

# Software Defined Networks and Critical Infrastructure

Dick Willson

Allied Partners

# Critical Infrastructure – Market Sectors

- Energy & Smart Grid
- Transportation
- Water
- Healthcare
- First responders
  - Police
  - Fire
  - Ambulance

# Software Defined Network

- Network controlled by user's applications
- Published Applications Programmer's Interfaces (API)
- Separation of Data and Control plane
- Hardware Agnosticism
- Standard Hardware Abstraction
- Heterogeneous Networks
- Network Virtualization

# Critical Infrastructure

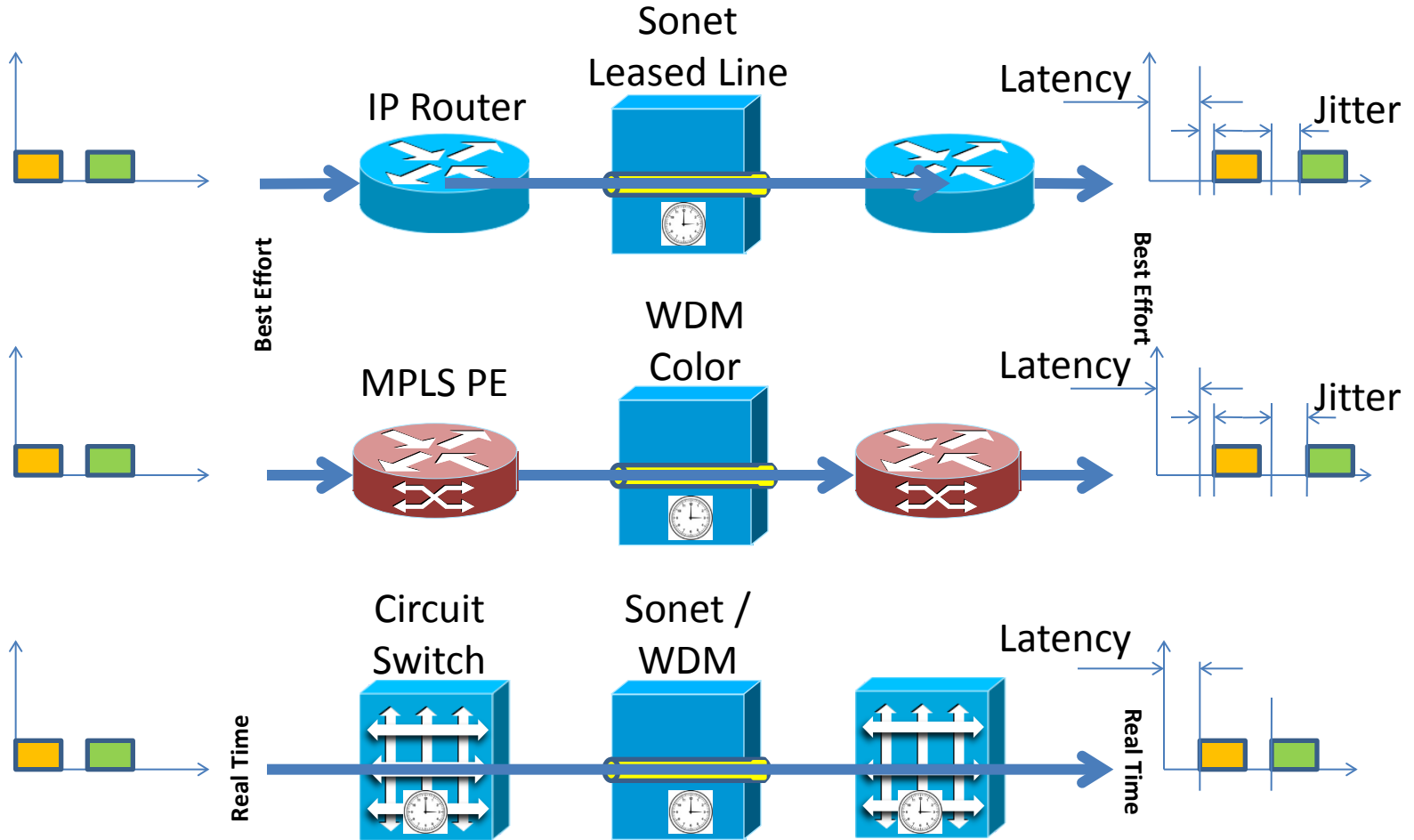
## SDN as “Industrial Internet”

- Mission-critical “real-time” local and wide-area
  - The right answer, delivered too late or “compromised”, becomes the wrong answer
- Distribution of Global Time
- Auto-scaling - applications indicate their resource needs *a priori*, providers scale the resources up/down
- Dynamic end-to-end resource management
- Network resources must be schedulable
- Traffic separation and protection
- Network Virtualization - “Virtual Overlay Networks”

