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OCTOBER 11-14

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**2021 Fall
Technical Forum**
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Operational Transformation

Using AI in network planning and operations forecasting

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**VIRTUAL EXPERIENCE
OCTOBER 11-14**

Observe and Store

Analyze and Predict

Decide and Act

Inventory & Measurements

- Equipment
- Connectivity
- Services
- Packet measurements
- Physical layer measurements

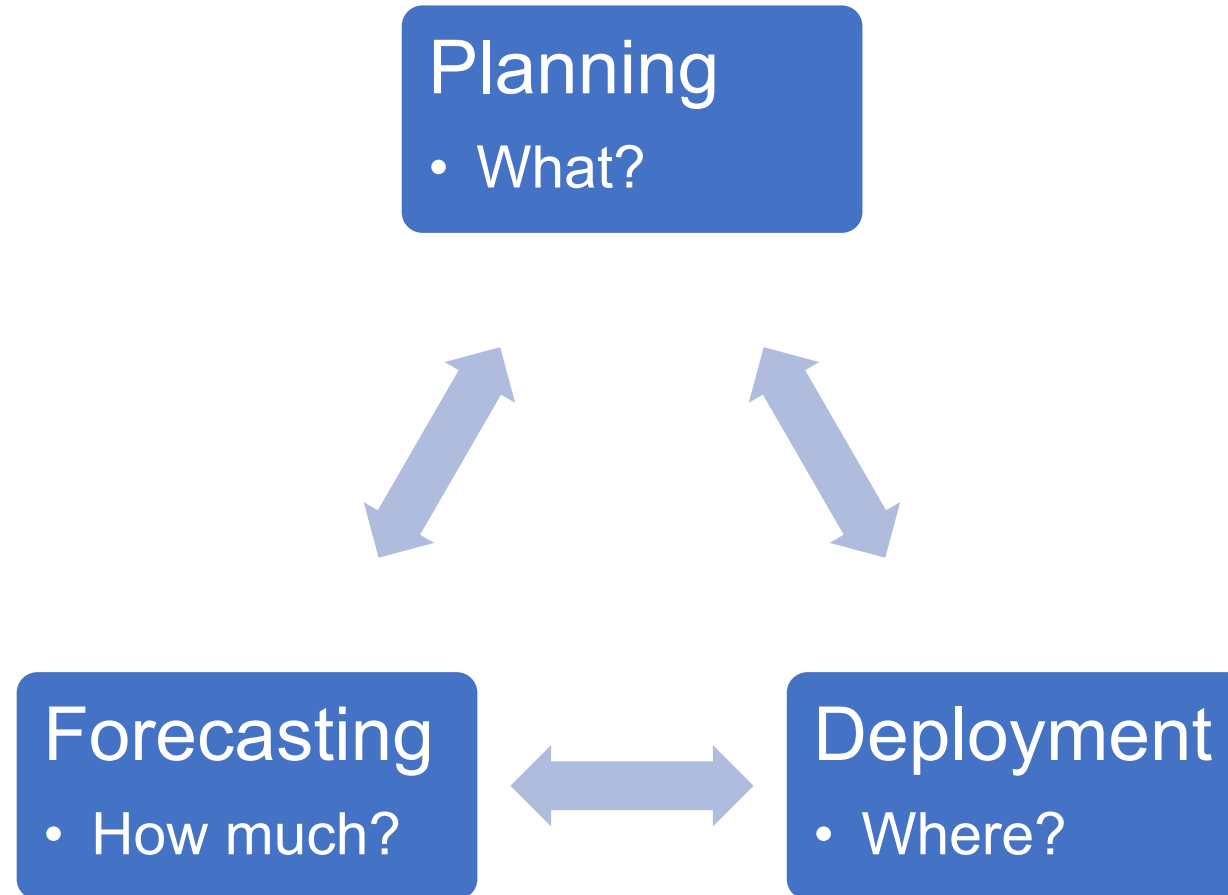
Big Data & AI

- Data engineering
- Data selection
- High capacity ML models
- Data imputation/compression
- AI Ops
- Automatic ML/AI

