Machine Learning Development Lifecycle Reliability

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Overview

MLOps + SDLC != ML DLC

Why Now and Why PE/SREs?

ML DLC Deep Dive on Top 3 Challenges

Recap

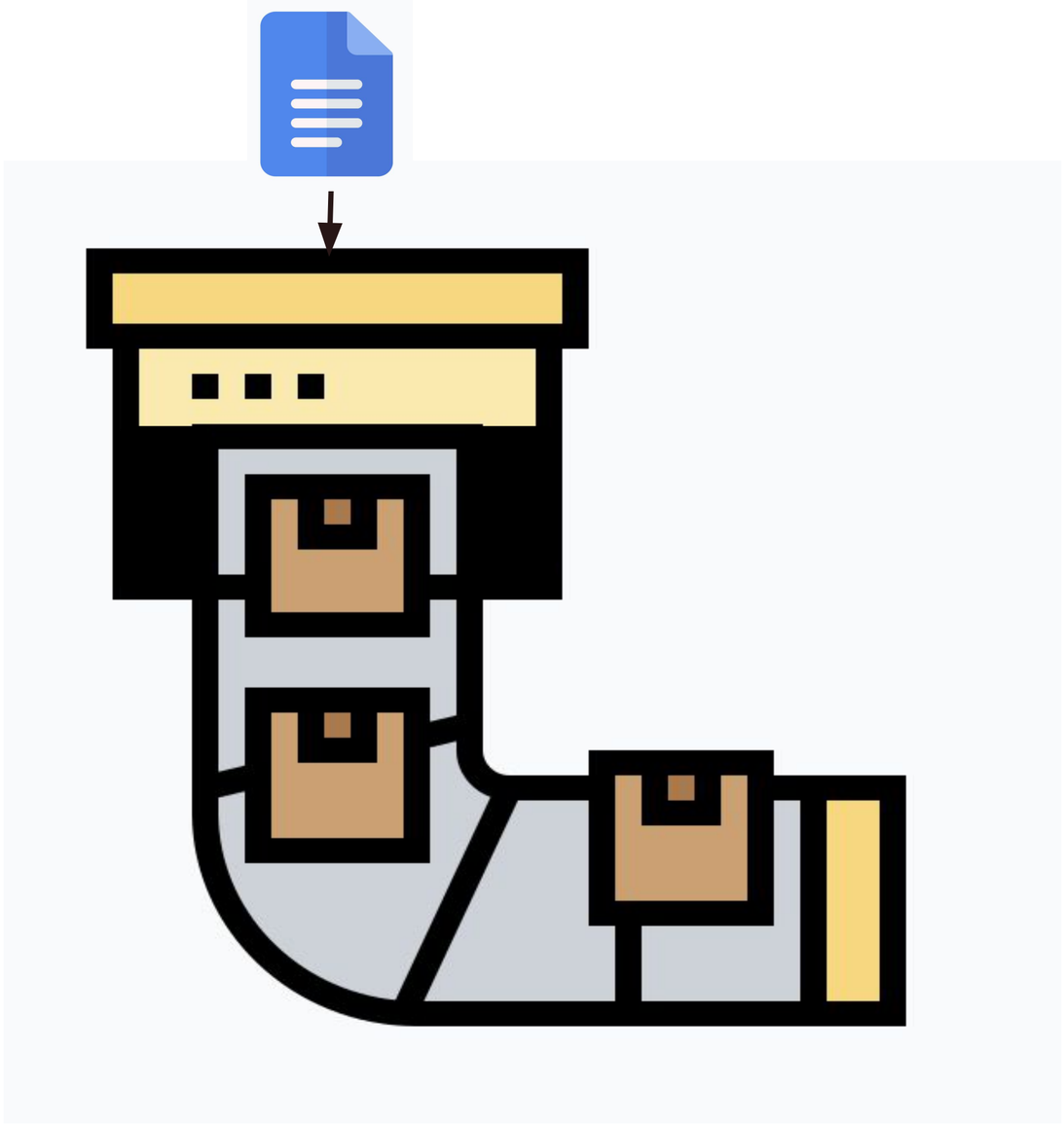
PE ~ SRE

ML Ops

- MLOps seeks to increase **automation** and improve the **quality** of production models, while also focusing on **business** and **regulatory** requirements.
- While MLOps started as a set of best practices, it is slowly evolving into an independent approach to **ML lifecycle management**.

MLOps Wikipedia

Software



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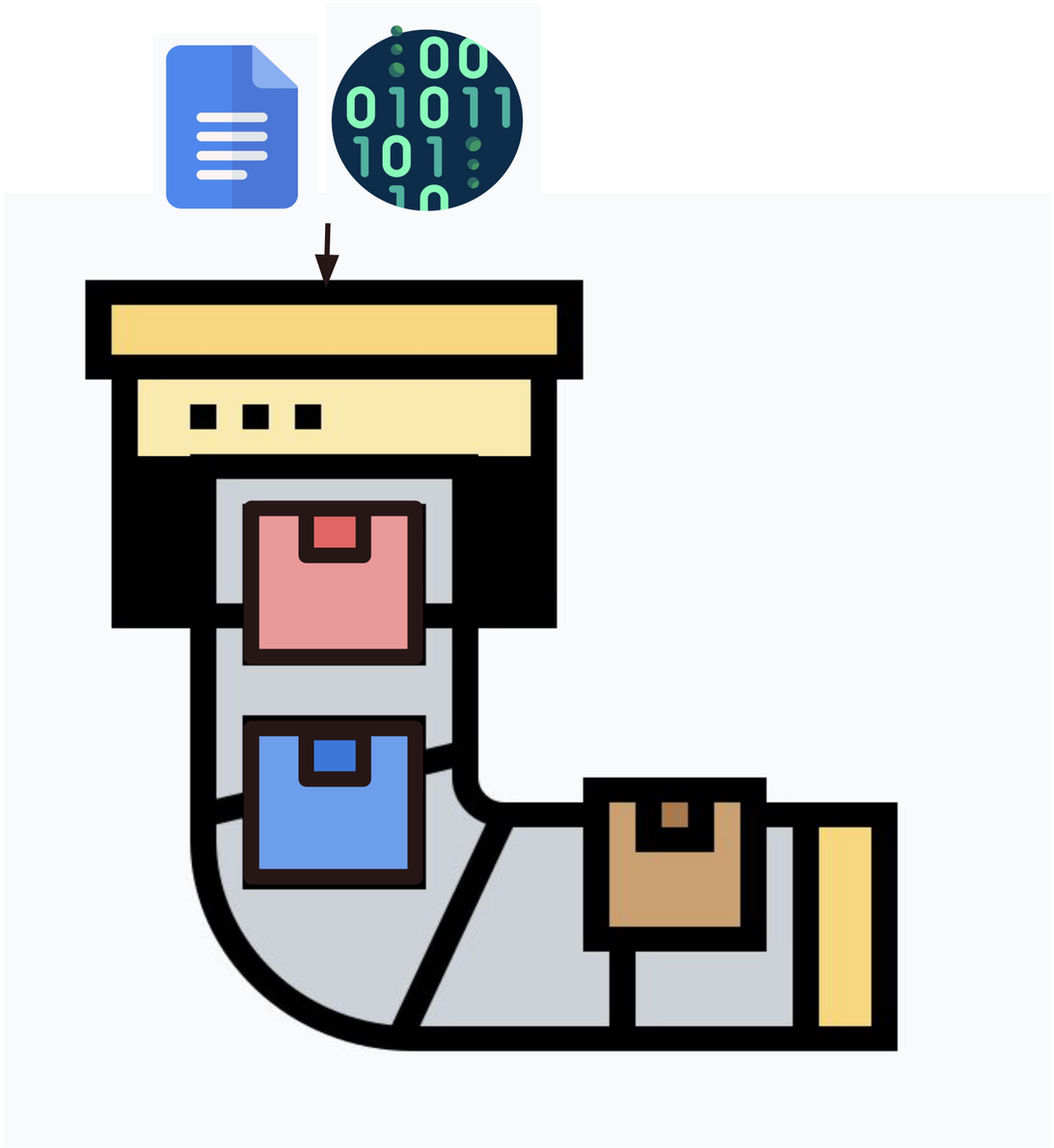
Machine Learning