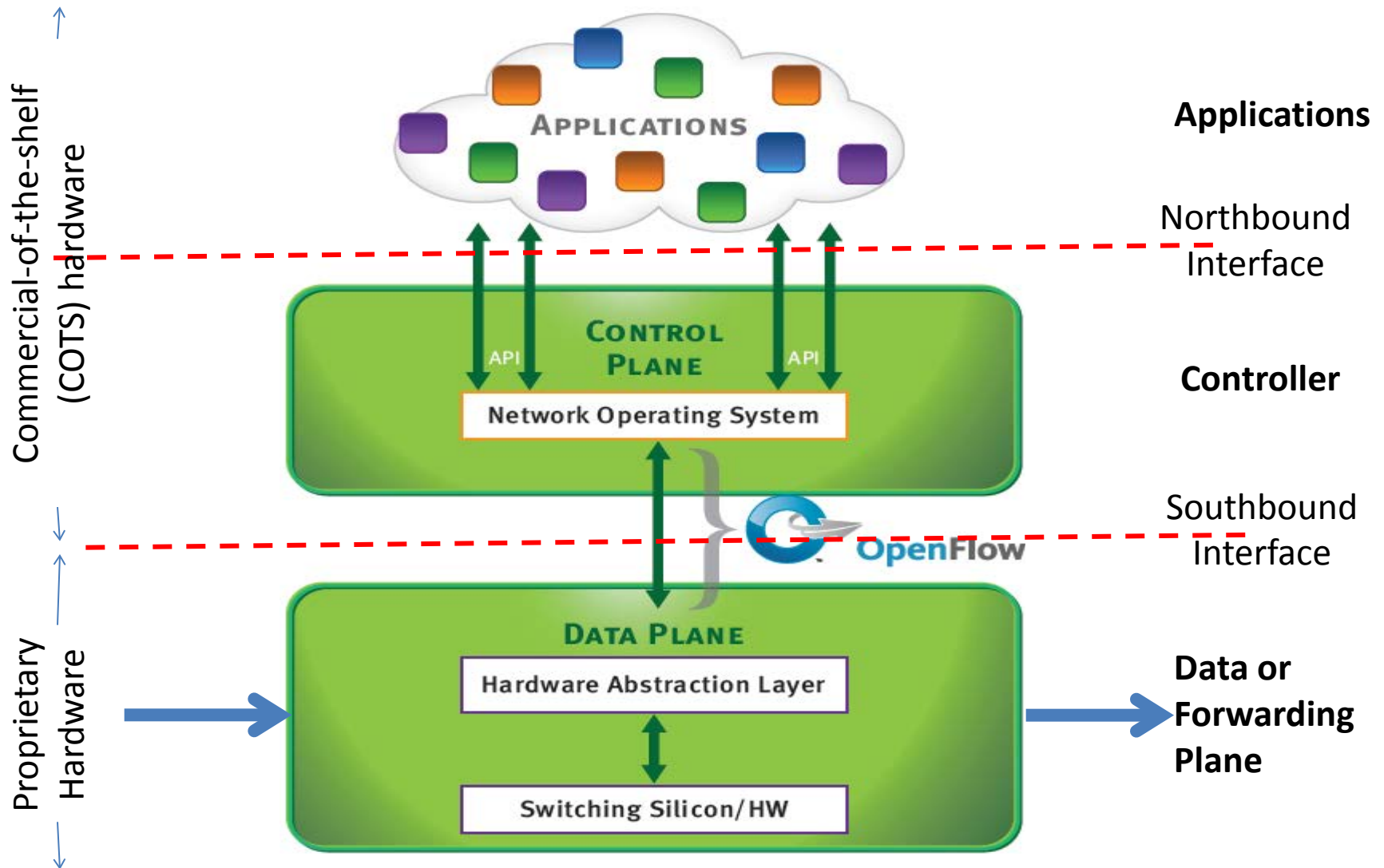
# Virtual Overlay Network

- A Virtual Overlay Network is one form of network virtualization that uses tunneling protocols to form paths between software-based network agents on servers and networked devices. Virtual overlay network software separates the virtual network from the underlying physical network hardware.

