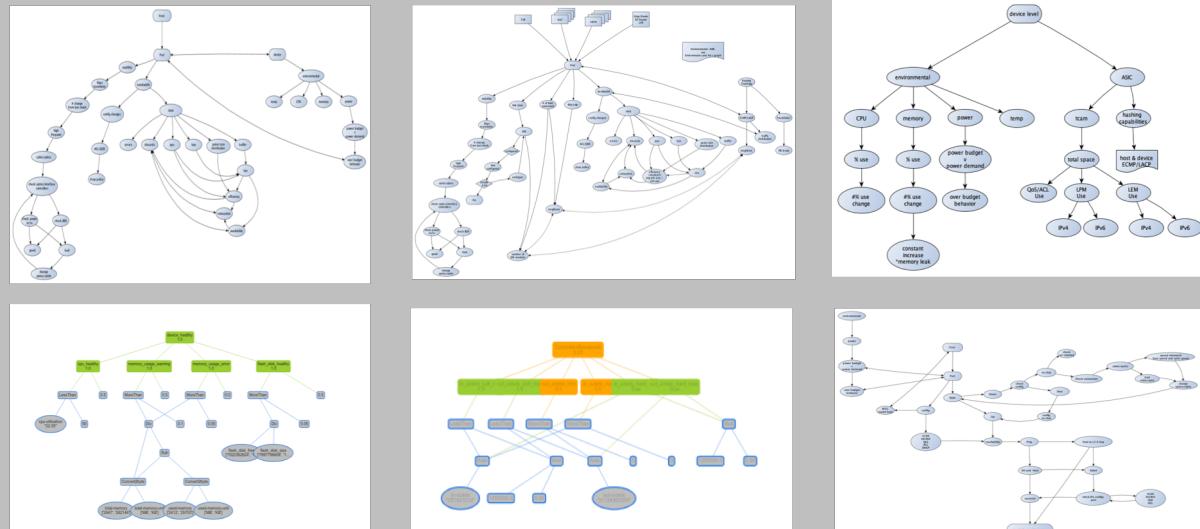


Context and Dependency Awareness of Data and Control Plane Relationship

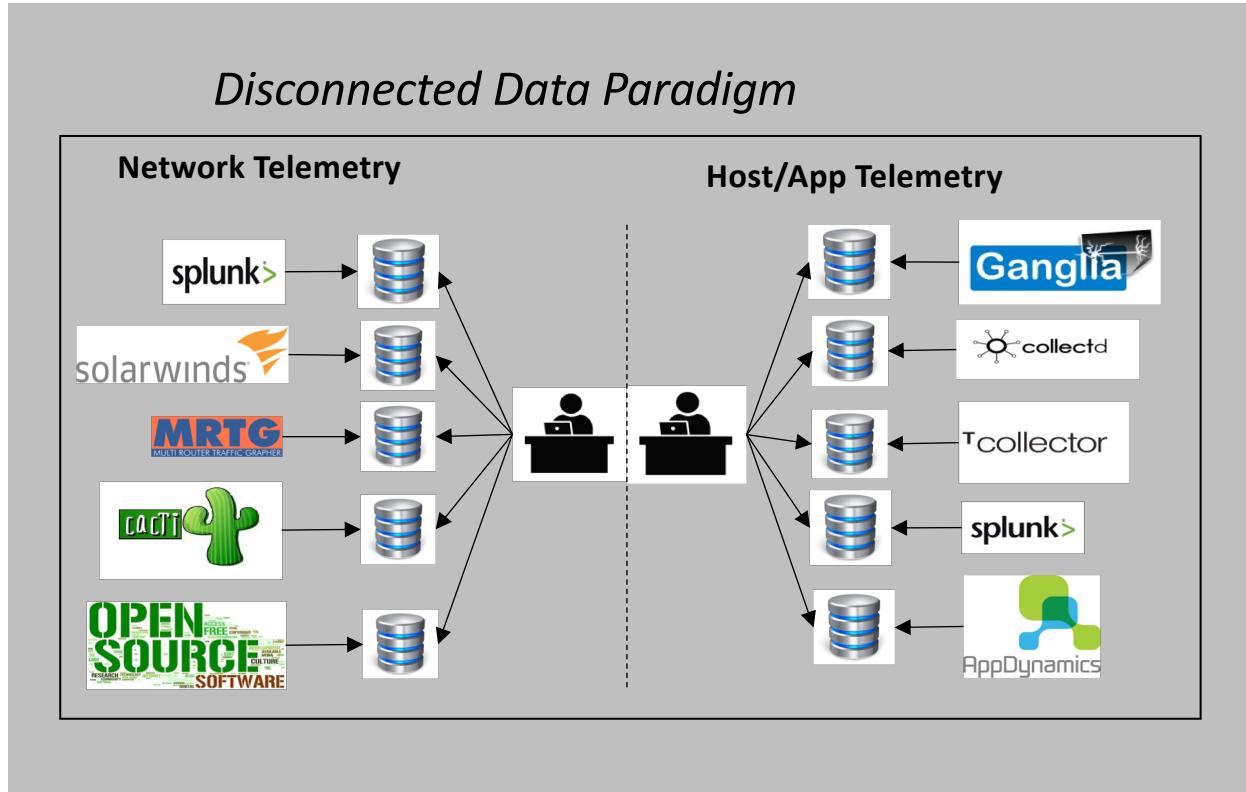
AI Net 2019

Complexity in operations and data drives behavior

Operational Workflows



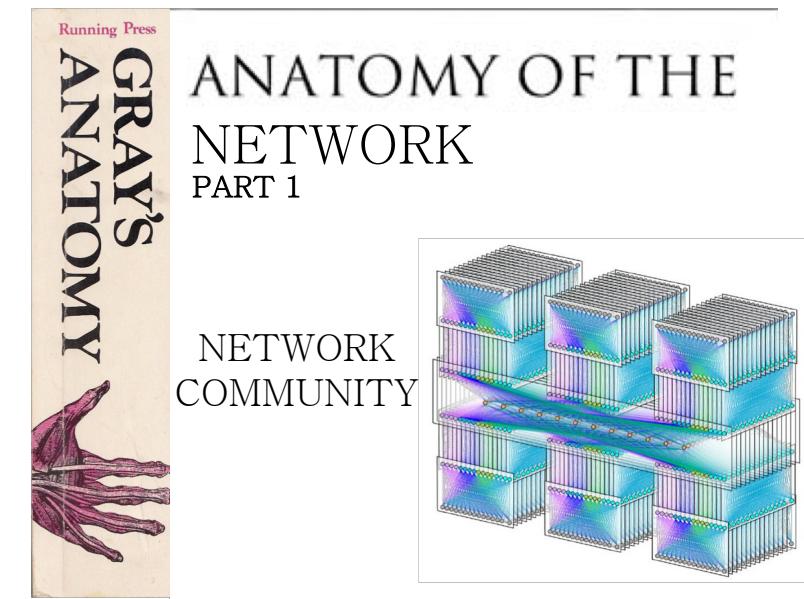
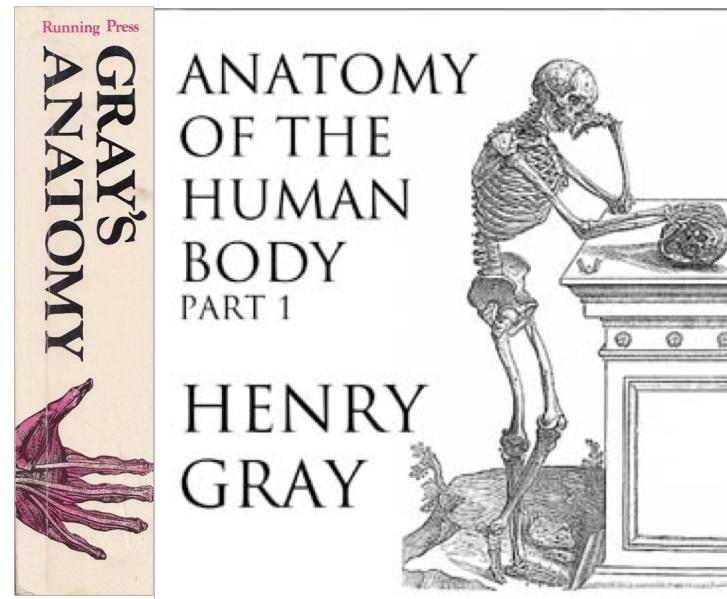
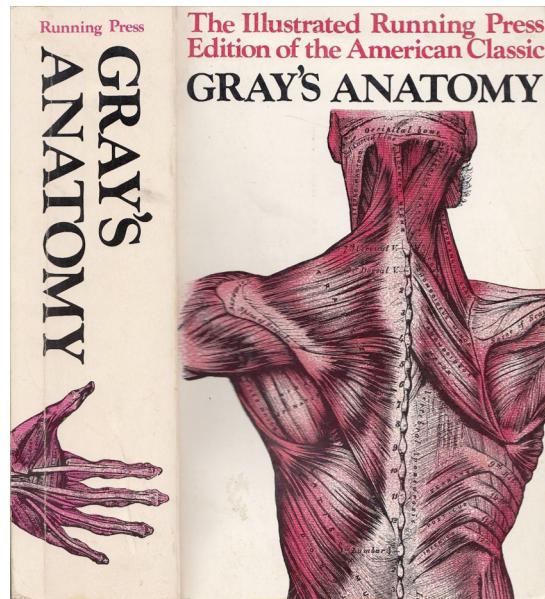
Disconnected Data Paradigm



Univariate -> multivariate

- Single value -> stream
 - If $x > \text{delta}$? (threshold approach, delta can be time dependent?)
 - $[x_1, x_2, x_3, x_4, x_5, \dots]$, does $[x_4, x_5, \dots]$ start to demonstrate a different pattern?
- Univariate -> multivariate
 - $[x_1, x_3, x_3, x_4, x_5, \dots]$
 - $[(x_1, y_1, z_1), (x_2, y_2, z_2), (x_3, y_3, z_3), (x_4, y_4, z_4), (x_5, y_5, z_5), \dots]$, are $[(x_4, y_4, z_4), (x_5, y_5, z_5), \dots]$ different from the rest?
- Single outputs -> Single reaction
 - Chasing singularities all over your universe
 - Challenges to diagnose all the symptoms of an illness, not just one.
- Multiple Outputs -> Educated/Multidimensional reaction
 - Knowing what illness/injury to treat and how it will heal all the associated symptoms

