

Distributed Workload Management

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CSCI-B 649 Science Gateway Architectures

Spring 2017 – Week 3 - January 27th 2017



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Today's Outline

- Recap Portal & API Server Load Balancing
- Microservice Architectures
- Distributed Workload Management
 - Synchronous Vs Asynchronous
 - Queues Vs RPC
- Project Theme 3

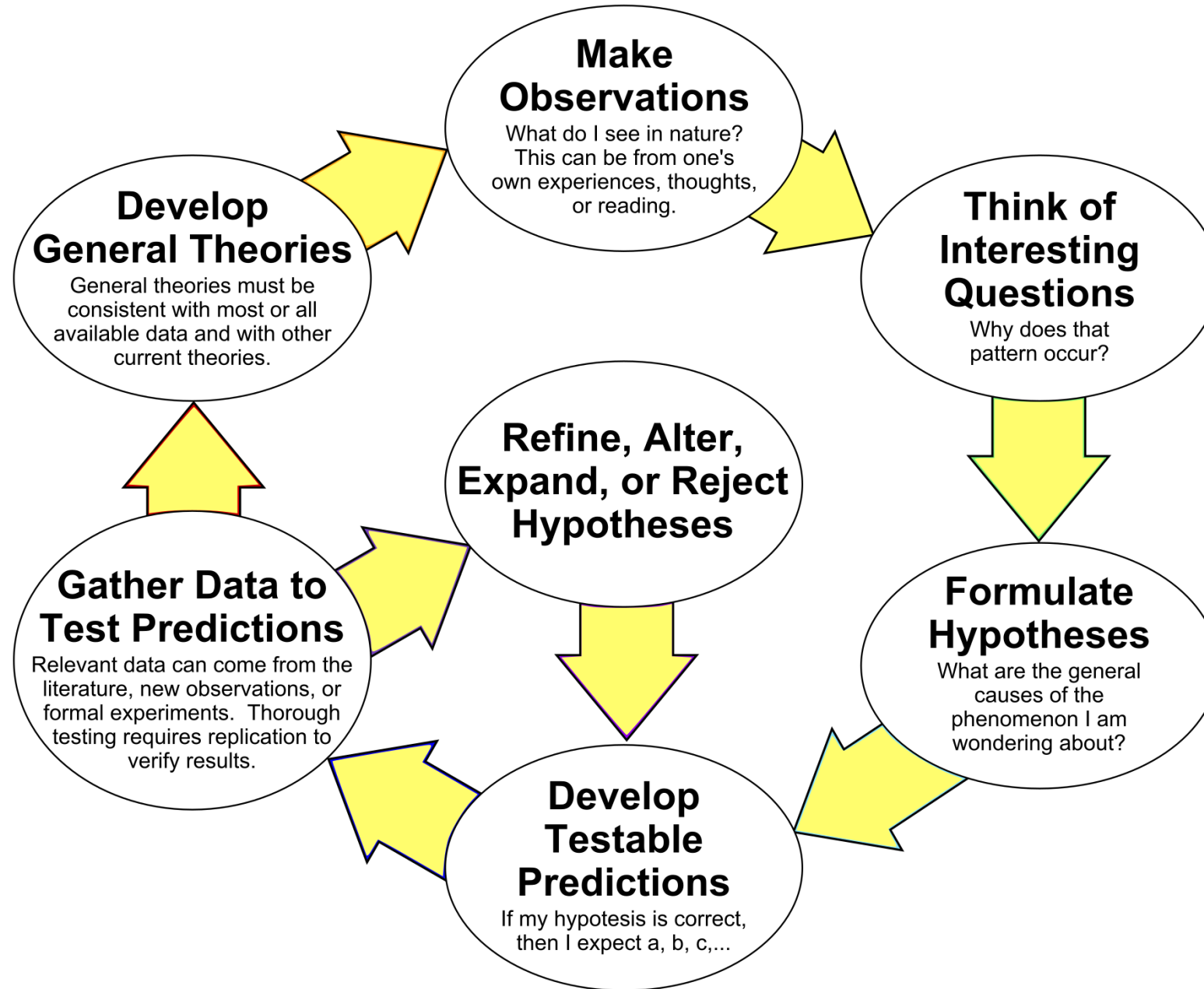


Anatomy of a Science Gateway

