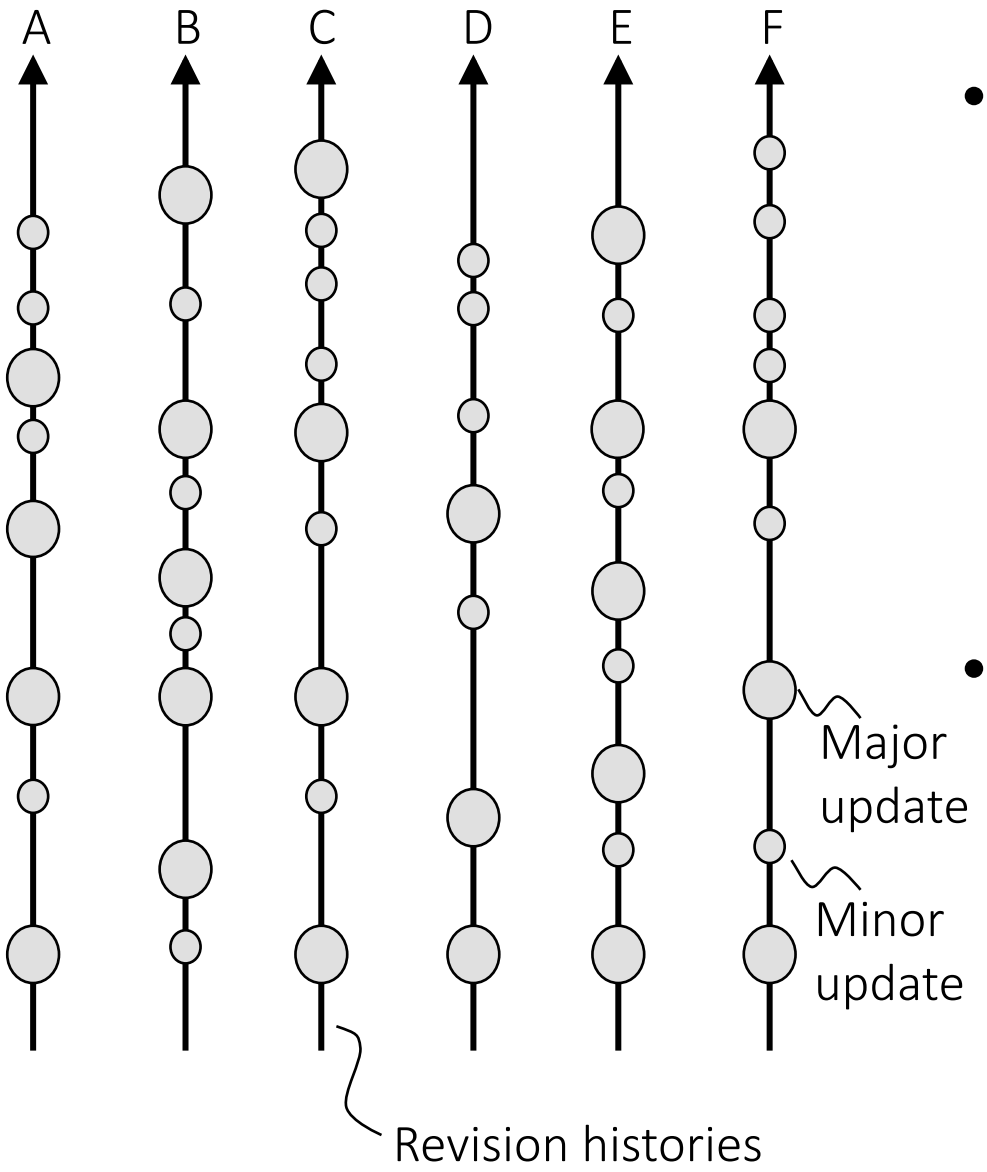
- Downgrade parts of app, i.e., one or more services to an older version until symptoms disappear

- Autonomic downgrade for immediate response to availability related events

Assumptions

- Performance monitor
  - Source of truth for app health
  - Measures end user experience using various site metrics
- Faults handled
  - Prolonged periods of poor response time
  - High error rates from service API calls
  - Frequent crashes of service
- Faults not handled
  - Infrastructure issues

