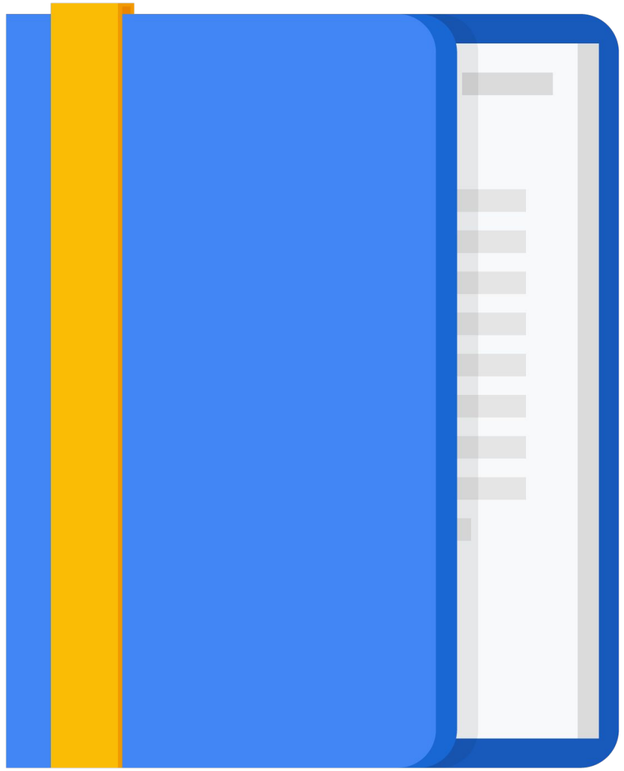
ML Metadata with TFX

Doug Kelly
ML Solutions Engineer, Google Cloud

Agenda

TFX pipeline metadata



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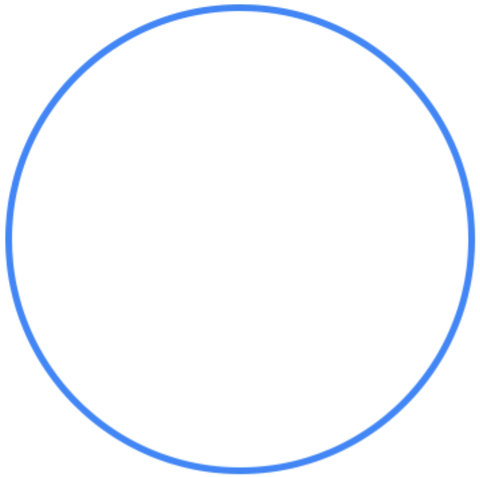

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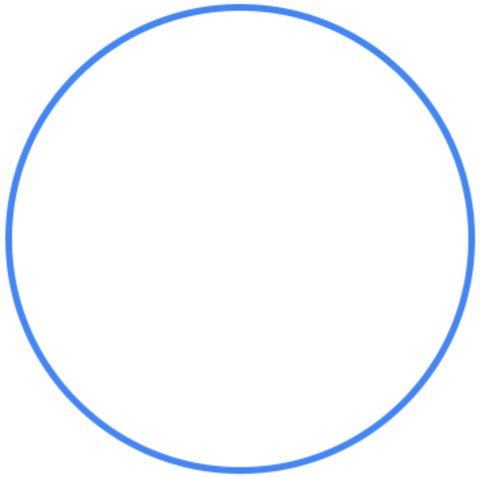

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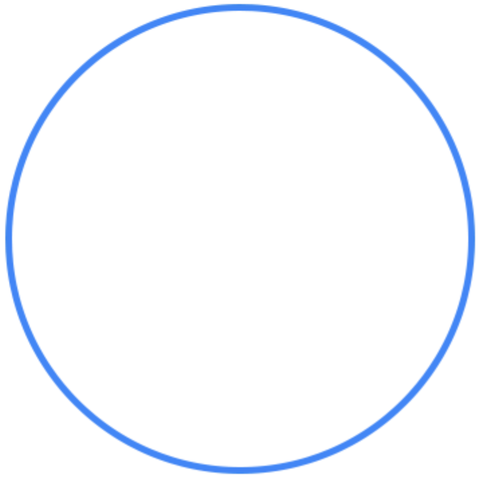

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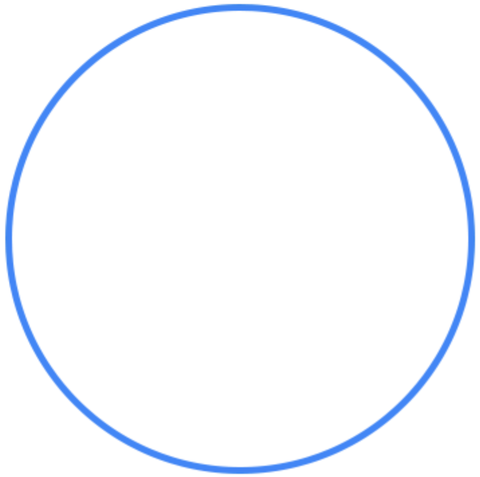

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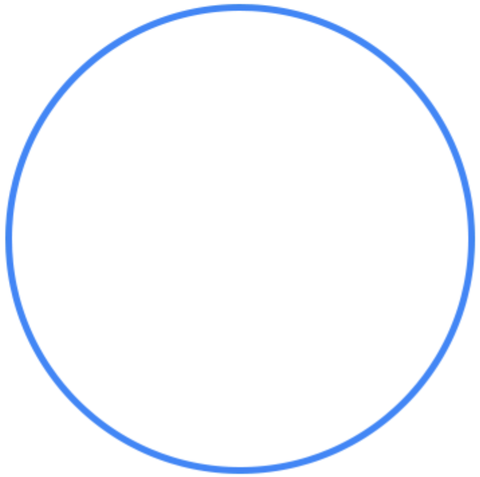

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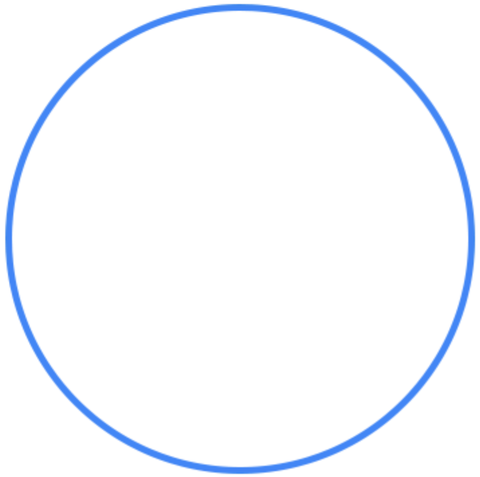

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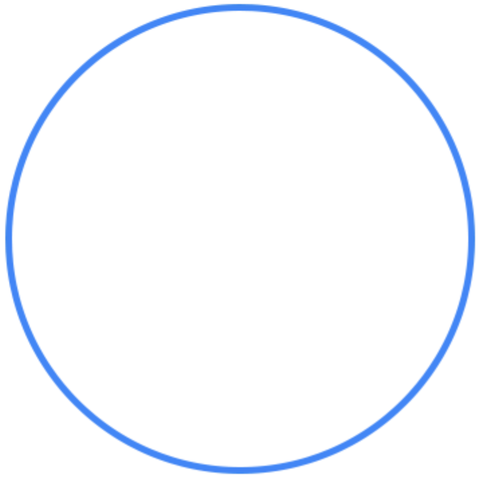
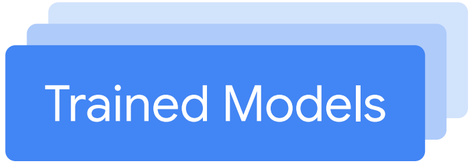
Why was model A preferred over model B?

