



Bringing it all together: Multi-layer software-defined networks and automated operations intelligence

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Understanding the SDN value equation

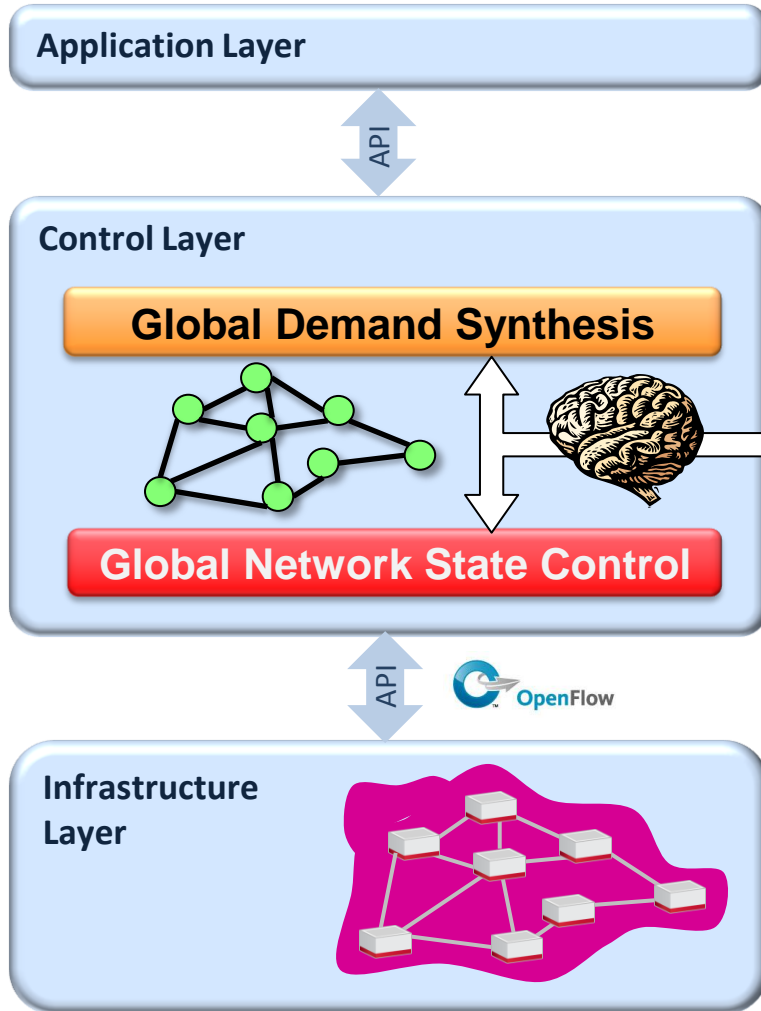
SDN is now accepted by network operators as key to:

- Opex and capex constraint
 - New service & revenue creation
- } → The pain point doublet

How does SDN deliver these impacts?

- Centralized control systems: enable “autonomic operations intelligence” in software to attack opex, capex and revenue
- Open architecture control systems: allow customer business differentiation through customization and innovation of functions

The control layer and autonomic operations intelligence



Control Layer:

Global control of network state
("supply")

Global view of service demands
("demand")



