RAPIDS

21.08 Release

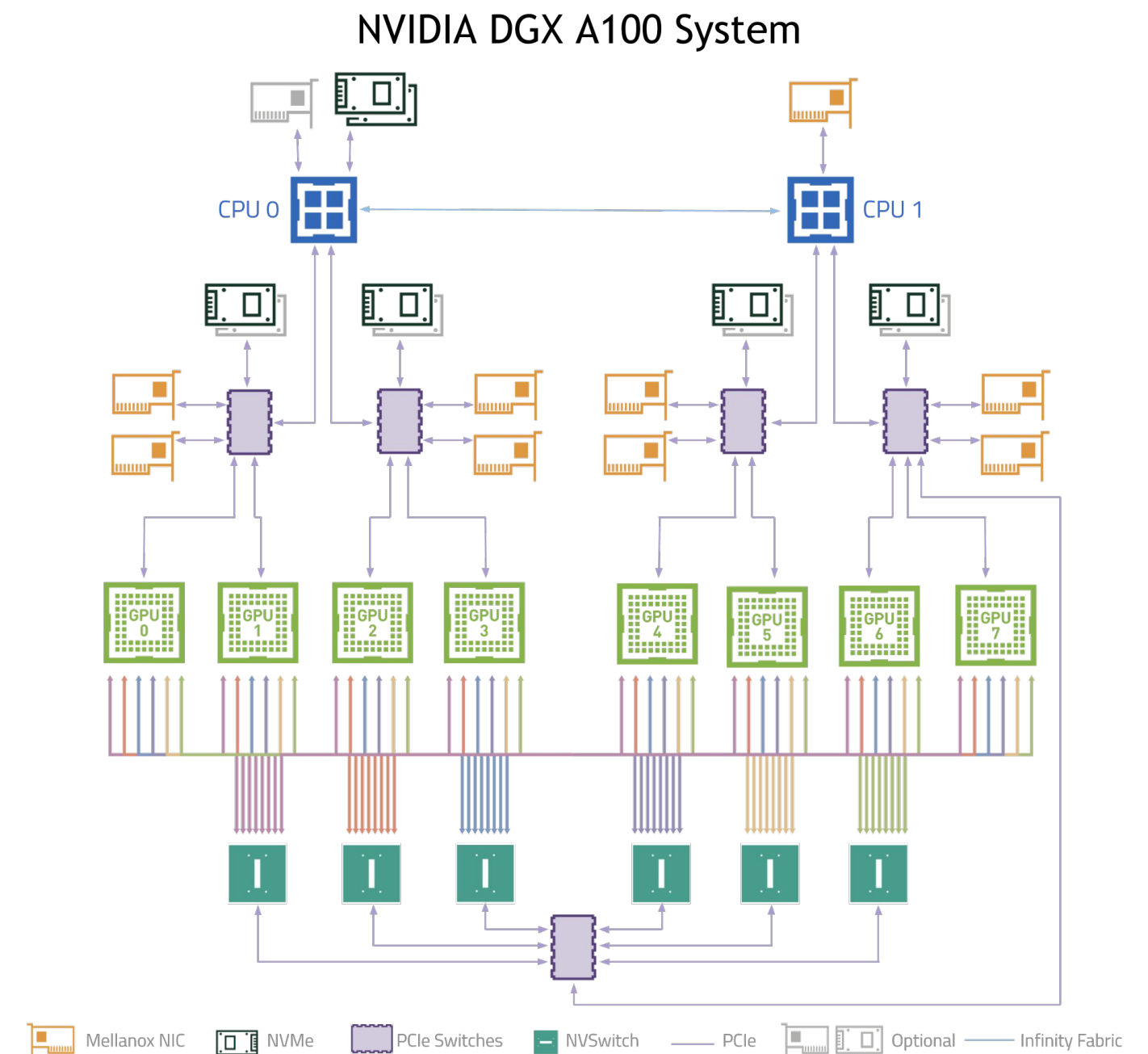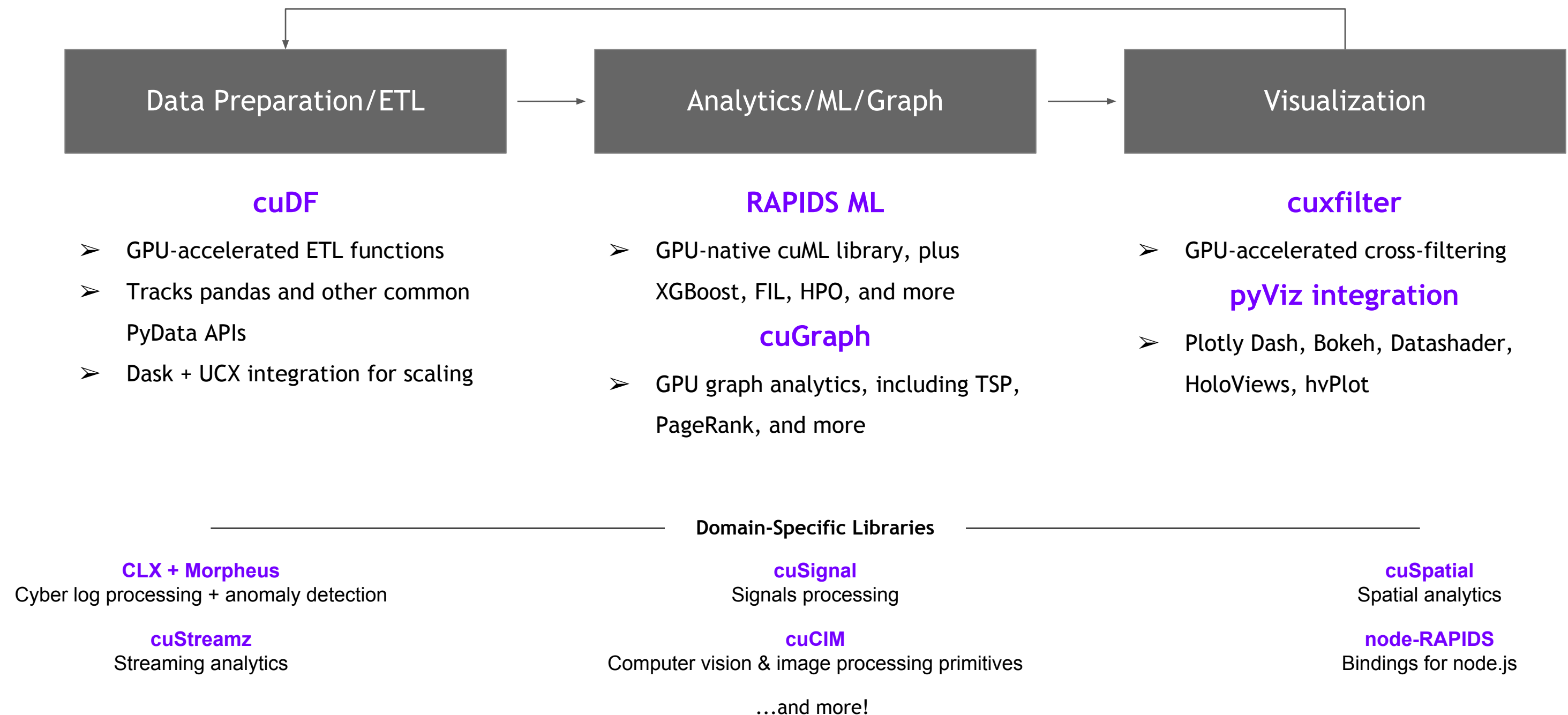# Why GPUs for Data Science?
Numerous hardware advantages

