

# Extending the Software-Defined Network Boundary

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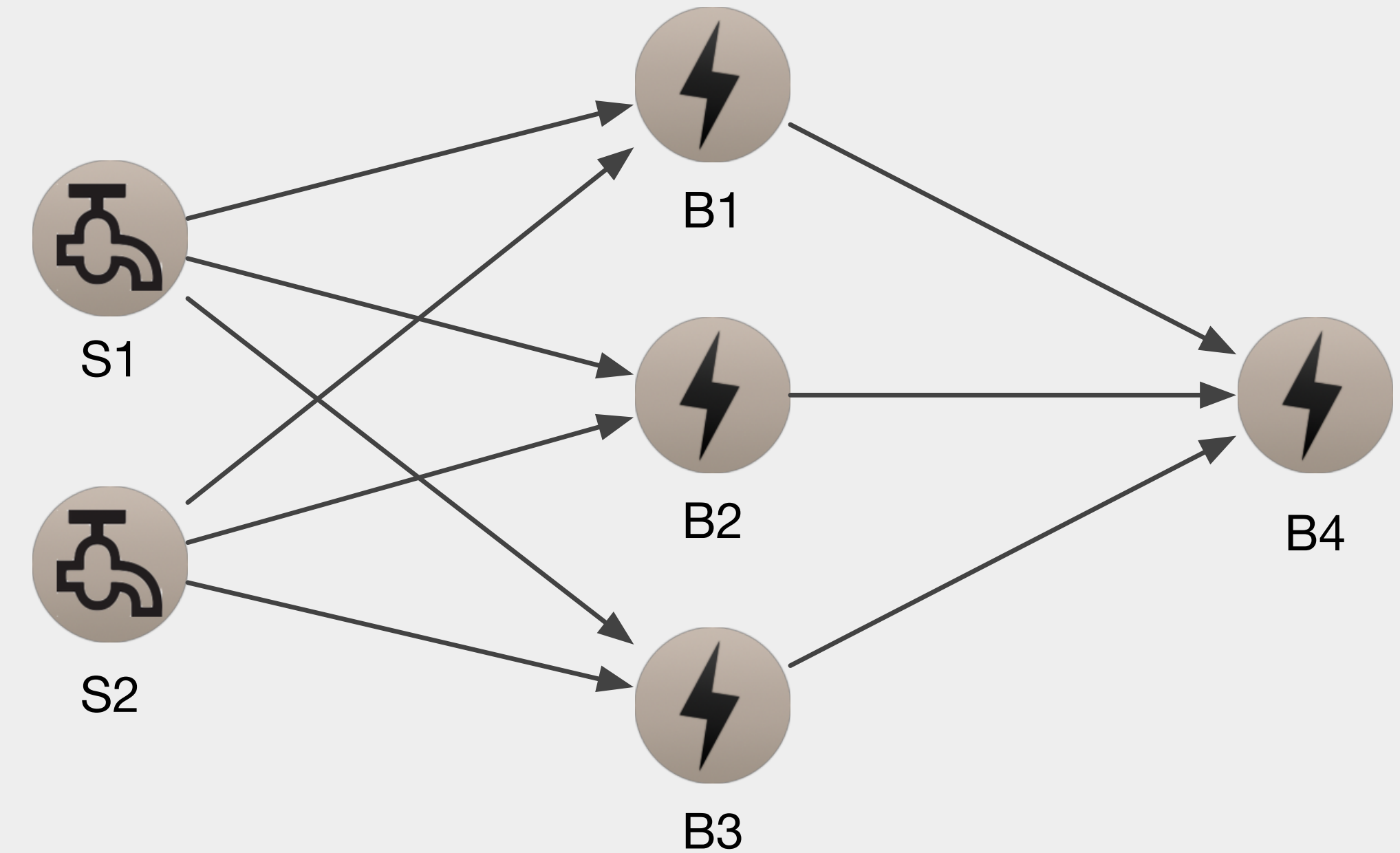
## Intra-Application Networks

Applications often implement custom internal, intra-application networks with responsibilities very similar to traditional networks.