Network Control & Planning

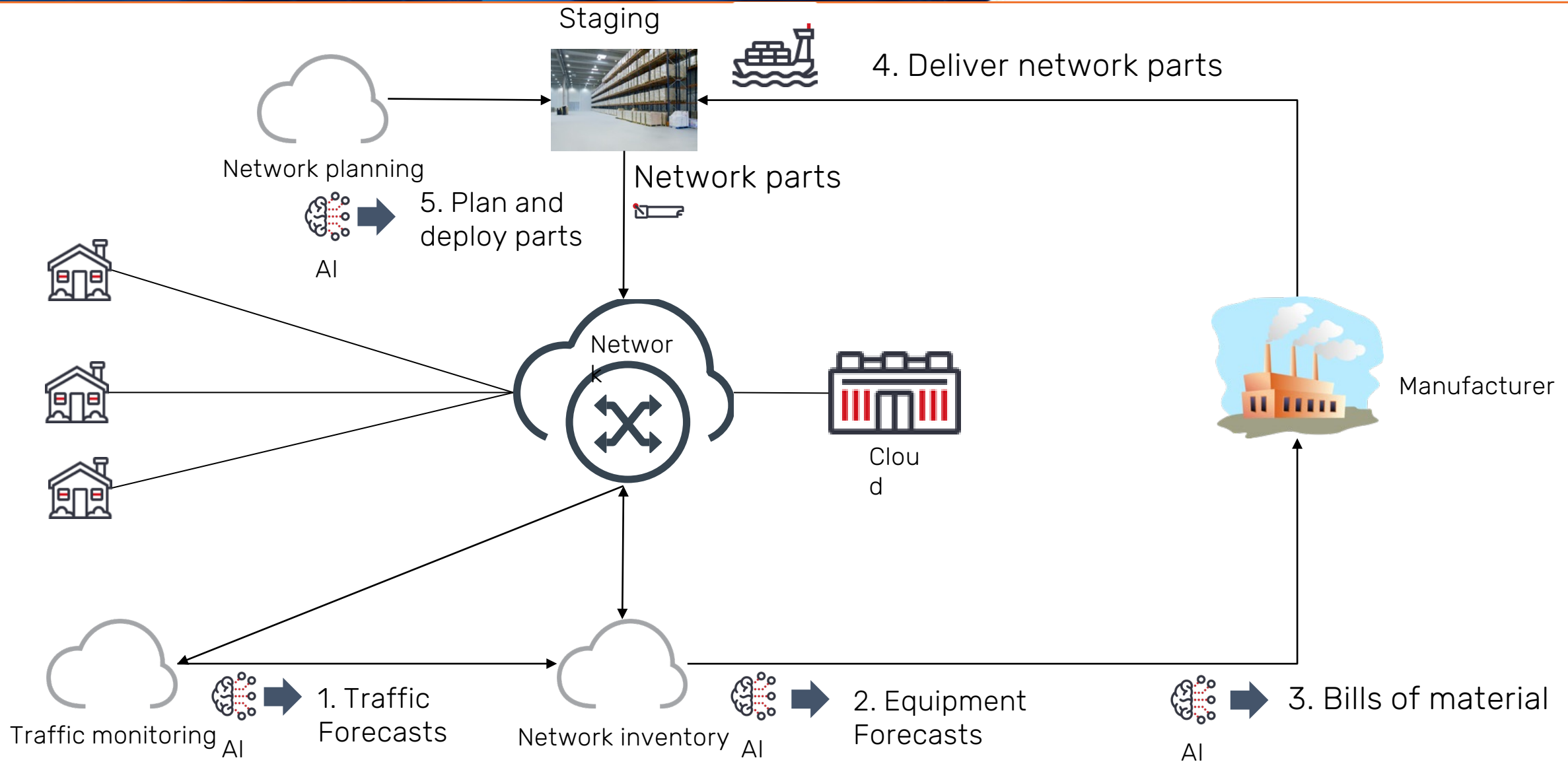
- Fixed, best effort algorithms
- Static policy
- Adaptable algorithms
- Dynamic policy

