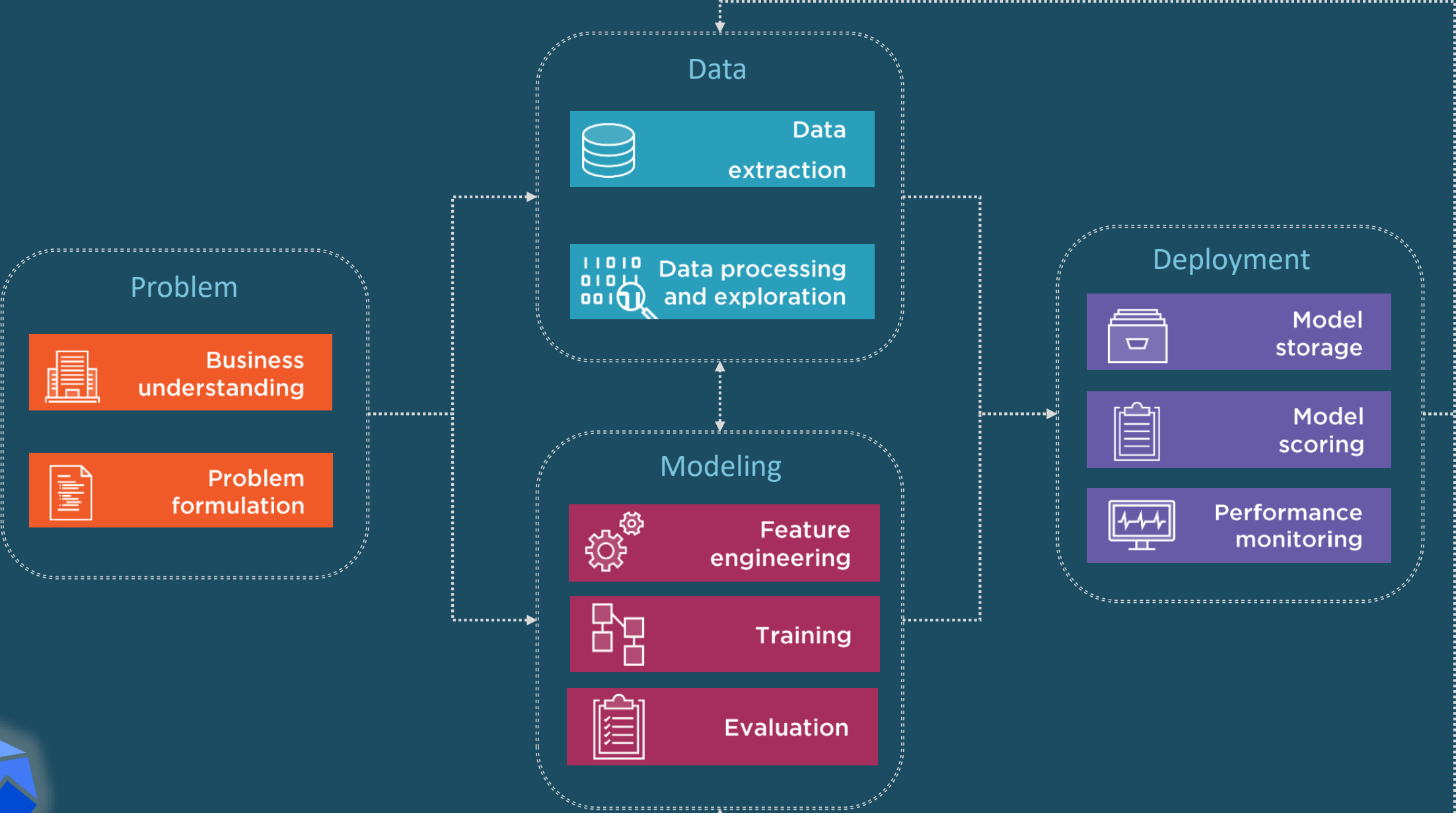


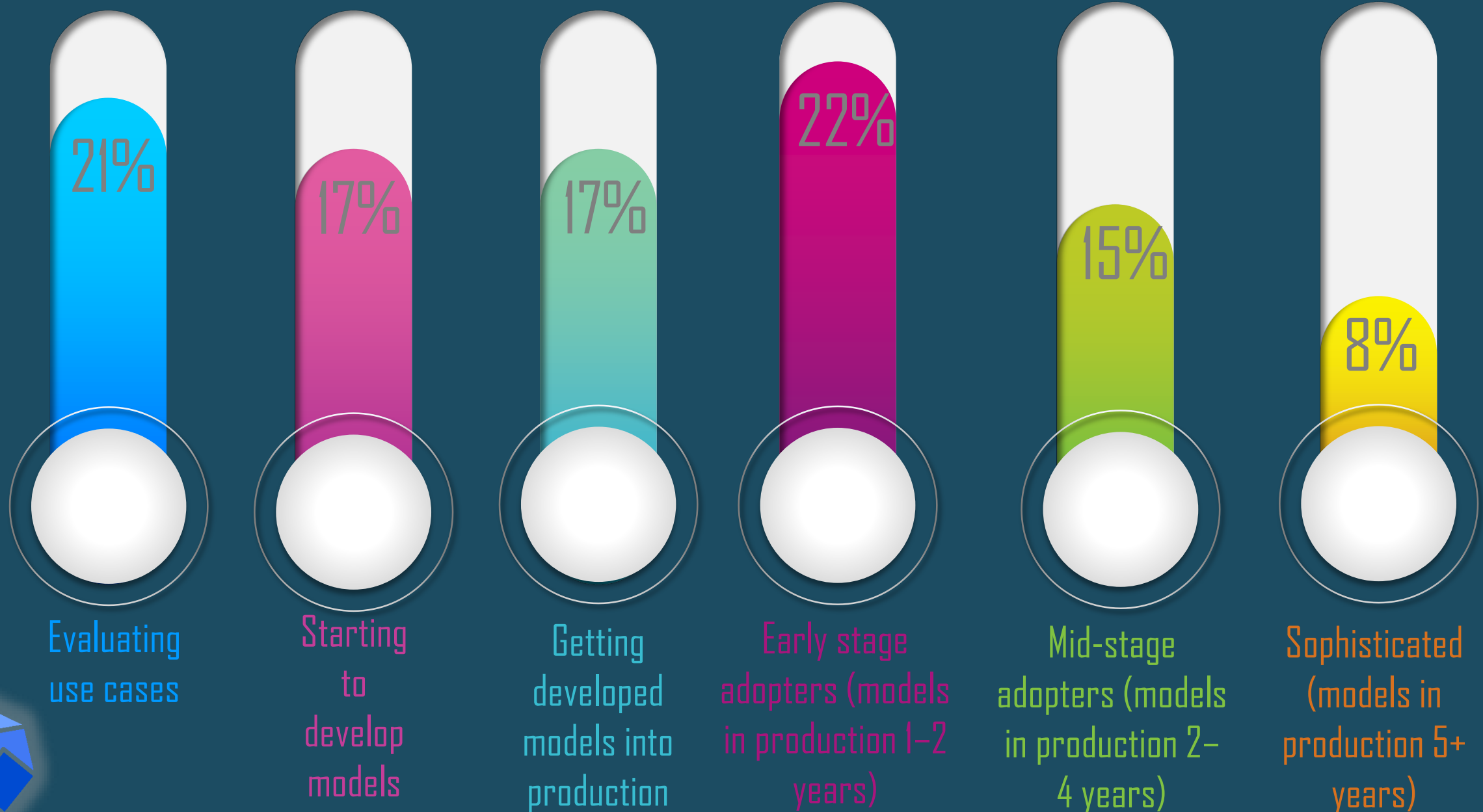
Managing Machine Learning with MLOps and Kubeflow



