ADD: Application and Data-Driven Controller Design

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1. Motivation and Problems

- Network composition is becoming more heterogeneous.
- SDN apps need fine-grained visibility to provide service customization and support network slicing.

However, collecting data with existing controllers means:

1. Apps independently & continuously interact w/ devices.
2. Apps maintain their own copies of collected data.
3. App logic is tightly coupled w/ specific devices/protocols.

=> redundant data retrieval & storage => unscalable

How can we enable general and efficient data access for SDN applications?

2. Approach

Decouple application logic from network data retrieval and storage

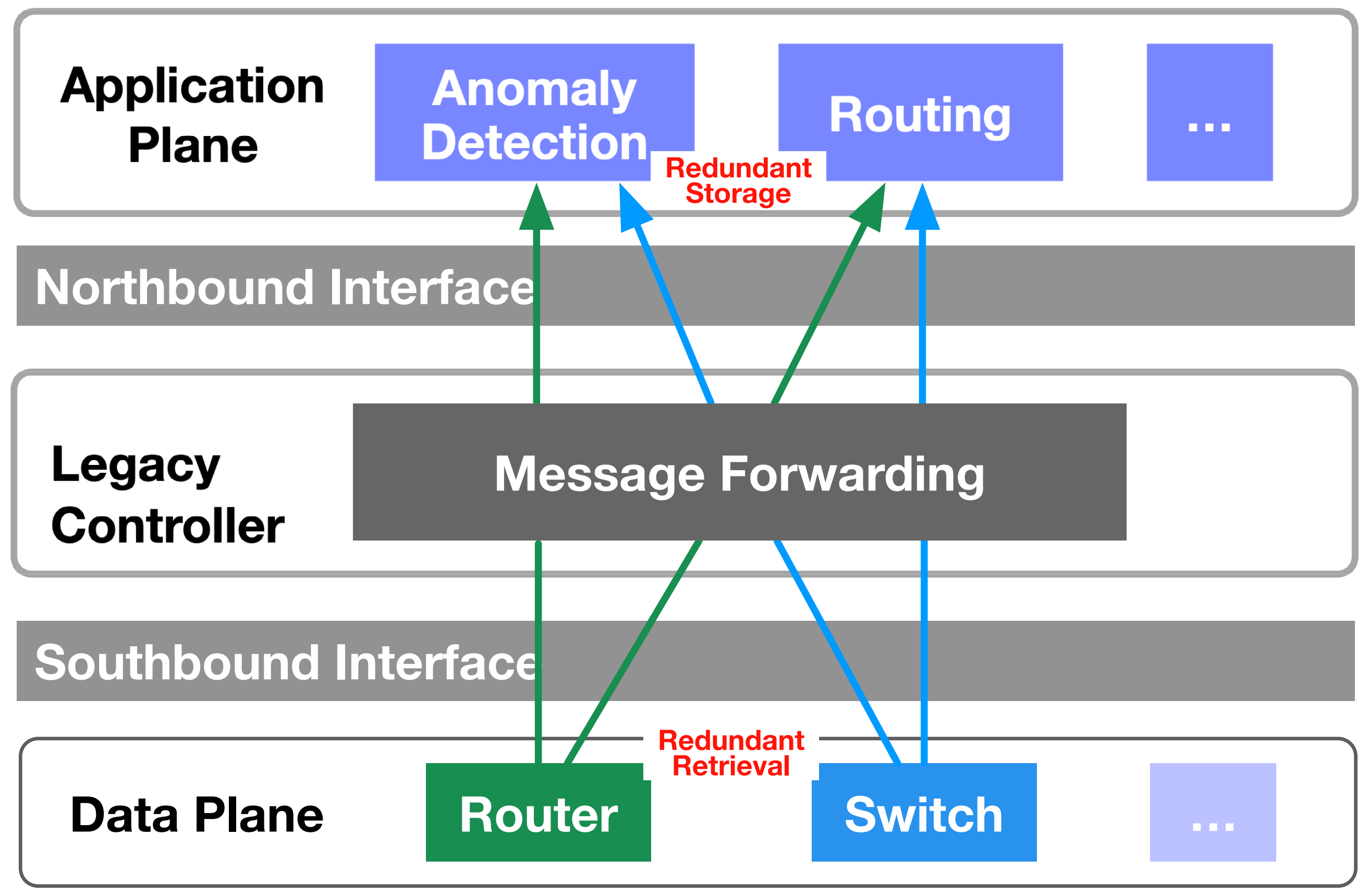
- Consolidates requests to eliminate redundant retrieval
- (Logically) centralizes data storage to eliminate redundant storage
- Uniform encoding of data across different sources to allow generic interface designs

Implications:

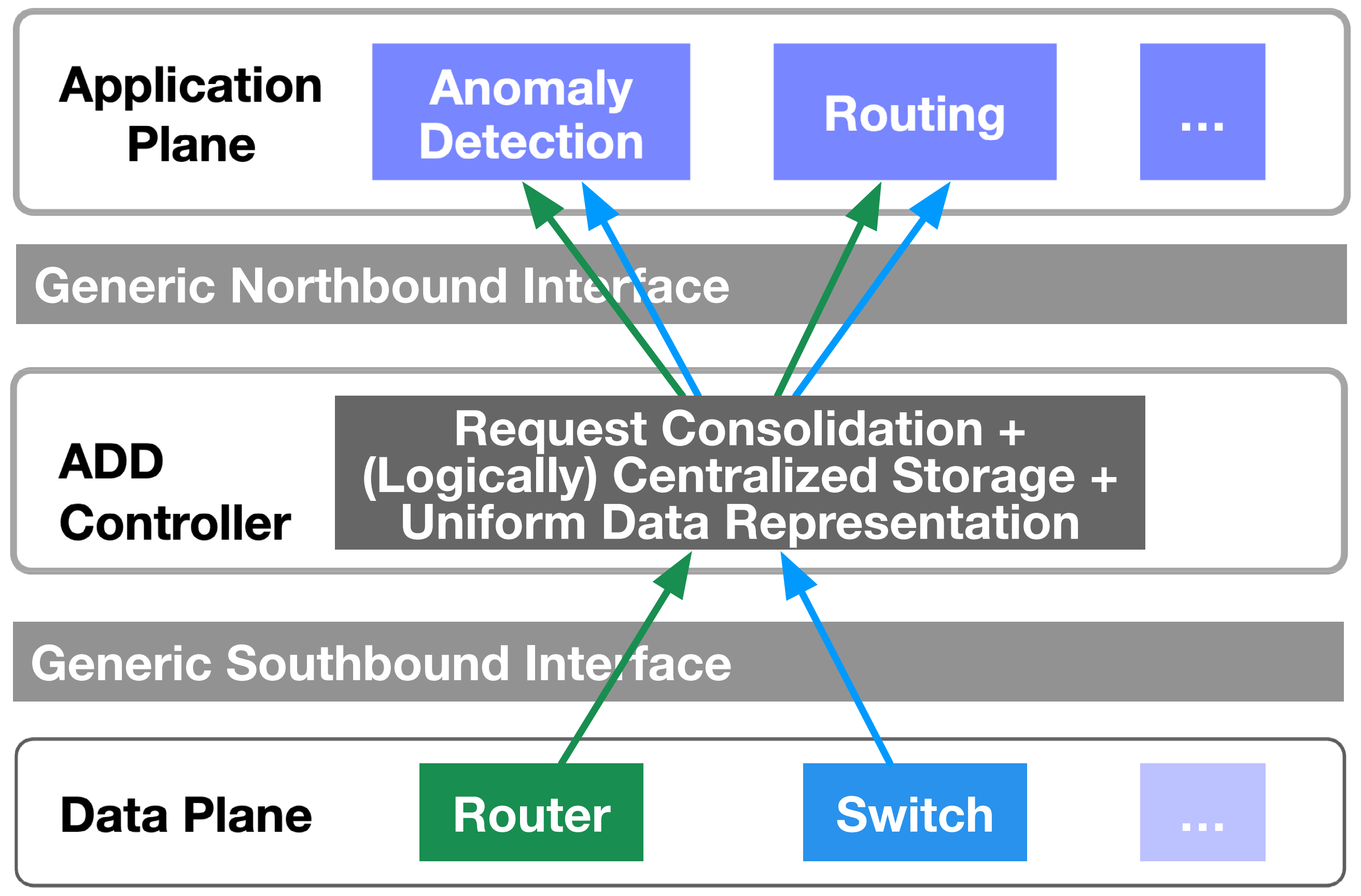
1. Applications focus on “what data are needed” and “what to do with them”.
2. Uniform programming model: apps subscribe to both events and data.

3. System Design

- Applications register their data interests (what to collect) with ADD.
- ADD collects and stores data automatically.
- Applications subscribe to data/events and react as programmed.