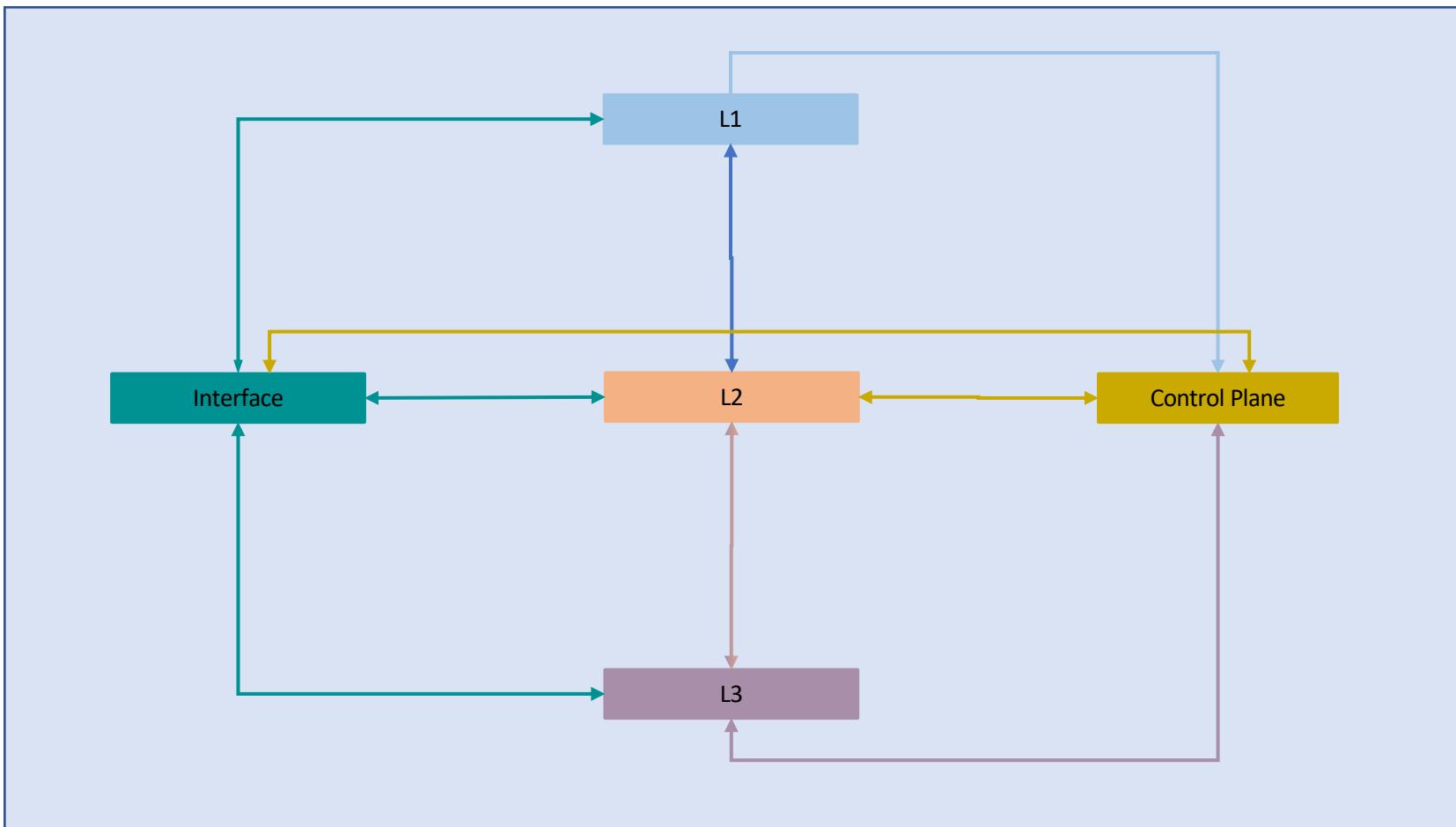
Building the Gray's Anatomy for Networks