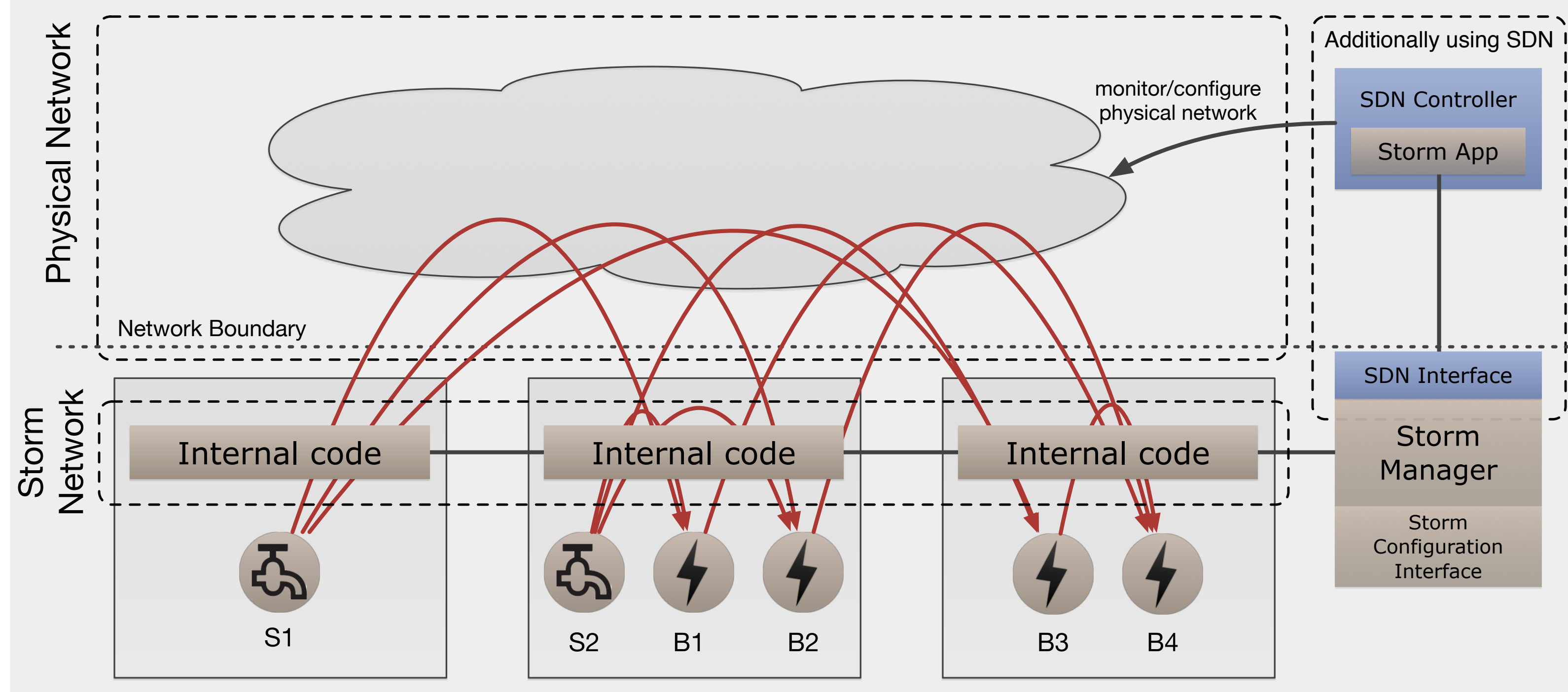
Especially stream processing systems:

- ▶ Real-time Analytics (e.g. Storm, Samza, S4)
- ▶ Sensor Network Systems (e.g. DataTurbine)
- ▶ Network Processing (e.g. NFV, Click)