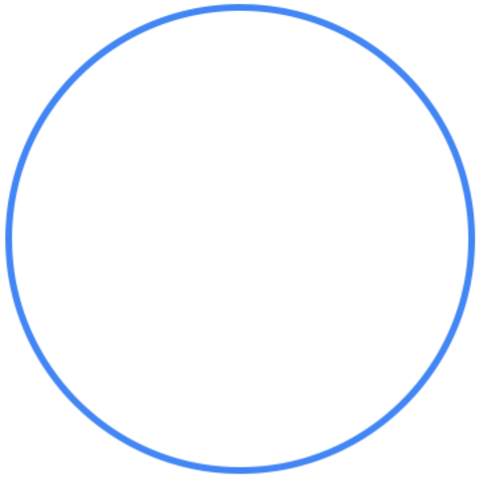
How was the training environment configured?



What is in TFX's Metadata Store?



Type definitions of artifacts and their properties



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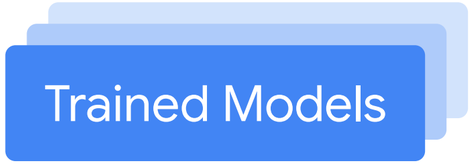

Type definitions of artifacts and their properties

Execution records (runs) of components

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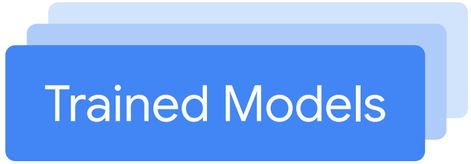

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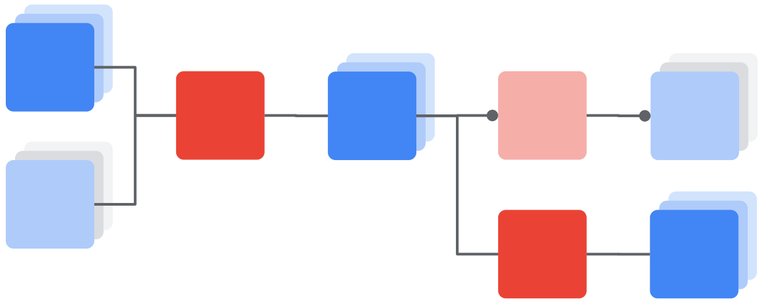
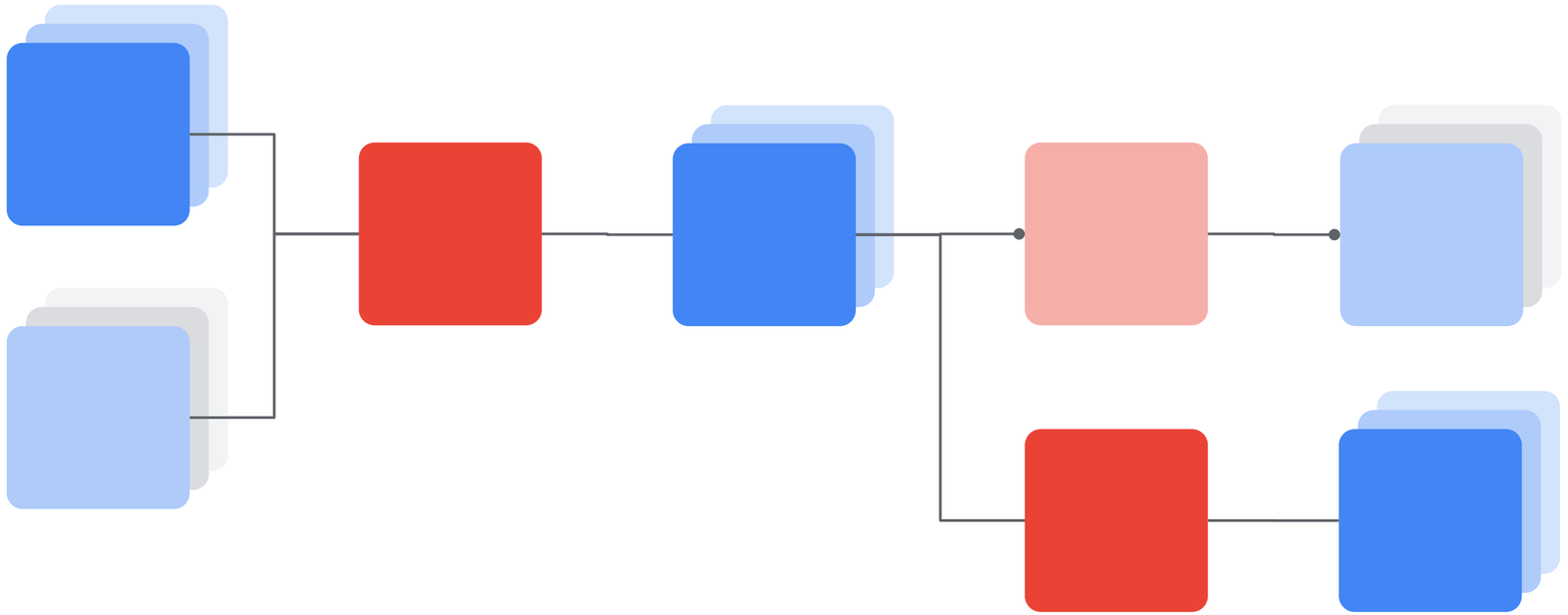


Data provenance across all executions

TFX Metadata-powered functionality

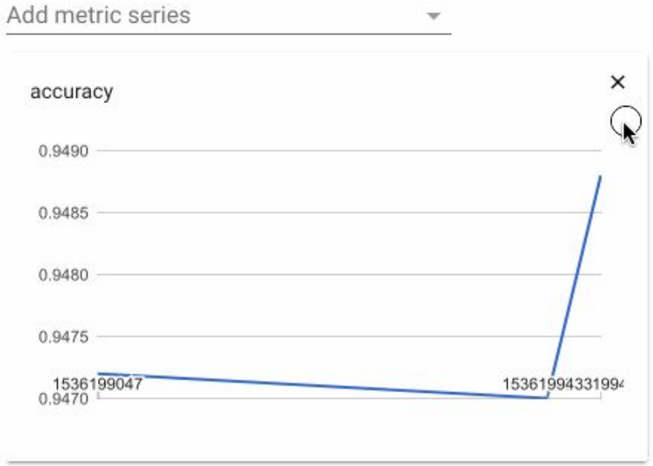
Trace model runs back to the data it was trained on