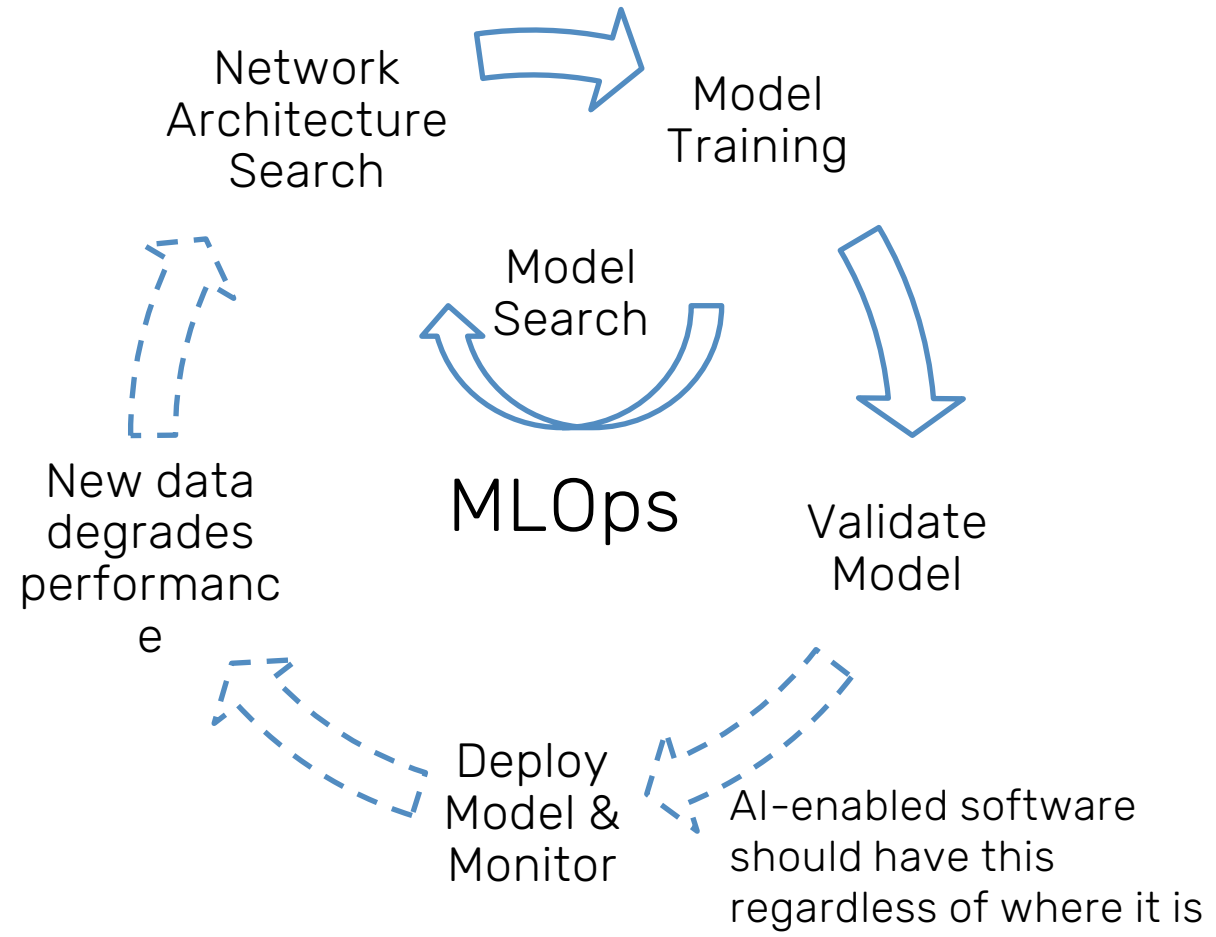
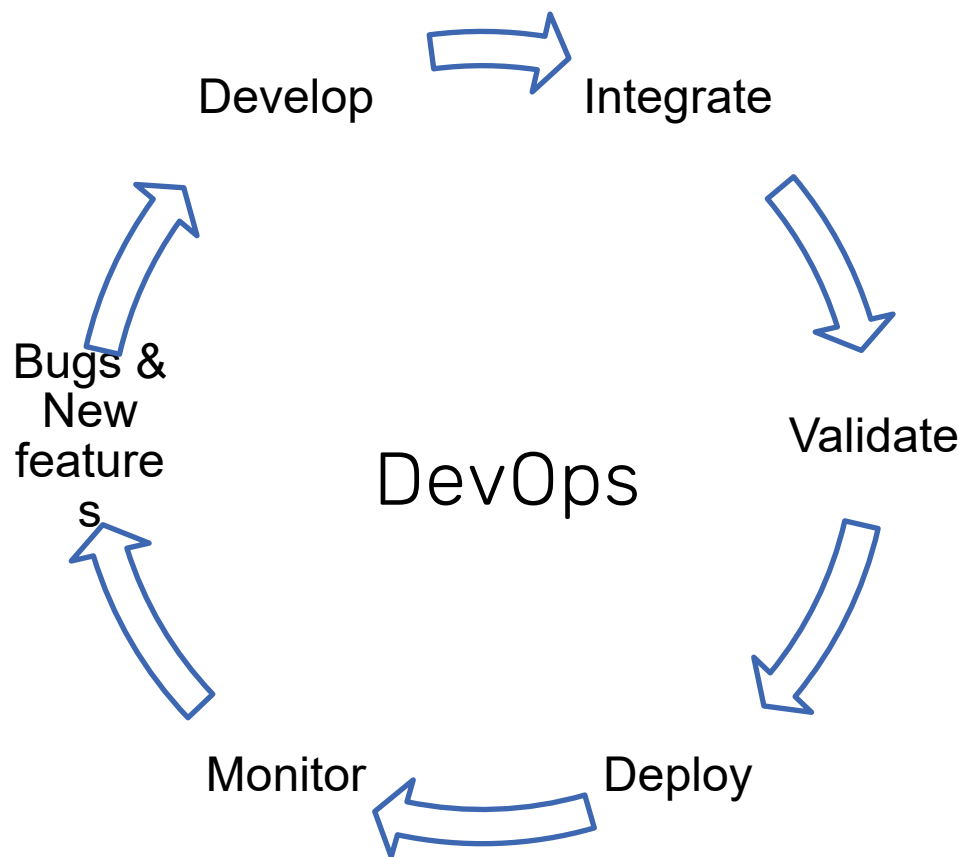
As predictions get better, the role of human judgment changes and more and more decision making can be automated