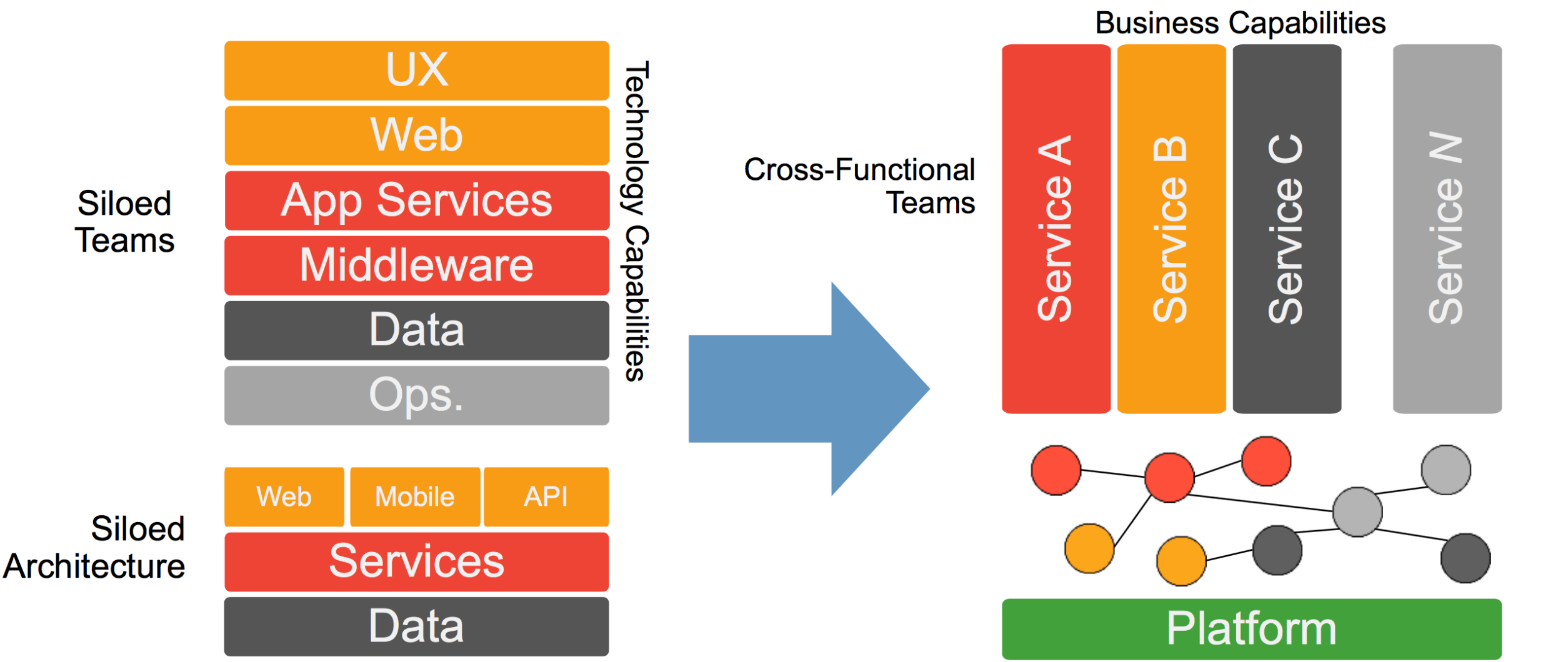
- Gateway User Interface
 - Web Portals
 - Desktop Clients
 - Social/ Collaboration Capabilities
- Security Infrastructure
- Execution Frameworks
 - Application Abstraction
 - Workflow construction & Enactment
 - Compute Resource Management
 - Scheduling
 - Messaging System
- Data Services
 - Replica Management
 - Provenance
 - Analyses
 - Reproducibility
 - Visualization



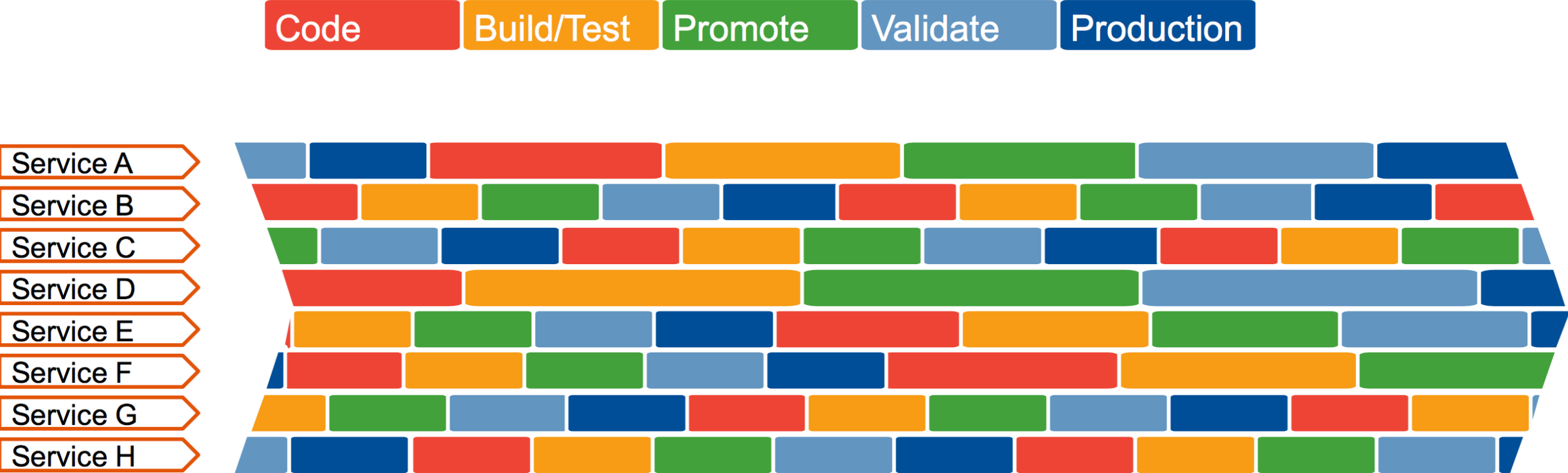
The Scientific Method as an Ongoing Process

