SDN/OPENFLOW
THE END OF THE WORLD AS WE KNOW IT?

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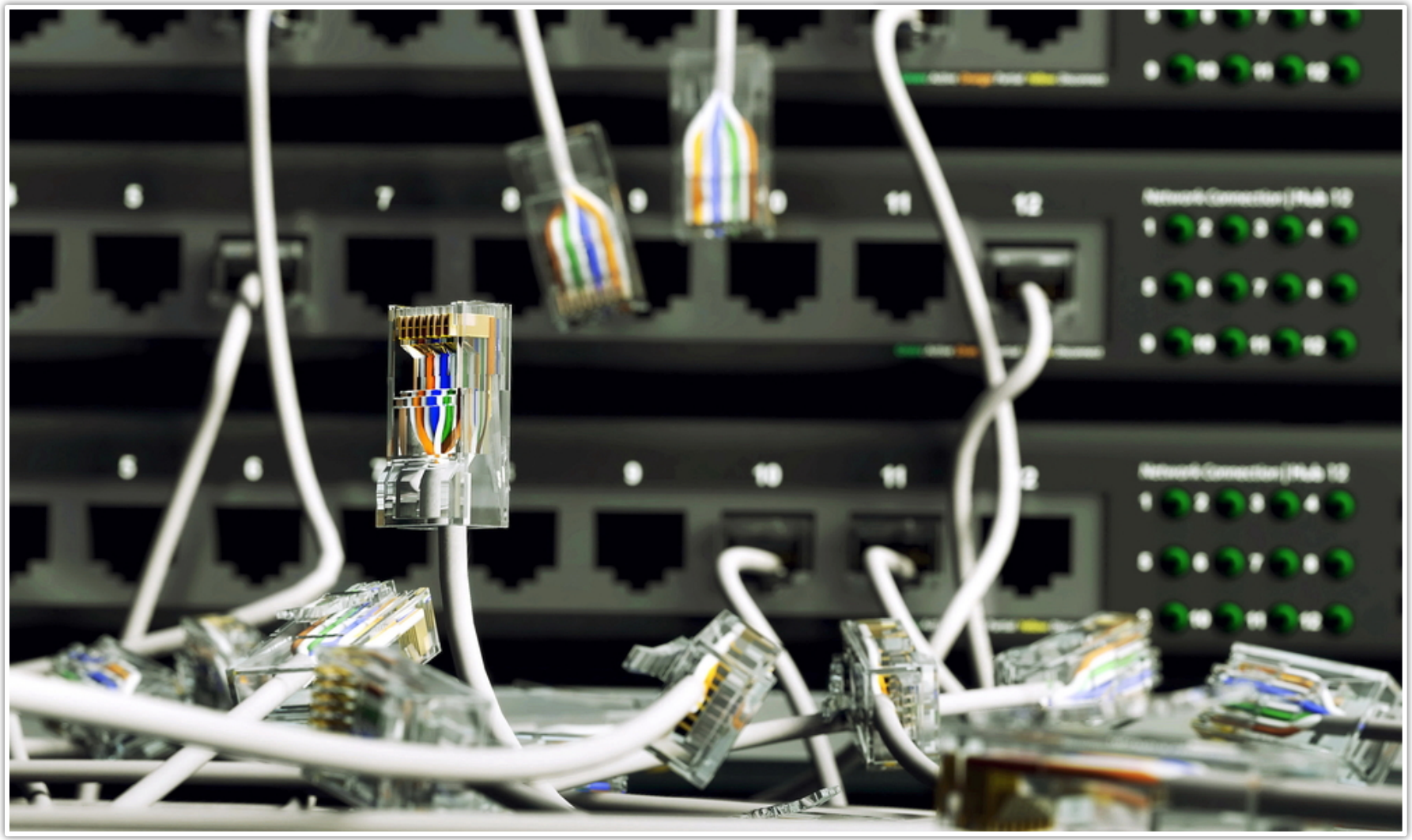
ONS - April 18th 2012

SDN THE END OF NETWORKING AS WE KNOW IT?



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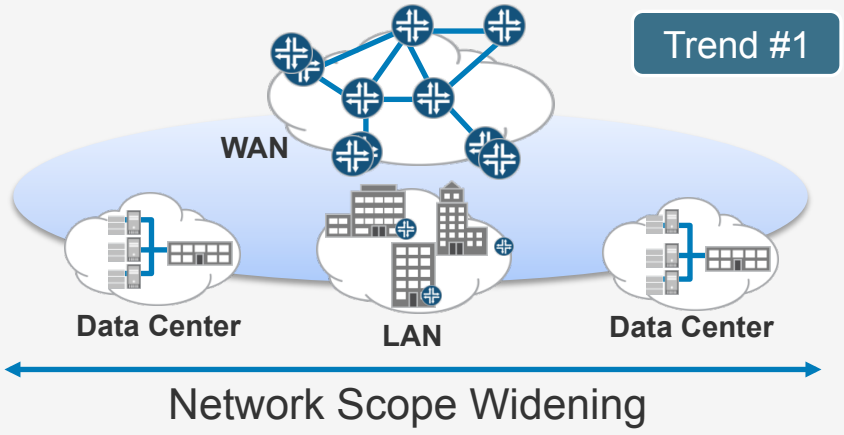
THE VALUE OF NETWORKING COMMUNICATION AND WORKLOAD

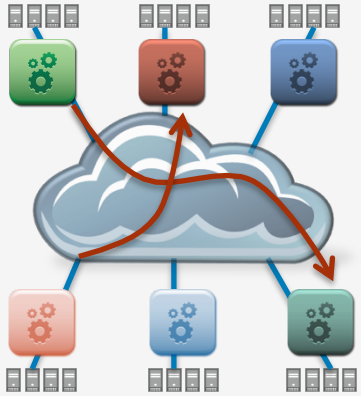


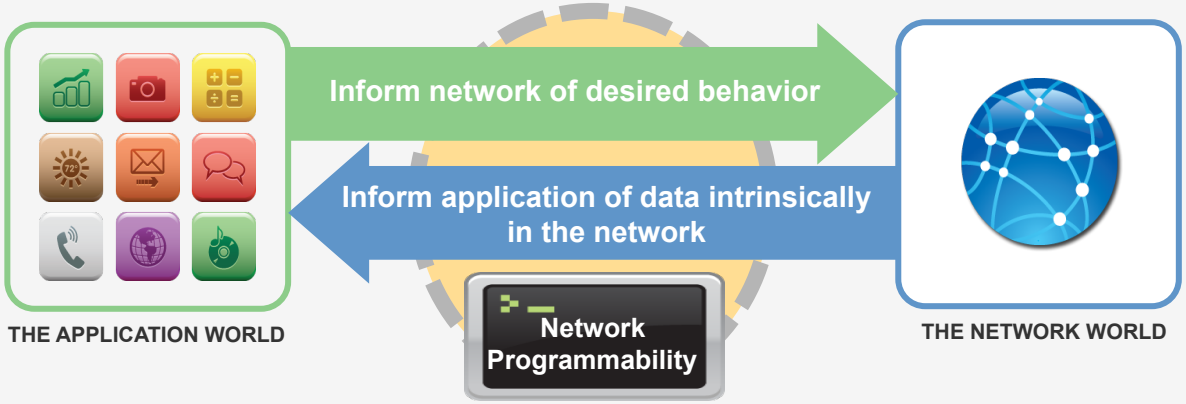
Trend #1

Trend #2

Orchestration:
Dynamic Workloads

Compute, Storage, Network as one resource pool





- Bi-Directional Communications
- Network edge has highest rate-of-change
- Existing provisioning systems are first attempt (mostly uni-directional)

