Software-Defined Networking (SDN): A distributed SDN control plane for large-scale networks

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What exactly is SDN and Why is it important ? [1]

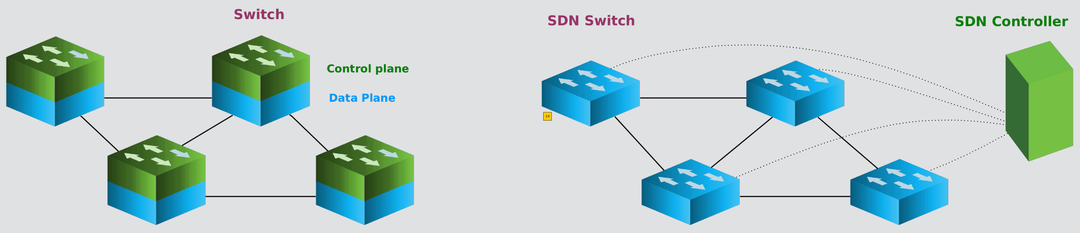
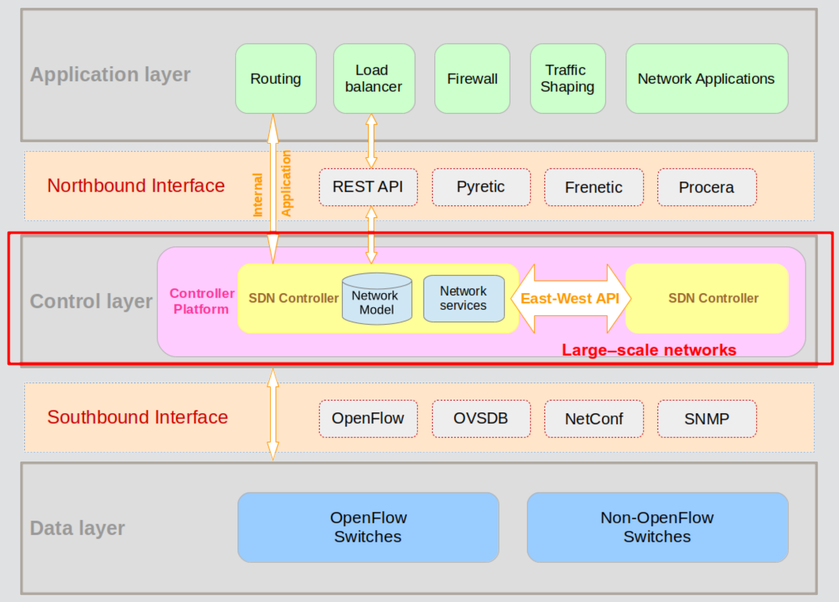


Figure: Conventional Networking Versus Software Defined Networking

- Separation between the Data and Control Planes (abstractions),
- Centralization of the Control logic in Software-based controllers,

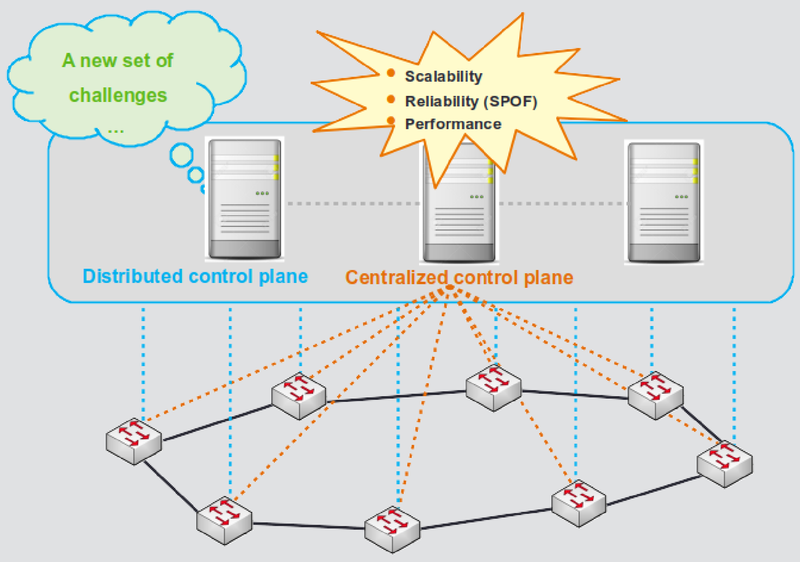
→ Network Programmability, Openness, Innovation, increased Visibility,
→ better Flexibility, better Network Management, Network Automation..