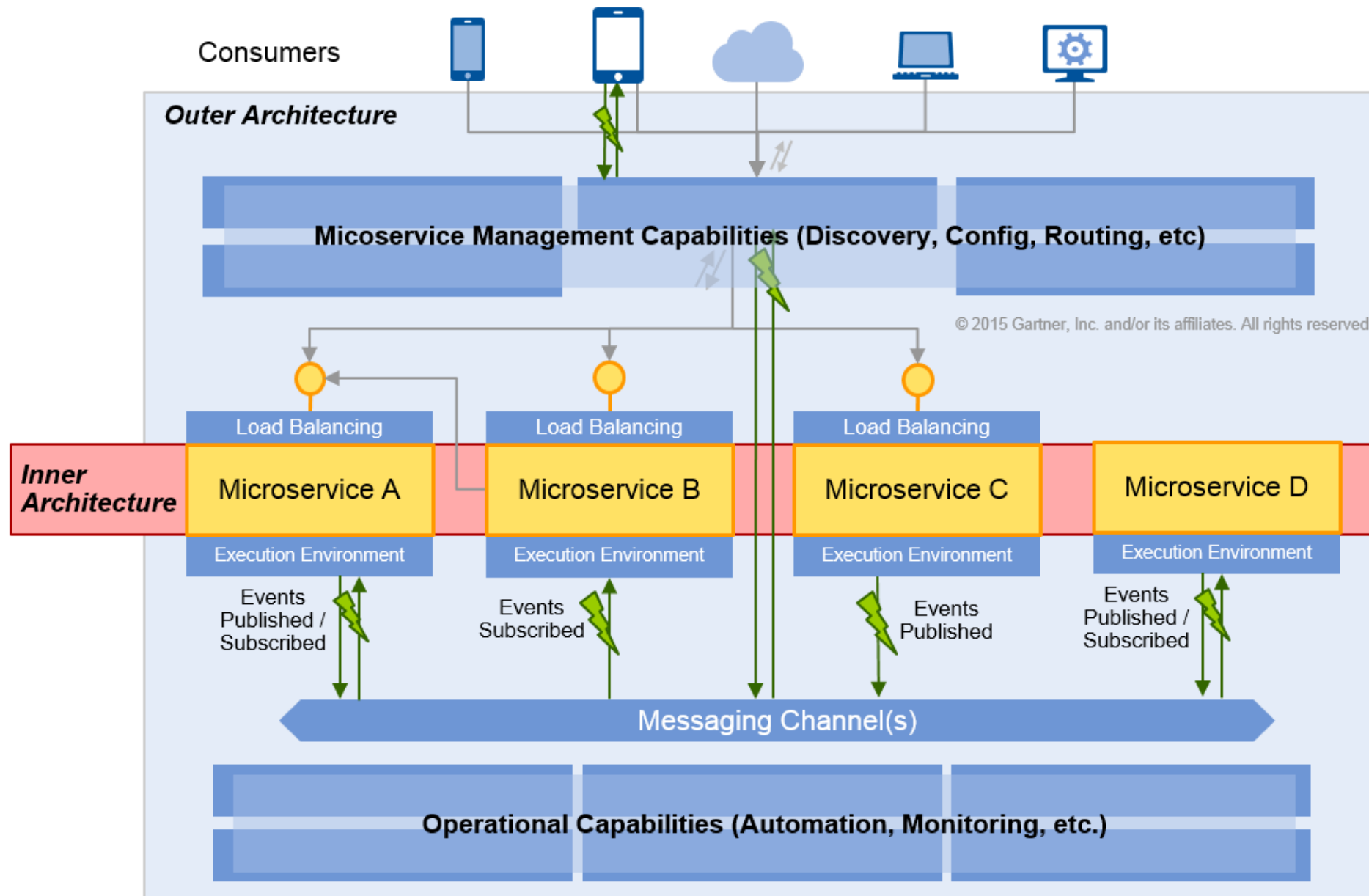


You Will Need to Shift ... and Accountability



Fluid Delivery by Minimizing Release Coordination





Legend:

Core Capability



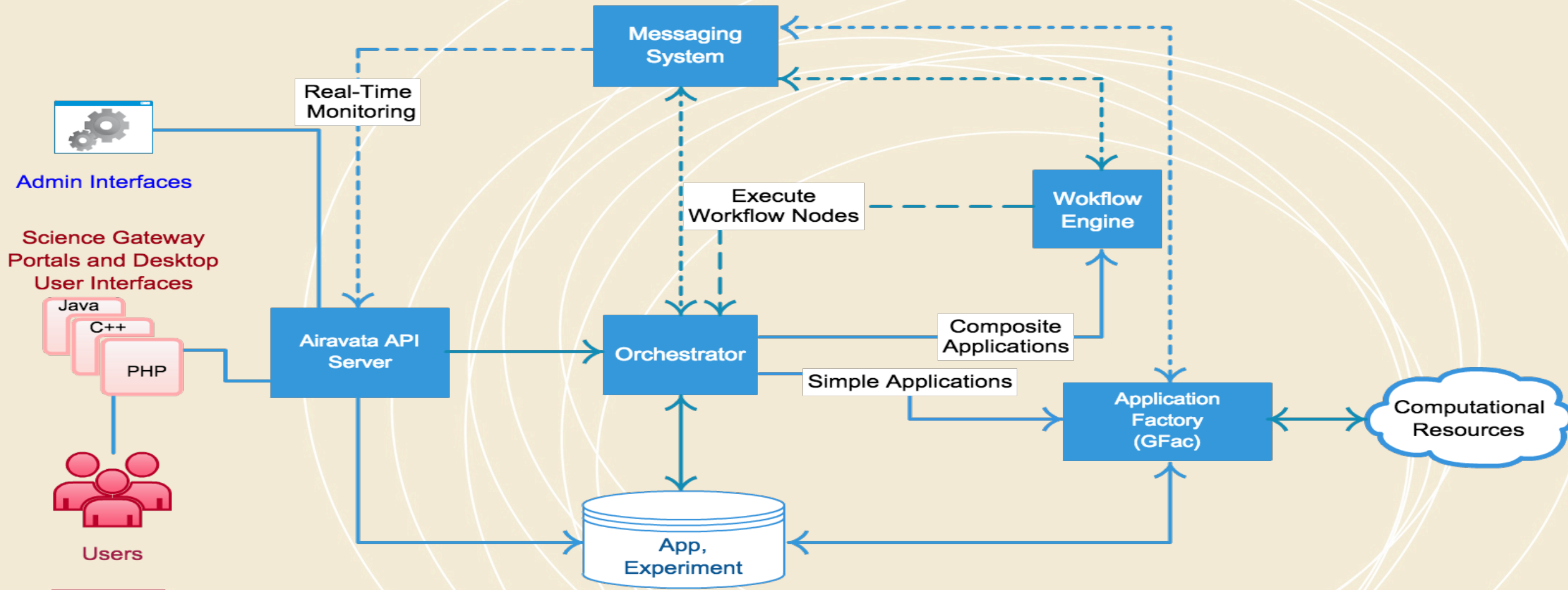
Synchronous Comms



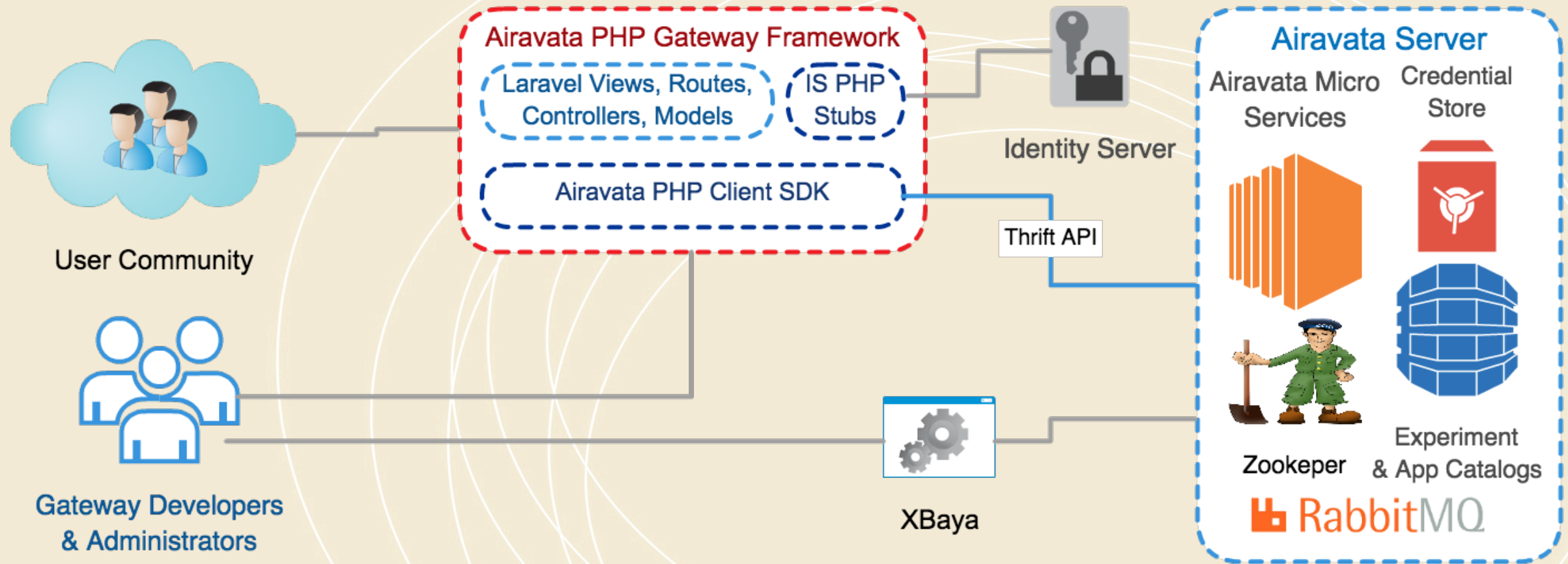