What is needed is programmatic bridging of application-network divide

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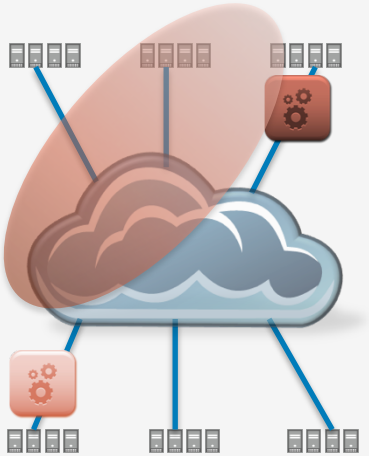
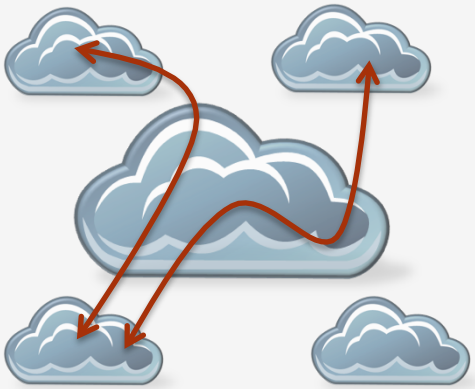
NETWORK PROGRAMMABILITY: APPLYING THE KNOWLEDGE

Proper orchestration requires an understanding of:

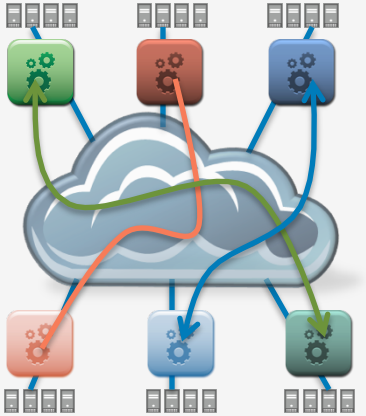
Locality & Affinity
Compute/Storage/External Resources



Topology & Path
LAN/WAN/Data Center Connectivity



Communications
What the Application Wants



Bi-Directional APIs: Bridge the Application and Network Worlds

DC EDGE	▪ High Rate of Change ▪ Externally Controlled ▪ Policy Enforcement	**TRANSPORT**	▪ Publish Topology and Instrumentation ▪ Programmed Topology/Path ▪ Guarantee Reliable Communications

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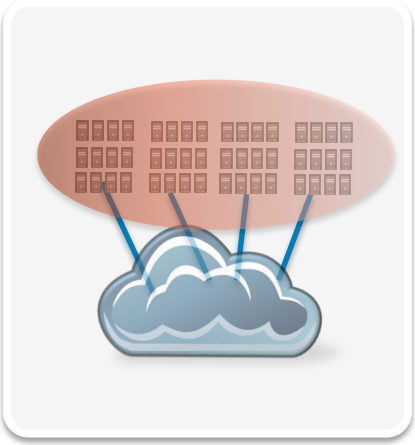
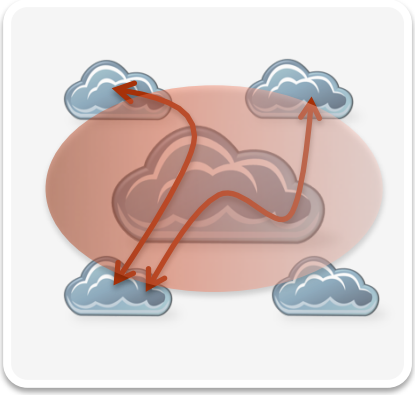
PROGRAMMABILITY OCCURS AT MULTIPLE LAYERS



Programming the Edge: Abstracting Communications

- Where are resources attached?
- Whom can talk to whom?
- High Rate-of-Change/Northbound Interface
- Abstract connectivity details from resource orchestration

Static Provisioning → SDN: OpenFlow



Programming the Transport: Abstracting Topology

- Manage the “Path” of communications
  – Speed-of-light, network utilization, assurance, etc.
- Abstract path details from Connectivity Layer

Static Config → SDN: BGP-TE, Stateful PCE

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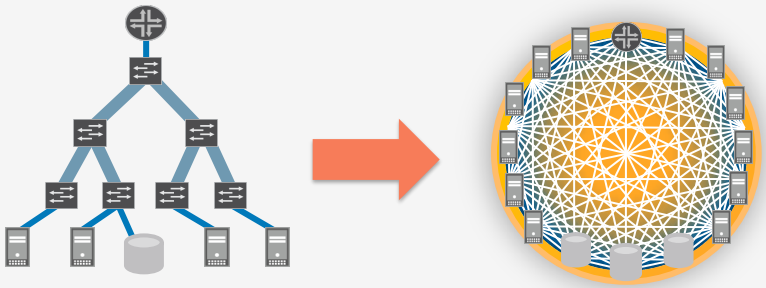
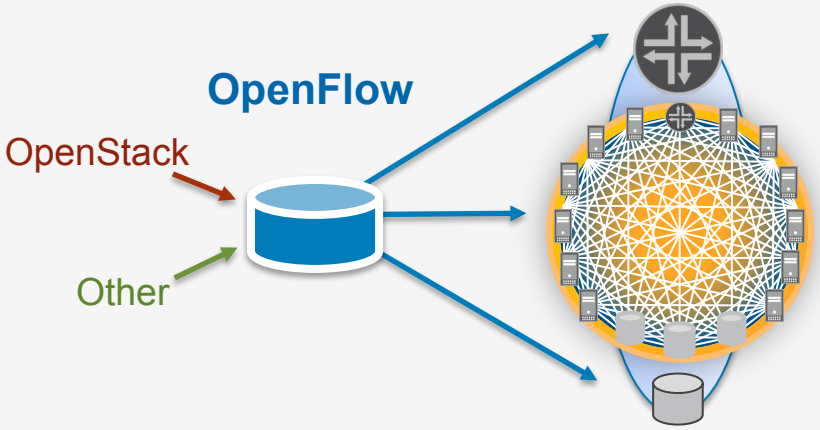
HOW DO WE GET THERE?

Device Abstraction: QFabric

- Universal Bandwidth and Connectivity
- Manage a Single Logical Device



Single Point of Programming



OpenFlow

FABRIC™

SDN is about adding new value to existing systems and workflows

- Enable High Rate-of-Change in the Edge
- Decouple Abstraction Layer from Transport Layer
- Free your equipment to add software-driven value
- SDN value requires *Bi-Directional* Communication

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FOCUS ON SOLVING REAL PROBLEMS

"SDN is a critical component to building a Next-Generation Distributed Cloud Service."

Jim Harding
CTO, Sabey Corp

CODONiS™
Bridging Healthcare and Life Sciences Computing

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Data Centers
At Intergate.Manhattan
375 Pearl