Supply & demand matching

- Revenue, capex

Automation

- Opex

Understanding the SDN value equation

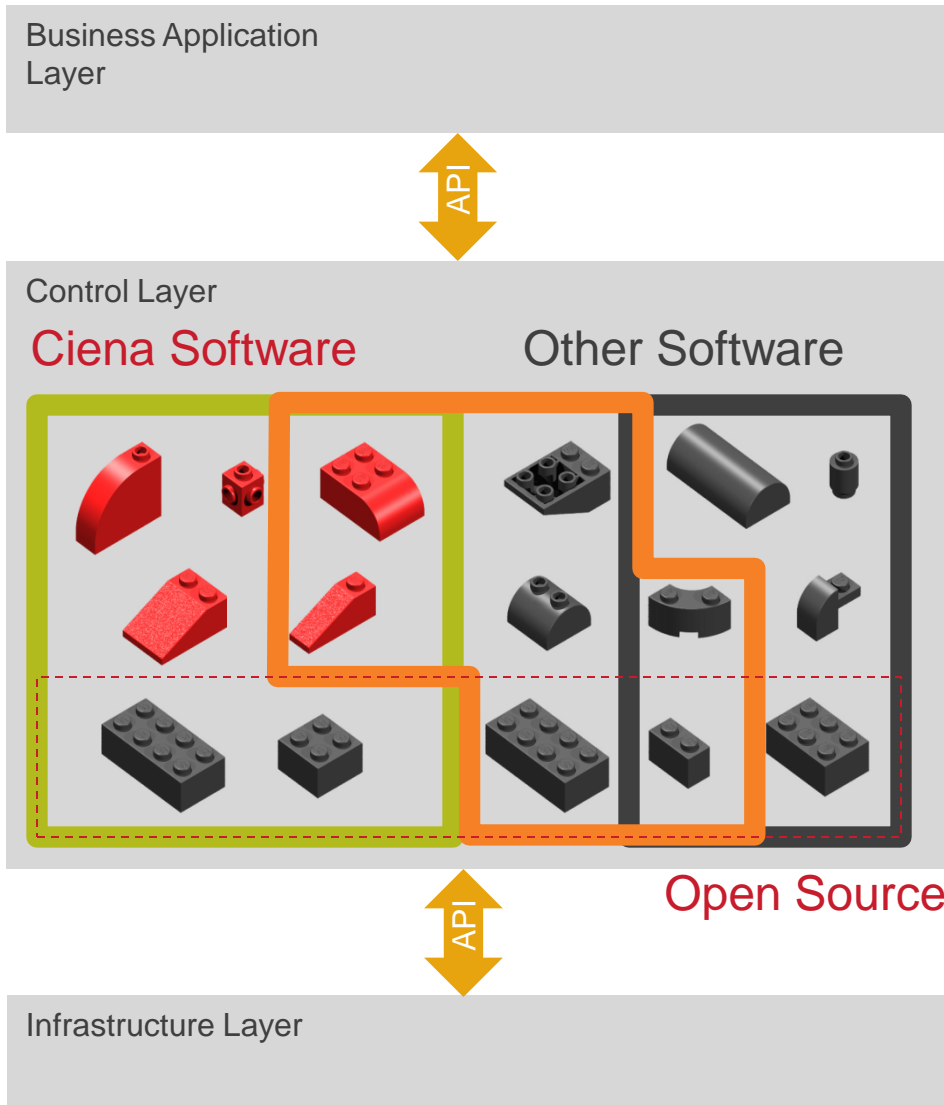
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Operator differentiation through “Lego block” openness



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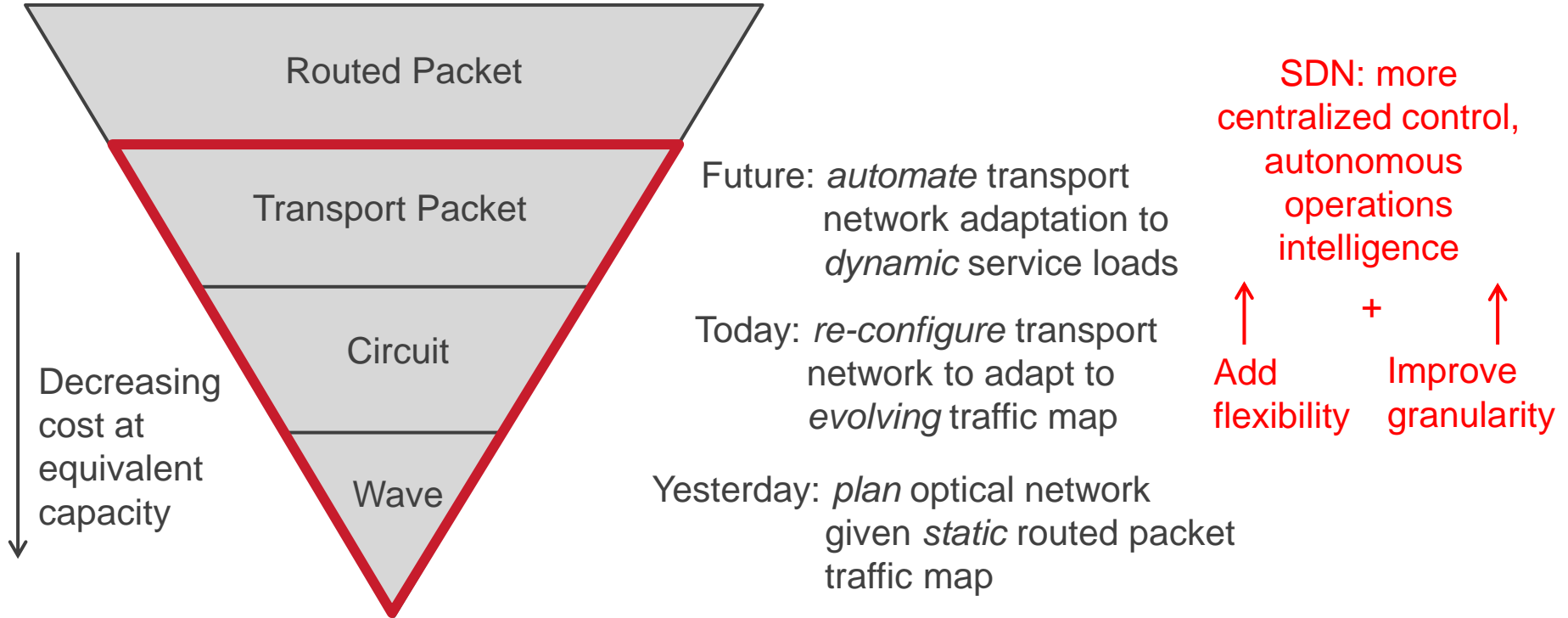
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Centralized control allows & drives “simplification” of the controlled networks:

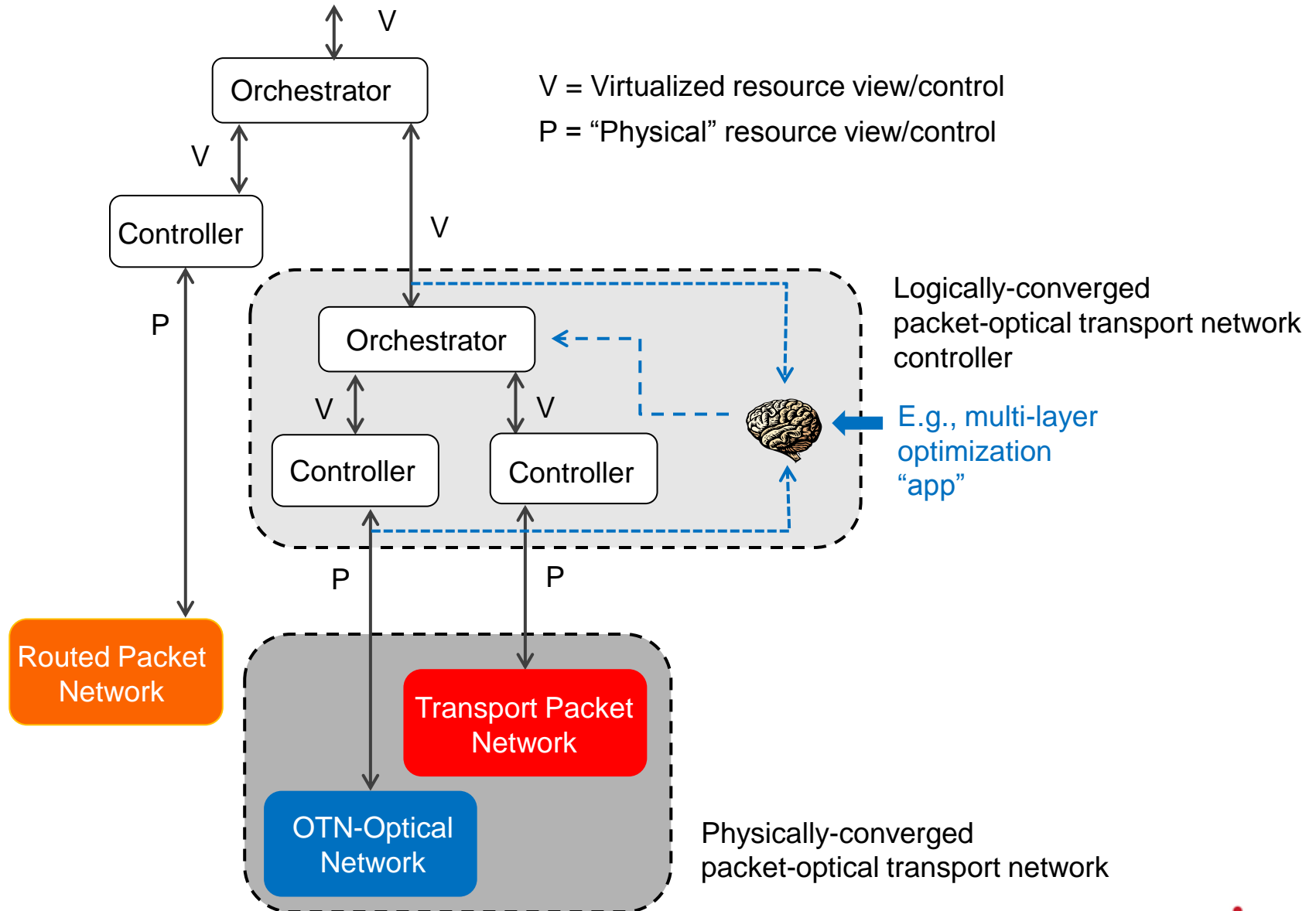
- Standardized control – “programming” – interfaces (e.g., OpenFlow)
- Removal of “point” service functions from network equipment to servers (NFV)
- Layer convergence - in network equipment, and in control plane/controllers