TFX Metadata-powered functionality

Compare previous model runs

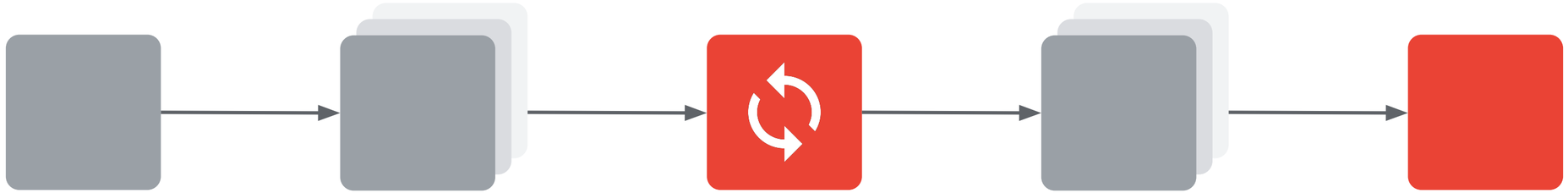
```
eval_results = tfma.make_eval_results([tfma_result_1, tfma_result_2, tfma_result_3],
                                      tfma.constants.MODEL_CENTRIC_MODE)
tfma.view.render_time_series(eval_results, OVERALL_SLICE_SPEC)
```

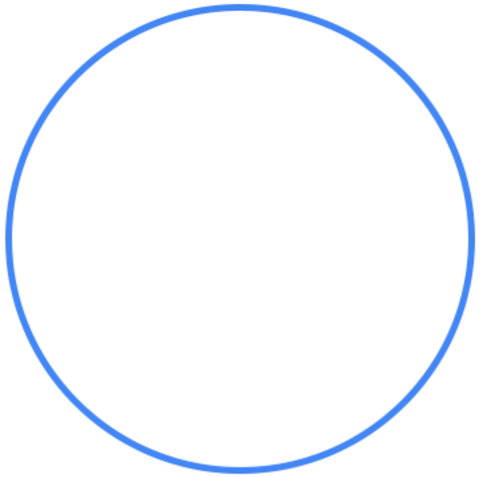


Model	Data	accuracy	accuracy_baseline	auc	auc_precision_recall	average_loss	label/mean
1536199479	data.csv	0.94880	0.94220	0.93168	0.98516	0.13980	0.94220
1536199433	data.csv	0.94700	0.94220	0.93165	0.98170	0.13979	0.94220
1536199047	data.csv	0.94720	0.94220	0.92914	0.99480	0.14103	0.94220

TFX Metadata-powered functionality

Re-use previously computed outputs





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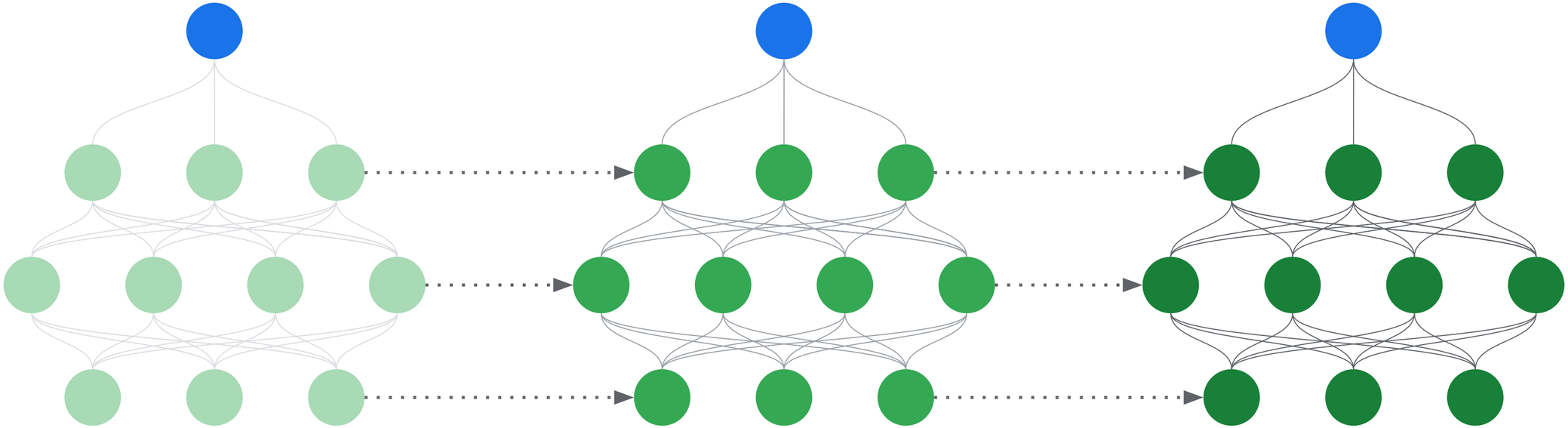