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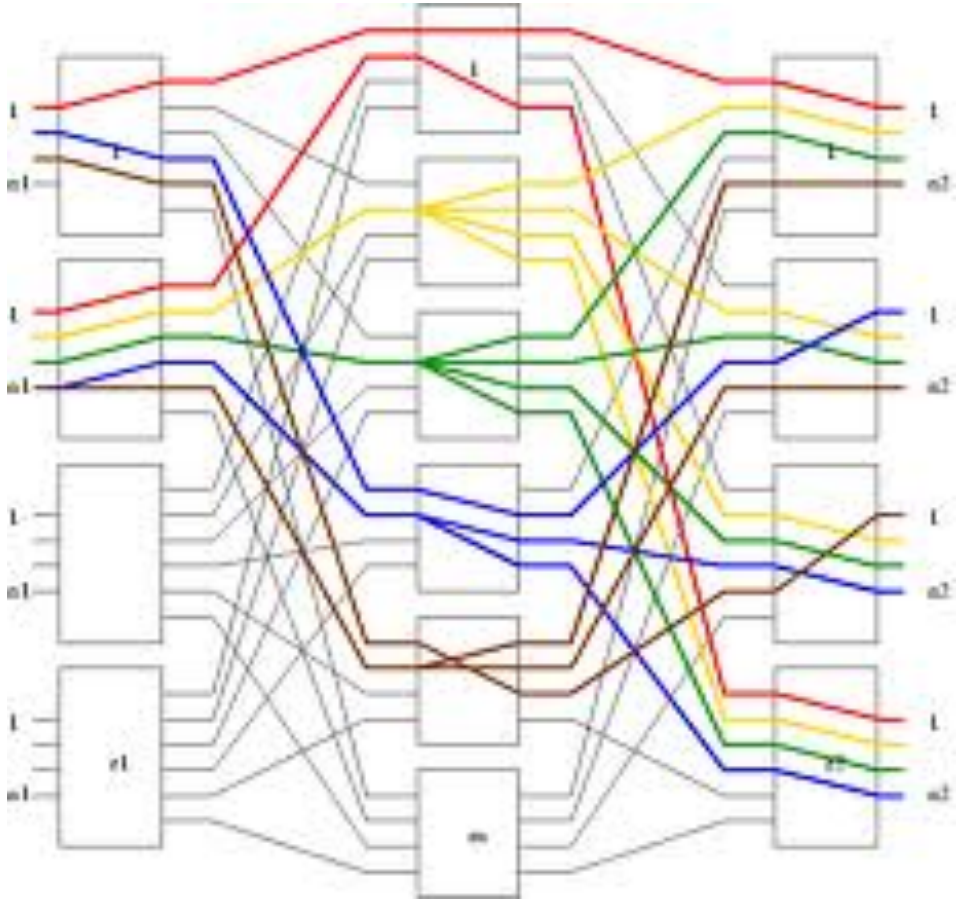
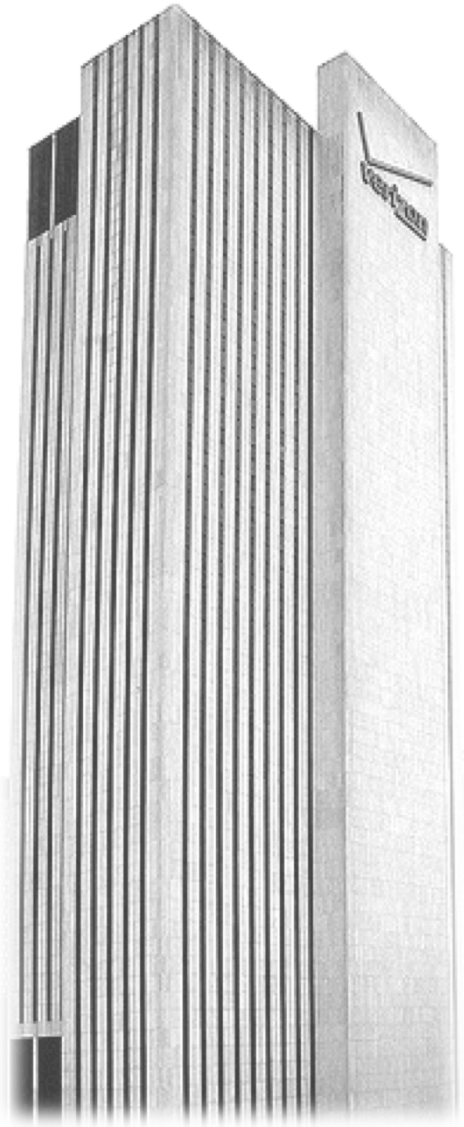
OUR NEED: CLOS-IN-A-BOX



Scaling thousands of Links Automatically

SDN/CLOS in a big box—multi-tenant scaling



- Purpose-built; master-planned
- One Million rsf
- 40 MW; 13.8kV distribution
- Carrier & Path Diversity
- **Planned SDN optical cross connect**
- **Planned SDN-based TOR-as-a-Service**
- **Low latency in Clos between floors**
- 25-30% power rate discount
- Security provided by NYPD
- Over 75MW of generator backup
- Over 200,000 gallons of fuel

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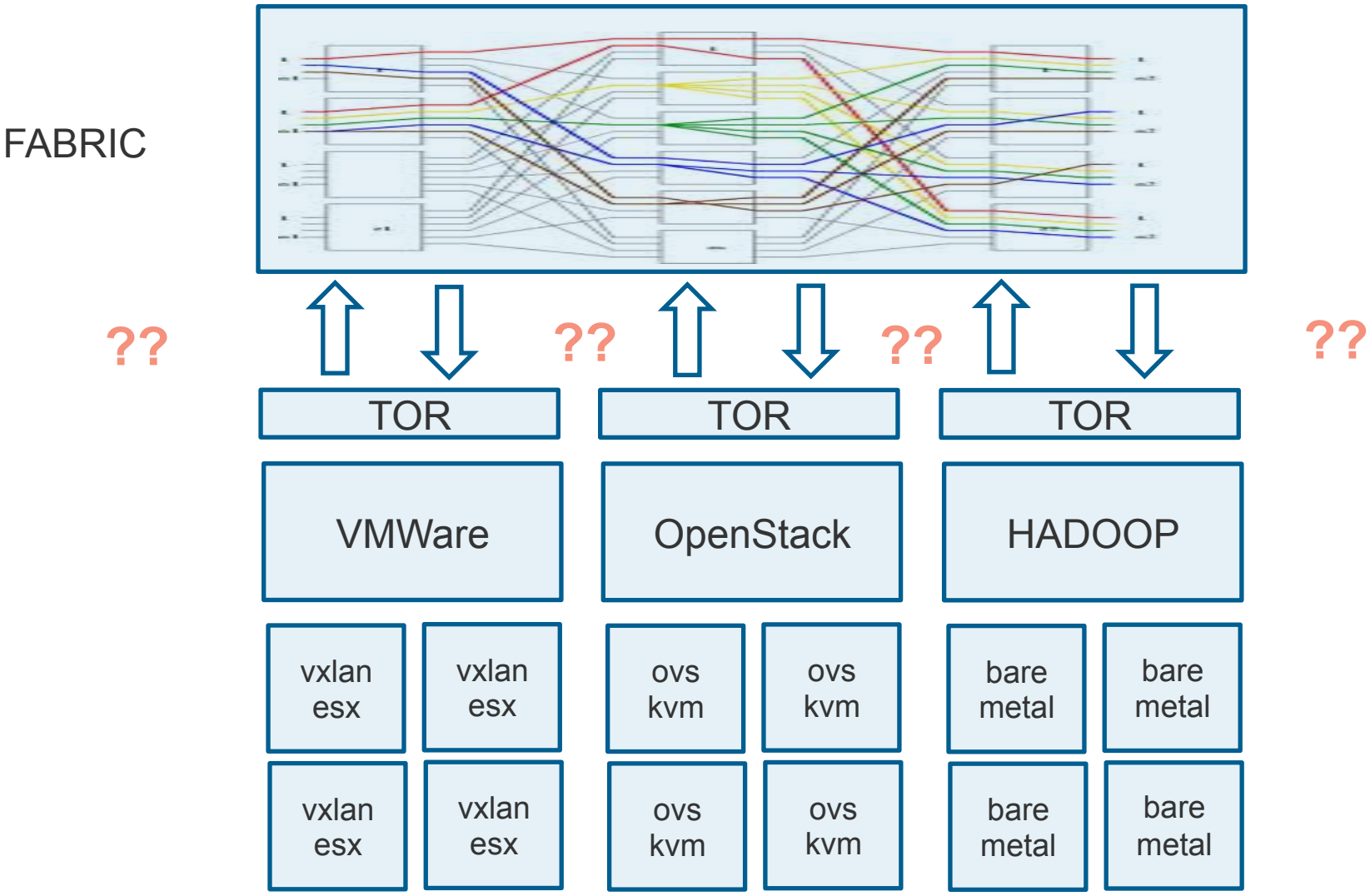
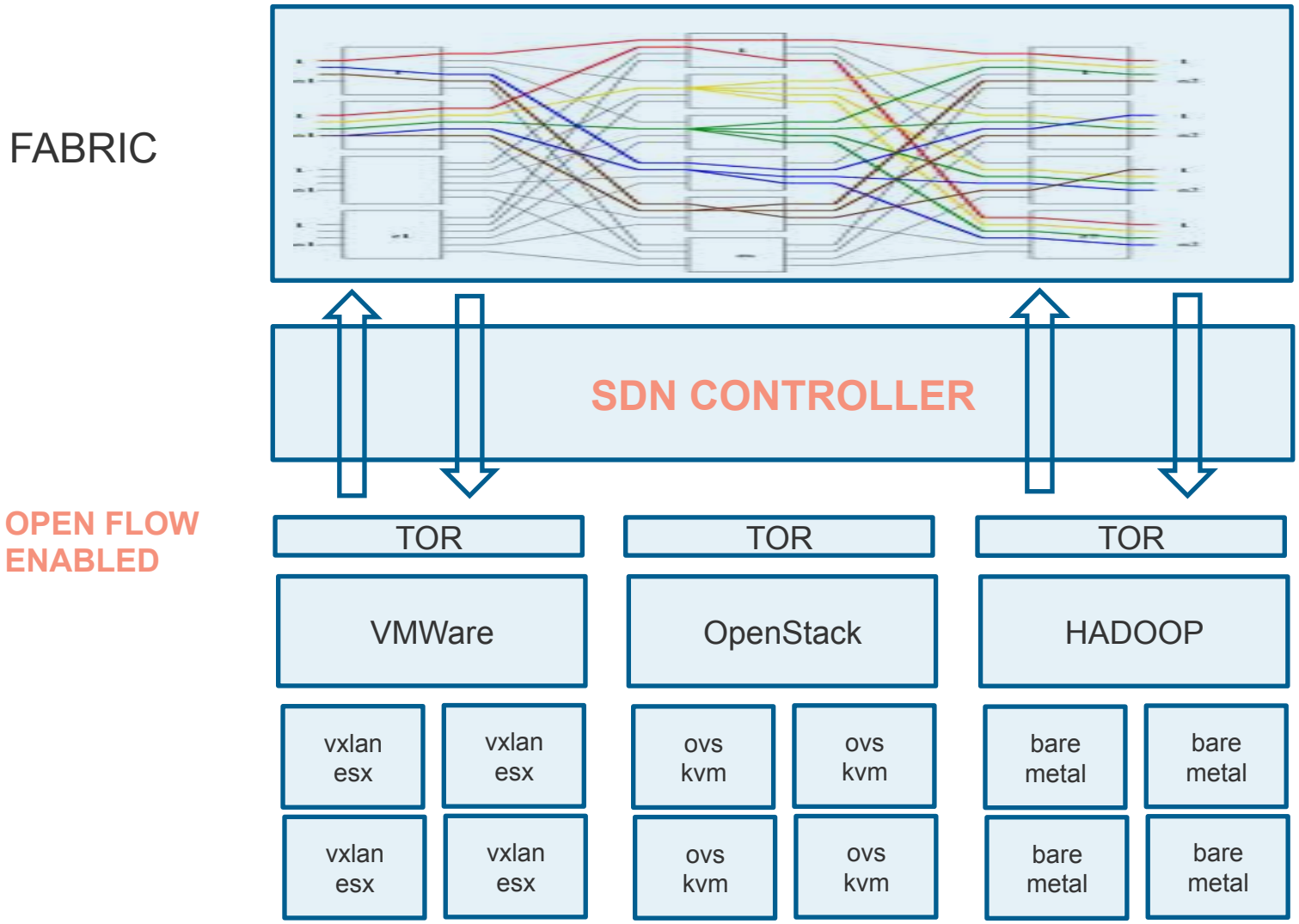
MISSING MANAGEMENT PLANE