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0→1

2011

Nature Reviews Drug Discovery

65% medical studies were inconsistent when retested

2017

Journals in Economic Sciences

48% peer review compliance rate

2020

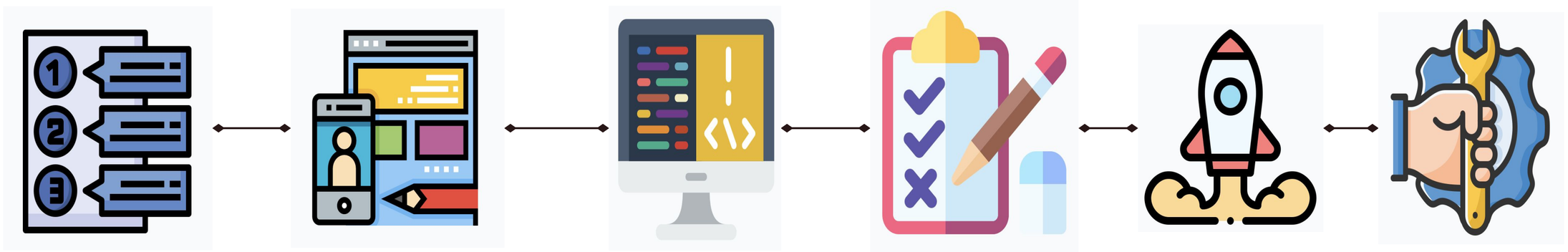
Carnegie Mellon University survey

90% of 1500 ML researchers believed in crisis of reproducibility of ML results

Prinz, F.; Schlange, T.; Asadullah, K. (2011). "Believe it or not: How much can we rely on published data on potential drug targets?". Nature Reviews Drug Discovery. 10 (9): 712. doi:10.1038/nrd3439-c1. PMID 21892149.
Vlaeminck, Sven; Podkrajac, Felix (2017-12-10). "Journals in Economic Sciences: Paying Lip Service to Reproducible Research?". *IASSIST Quarterly*. **41** (1–4): 16. doi:10.29173/iq6. hdl:11108/359.
https://blog.ml.cmu.edu/2020/08/31/5-reproducibility/

1→10,000

Software Development LifeCycle



Requirements Design Coding Testing Deployment Maintenance

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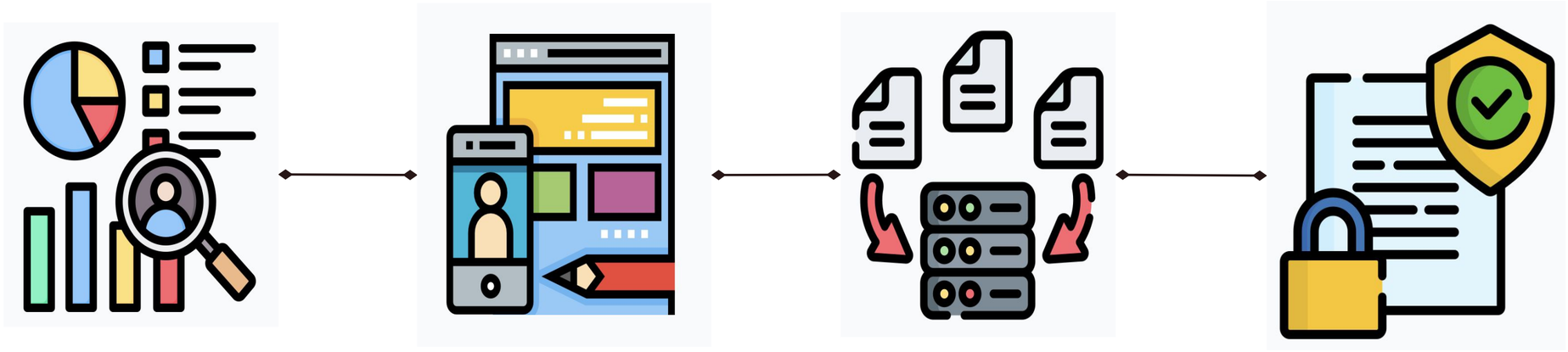
ML Development LifeCycle



Research Design Demand Privacy

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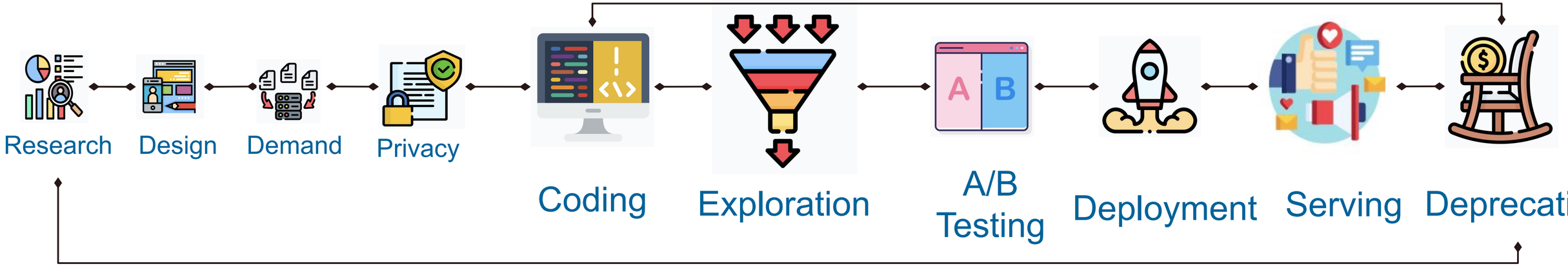
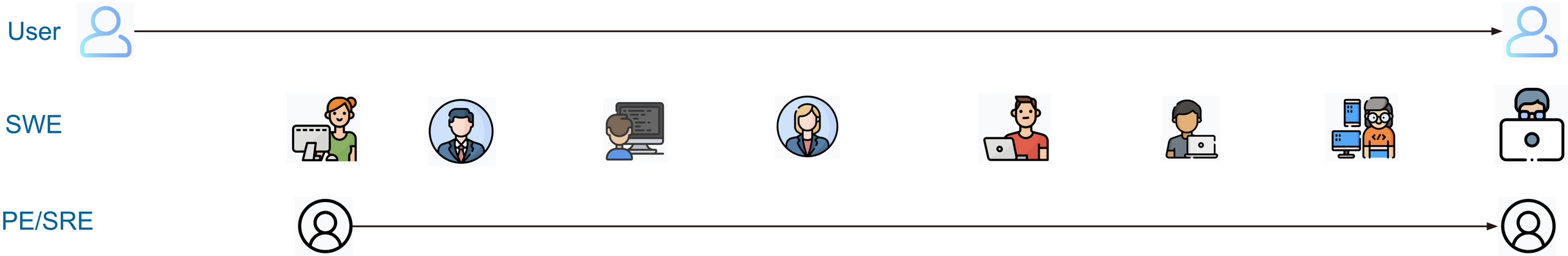
ML Development LifeCycle