Advanced TFX use case: pipeline warm starting

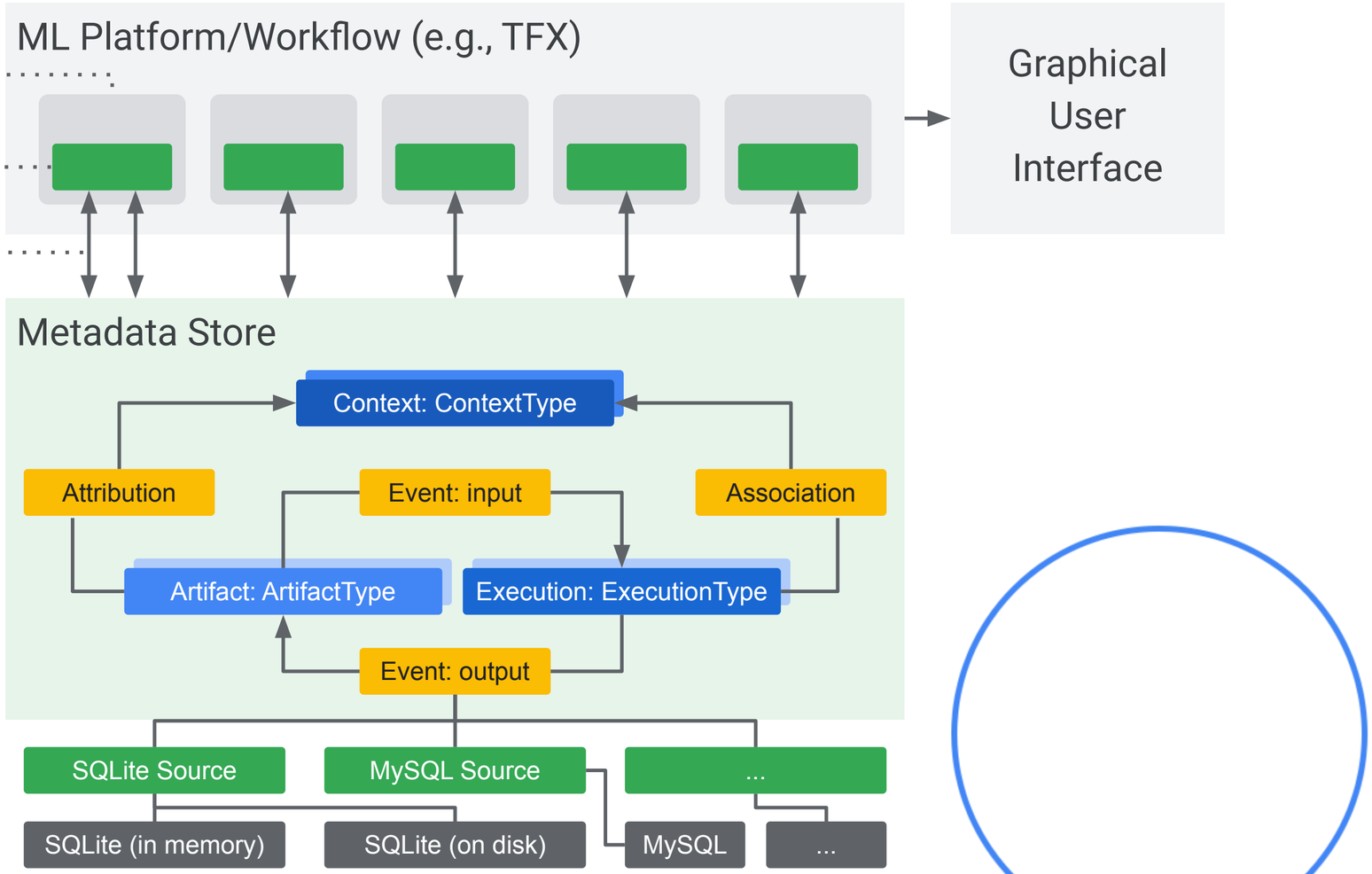
```
# Get the latest model so that we can warm start from the model.
 latest_model_resolver = ResolverNode(
     instance_name='latest_model_resolver',
     resolver_class=latest_artifacts_resolver.LatestArtifactsResolver,
     latest_model=Channel(type=Model))

 # Uses user-provided Python function that implements a model using TF-Learn.
 trainer = Trainer(
     module_file=module_file,
     transformed_examples=transform.outputs['transformed_examples'],
     schema=schema_gen.outputs['schema'],
     base_model=latest_model_resolver.outputs['latest_model'],
     transform_graph=transform.outputs['transform_graph'],
     train_args=trainer_pb2.TrainArgs(num_steps=10000),
     eval_args=trainer_pb2.EvalArgs(num_steps=5000))
```

ML Metadata (MLMD) library data model

Pipeline components/steps

MLMD client libraries

Metadata and lineage about input/output artifacts



ML Metadata in action

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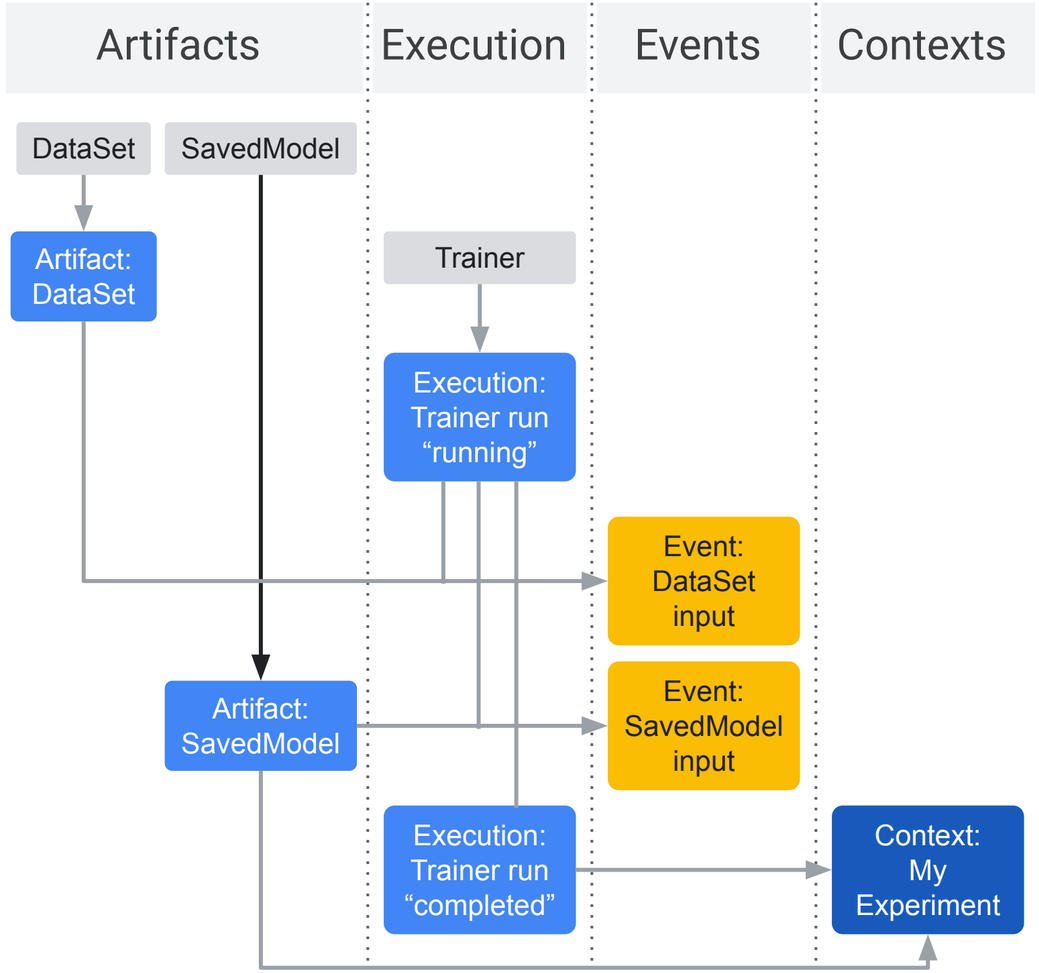