- ▸ Thousands of cores with up to ~20 TeraFlops of general purpose compute performance
- ▸ Up to 1.5 TB/s of memory bandwidth
- ▸ Hardware interconnects for up to 600 GB/s bidirectional GPU <--> GPU bandwidth
- ▸ Can scale up to 16x GPUs in a single node

Almost never run out of compute relative to memory bandwidth!

NVIDIA DGX A100 System

CPU 0   CPU 1

GPU 0 GPU 1 GPU 2 GPU 3 GPU 4 GPU 5 GPU 6 GPU 7

Mellanox NIC   NVMe   PCIe Switches   NVSwitch   PCIe   Optional   Infinity Fabric

What is RAPIDS?
End-to-End GPU Accelerated Data Science

Data Preparation/ETL	Analytics/ML/Graph	Visualization

cuDF

➢ GPU-accelerated ETL functions

➢ Tracks pandas and other common PyData APIs

➢ Dask + UCX integration for scaling

RAPIDS ML

➢ GPU-native cuML library, plus XGBoost, FIL, HPO, and more

cuGraph

➢ GPU graph analytics, including TSP, PageRank, and more

cuxfilter

➢ GPU-accelerated cross-filtering

pyViz integration

➢ Plotly Dash, Bokeh, Datashader, HoloViews, hvPlot

Domain-Specific Libraries

CLX + Morpheus
Cyber log processing + anomaly detection

cuSignal
Signals processing

cuSpatial
Spatial analytics

cuStreamz
Streaming analytics

cuCIM
Computer vision & image processing primitives

node-RAPIDS
Bindings for node.js

…and more!