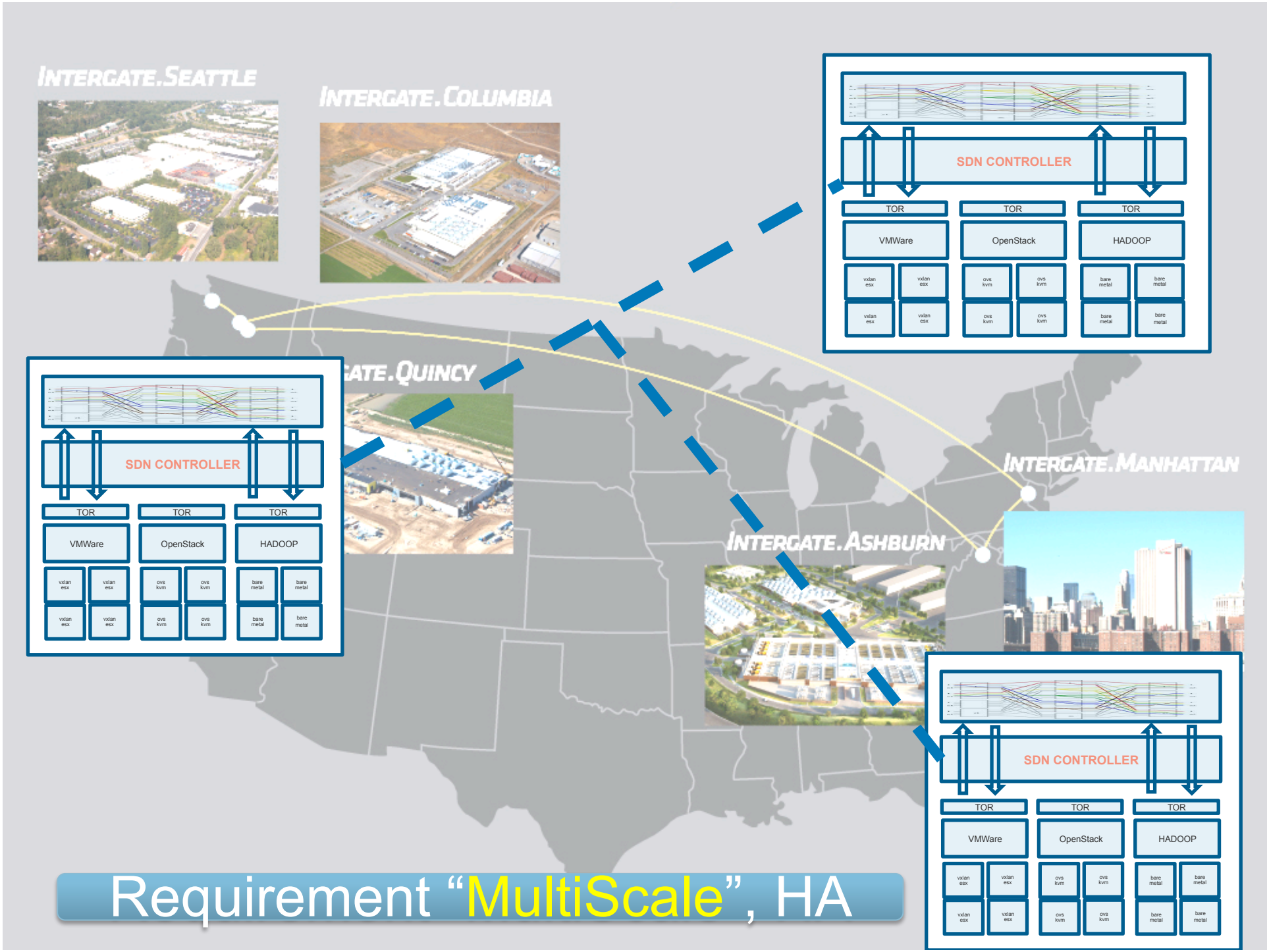


Controller Needed to Manage Across Stacks

SDN: SCALING THE MANAGEMENT PLAN



Controller Integrated Across Stacks


INTERGATE.SEATTLE
INTERGATE.COLUMBIA
SDN CONTROLLER
TOR
TOR
TOR
VMWare
OpenStack
HADOOP
vxlan esx
ovs kvm
bare metal
SDN CONTROLLER
INTERGATE.QUINCY
INTERGATE.MANHATTAN
INTERGATE.ASHBURN
SDN CONTROLLER
Requirement “MultiScale”, HA

Vendor Integration Challenge

- They Enable Open Flow in Switches

- We Integrate controller with Switches and our Stacks

- We Manage flow through Fabric

- If not enabled, Overlay/Tunnel through it (like MPLS today)

- They Innovate around openvswitch and derivatives

- We run at scale—HA-based controllers (not there yet)