## Example Processing Topology in Storm



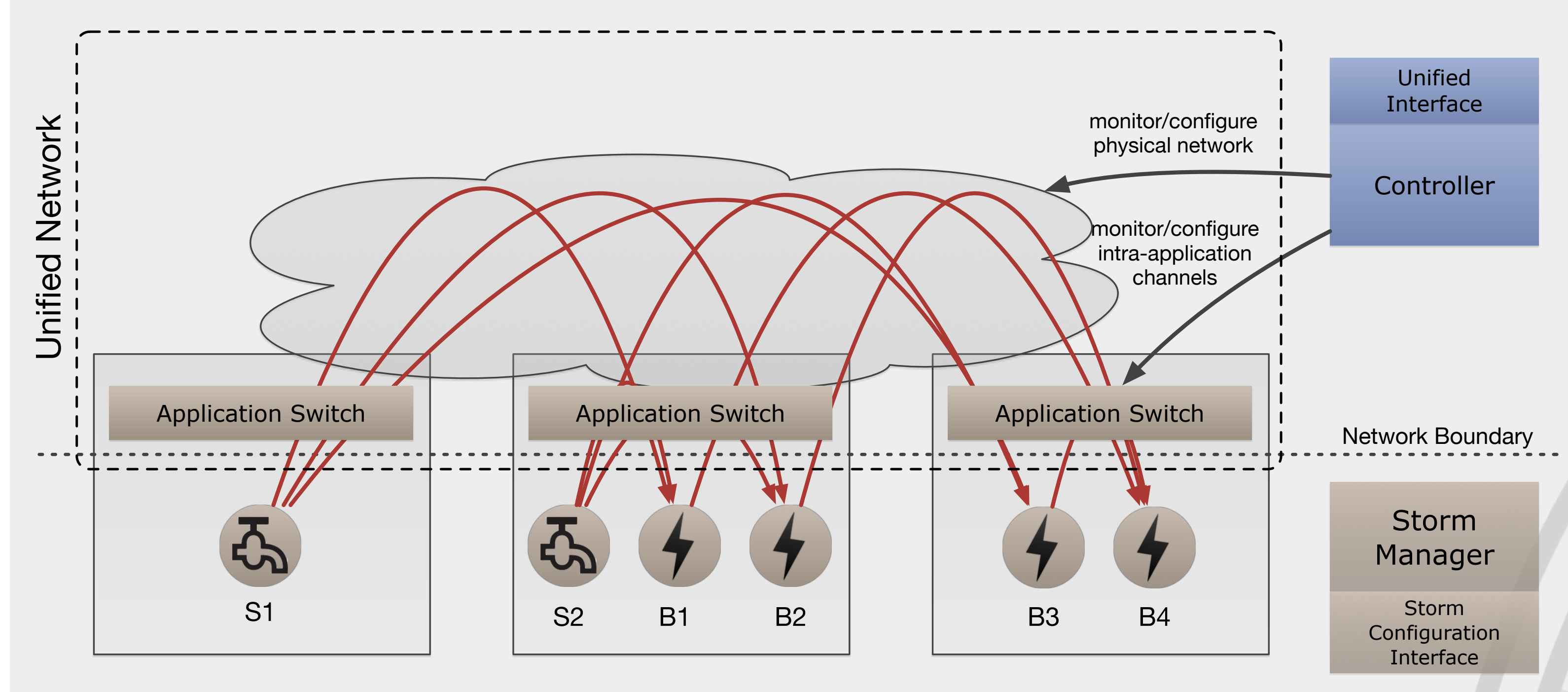
## Today: Two Separate Networks with Different Control Interfaces