Overview of Changes: RAPIDS 21.08 Release

▶ **cuDF** Decimal support for CSV reader, functionality to convert dataframe to struct series; fillna added to groupby; supports multiple inputs in JSON and ORC reader; list read and write support for ORC; experimental read support for structs in ORC; experimental support for null in UDFs for Python;

▶ **cuML** New Bernoulli Naive Bayes model; improvements to HDBSCAN, ARIMA, FIL and Random Forest; new weighted multi-node multi-gpu KMeans algorithm; new distances added to pairwise_distances;

▶ **cuGraph** Doubly Compressed Sparse Row and Doubly Compressed Sparse Column support added to libcugraph; graph batching for C++; epsilon parameter added to Hungarian algorithm; continued improving graph primitives for performance; depth limit functionality on traversal algorithms; Enhanced multi-gpu scaling

▶ **CLX** Maintenance to existing code; working through including CLX use cases in Morpheus

▶ **cuCIM** Add functionality to perform morphological thinning of a binary image

cuDF Updates: Deep Dive
Release 21.08

Features added in 21.08

- Decimal data type is now supported for csv reader function in Python
- List read and write, and experimental read support for structs in ORC
- *Read_json* supports reading multiple input files/buffers
- *Fillna* feature added to groupby
- Experimental support for handling null in UDFs for Python
- cuDF Dataframe has new functionalities for structs : *to_struct* and *explode* methods

Planned Upcoming Features

- Expanded support for additional decimal types
- Enhanced ORC struct and map support
- Conditional equijoins support in libcudf

cuML Updates: Deep Dive
Release 21.08

Features added in 21.08

▸ Single-GPU implementation of _Bernoulli Naive Bayes_ algorithm

▸ Added support for chebyshev, canberra, hellinger and minkowski distances for _pairwise distance_ calculations

▸ Vector leaf prediction and significant improvements and optimizations to the _Forest Inference Library_ (_FIL_)

▸ _GTIL_ (_General Tree Inference Library_) for CPU inference was introduced to the _FIL_ backend for _Triton_

▸ Multiple improvements to the new _Random Forest_ backend to optimize memory and performance.

▸ Add weighted _KMeans_ sampling for _KernelSHAP_

▸ Support for weighted sampling in the multi-node multi-gpu _KMeans_ algorithm

▸ Many more model-specific improvements and bug fixes: _ARIMA_ memory improvements, dtype conversion optimization for _FIL_, multiple _HDBSCAN_ improvements ...

Planned Upcoming Features

▸ Categorical features support in _FIL_

▸ Support for missing observations, padding and exogenous variables for _ARIMA_

▸ Single-node single-GPU implementation of _Gaussian Naive Bayes_
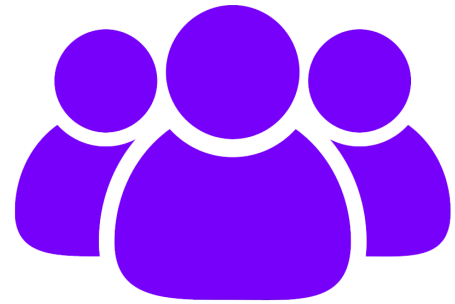
cuGraph Updates: Deep Dive
Release 21.08

Features added in 21.08

- *Doubly Compressed Sparse Row and Doubly Compressed Sparse Column* support added to libcugraph
- *Epsilon* parameter is now supported in the *Hungarian* algorithm
- Random Walk updated to improve performance
- Resolve tech debt and enhance the library
- Depth limit functionality on traversal algorithms
- Addressed issues with multi-gpu scaling
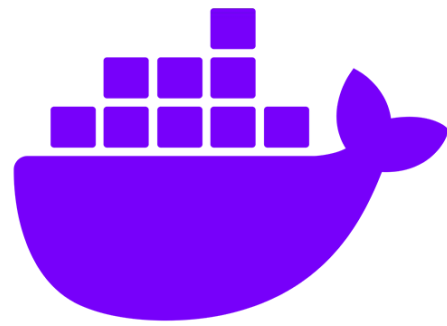
Planned Upcoming Features

- *Biased Random Walk*
- *Multi-Seed Breadth First Search*
- *Multi-GPU Triangle Counting*
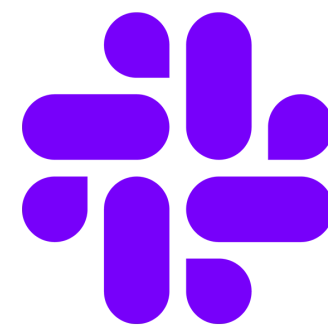- *Multi-GPU HITS*

Join the Conversation

GOOGLE GROUPS
https://groups.google.com/forum/#!forum/rapidsai

DOCKER HUB
https://hub.docker.com/r/rapidsai/rapidsai

SLACK CHANNEL
https://rapids-goai.slack.com/join

STACK OVERFLOW
https://stackoverflow.com/tags/rapids

THANK YOU

@RAPIDSai

RAPIDS