- All of us ….Invent new network types

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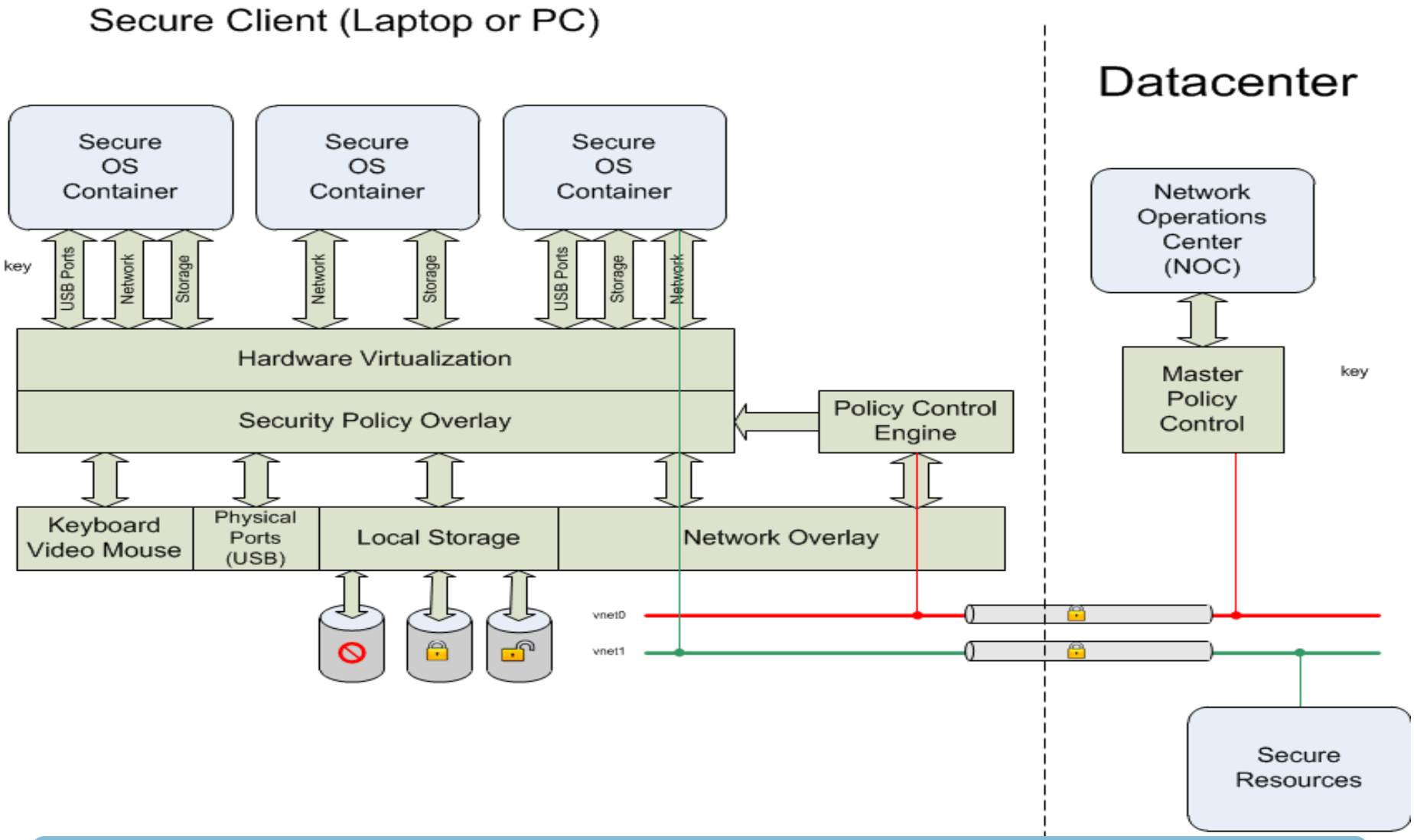
NEW NETWORKS IN HEALTHCARE



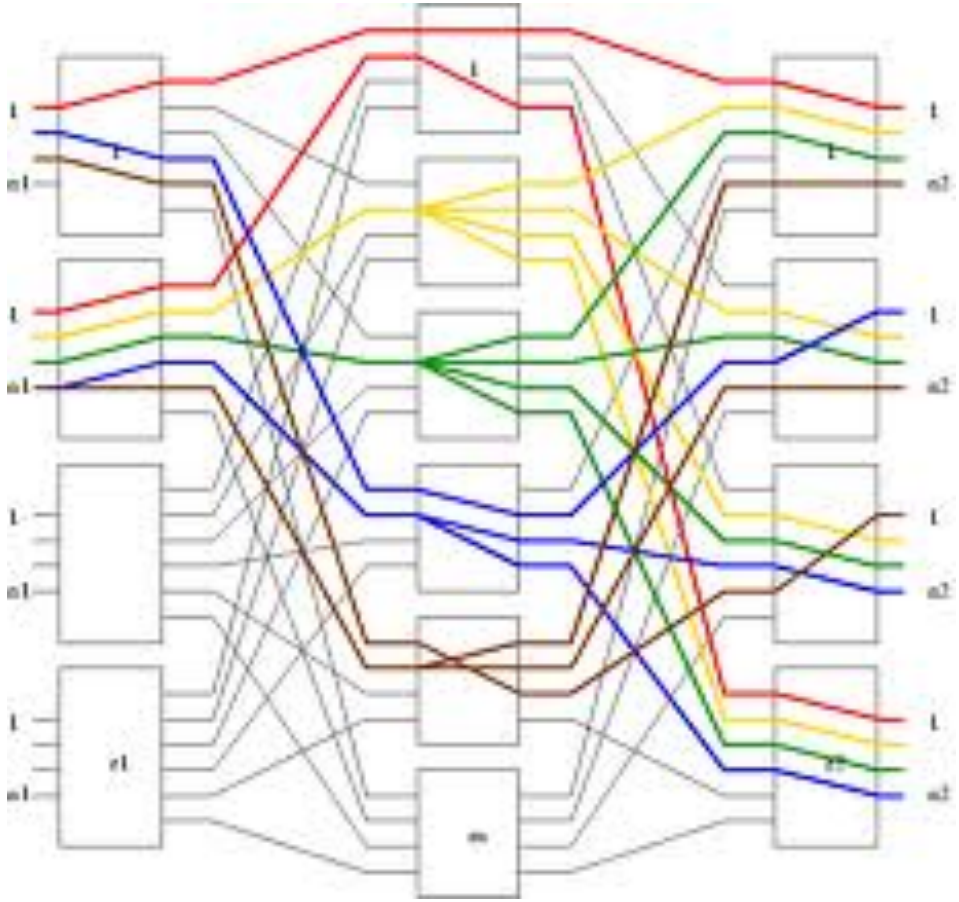
Securing all Resources through SDN Control

NEW TERM: "MULTISCALE"

- First there was "Biology"
- Then there was "Systems Biology"
- Then there was "Network Biology"
- Now…the term biologists use to describe complexity is MULTISCALE