App-Bisect: Autonomous Healing

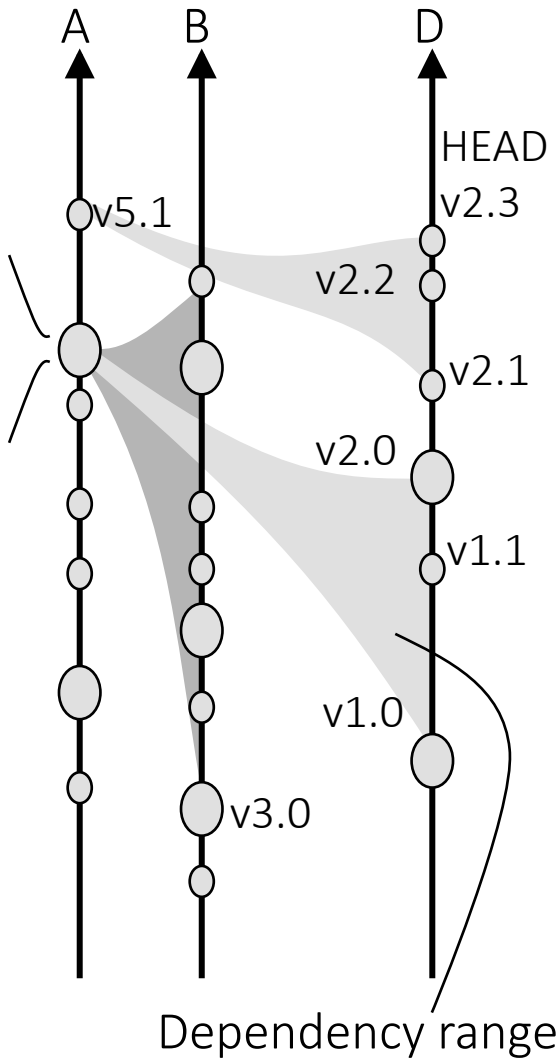


- Evaluate all possible compatible & older versions of service combinations **in production**, alongside current deployment
- Stop search upon finding the most recent combination of versions that offer the desired end user experience

Compatible Combinations of Microservices

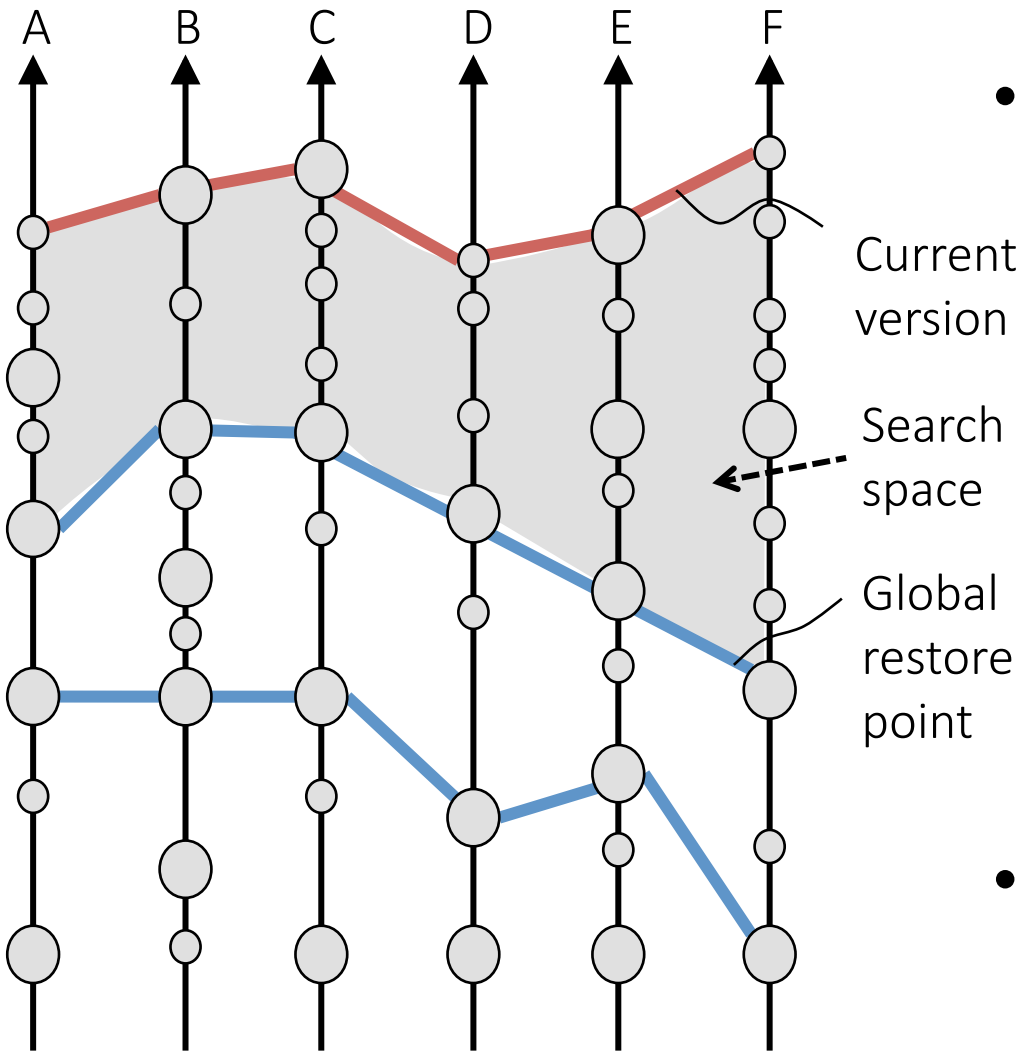
App Manifest file

```
{
"name": "A",
"version": "5.0",
…
"dependencies": {
    "B": ">= 3.0",
    "D": ">= 1.0
          || <= 2.0"
  }
…
}
```