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Challenge 1: Observability

FANTASTIC
VO Models
AND WHERE
TO FIND THEM

Ownership Challenges

Source 1 → Not a current employee

Source 2 →

Source 3 →

Source4 →

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Ownership Solutions

- Centralize Ownership for consistency
- Replace Owners with Oncall Rotations
- Build Monitoring and Alerting
- Establish Auto Escalation

Production Models

Ads | Instagram | Reels | Marketplace

Top Line Metrics

Table & Metric Data Last Updated: Dec 9, 9999

Total Models	Pytorch	Staled	Not Training	Average / Target Maintainability Index	Launches This Month/Half	Monthly Distinct Users
300	100	2	8	85 / 90	0 / 100	2 k

Vital Dashboards

Prediction Stability | Revenue Stability | Calibration Stability | Model Staleness | ML Diagnosability

Ongoing SEVs

SEV 3

SEV 3 Example: Training crashes

Search... Save

300 search results

Post | + Create SEV

Ranking | Targeting | Identity

Column Settings

CoreML

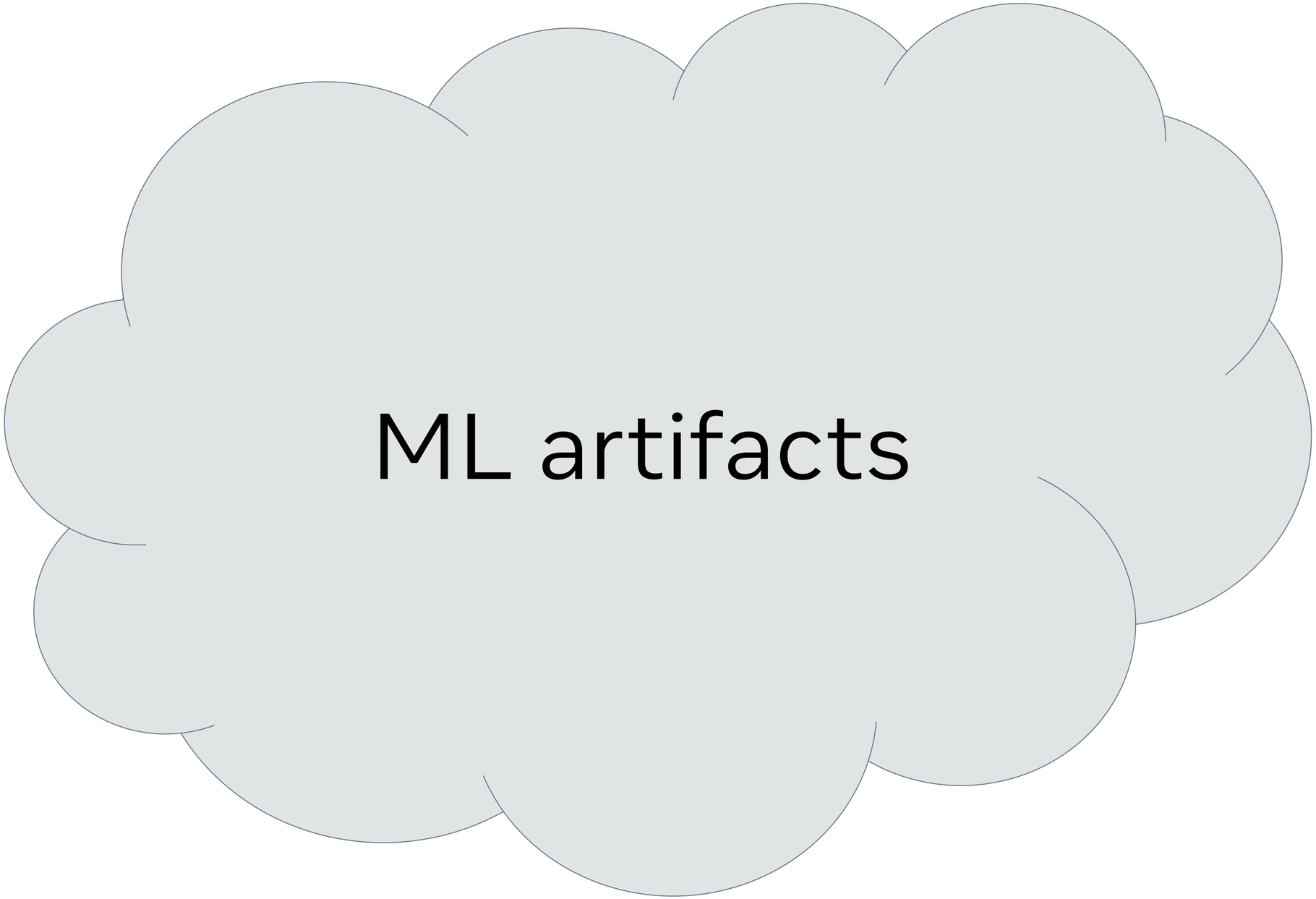
Model Type	Model	Launch Time	Snapshot Staleness	Maintainability Index	Revenue Importance	Training Type	Framework	Architecture	Package	Fallback	Owner	Oncall
example_model_type	999 ▾ History Recent 10: 888 777 666 555 444 333 222 111	September 9, 9999	4h ago SLA: 14 hours	88	7%	Online	Pytorch	SPARSENN	example_pkg:200	900	Example Owner	Current Oncall ads_coreml_m...