To achieve full automation, all parts of the process need to be automated. Forecasting is essential to prevent over/under provisioning of equipment.

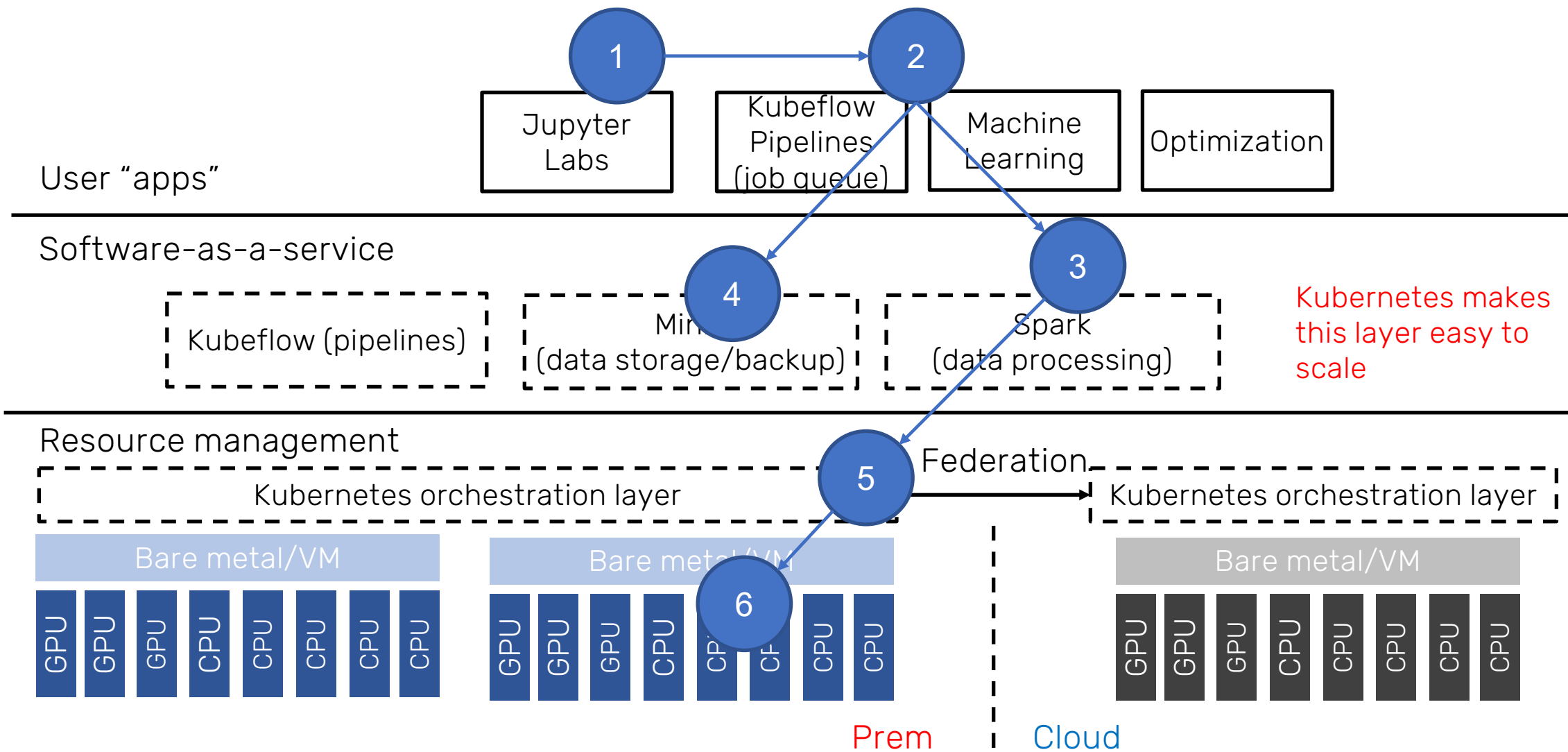
High quality predictions lead to more automated decision making





The DevOps cycle is daily, hourly, monthly. It is enabled in the cloud with Software-as-a-Service. MLOps cycle is triggered by data changes if model efficacy decreases sufficiently.

The technology is here and needs widespread adoption by network operators



There is a lot of software coming out of CNCF that can be used to implement a modern AI platform