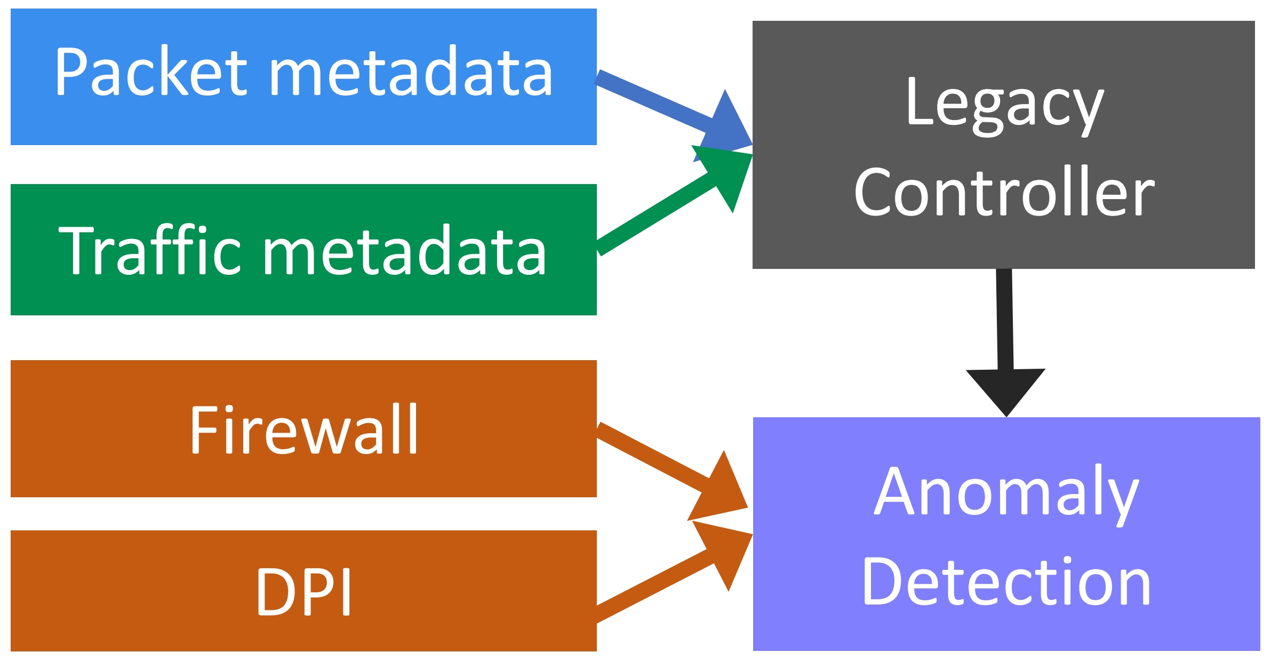
Data Flow of a Legacy SDN Controller


Application Plane
Anomaly Detection
Routing
...
Generic Northbound Interface
ADD Controller
Request Consolidation + (Logically) Centralized Storage + Uniform Data Representation
Generic Southbound Interface
Data Plane
Router
Switch
...

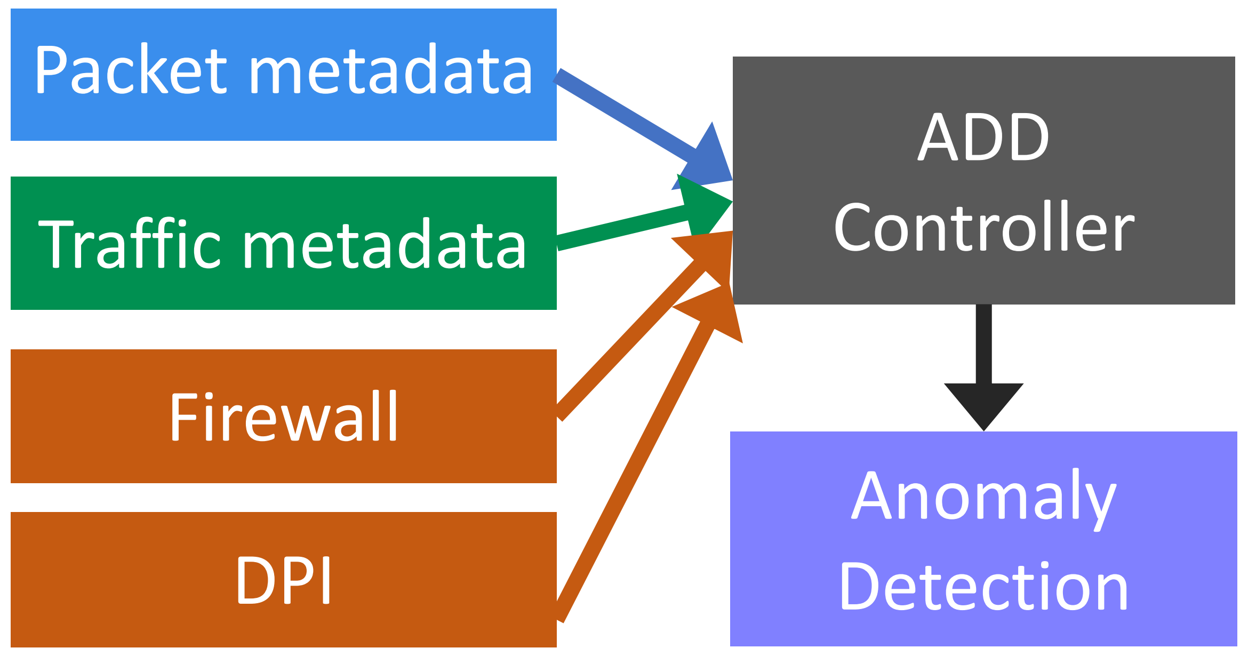
Data Flow of an ADD Controller

4. Use case – Anomaly Detection

- With ADD, an anomaly detection app can easily utilize data from different sources.
- Application logic and data retrieval are completely decoupled.
- Our prototype anomaly detection app based on ADD can detect anomalies 30+ seconds faster than a comparable commercial program (more details in the paper).



Programming Model w/ Legacy Controller



Programming Model w/ ADD Controller