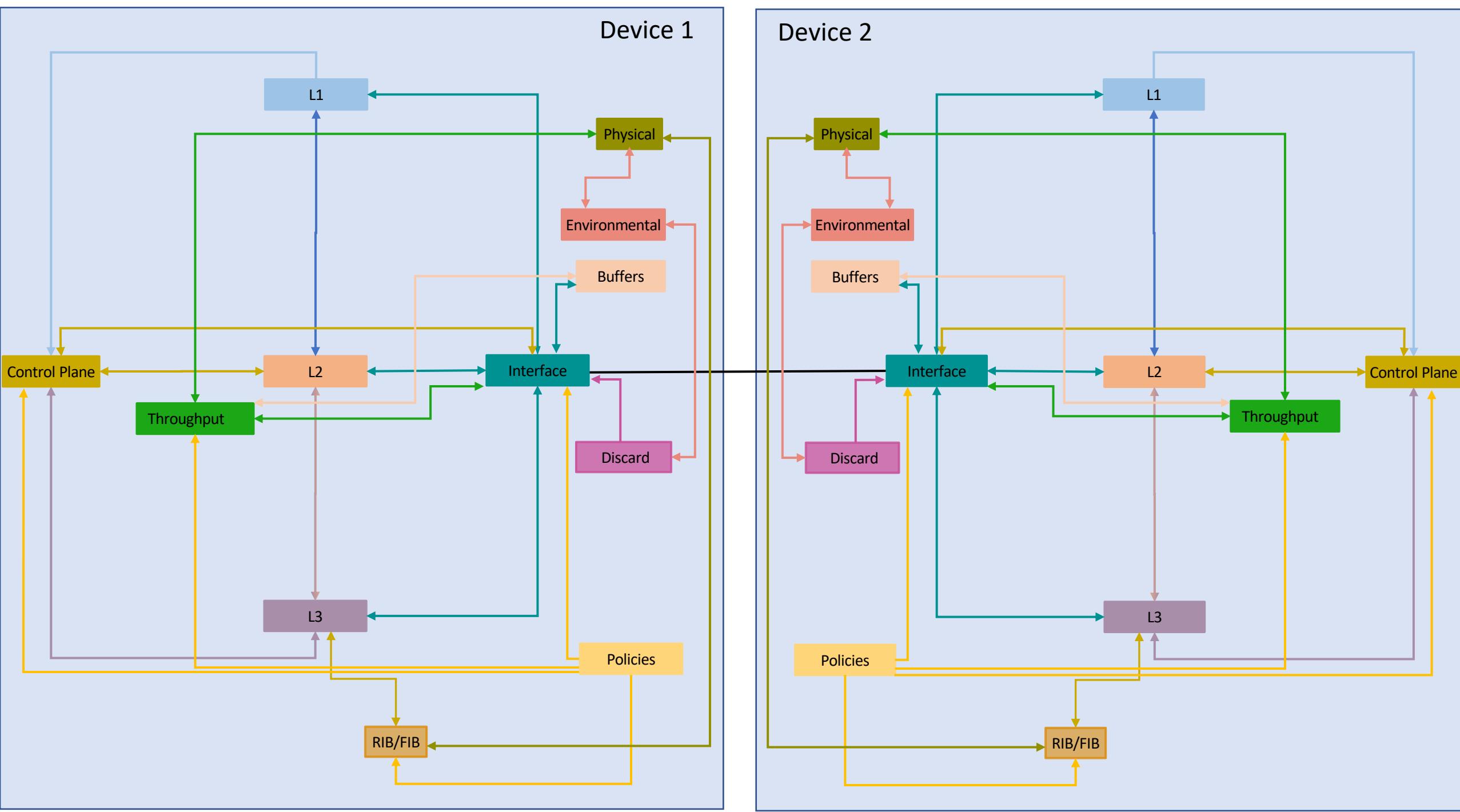


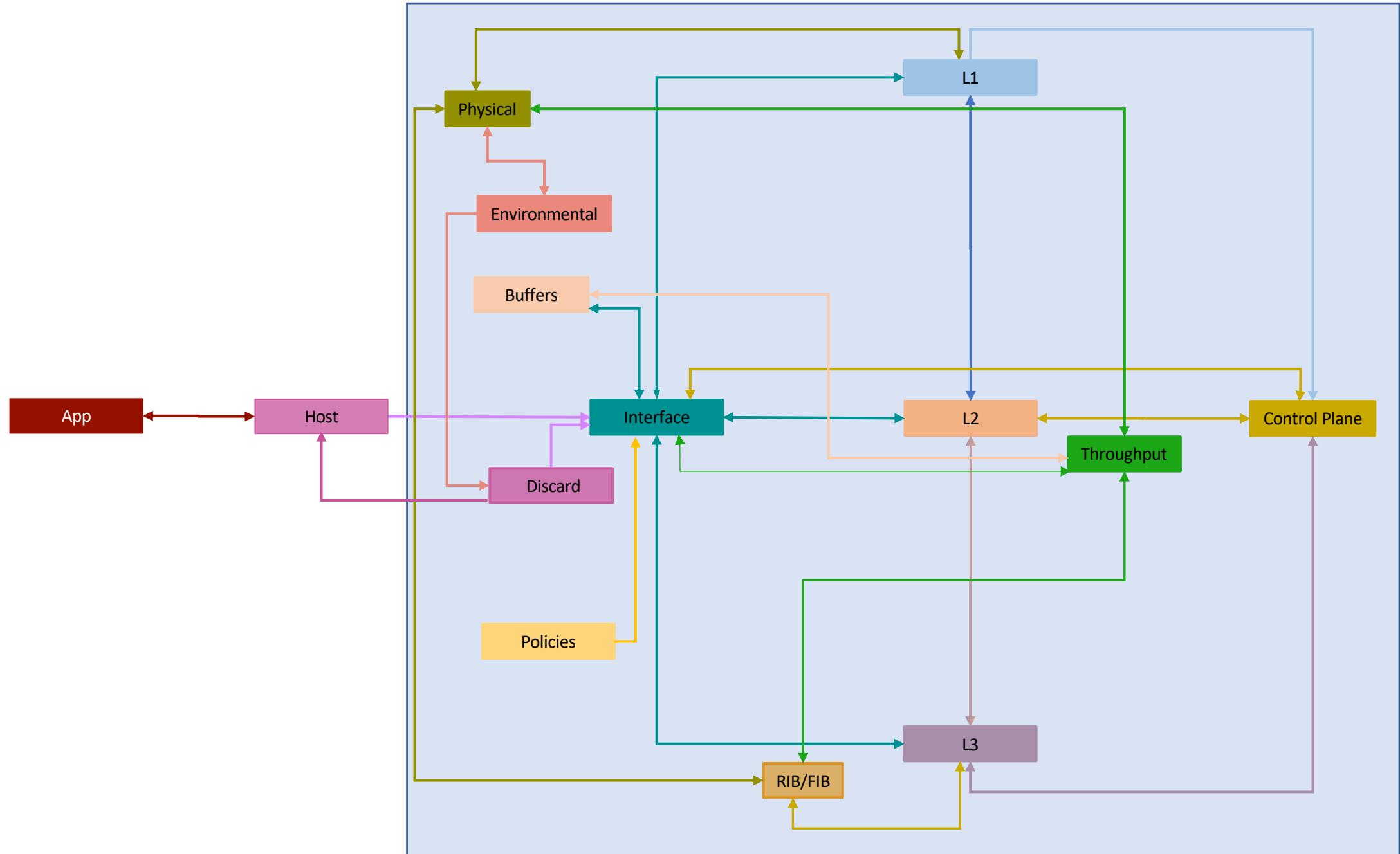
Data Types, Causal Connections and Event Vectors