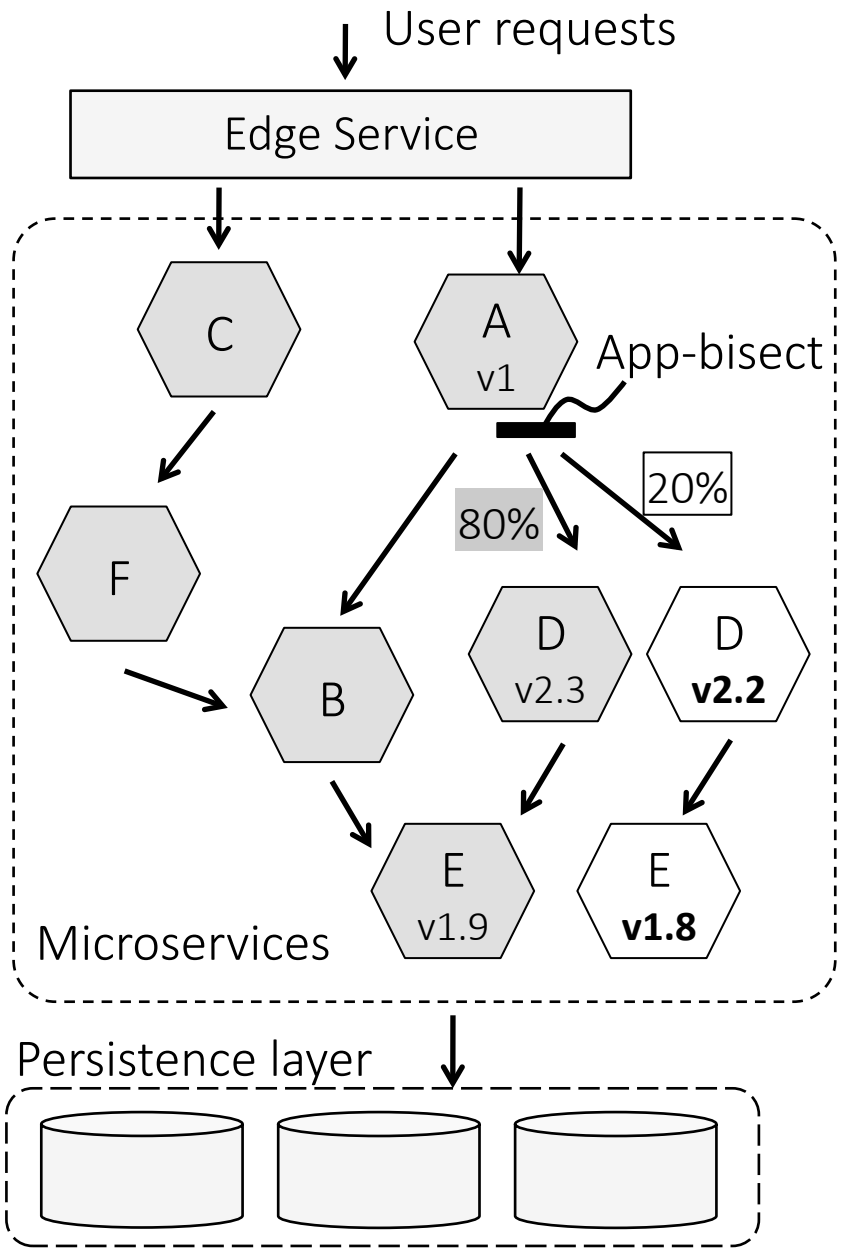
- Leverage version dependencies across services
- When reverting a service to its earlier incarnation, revert dependent services to their most recent and compatible version
- Ensures that a deployed combination of services is compatible