CNCF Cloud Native Landscape
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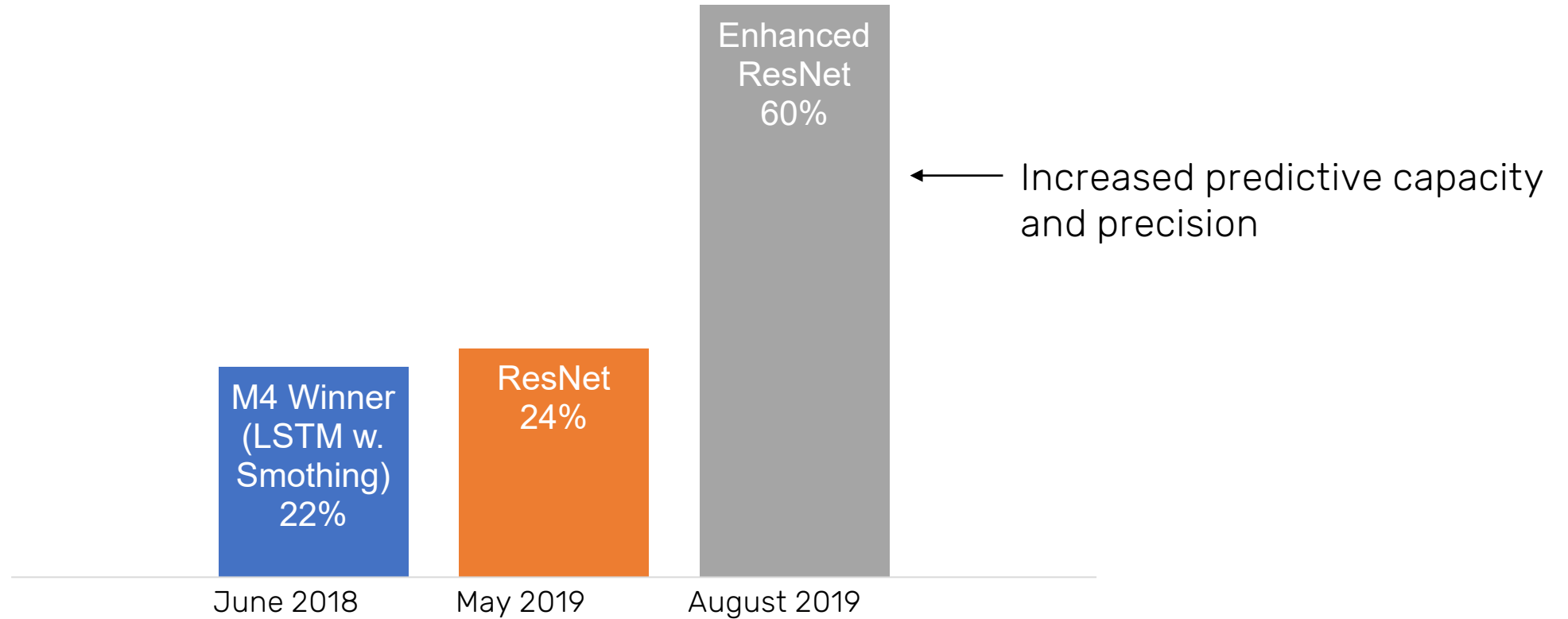
Overwhelmed? Please see the CNCF Trail Map. That and the interactive landscape are at l.cncf.io

The landscape is organized into several functional categories:

- App Definition and Development:** Includes projects like Viteks, KV, cloudevents, HELM, and argo.
- Database:** Lists various database solutions.
- Streaming & Messaging:** Includes Kafka, Pulsar, and others.
- Application Definition & Image Build:** Features Helm, Tekton, and others.
- Continuous Integration & Delivery:** Includes Argo, Jenkins, and others.
- Platform:** Divided into Certified Kubernetes - Distribution, Certified Kubernetes - Hosted, Certified Kubernetes - Installer, and PaaS/Container Service.
- Observability and Analysis:** Includes Monitoring, Logging, Tracing, and Chaos Engineering.
- Orchestration & Management:** Includes Kubernetes, etcd, gRPC, Envoy, API Gateway, and Service Mesh.
- Runtime:** Includes Cloud Native Storage, Container Runtime, and Cloud Native Network.
- Automation & Configuration:** Includes Ansible, Puppet, and others.
- Container Registry:** Includes Harbor, Quay, and others.
- Security & Compliance:** Includes Falco, Clair, and others.
- Key Management:** Includes Vault, AWS Key Management Service, and others.
- Provisioning:** Includes Chef, Ansible, and others.
- Special:** A section for various other providers and partners.
- Kubernetes Certified Service Provider:** Lists various CSPs.
- Kubernetes Training Partner:** Lists various training providers.