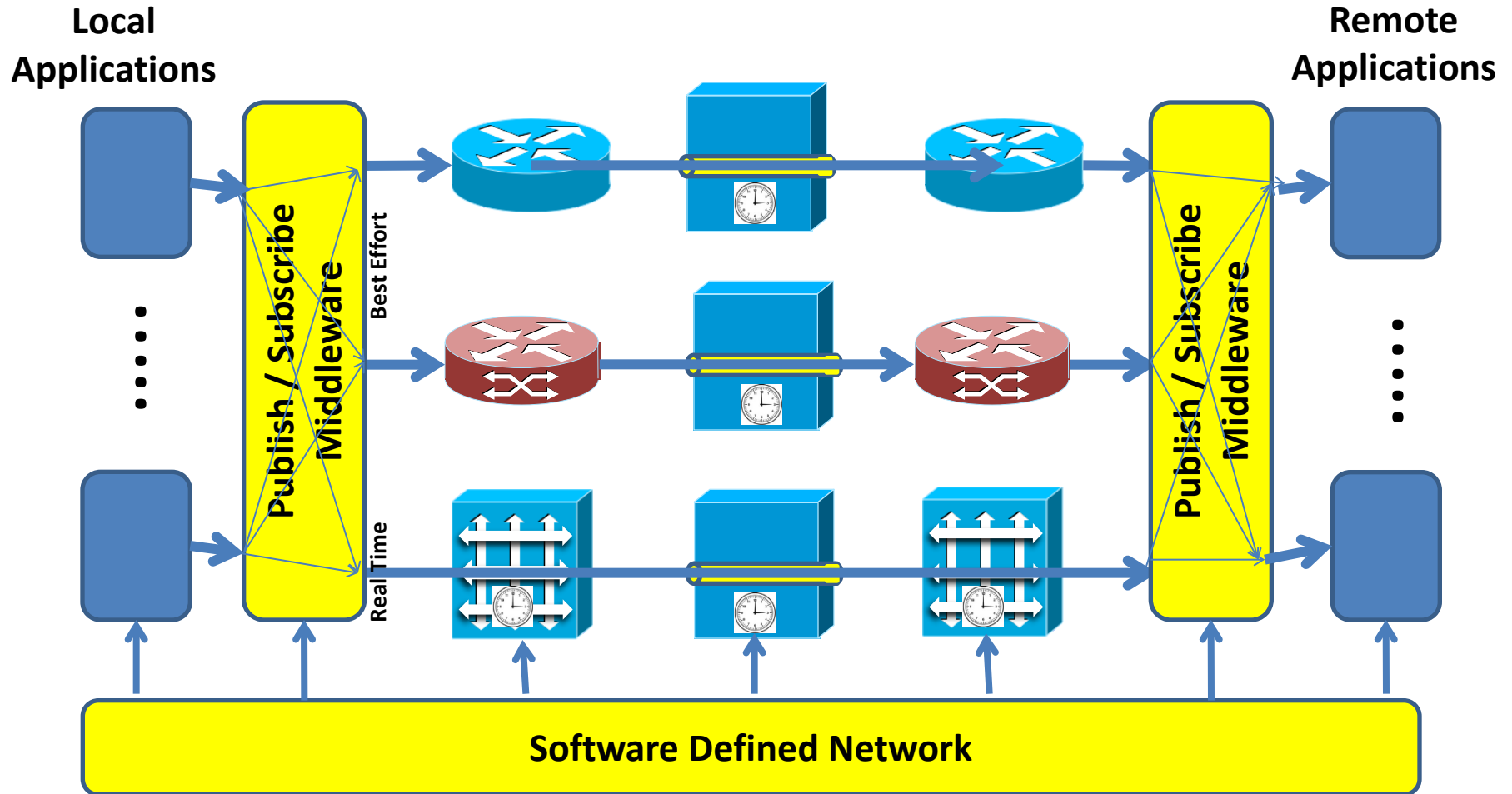
# Networking Options



# OpenFlow Software Defined Network

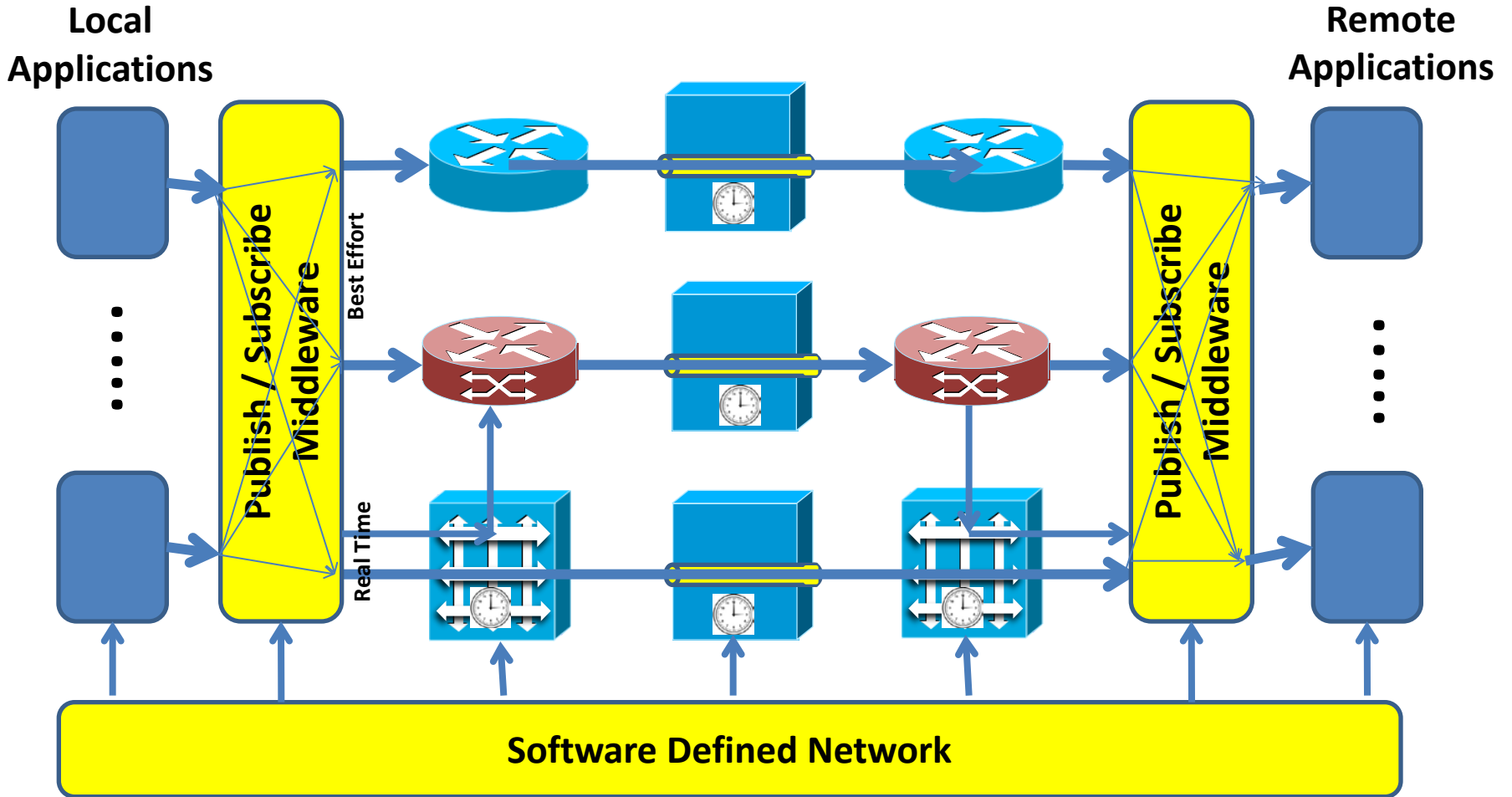


# Software Defined Network





# Virtual Overlays



# IBM Distributed Overlay Virtual Ethernet (DOVE) Switches

Existing Physical Network