ML workflow



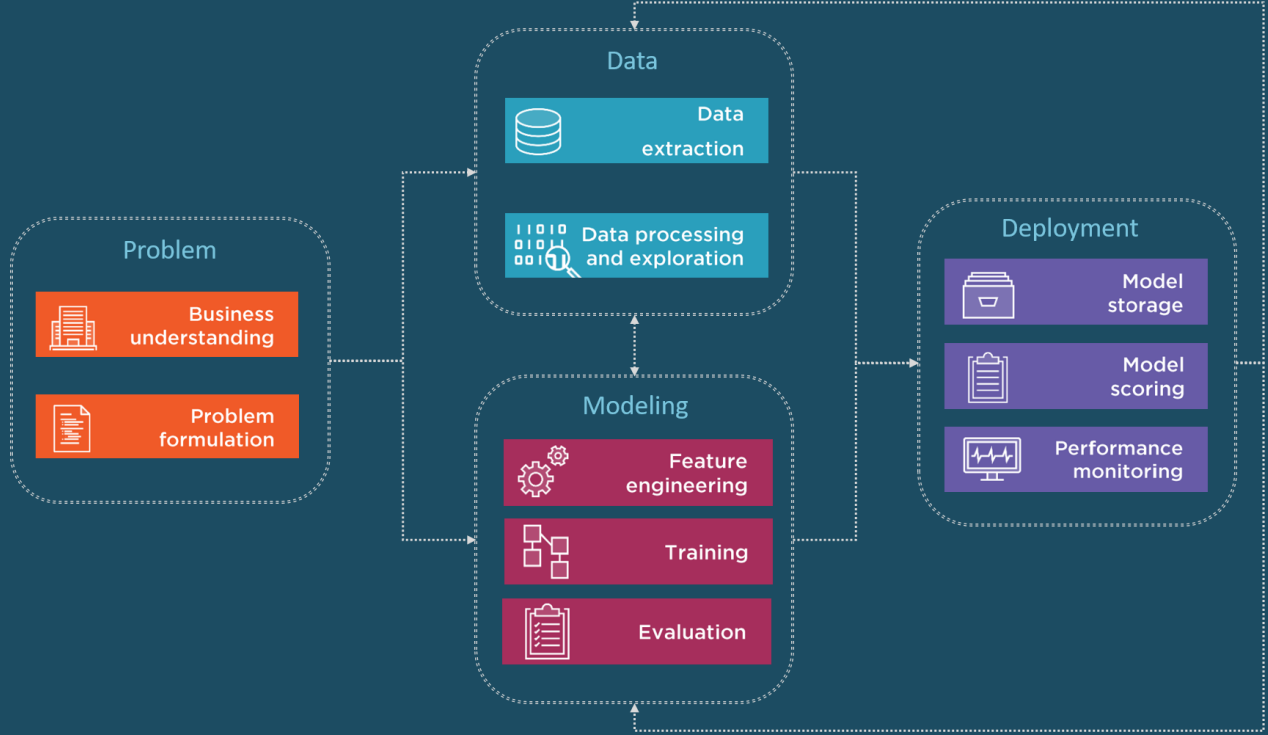
ML maturity levels - 2020



ML current scenario



Typical software development workflow and toolkit



Machine Learning workflow



Increased time to production



Low return on investment



Doesn't work seamlessly

ML current scenario

Hardware utilisation



GPU Resource
Consumption

Collaboration



Work in team with different
environments

Track experiments



Track and compare
experiments

Logging



Generate, analyse and
act on monitoring logs

Scale

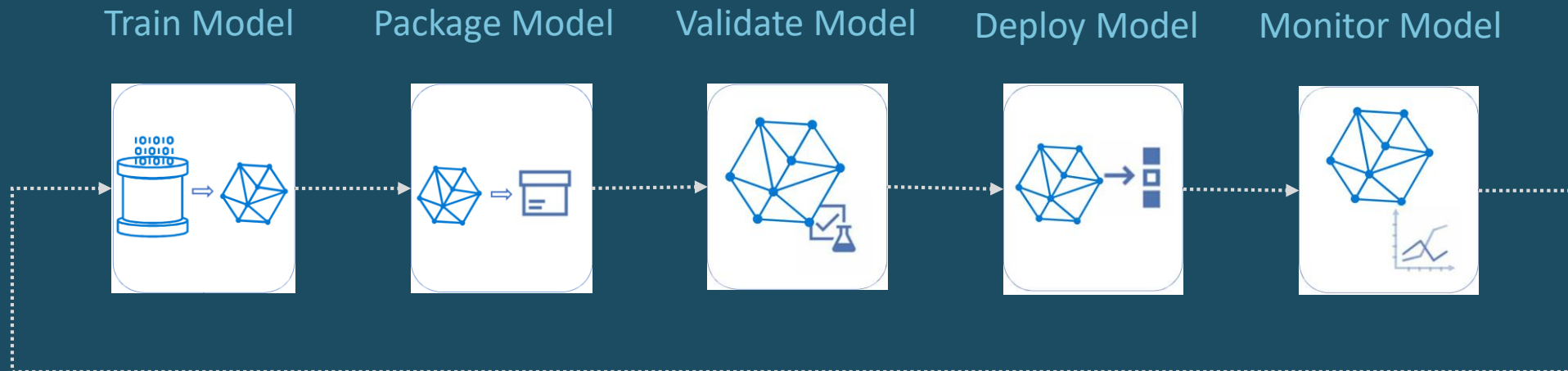


Deal with scale



E2E ML lifecycle

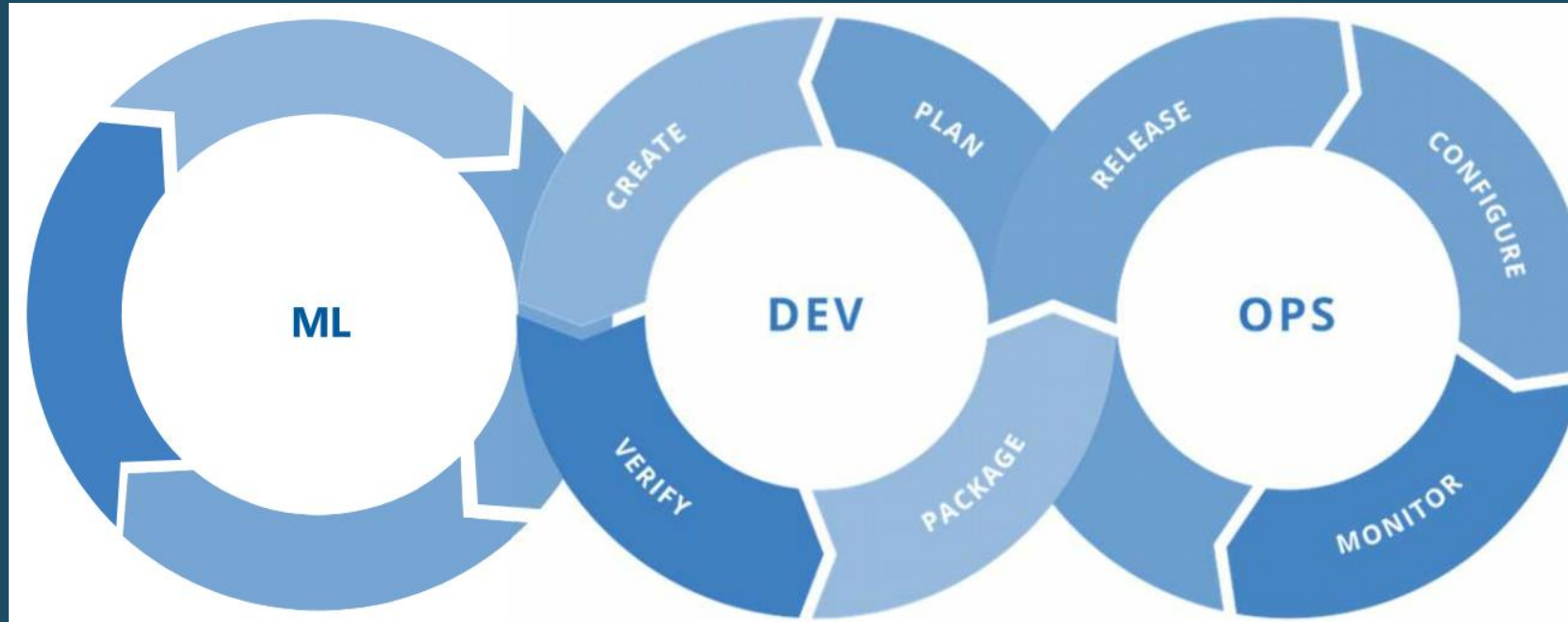
- **Develop & train model** with reusable ML pipelines
- **Package model** using containers to capture runtime dependencies for inference
- **Validate model** behavior functionally, in terms of responsiveness, in terms of compliance
- **Deploy model** to cloud & edge, for use in real-time / streaming / batch processing
- **Monitor model** behavior & business value, know when to replace / deprecate a stale model



Retrain Model



MLOps = ML + DEV + OPS



Experiment

Data Acquisition
Business Understanding
Initial Modeling

Develop

Modeling + Testing
Continuous Integration
Continuous Deployment

Operate

Continuous Delivery
Data Feedback Loop
System + Model
Monitoring



MLOps Benefits

Automation / Observability

- Code drives generation and deployments
- Pipelines are reproducible and verifiable
- All artifacts can be tagged and audited

Validation

- SWE best practices for quality control
- Offline comparisons of model quality
- Minimize bias and enable explainability

Reproducibility / Auditability

- Controlled rollout capabilities
- Live comparison of predicted vs. expected performance
- Results fed back to watch for drift and improve model