Bounding Search w/ Global Restore Points



- Global restore points
  - Created by developers
  - Signify points in application's history where major updates were made, e.g., schema changes
  - Cannot revert beyond this point
- Search starts from current version to the most recent global restore point

Evaluating Downgraded Versions

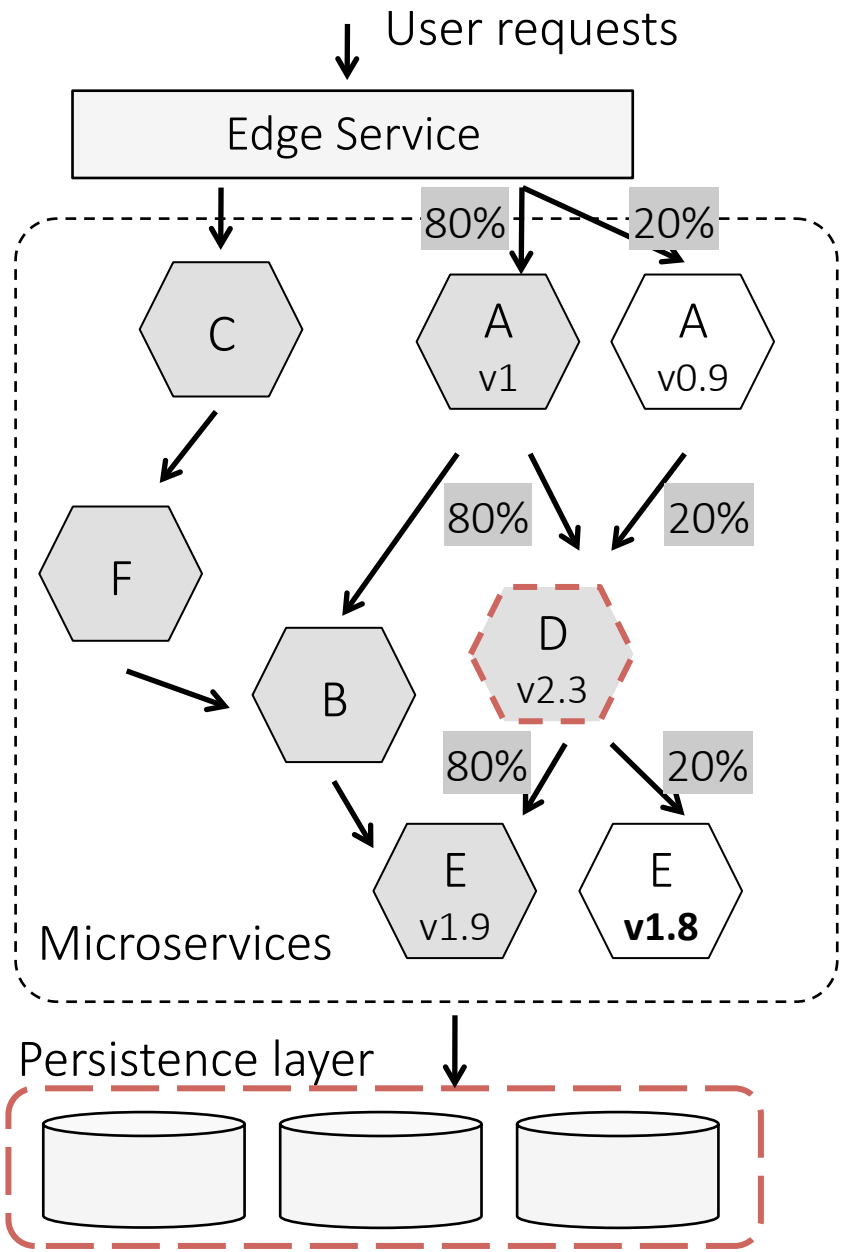


- Version-aware routing using SDN infrastructure
- Deploy & route portion of user traffic through an older service chain
- Monitor application metrics for error symptoms

Routing Across the Right Versions

- Leverage the SDN substrate
- Uniquely identify services of a given version using <Machine-IP, SDN-switch-port>
- Setup routes according to the combination of versions being tested
- Not the most cleanest solution, but requires no modifications to the application

Open Issues



- Application abstractions for version-aware aware routing
- Dealing with state (data stores) when testing older versions of services

Thank You