The Logically-Centralized SDN control architecture

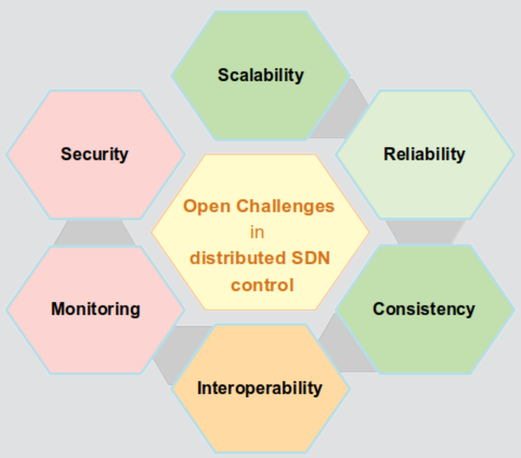


→ Classification of existing SDN controller platforms (ONOS, ODL..) [1]

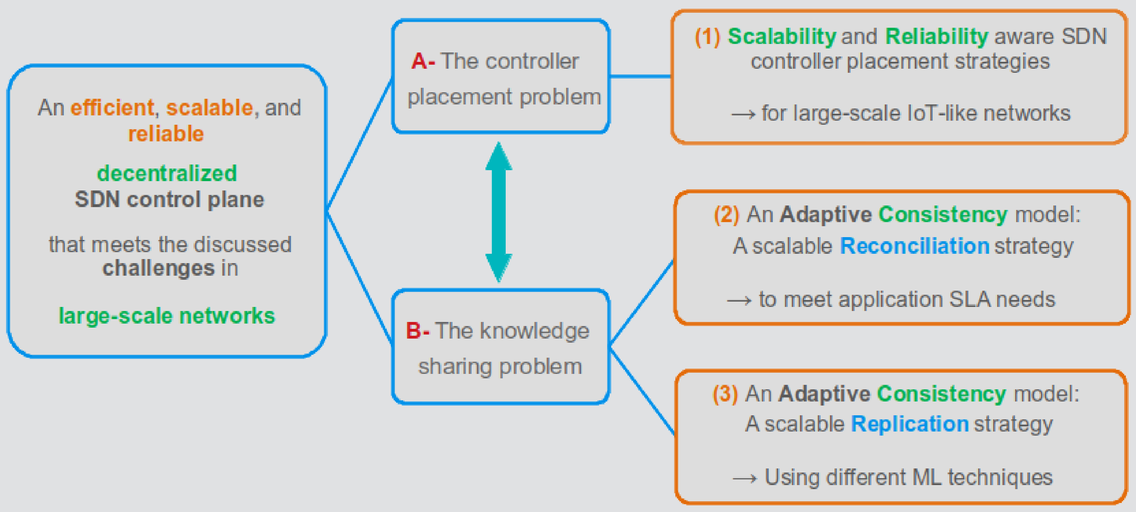
Physically-Centralized vs Physically-Distributed SDN Control



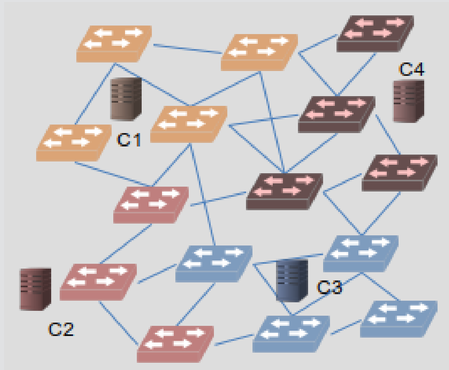
Major Distributed SDN Control Challenges