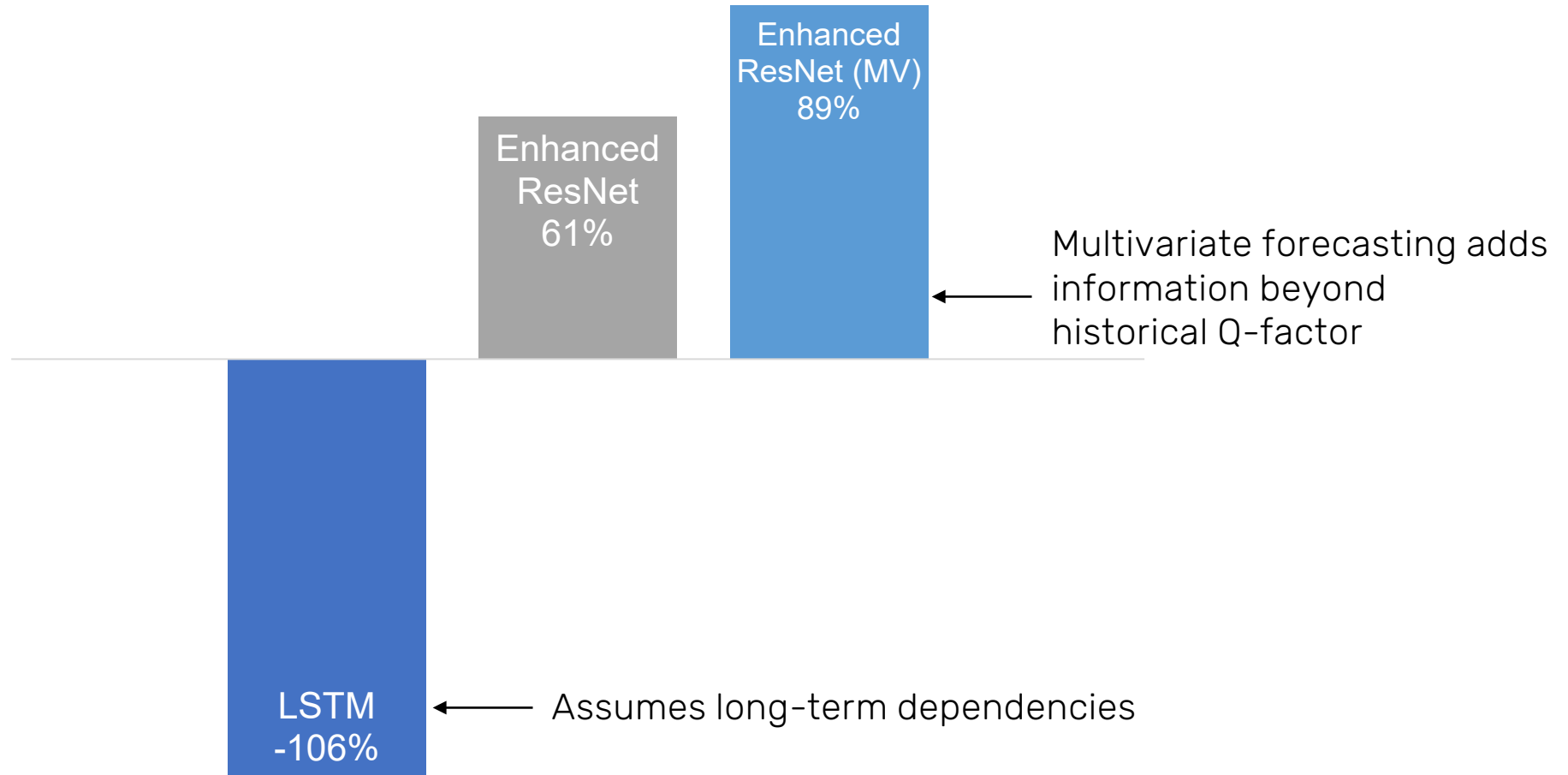
CLOUD NATIVE Landscape
This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path.
l.cncf.io

Gain over baseline (M4 dataset)



In about a year DNNs have allowed us to make a leap that wasn't possible for almost 40 years. Forecasting baselines have been hard to beat in competitions until now. We can now routinely get improvements in accuracy of over 50%,

Gain over baseline (Q-factor forecast)



Classical forecasting algorithms (including DNN-based algorithms) do not work well on network data. New approaches have been developed using both single measurement and multiple measurements as inputs.

Key Takeaways

- 1 AI is a prediction technology. Prediction is the process of filling missing information.
- 2 There are many uses cases where filling missing information can reduce optical network costs or improve network performance.
- 3 Network planning can be automated with the use of AI technologies for forecasting and optimization.



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Thank You!

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