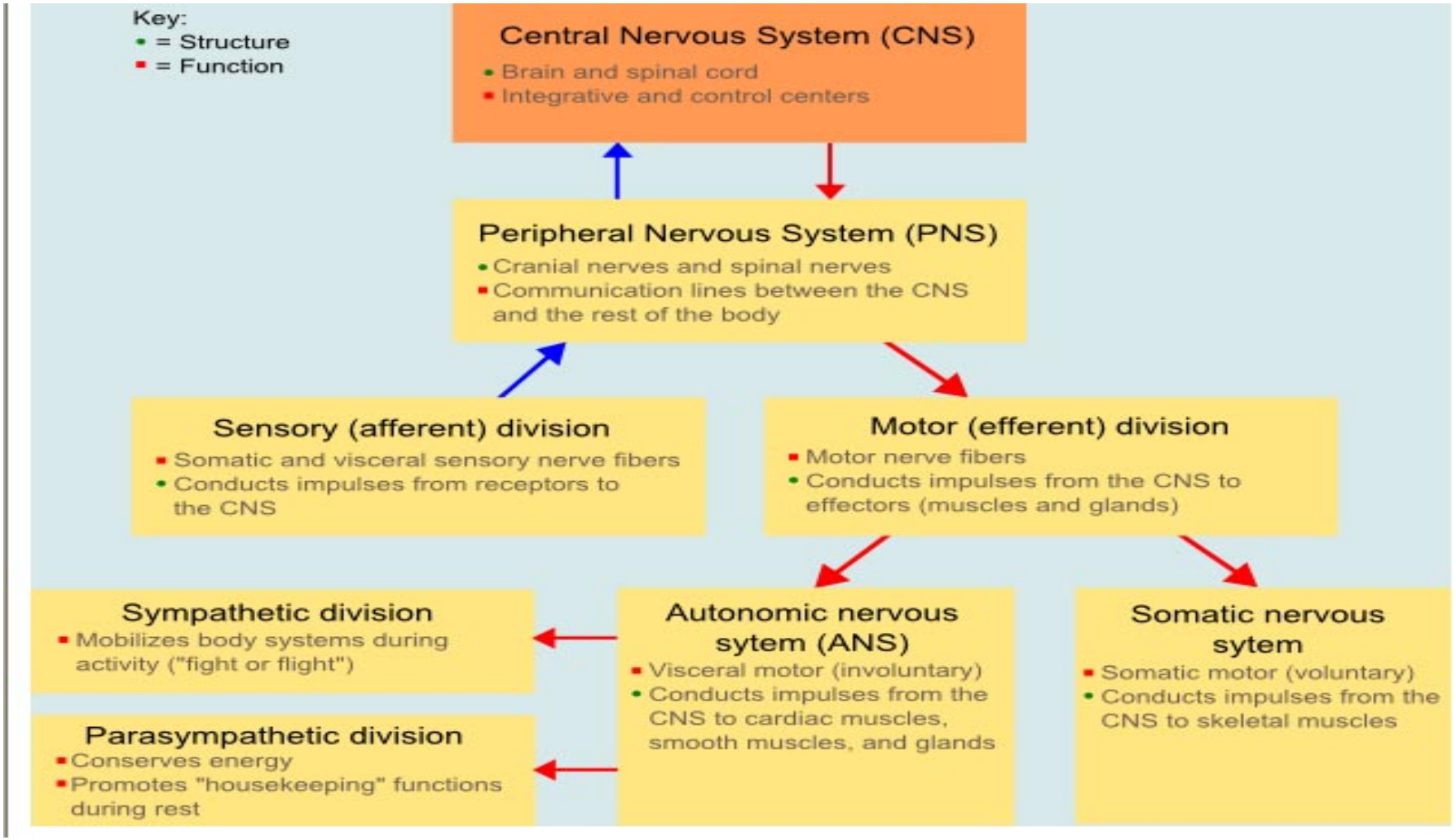
HA, SDN Networks are in the Class of MultiScale

CLOS-IN-A-WET/BIOLOGY BOX



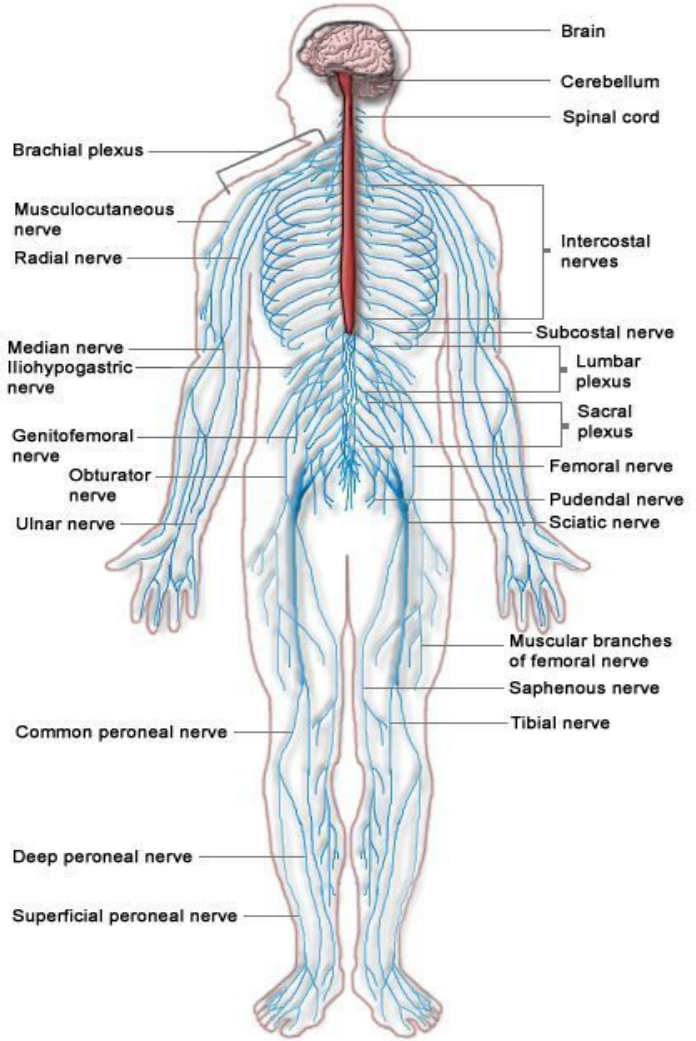
Scaling thousands of Links Autonomically

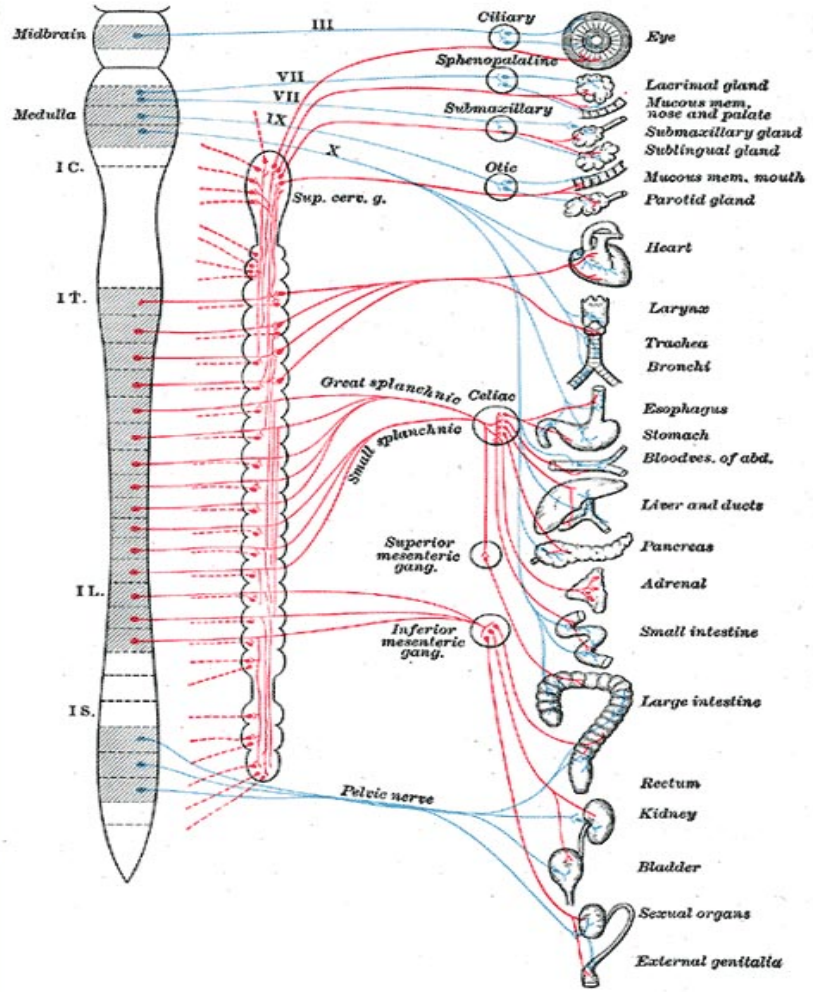
LIFE: SDN-BASED, MULTISCALE, MULTISTAGE NETWORKING