Asynchronous Comms

Gartner

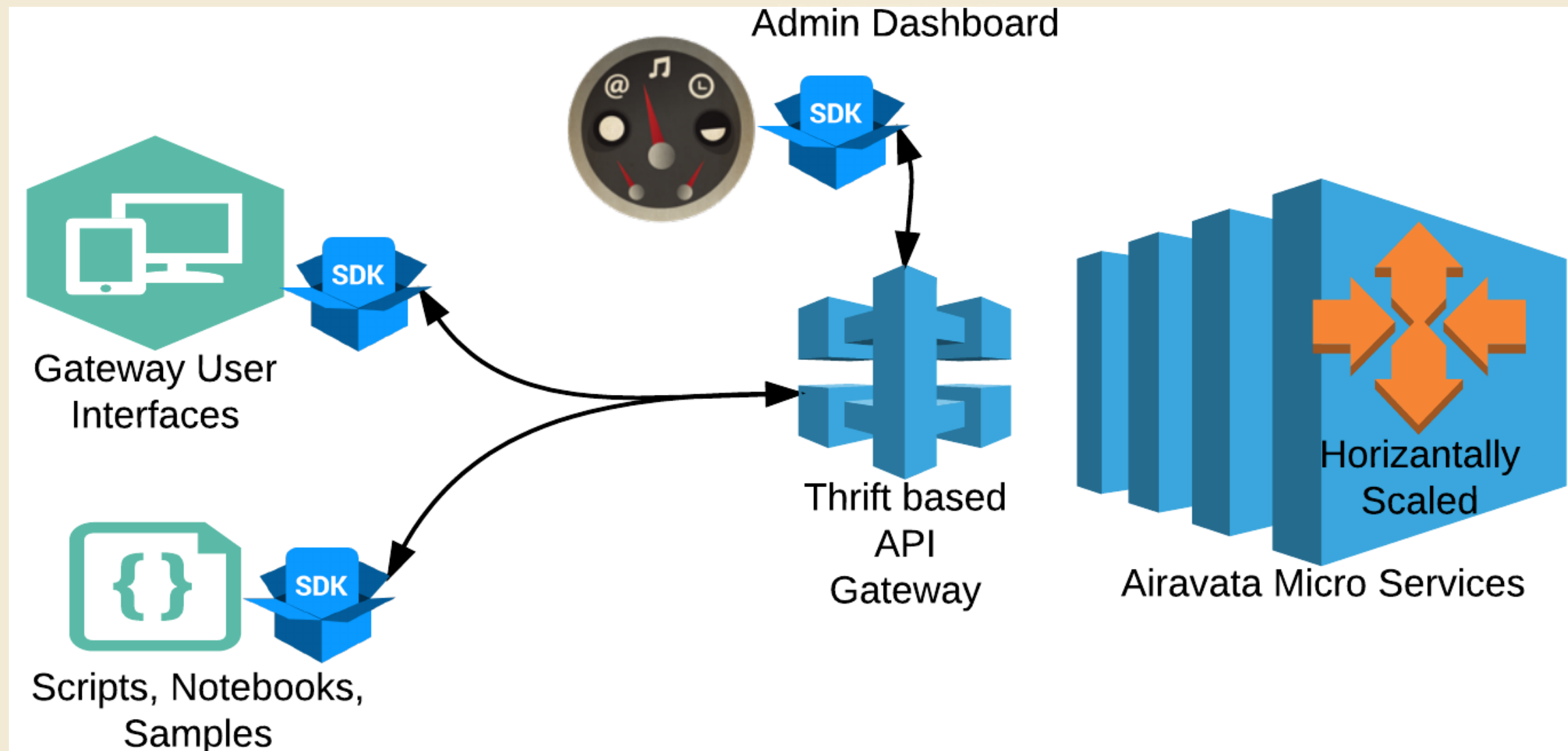
Airavata: Multi-Tenant Gateway Middleware