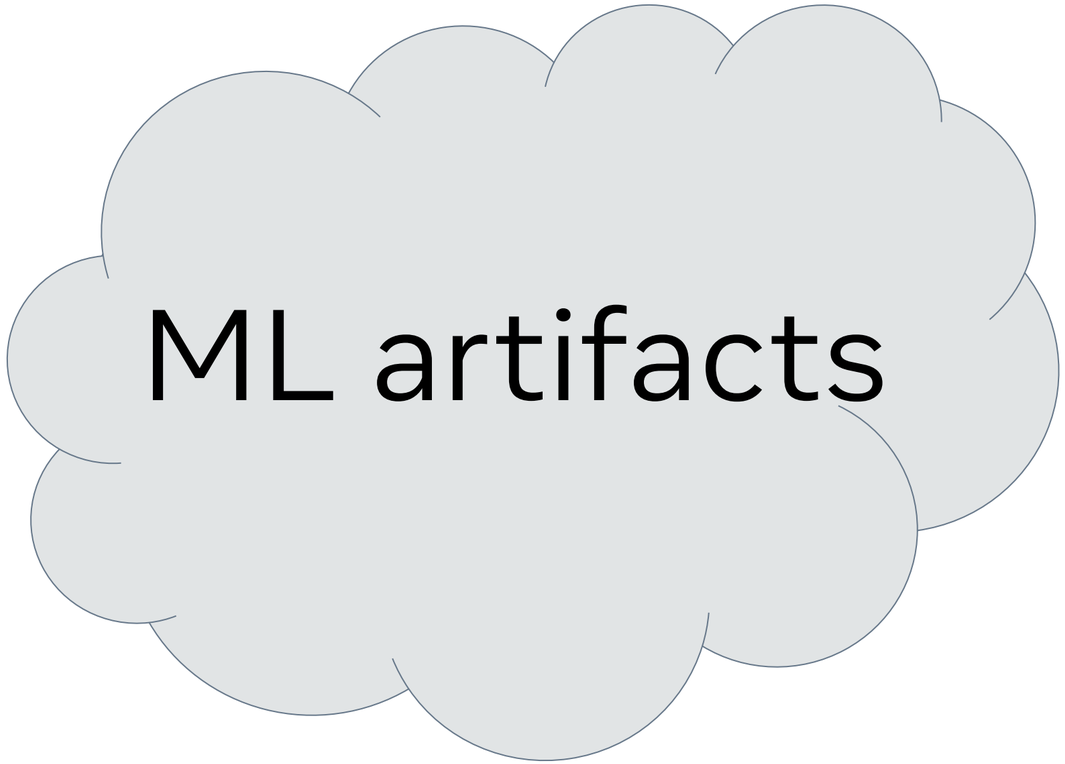
Screenshot with Example Data

North Star: One-stop shop of ALL Production Models

Benefits:

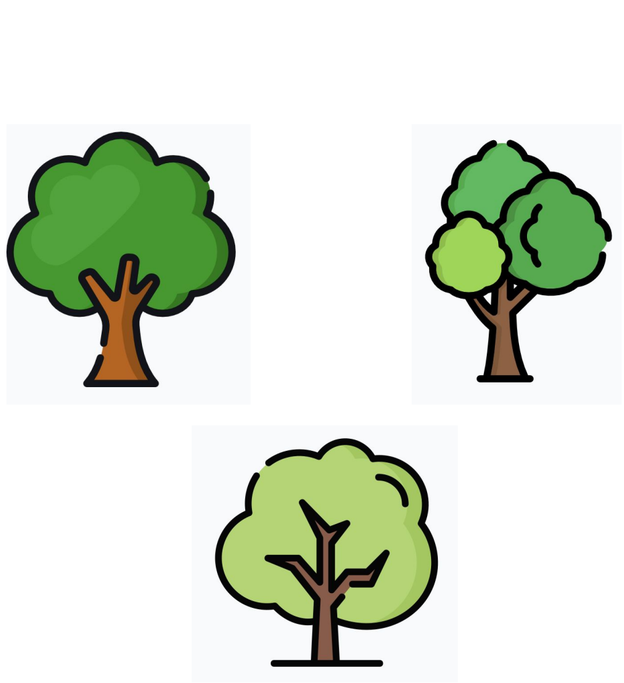
- Identify and mitigate incidents faster
- Build Centralized Monitoring and Alerting
- Integrate with other systems easily


ML artifacts



Production ML Artifacts

Scalability



Tree Level View

Forest Level View

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Challenge 2: Capacity

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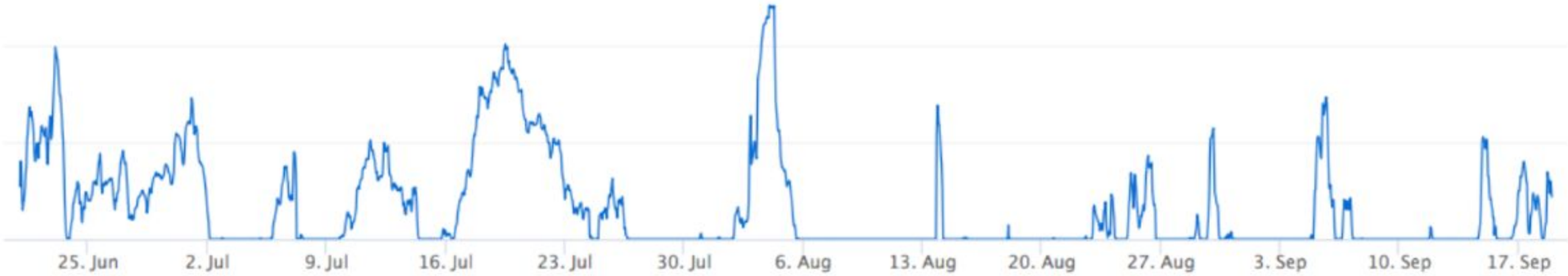
Capacity Crunch Debugging