Main Contributions



A- The Controller Placement Optimization Problem

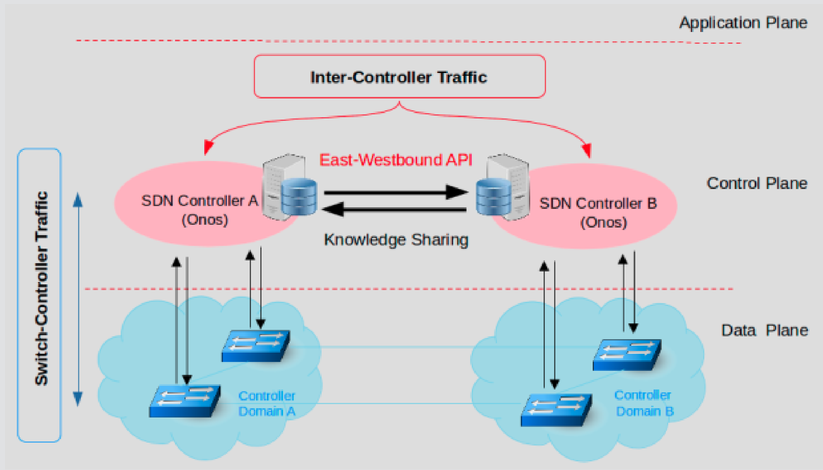


- Finding the appropriate number and locations of the SDN controllers,

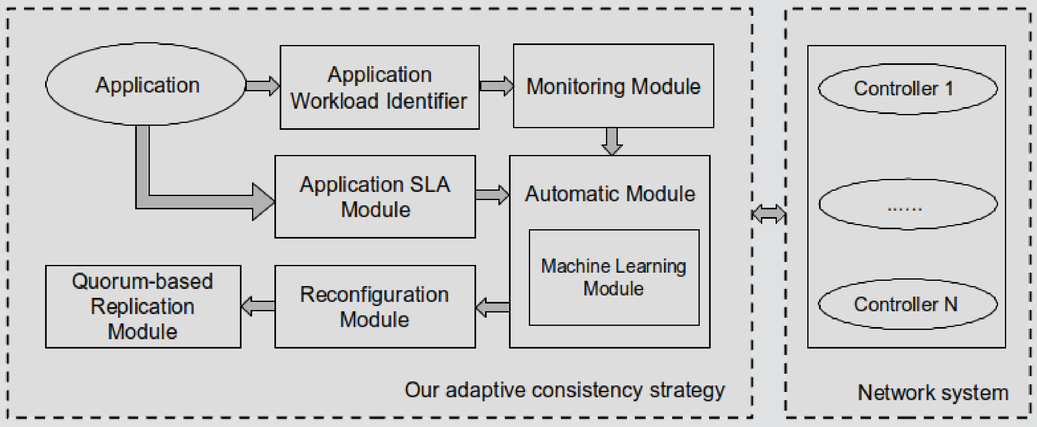
⇝ to achieve the best trade-off between performance and reliability criteria,

- Multi-criteria placement algorithms, Gradual context-based strategies [2].

B- The Knowledge Sharing Problem



Inter-controller communication is needed → correct application behaviors
⇝ too much Overhead (performance ↓) especially in large-scale SDNs.
⟹ Need for **an adaptive multi-level consistency** for large-scale SDNs?



- We propose adaptive and time-varying control consistency models [3] [4]. They adapt to changing network and application conditions

⇝ to satisfy application SLAs & minimize inter-controller overheads at scale.

- In [5], the proposed Quorum-based consistency strategy uses RL (Q-learning). It is implemented on ONOS for our CDN-like application.

Ongoing Work and Future Perspectives

- Towards a standardized distributed SDN control plane:
  - ▷ An interoperable, automated, scalable and reliable SDN control plane,
  - ▷ Securing the SDN control plane (the inter-controller communications).
- Innovative use-cases for the intelligent next-generation networks:
  - ▷ Application of AI and distributed SDN to the sliced 5G core network.

References

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[5] F.Bannour, S.Souihi, and A.Mellouk.
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