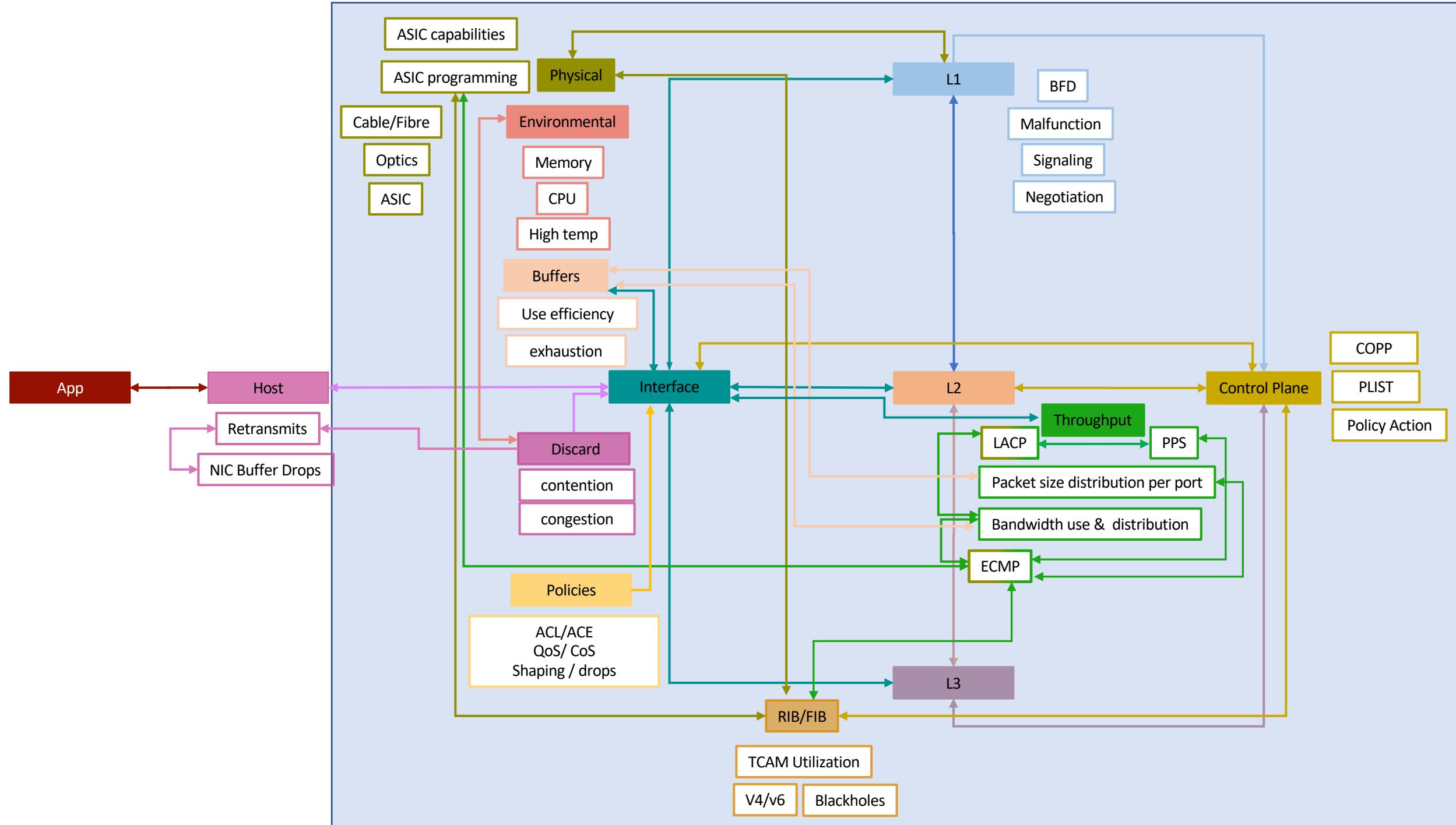
<u>State/Data Types</u>	<u>Behavioral</u>		<u>Events</u>	
Configuration	ACL / ACE	Link speed	ASIC ECC errors	Mac move
Environmental	ASIC	Link stability	BFD state change	Memory Leak
Feature	Bandwidth utilization	Maintenance windowing	Buffer starvation	MTU mismatch
Flow	Buffer utilization	Quality of service	CDP drop	Neighbor state change
Hardware	Buffer utilization efficiency	RIB/FIB consistency	CEF punts	Packet drops
Availability	Congestion	RIB/FIB utilization	DDoS	Port state change
Operational	Contention	Route convergence	Device failure	Power budget exceeded
Platform	Control plane policing	Route stability	Disk full/failure	Power supply failure
Protocol	Device environmental	Route updates	ECMP imbalance	Process failure
Routing	Device health	Router health	Fan failure	Route failure out of memory
Security	ECMP load distribution	Telemetry health	Fat fingered config	Route Flap
Compute	Flow path	Transceiver health	High CPU	Route loop
Application	Incast	Transceiver state	High fan speed	Route mis-programmed
	Interface health	Tunnel health	High temperature	Routing blackhole
	Interface state	Quality of service	Interface Errors	Telemetry failures/congestion
	LACP load distribution	RIB/FIB consistency	LACP imbalance	Transceiver power issue
	Link health		LACP member failure	Transceiver TX lane degradation
			Link failure	Tunnel/midpoint drop
			LLDP drop	