Reference Gateway <-> Airavata Services



Phase 1 Projects

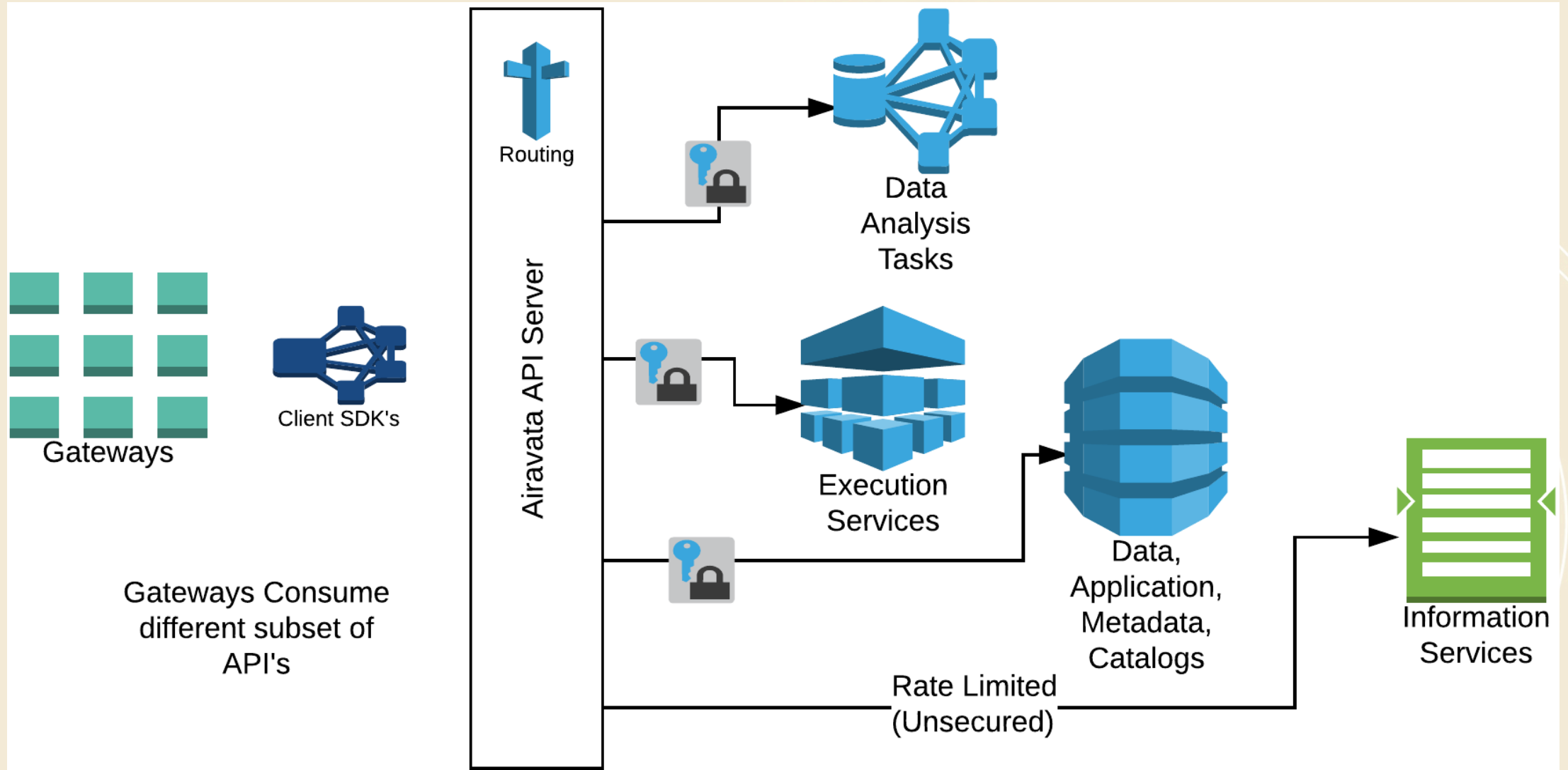


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Phase 2 Projects



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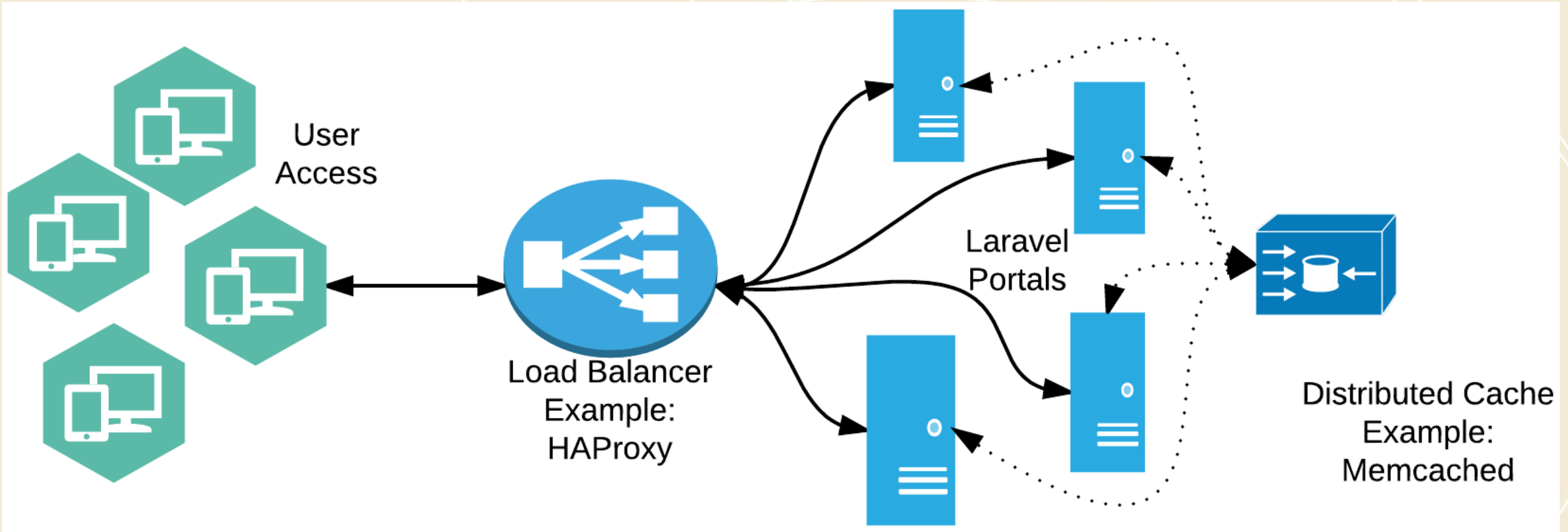
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Project Theme 1: Scalable Web Portal

- Load balance Laravel Portal.
- Fail Over to other regions in Amazon.
- Use distributed cache for session and security management.
- Easily Deployable.
- Have a Build and make it IDE and Developer friendly
- Facilitate micro-feature releases
- Connect laravel Portal with Thrift API Server



First 2 weeks Goal 1:



Example Test Case:

- Have multiple gateway instances:
 - sneha.scigap.org, marcus.scigap.org, mayank.scigap.org, eldho.scigap.org, ameya.scigap.org, anuj.scigap.org, sagar.scigap.org.....
 - Each of these portals have their own look and feel and functionality.
 - They all can be hosted from one web server.
- How can we scale the number of gateways.
- How can we not be nervous about hardware failures?
- How can we move from “pets to cattle’s”?



“Pets vs Cattle” (Yes, again)



Scale Up

• Servers are like pets.

Pets are given names, are unique, lovingly hand raised and cared for. When they get ill, you nurse them back to health



Scale Out

• Servers are like cattle.

Cattle are given numbers and are almost identical to each other. When they get ill, you get another one.

“

“Future application architectures should use Cattle but Pets with strong configuration management are viable and still needed”

- Tim Bell, CERN

The above adapted from Tim Bell, CERN

<http://www.slideshare.net/noggin143/20121017-openstack-cern-accelerating-science>



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Project Theme 2: Load Balance API Gateway

- Thrift based multiplexed API Gateway
- Fault Tolerant
- Load Balanced
- Scalable
- Pluggable
- Facilitate Overlaid Features



System State



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Work distribution capabilities

- Decoupling
- Impedance mismatch
- Scaling, Elasticity
- Fault Tolerance (Resilience)
- Asynchronous Communications



Few Approaches

- RPC
- Message based
 - Work Queue, Master-Worker
- Hybrid



Patterns

- Independently deployable and fully contained
- Design for automation
- Design for Failure
- Auto-Scaling
 - Circuit Breaker pattern
 - Timeouts



Pragmatic Concerns

- Business logic should be stateless.
- Data Caching becomes important.
- Contributor on-boarding is important.
- Developers are “humans”
 - Make learning, development, testing IDE compatibility and deployment seamless so they can have some life.