== VELOCITY and SECURITY for ML



MLOps with Kubeflow + CI/CD



Jenkins

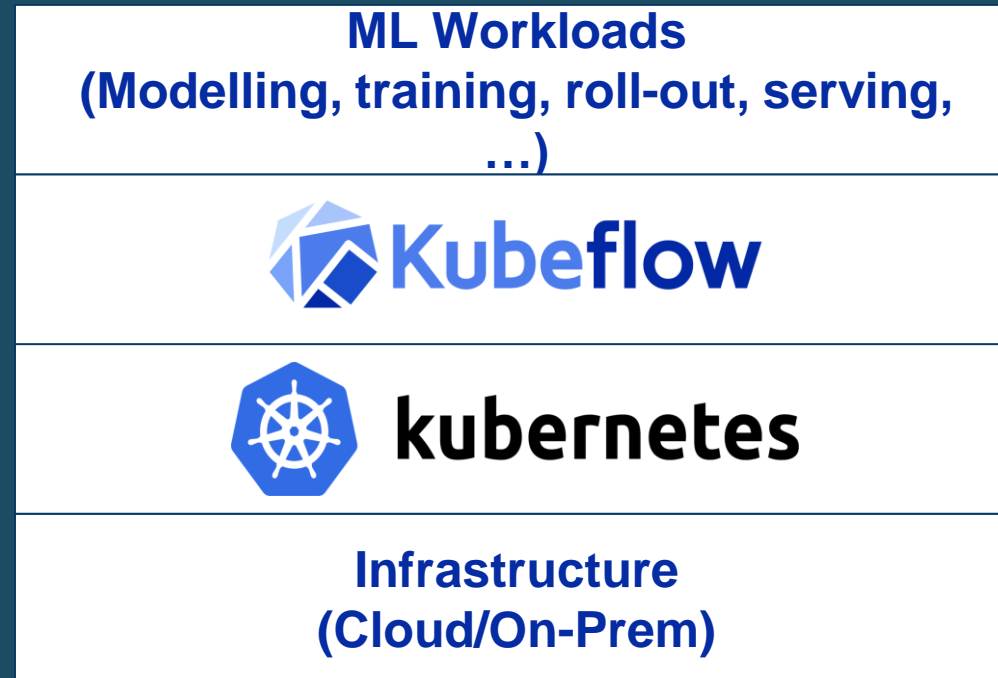


Azure DevOps



Kubeflow

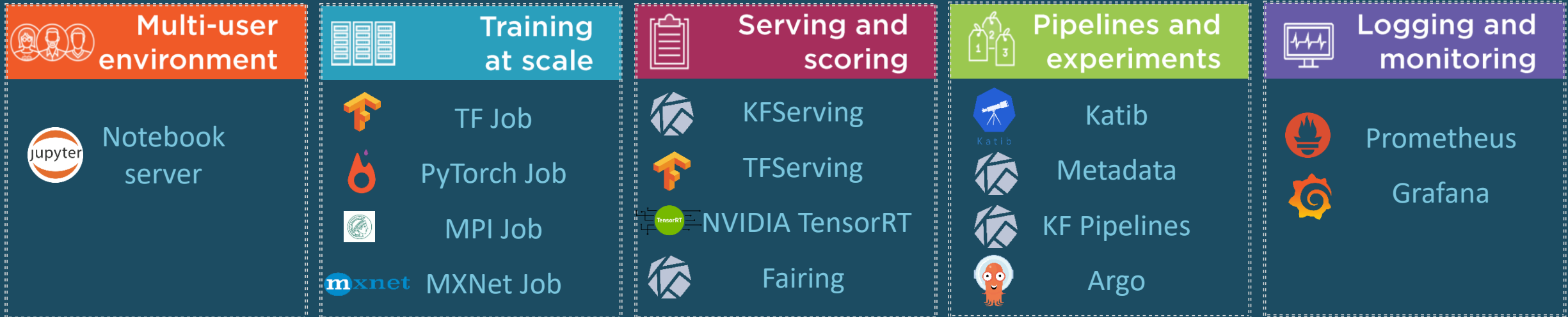
Kubeflow – Machine Learning toolkit for Kubernetes



- Open source machine learning toolkit for Kubernetes
- Simple, portable and scalable workflow
- Adapted Kubernetes for Machine Learning
- Originated at Google



Kubeflow components



ML in real world multi-cloud