Model Backlog



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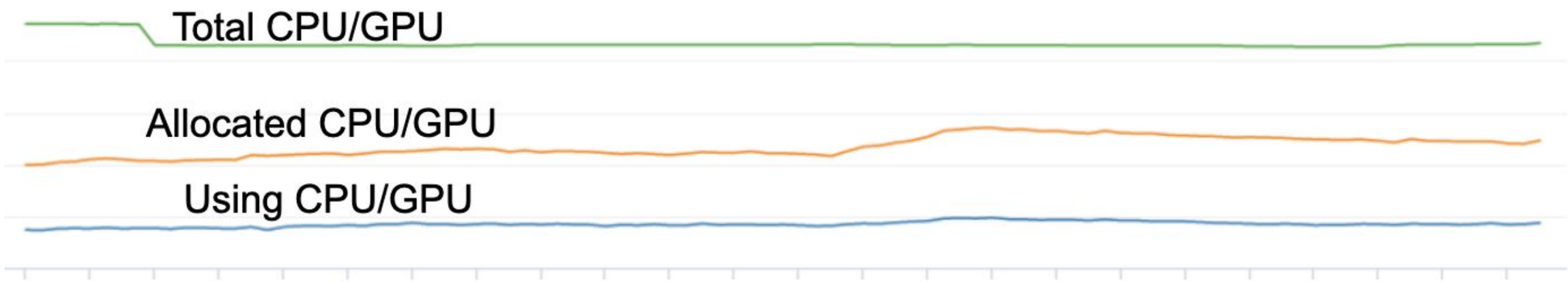
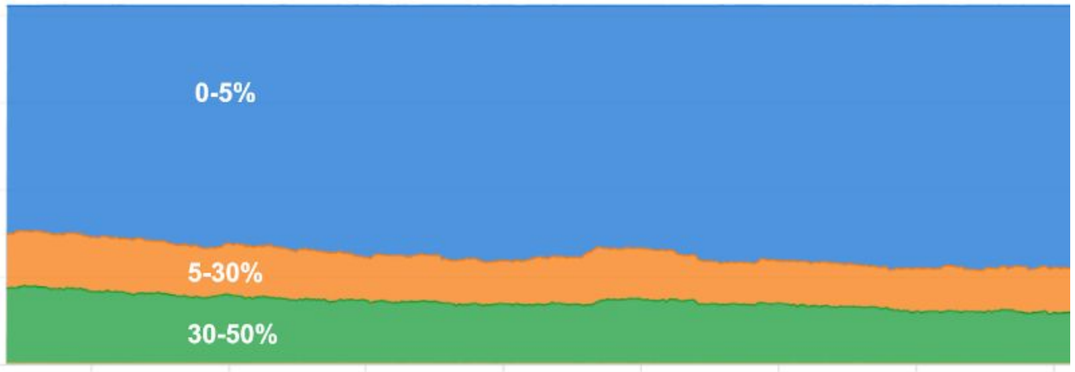
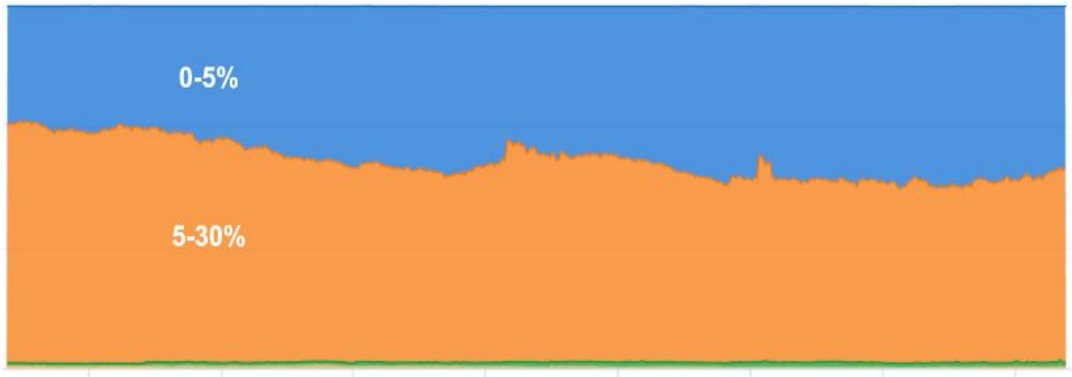
Capacity Crunch Debugging