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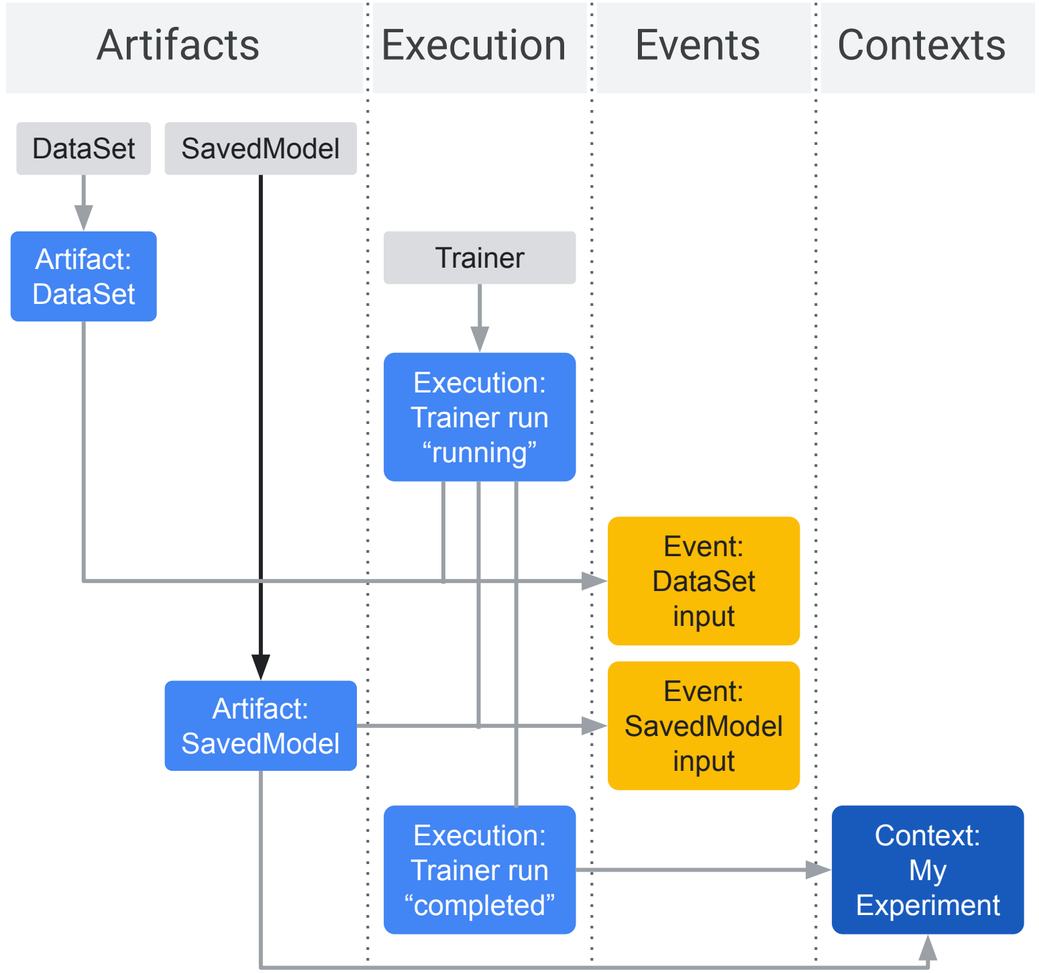

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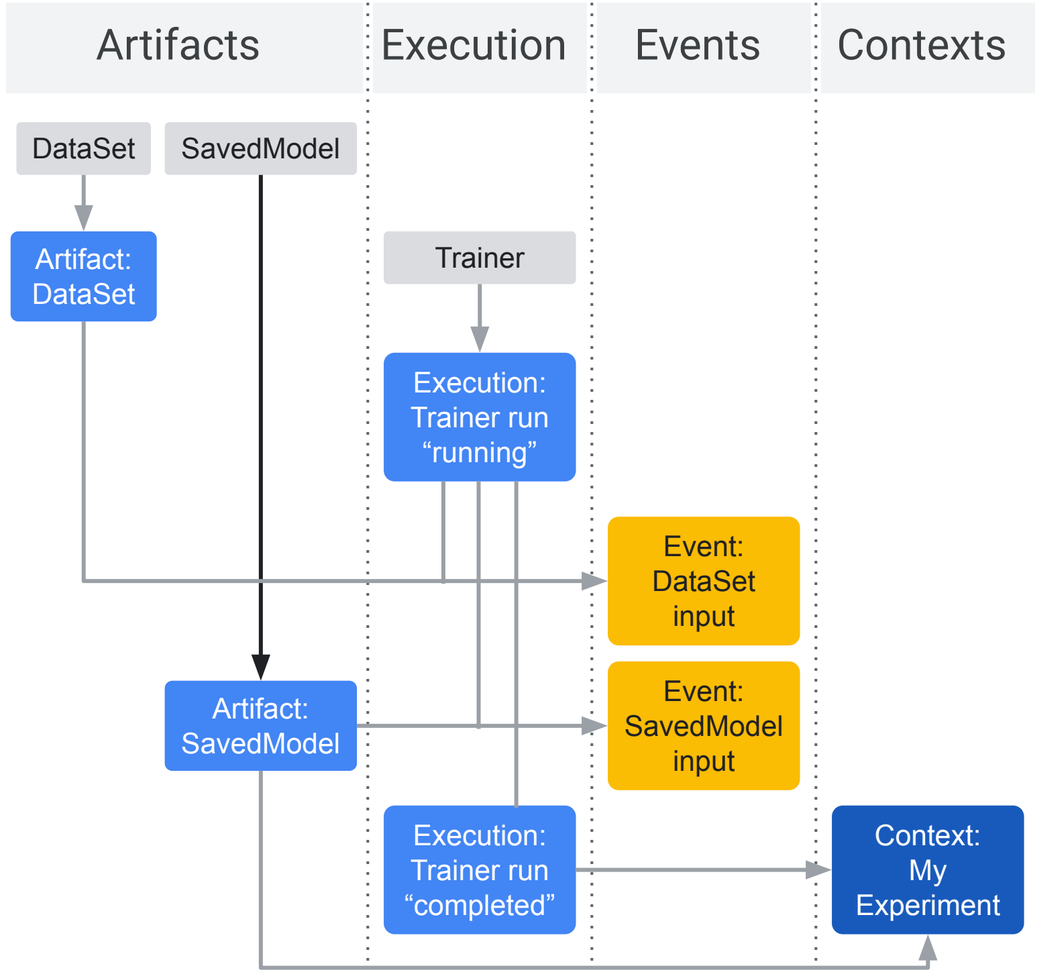
3. Create DataSet Artifact.