Architecture != Implementation



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We do not know what we do not know

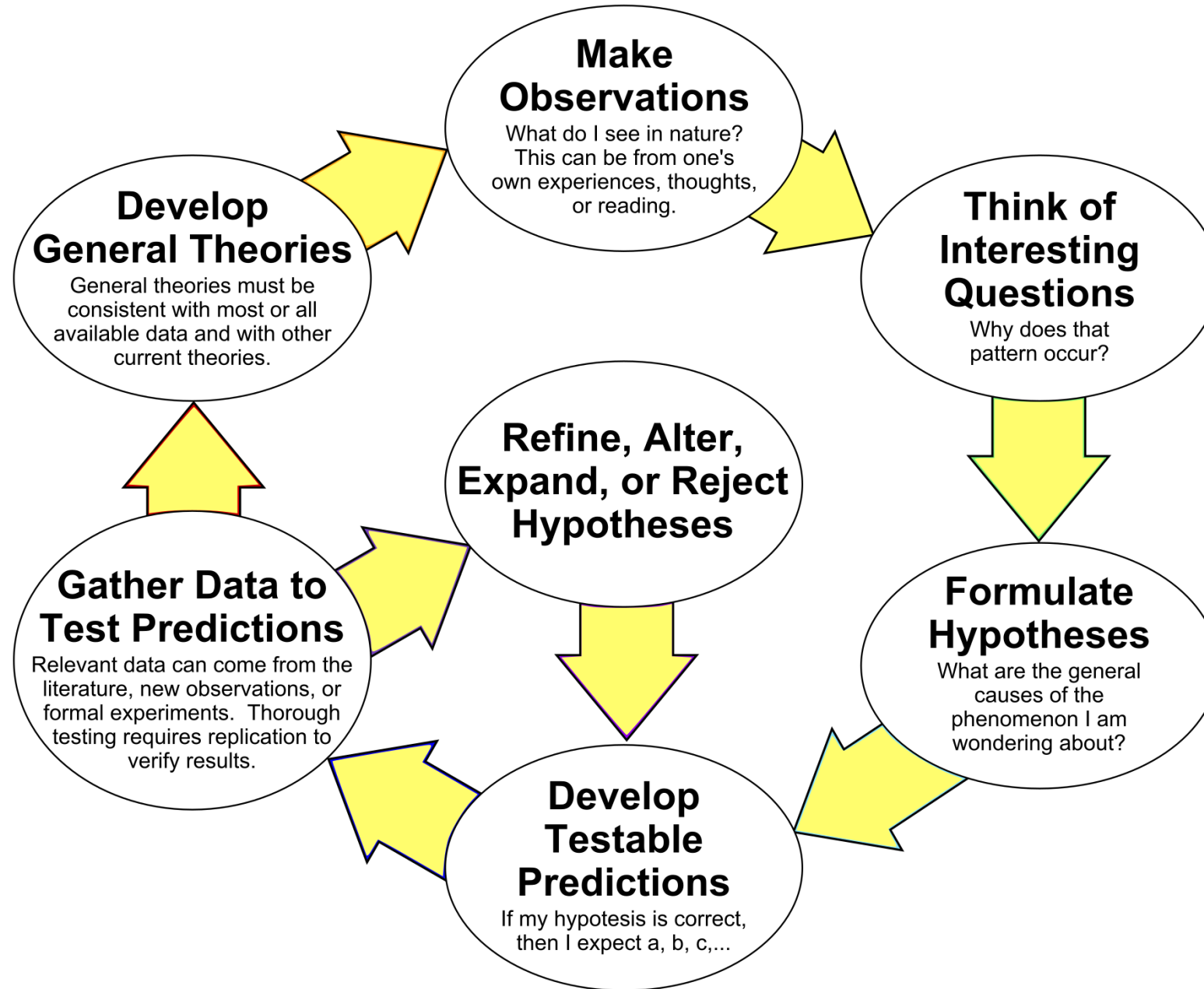


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The Scientific Method as an Ongoing Process



Teams per theme

- Portal
 - Sneha, Mayank, Ameya, Thanmai
- API Server
 - Sagar, Supreet, Eldho, Anuj
- Distributed Workload Management
 - Ajinkya, Gourav, Amrutha, Supun



Timeline

- Next Friday Feb 3rd
 - Present design choices
 - Discuss Hurdles
- Following Friday Jan 10th
 - Demonstrate Workload management approaches



Thoughts?

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