Training Fleet CPU/GPU Usage %

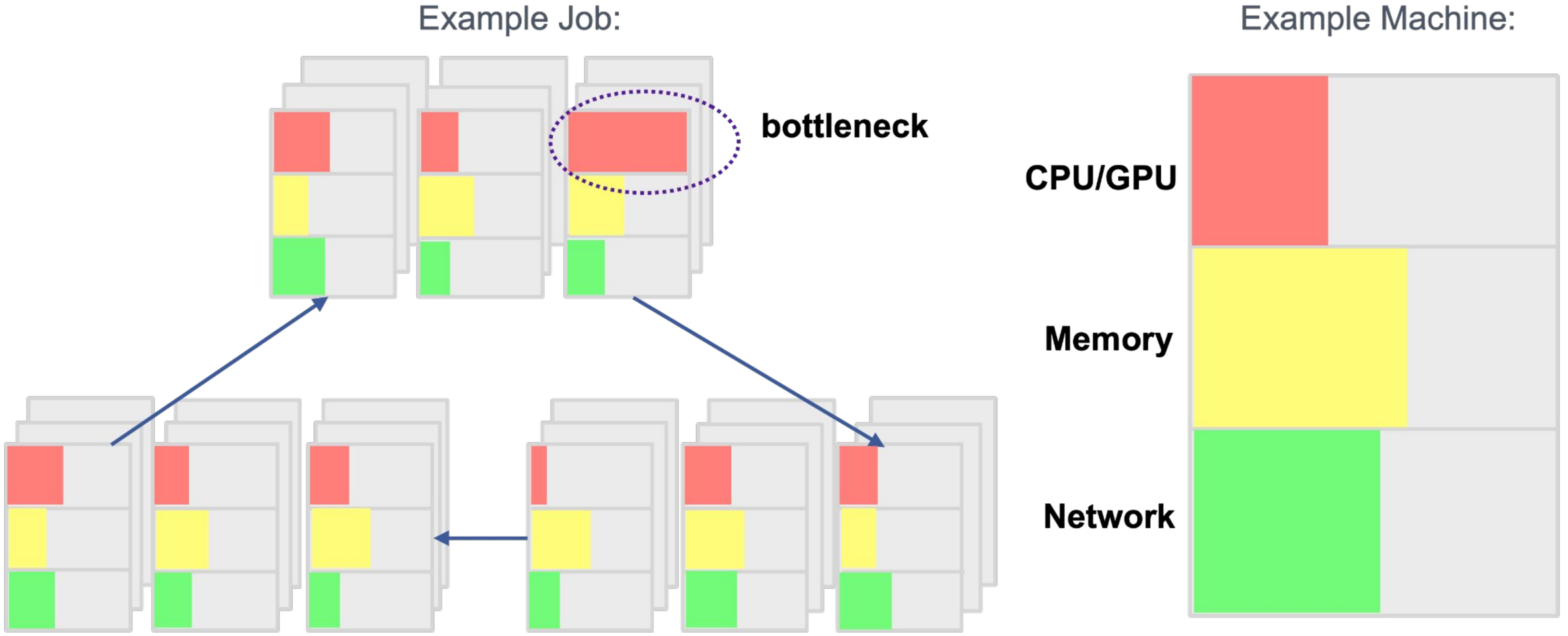


Training Fleet Memory Usage %



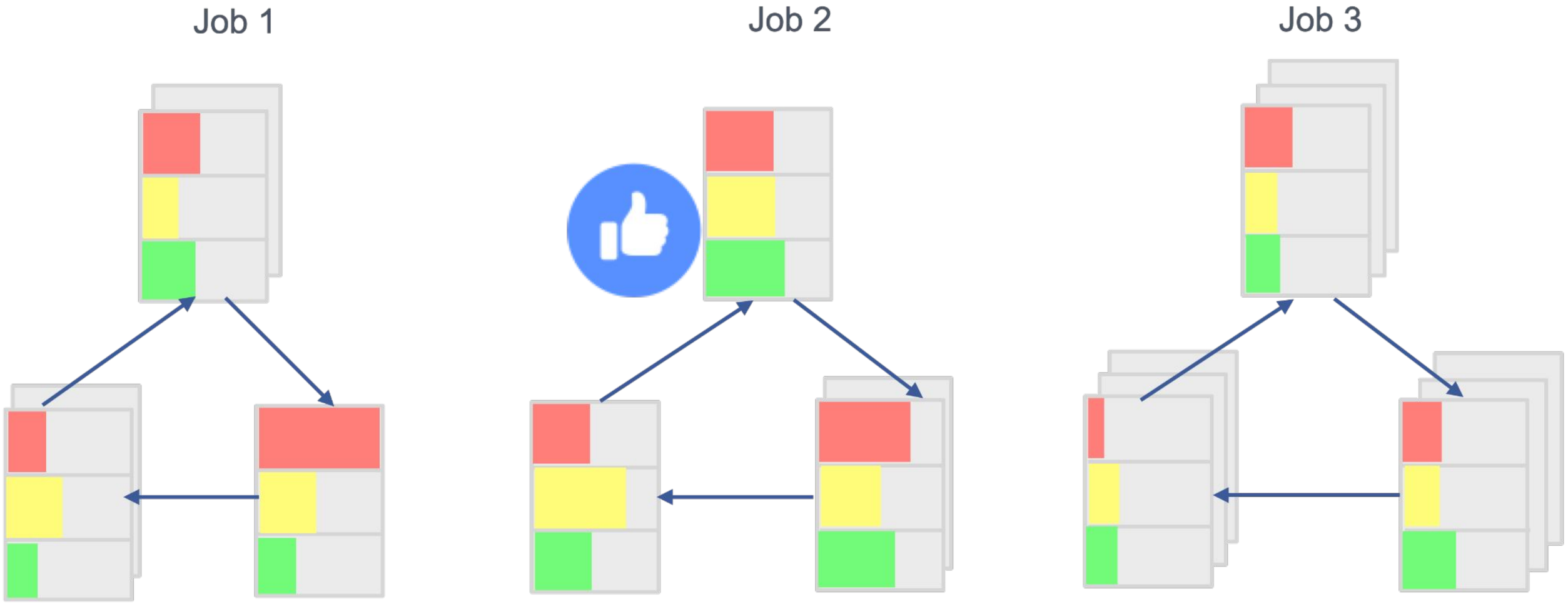
Capacity Crunch Debugging

Detailed Resource Usage: $ cli_tool_name status --resource <job_id>

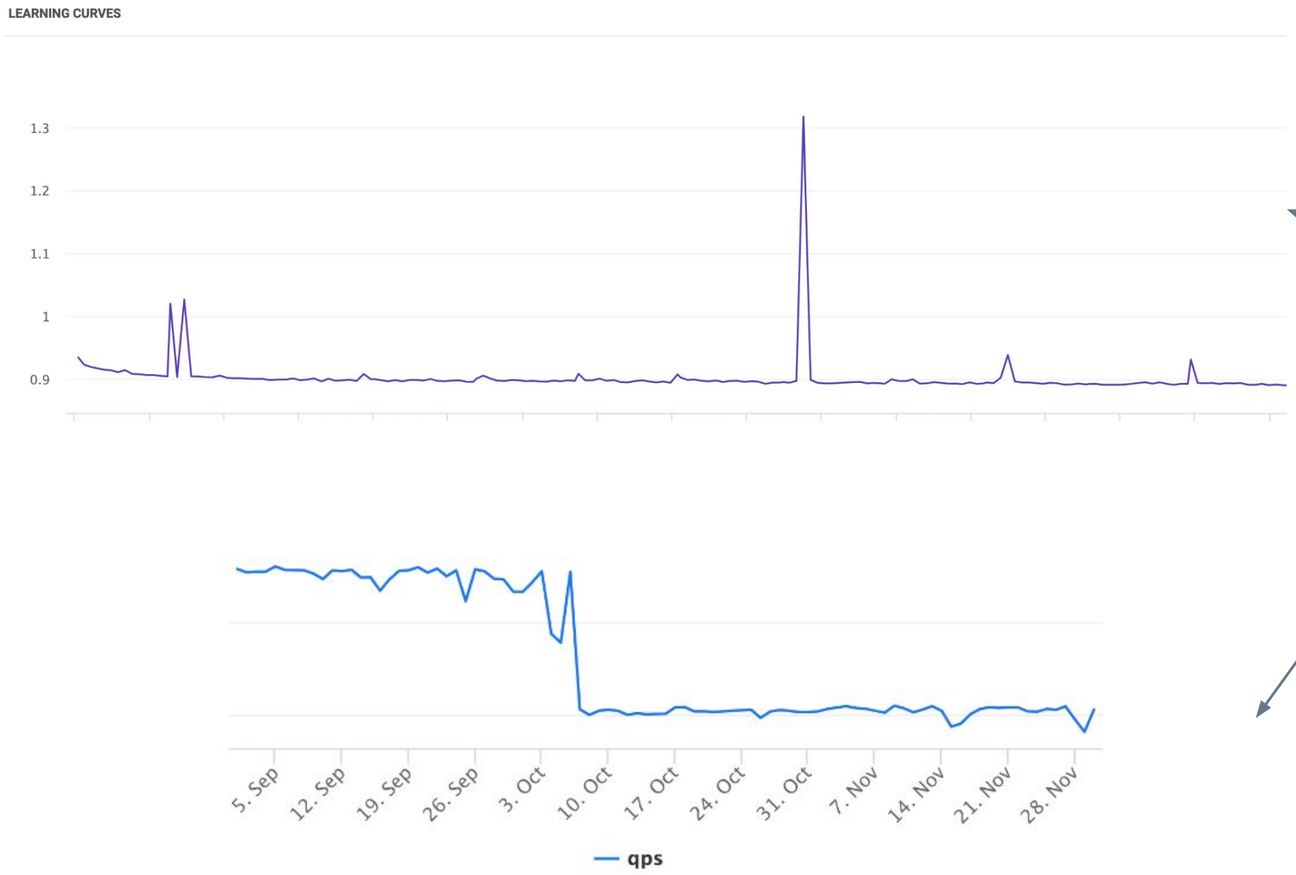


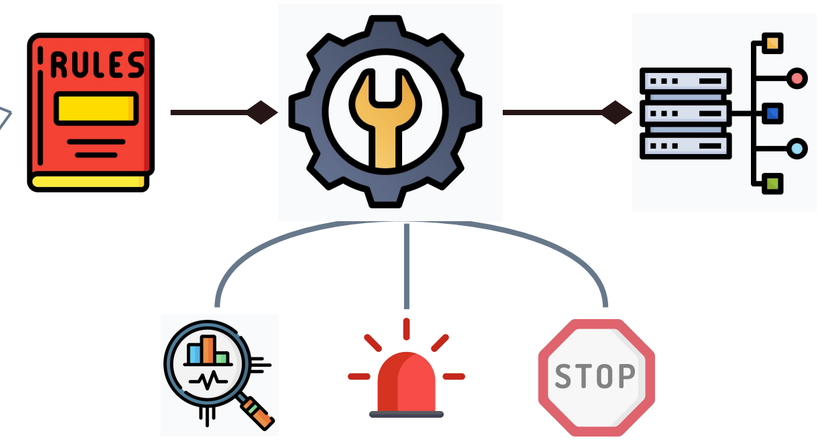
Capacity Crunch Debugging

Find Best Practice: $ cli_tool_name compare --job-ids "id1 id2 id3 ..."