Multi-layer: the “inverted pyramid” of network layer economics



→ Maximize inverted pyramid economics in dynamic service environments

One flexible way to make it work – “cascaded virtualization”



Showing it in action: Ciena's OPⁿ test-bed

Ciena
Internet2
CANARIE
Starlight

Ottawa

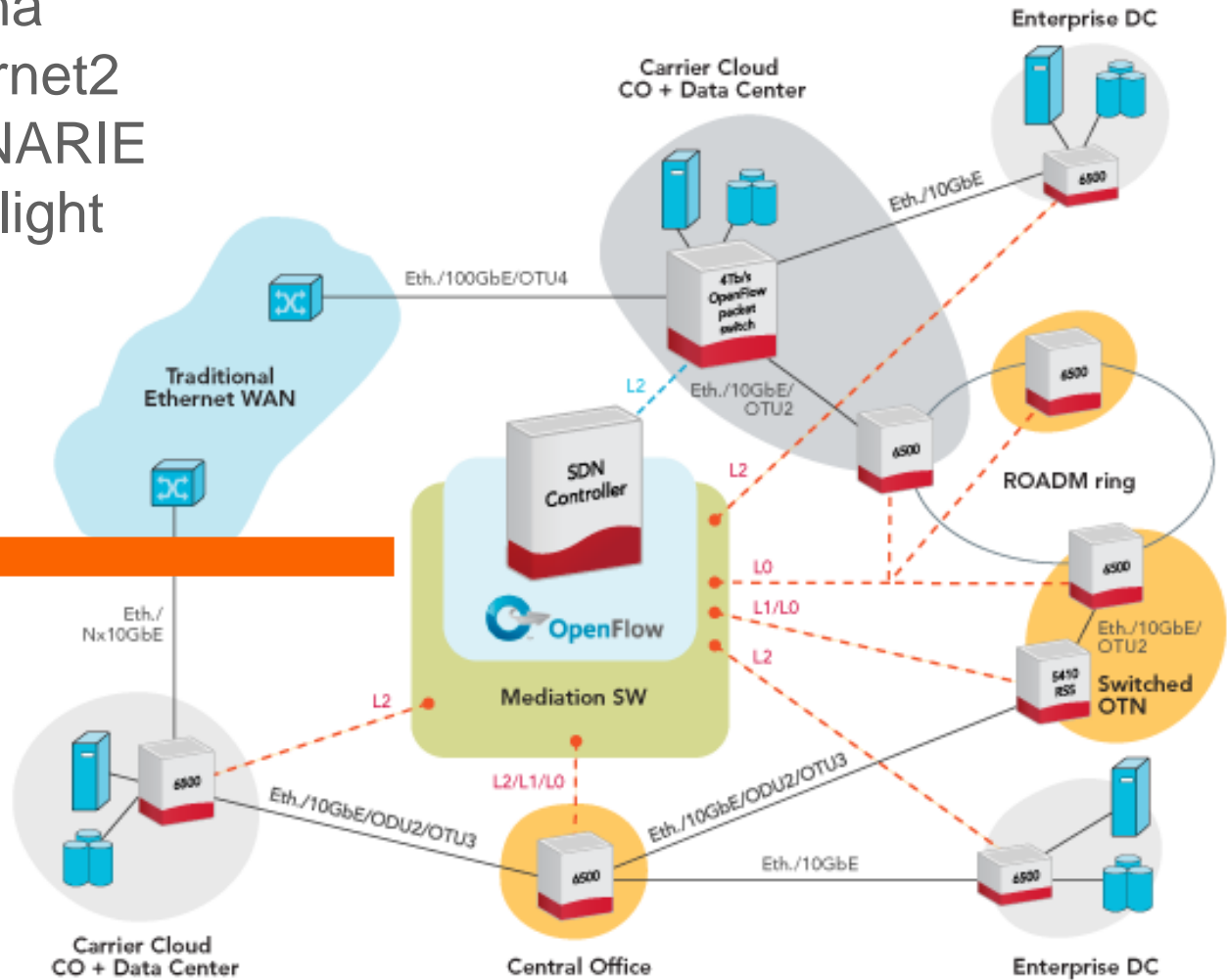


Multi-layer optimization



Dynamic pricing

Chicago



Baltimore

Evolving carrier networks with SDN: Expanding revenues, constraining costs