### Complexity/Flexibility Tradeoff:

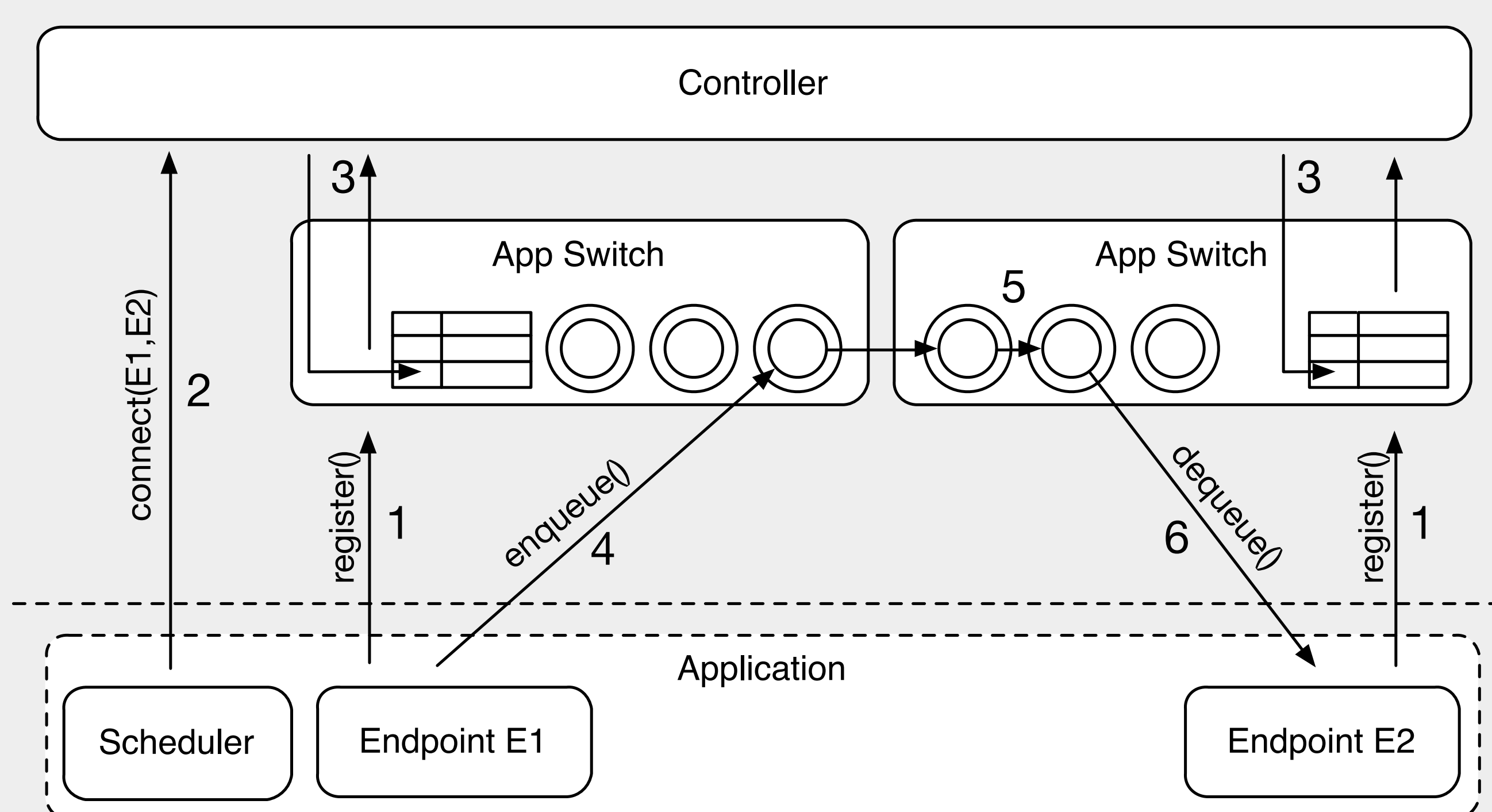
- ▶ Flexibility problems in current implementations
- ▶ e.g. Rebalancing in Storm
- ▶ e.g. Click graphs local to a single machine
- ▶ Possible to get around some of these issues with additional patches (increased complexity) but nonuniversal solution

## A Unified Network: Push the SDN-Controlled Network into the Application Layer



- ▶ Free applications from network management tasks
  - ▶ When network functionality is extended all applications benefit from it
  - ▶ Revisits the question of a new network interface
  - ▶ Initial attempt is implemented in our prototype
- SDN is an enabling technology

## Prototype/Application Integration



- ▶ Prototype controller and application switch leveraging Linux D-Bus technology
- ▶ Integration into two existing systems
- ▶ Storm stream processing framework through custom processing elements
- ▶ Click modular router through custom source and sink Click elements