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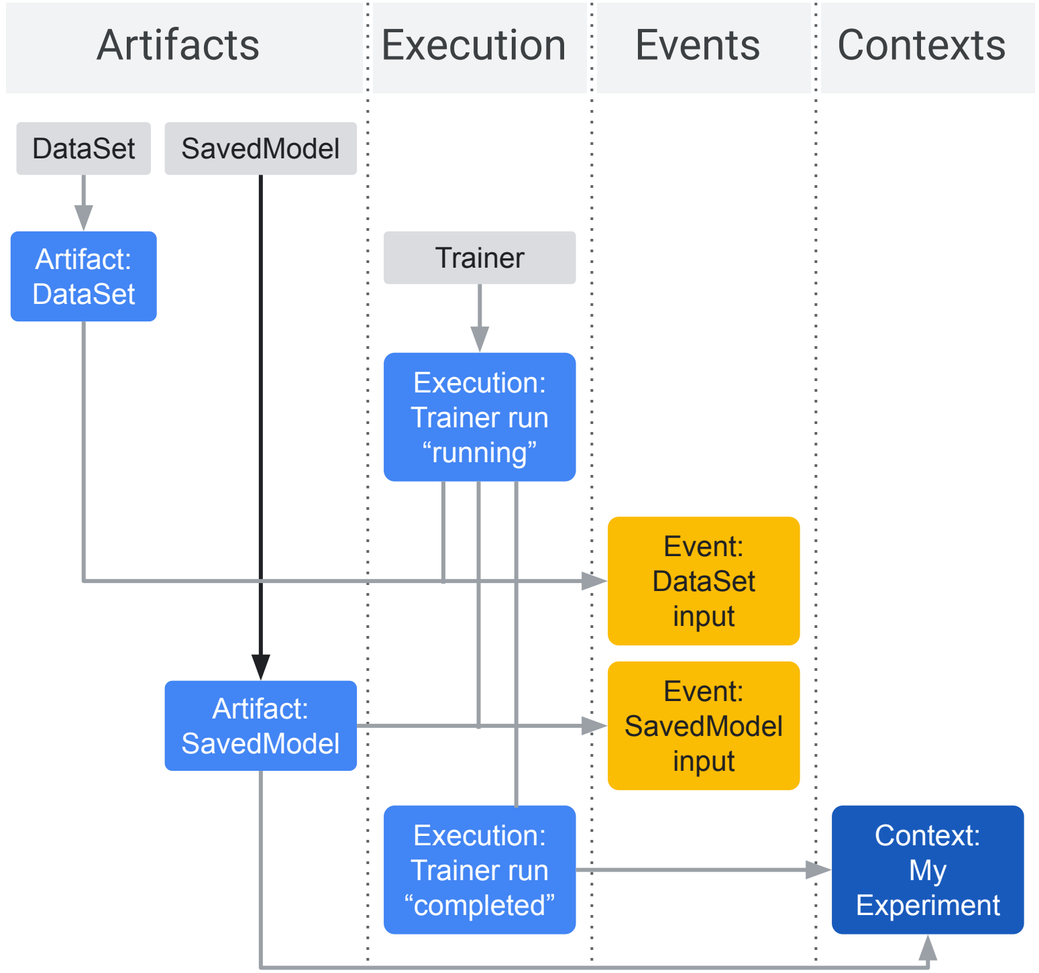
3. Create DataSet Artifact.
4. Create Execution for Trainer.



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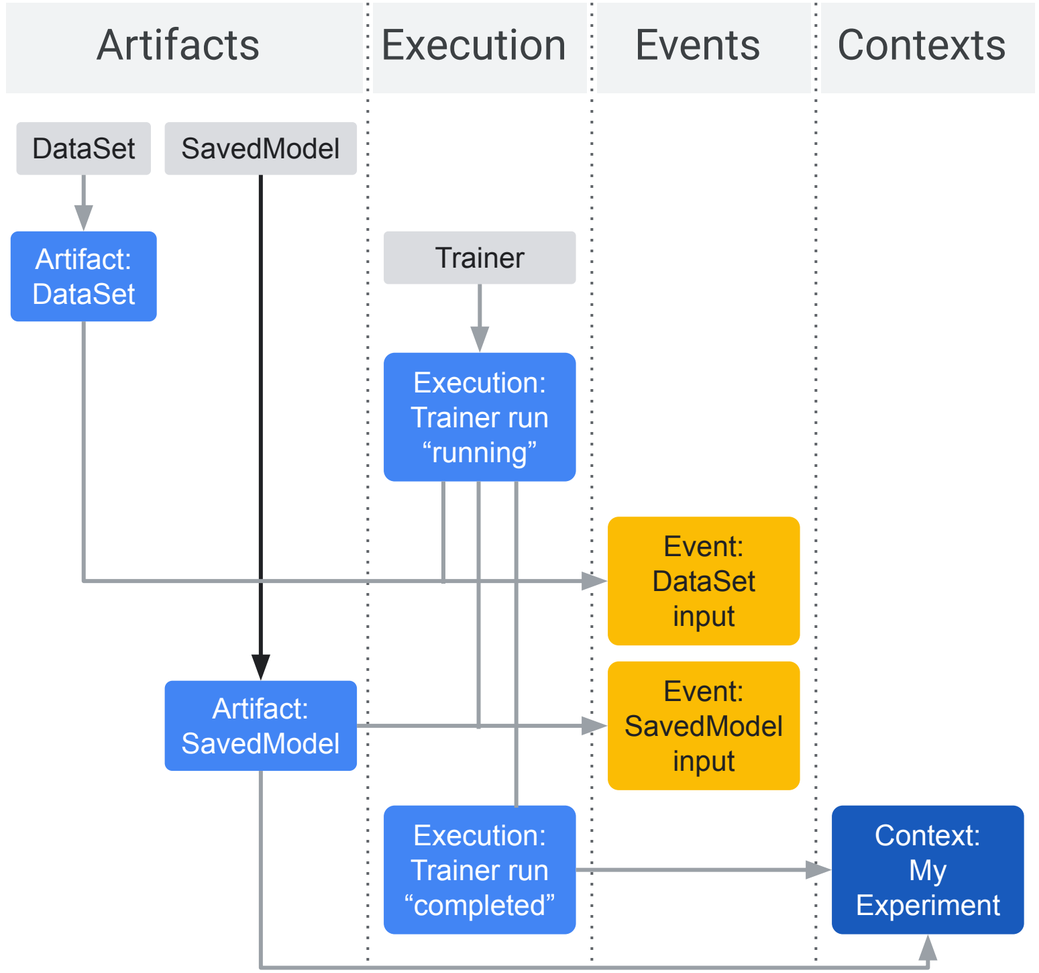

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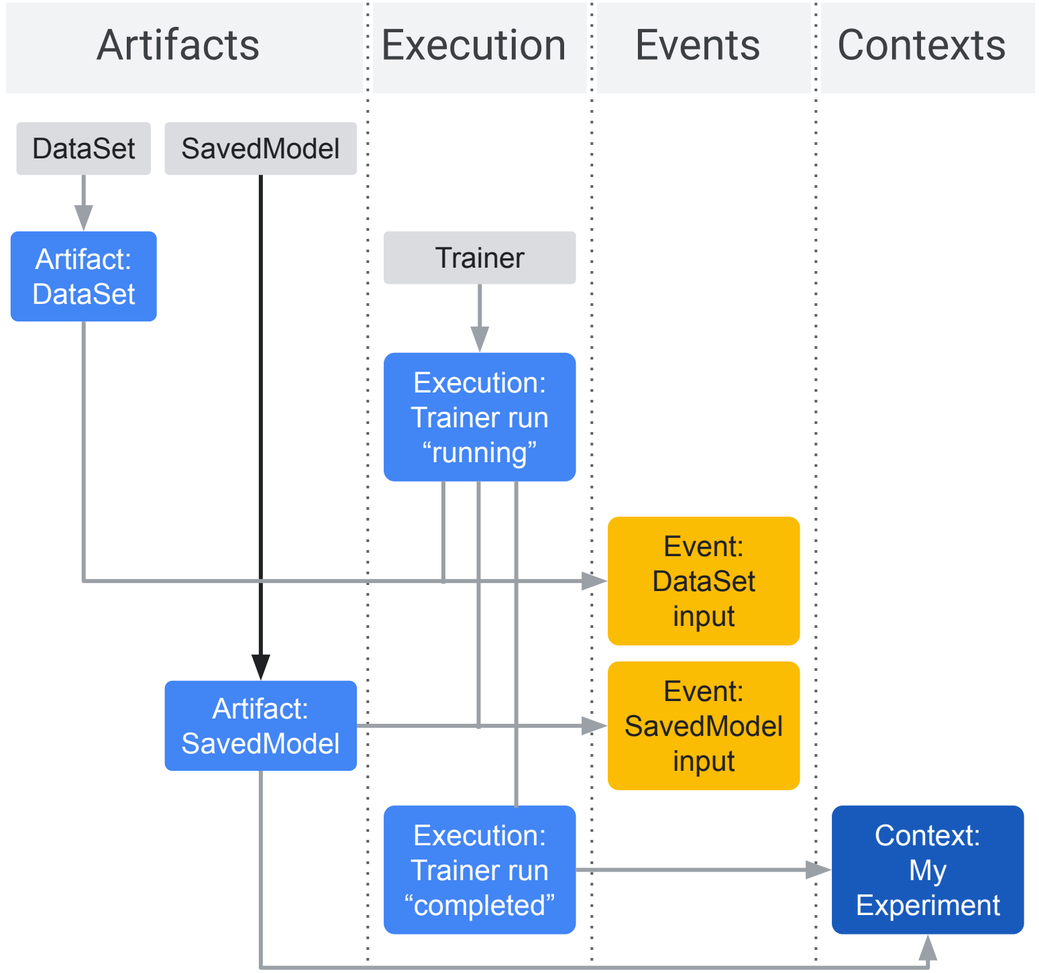