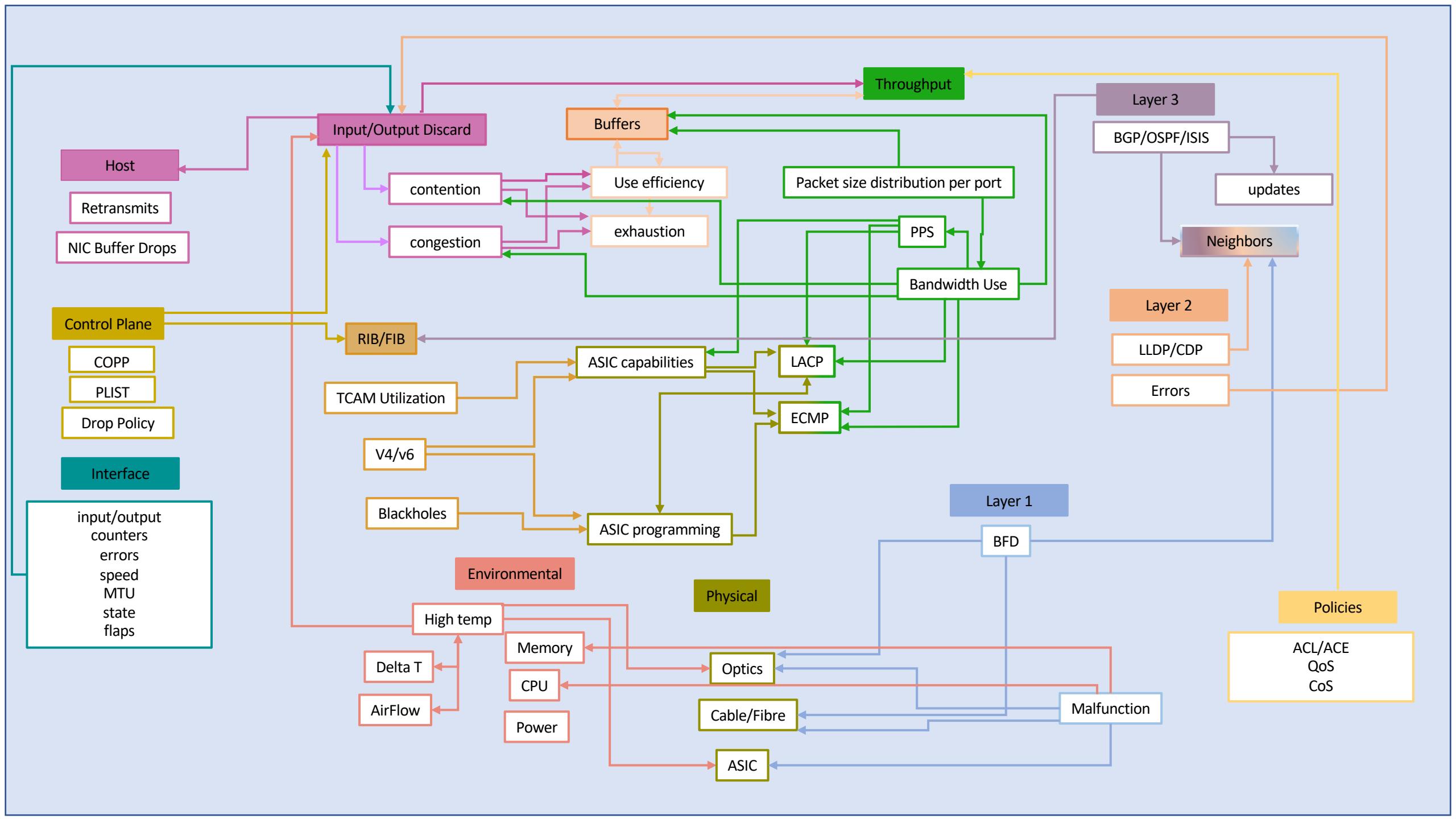
Relationships start out Simple

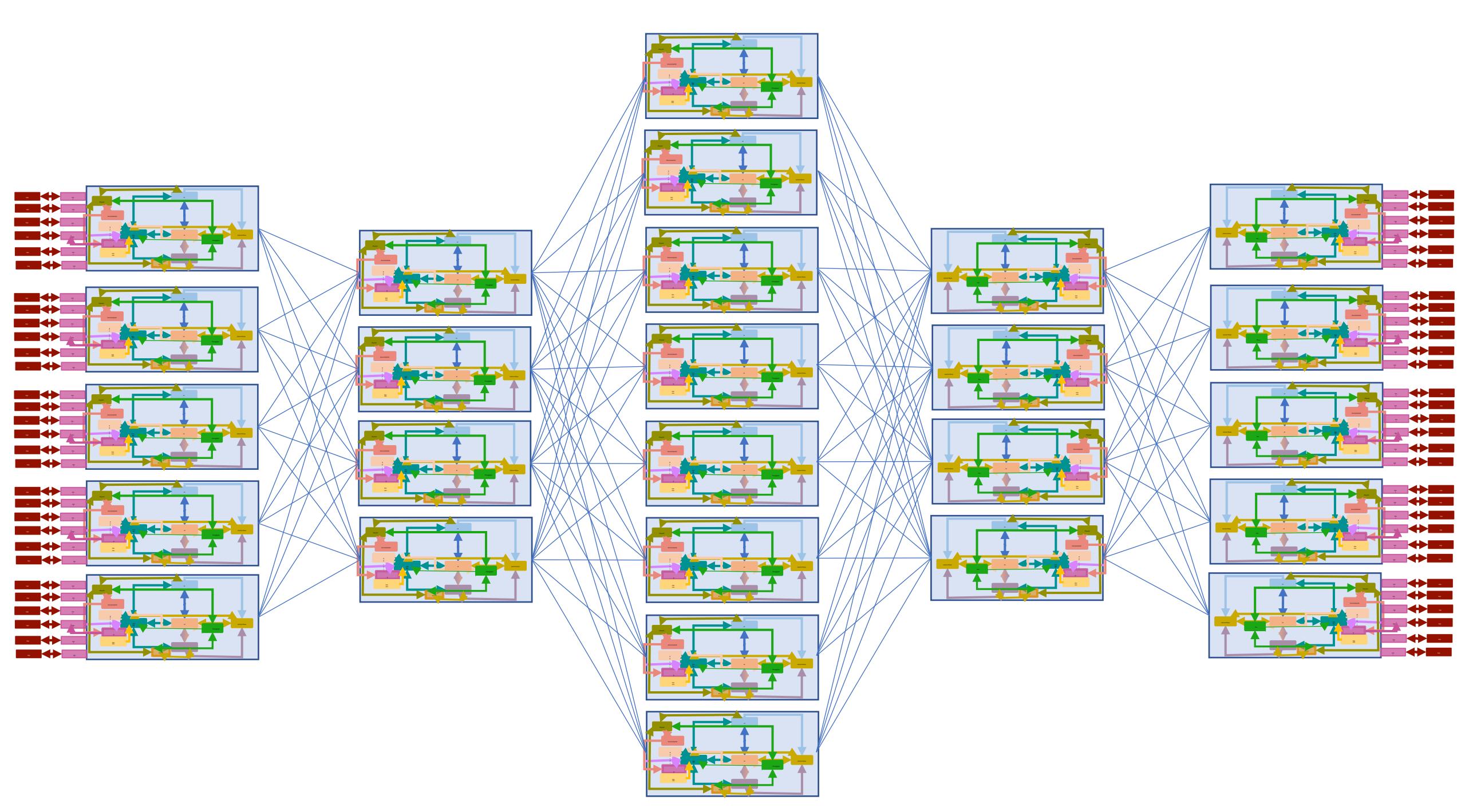




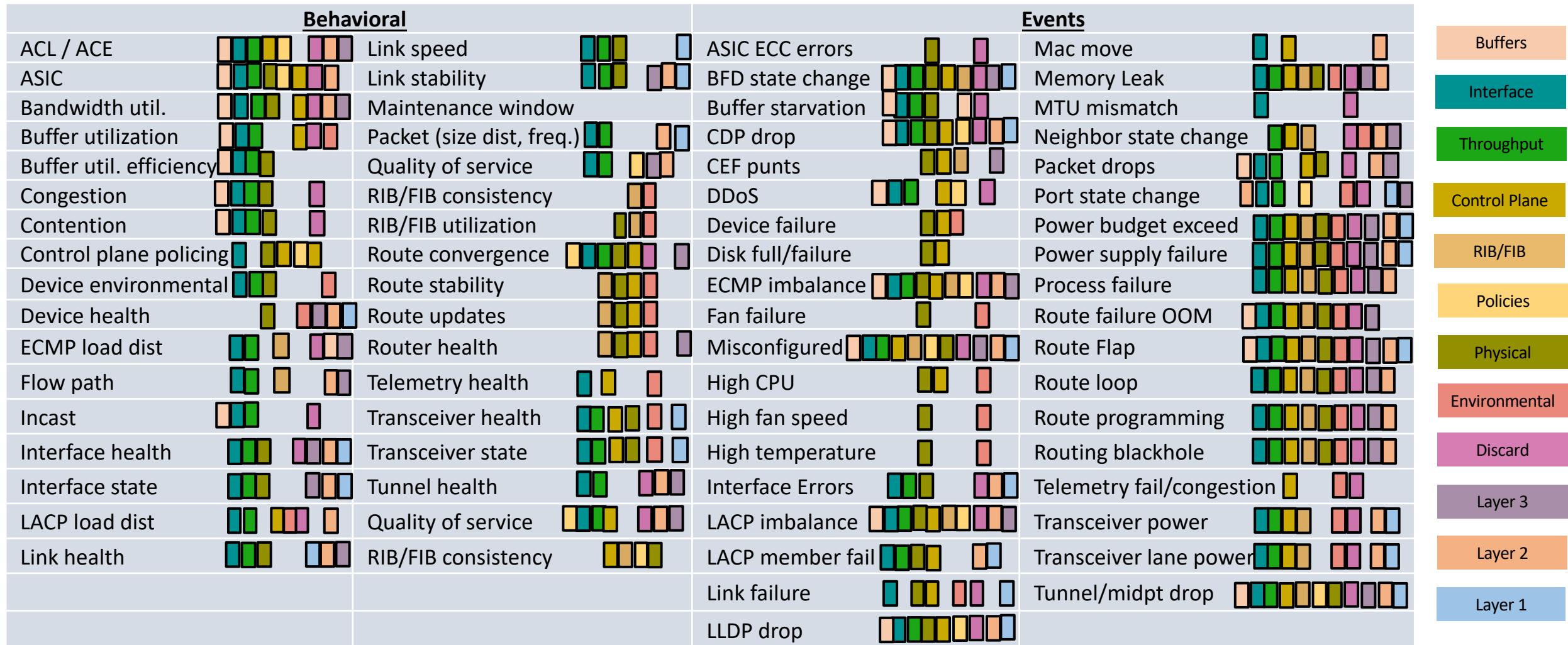




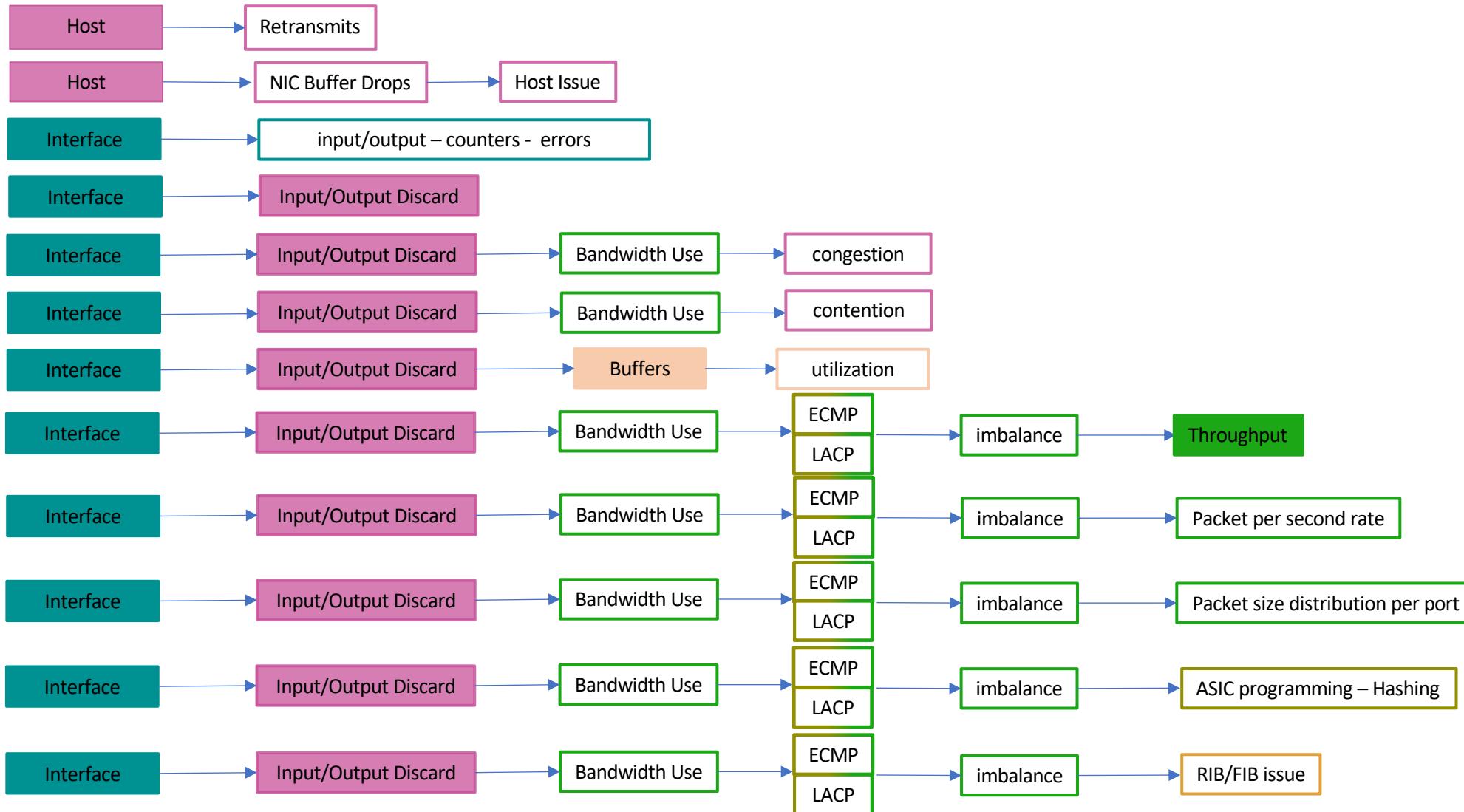




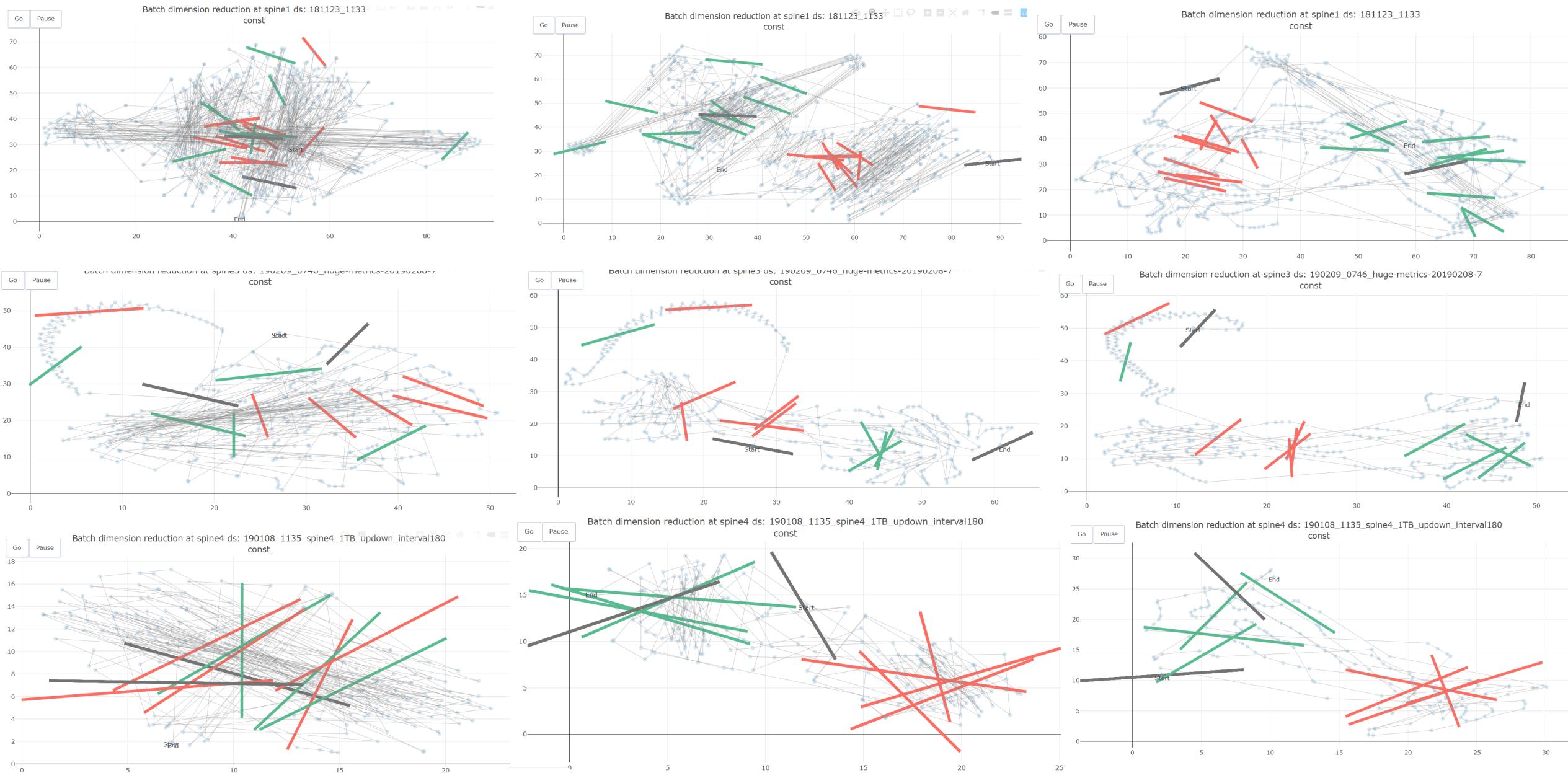
Causal Connections and Event Vectors



Event Vectoring – Retransmits/Drops



Value of Network Domain Knowledge to ML/AI Community



Where do we go from here?

- Goal: a Network Anatomy, Diagnostic and Treatment reference guide
- The knowledge is out there, but it is tribal with the network engineers/network operators
- Let's build a community-based information base
 - Starting with event vectors



URL: <https://github.com/apletcher/NADT-Guide>

Q&A

Thank You