ML Guardian





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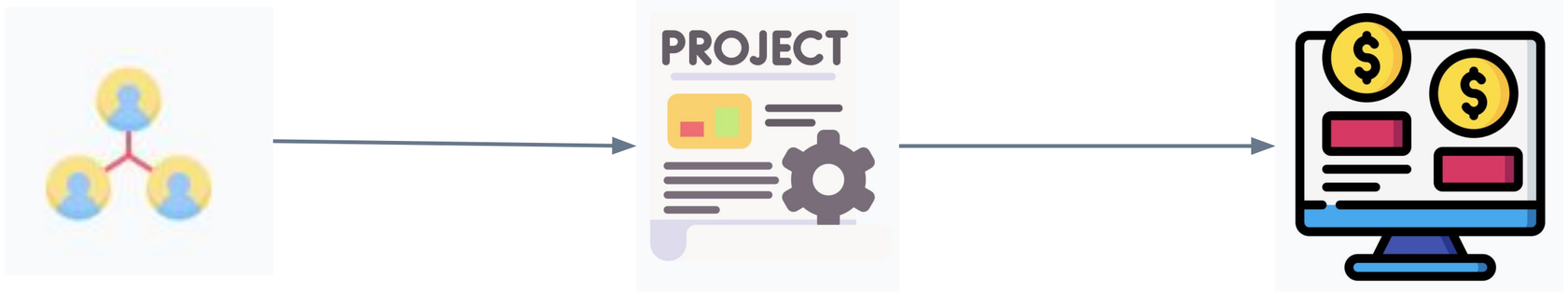
Admission Control Evolution



Team- based

Project- based

ROI- based

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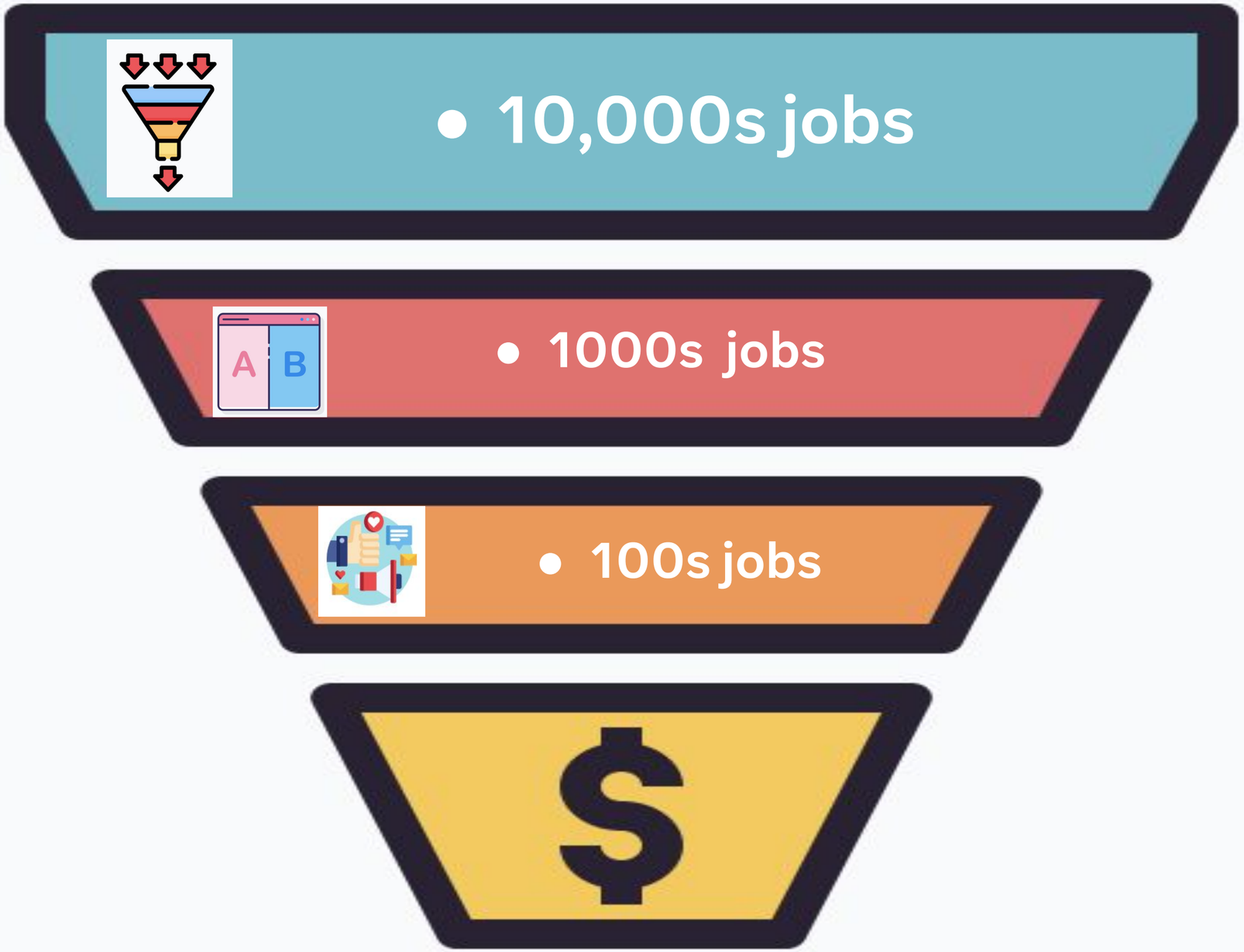