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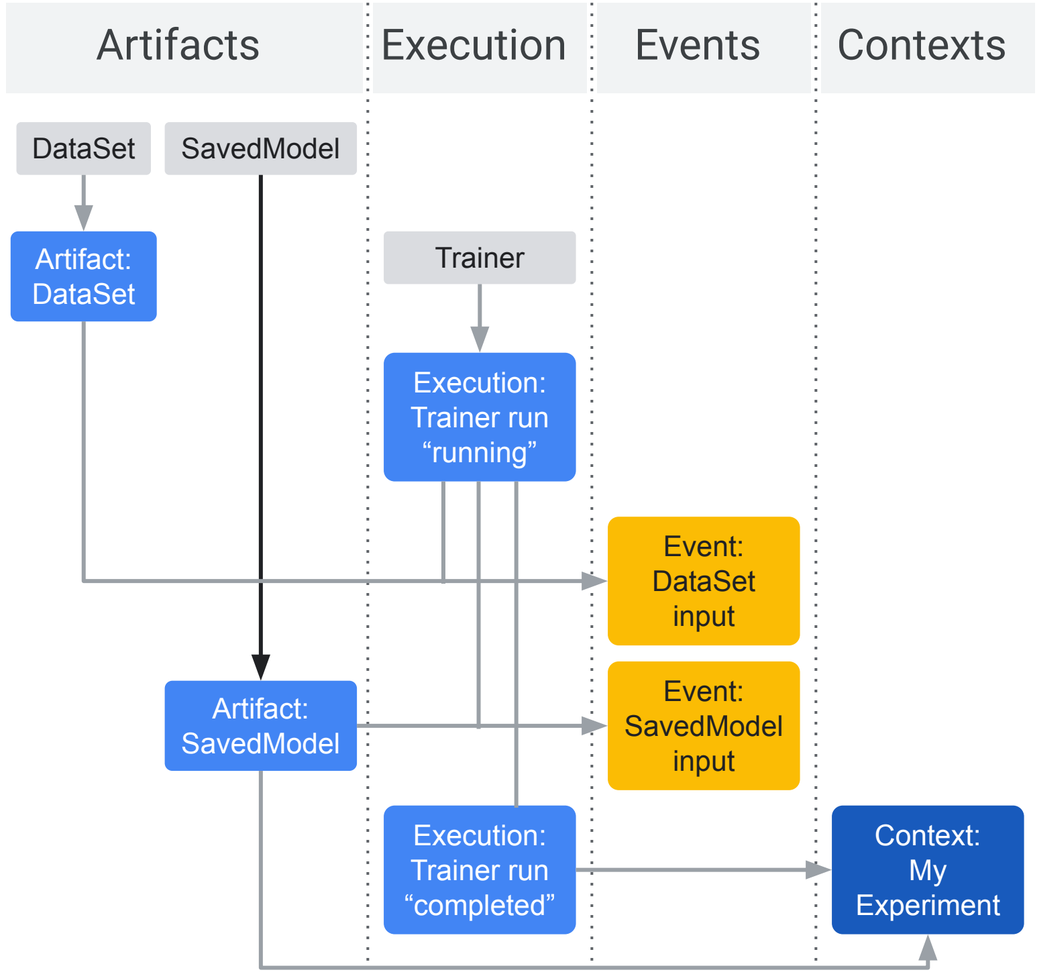
6. Train Model and Create SavedModel Artifact.
7. Write SavedModel and record output event.



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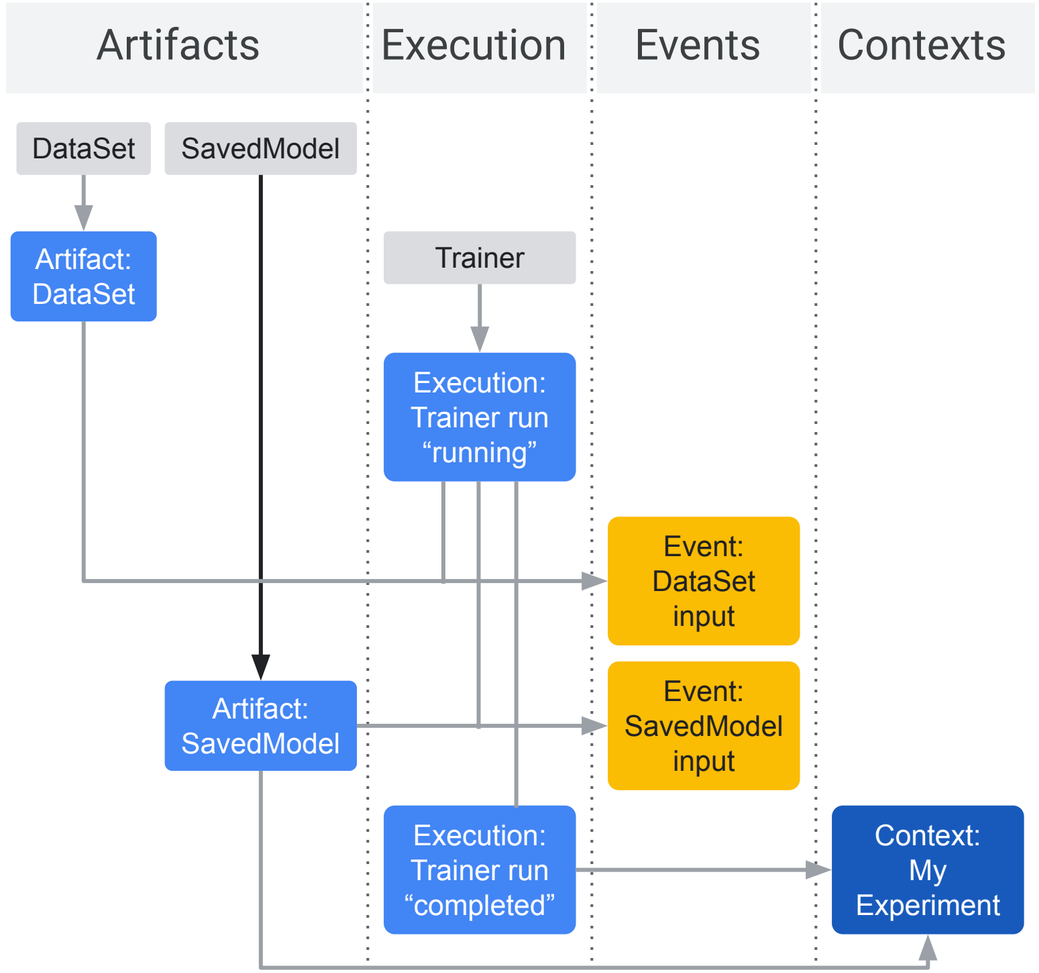