Scaling thousands of Links Autonomically

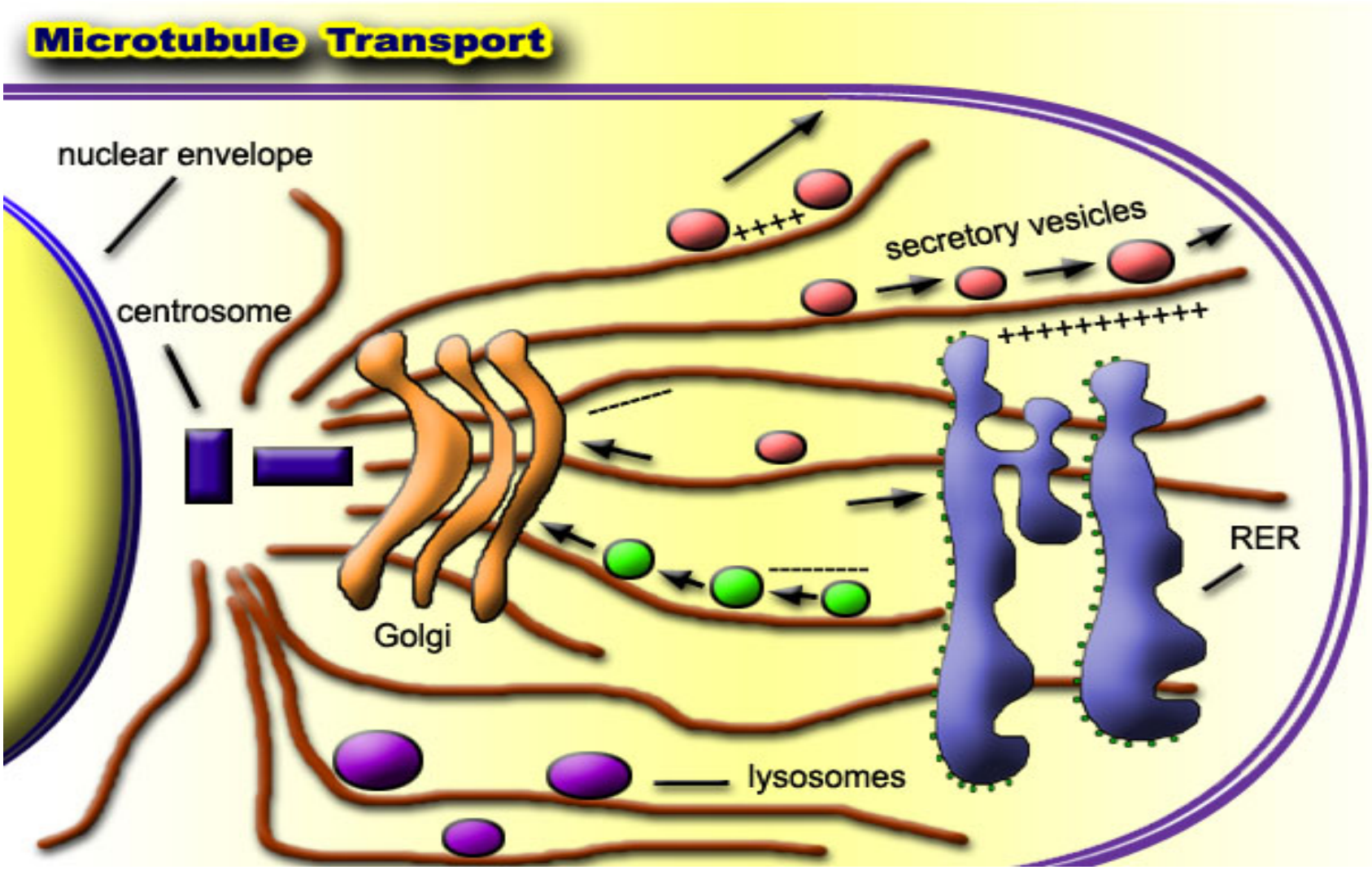
BONE-SHIELDED CNS TO PNS CROSS-CONNECT





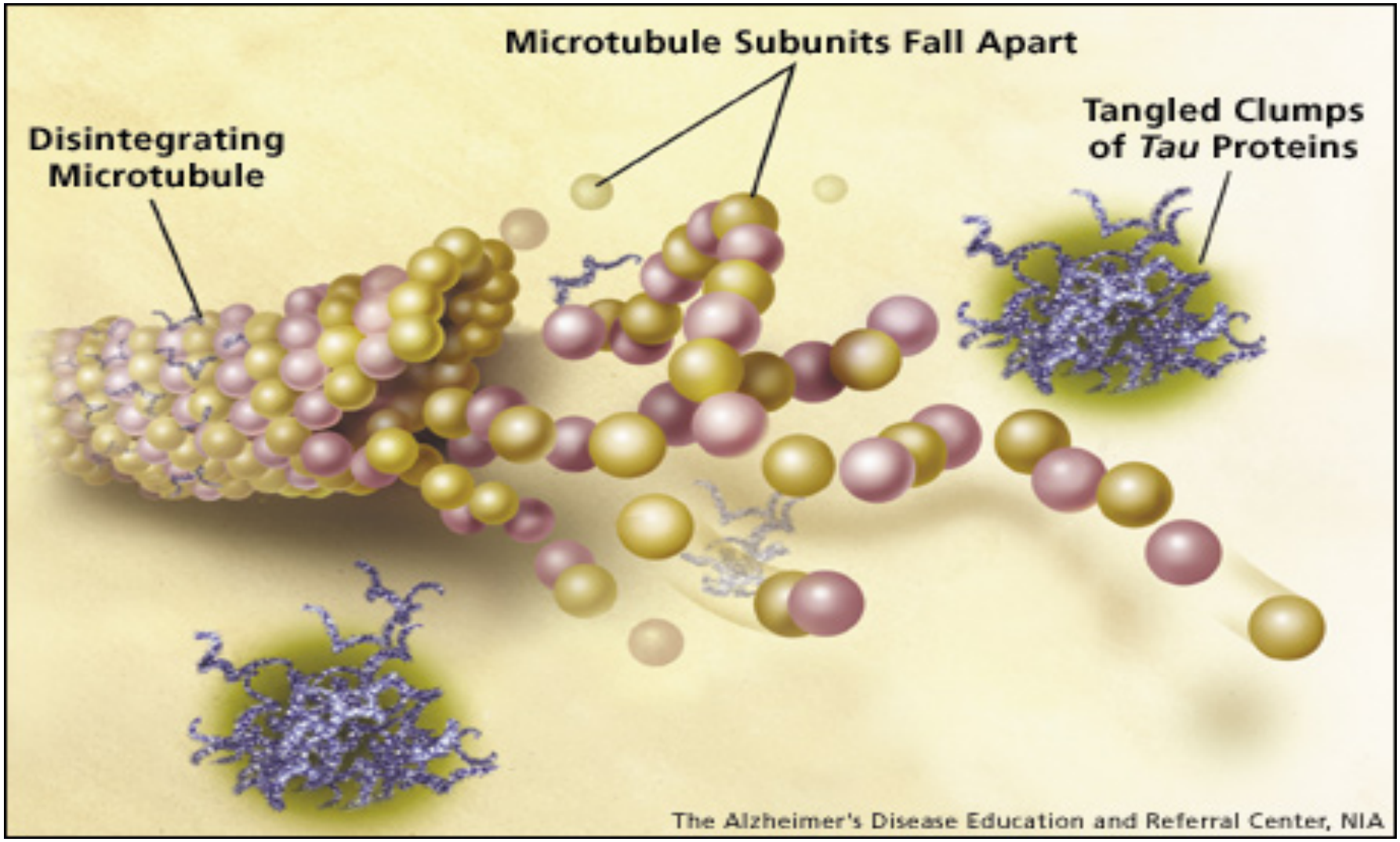
"Nerves"—elegant edge device signal transport