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Reliability

90%

Reliability

.9 * .9 * .9 * .9 * .9 = 59%

Reliability

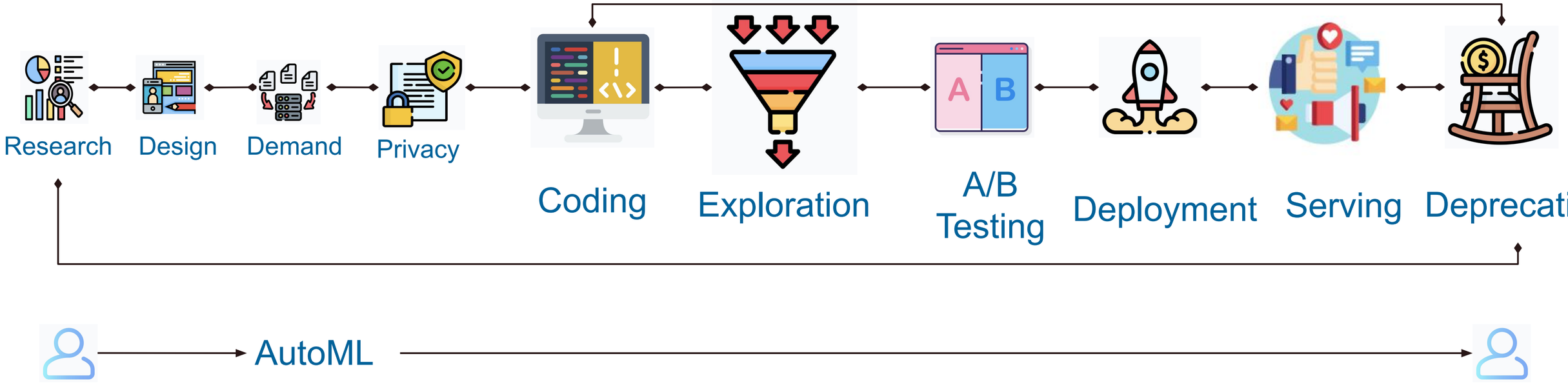
99%

Reliability

.99* .99* .99* .99* .99 = 95%

Challenge 3: Reliability

ML Development LifeCycle



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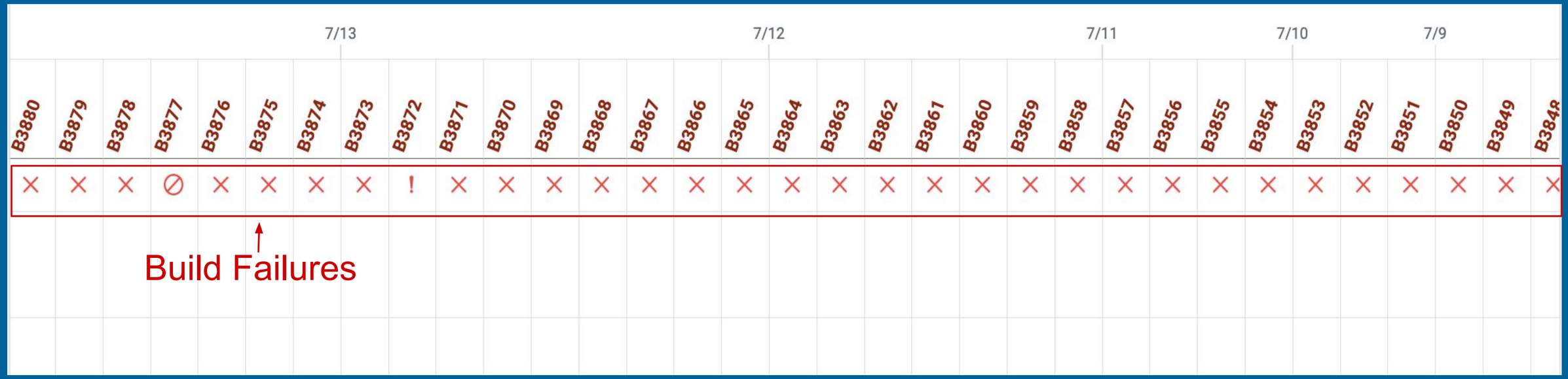
AutoML Package Release



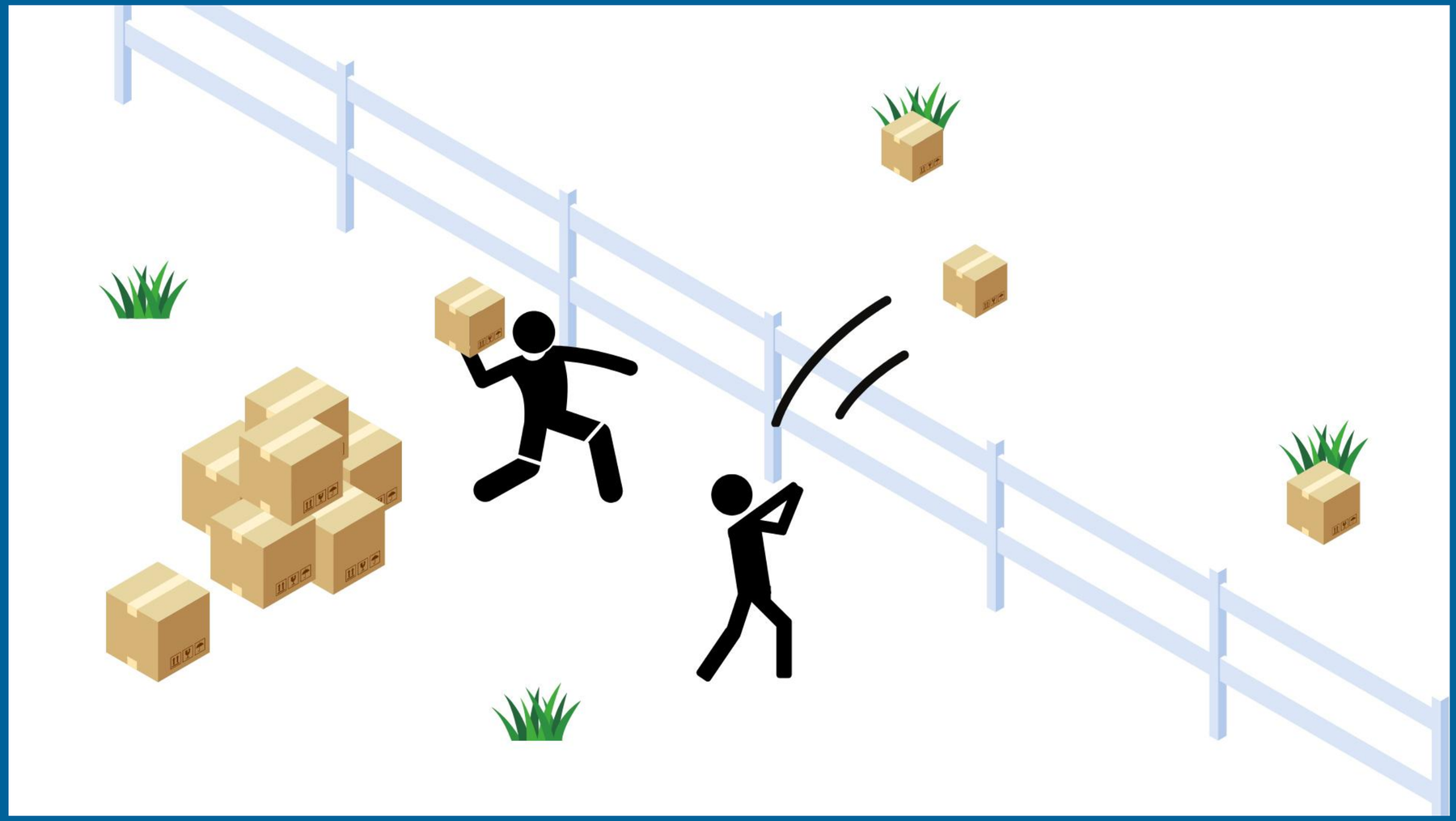
AutoML Package Release

AutoML Package Release

Takeaways

Nondeterministic

Takeaways



Takeaways

AdsML PE Team

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Qingyu Wang
Sidd Choure
Tianchen Zhong
Yansong Chen
Yan Yan

Thank you!