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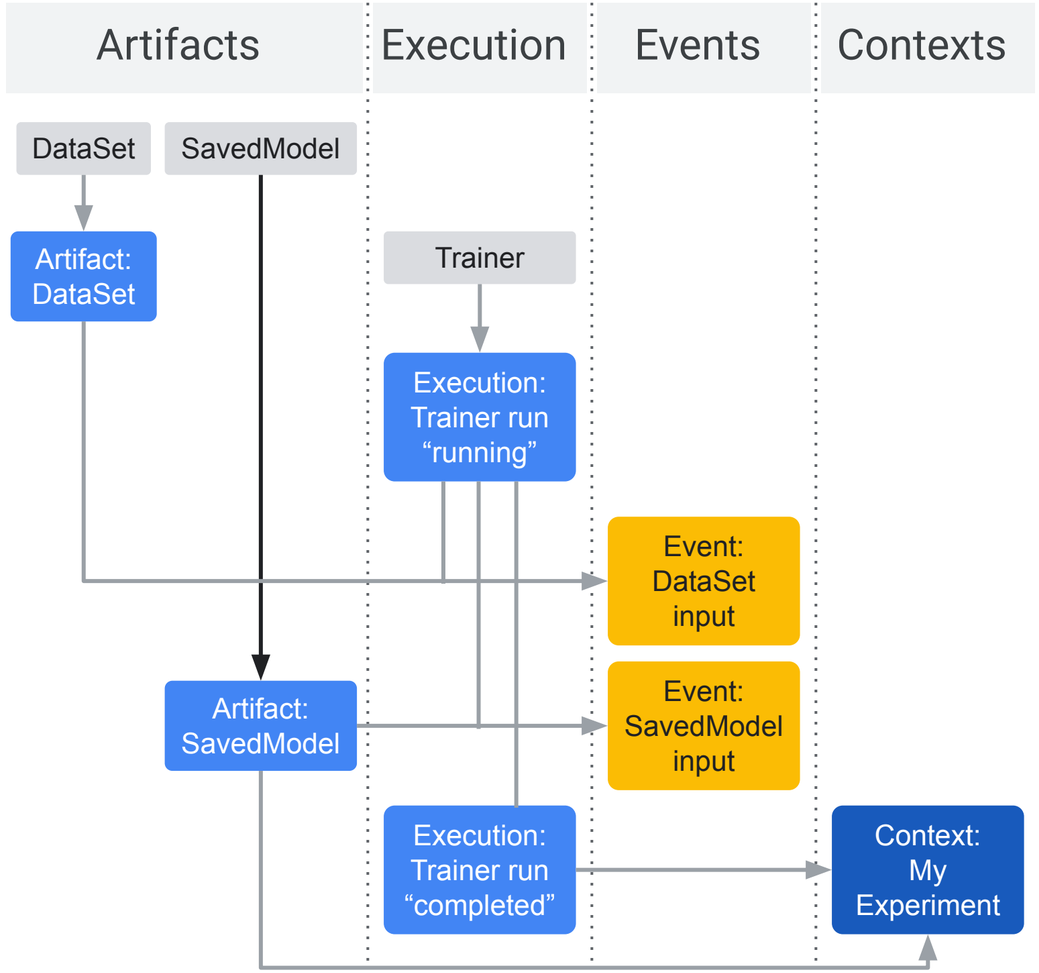
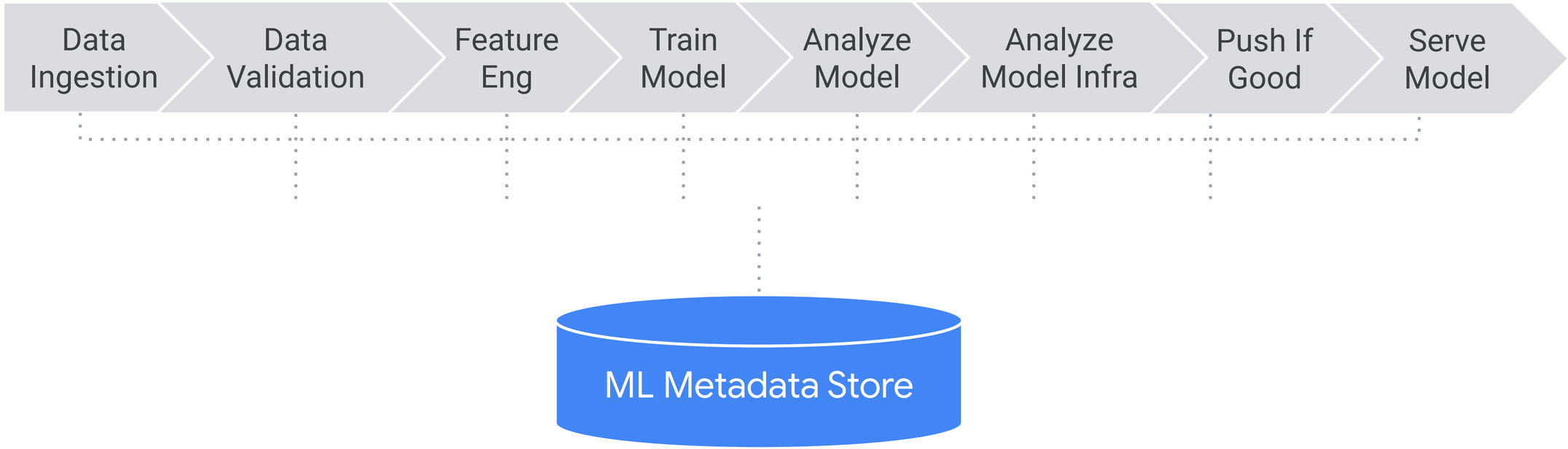
9. Annotate the experiment with a Context.



Metadata enables TFX task and data-aware pipelines



Lab

TFX Pipeline Metadata

Google Cloud