NETWORKS IN EVERY CELL



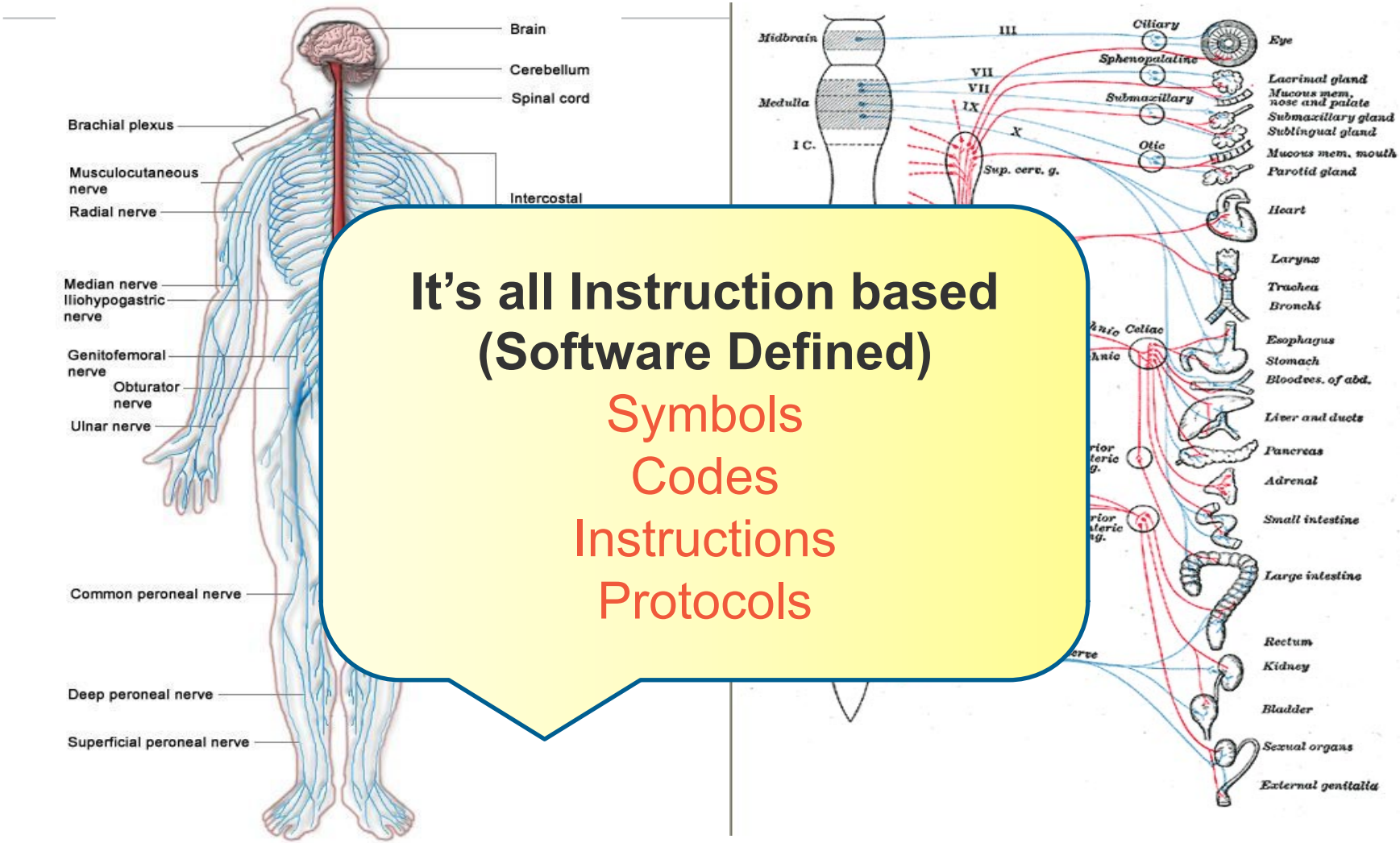
Mircotubules are provisioned/torn down on demand

WHEN NETWORKS GO WRONG: DISEASE



Life Sciences: Trying to understand networking better

BONE-SHIELDED CNS TO PNS CROSS-CONNECT



It's all Instruction based (Software Defined)

Symbols

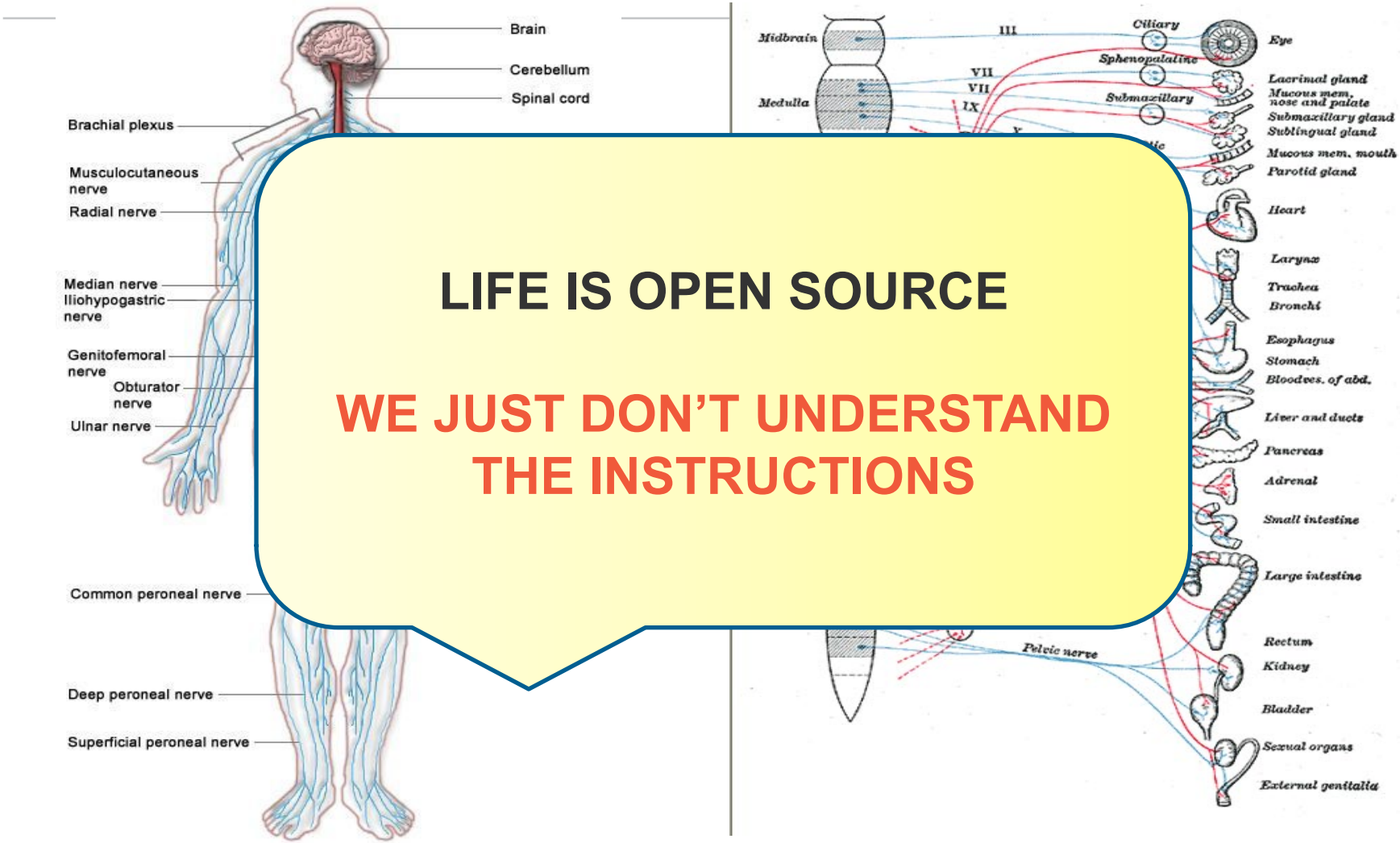
Codes

Instructions

Protocols

Instructions build *and* run the networks

BONE-SHIELDED CNS TO PNS CROSS-CONNECT



LIFE IS OPEN SOURCE

WE JUST DON'T UNDERSTAND THE INSTRUCTIONS

Coding and Regulatory Genes Operate Life

The Digital – Life Virtuous Cycle

- The more we understand biology, the better we make **TECHNOLOGY**

- The better we make technology the more we can understand **BIOLOGY**

- The more we apply technology to biology the better we can **LIVE**

- **SDN is a new, enabling technology in the cycle**

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everywhere