- Switches learn MAC addresses of physical hosts and not of VMs
- Routers route IP addresses of physical hosts and not of VMs
- Switches and routers are not aware of VMs and DOVE Networks

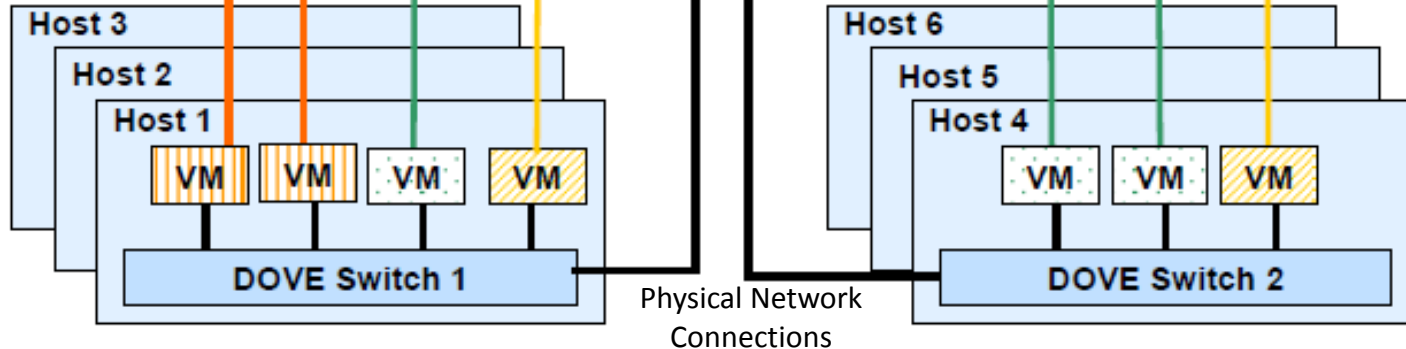
Data Center Network

DOVE Network 1

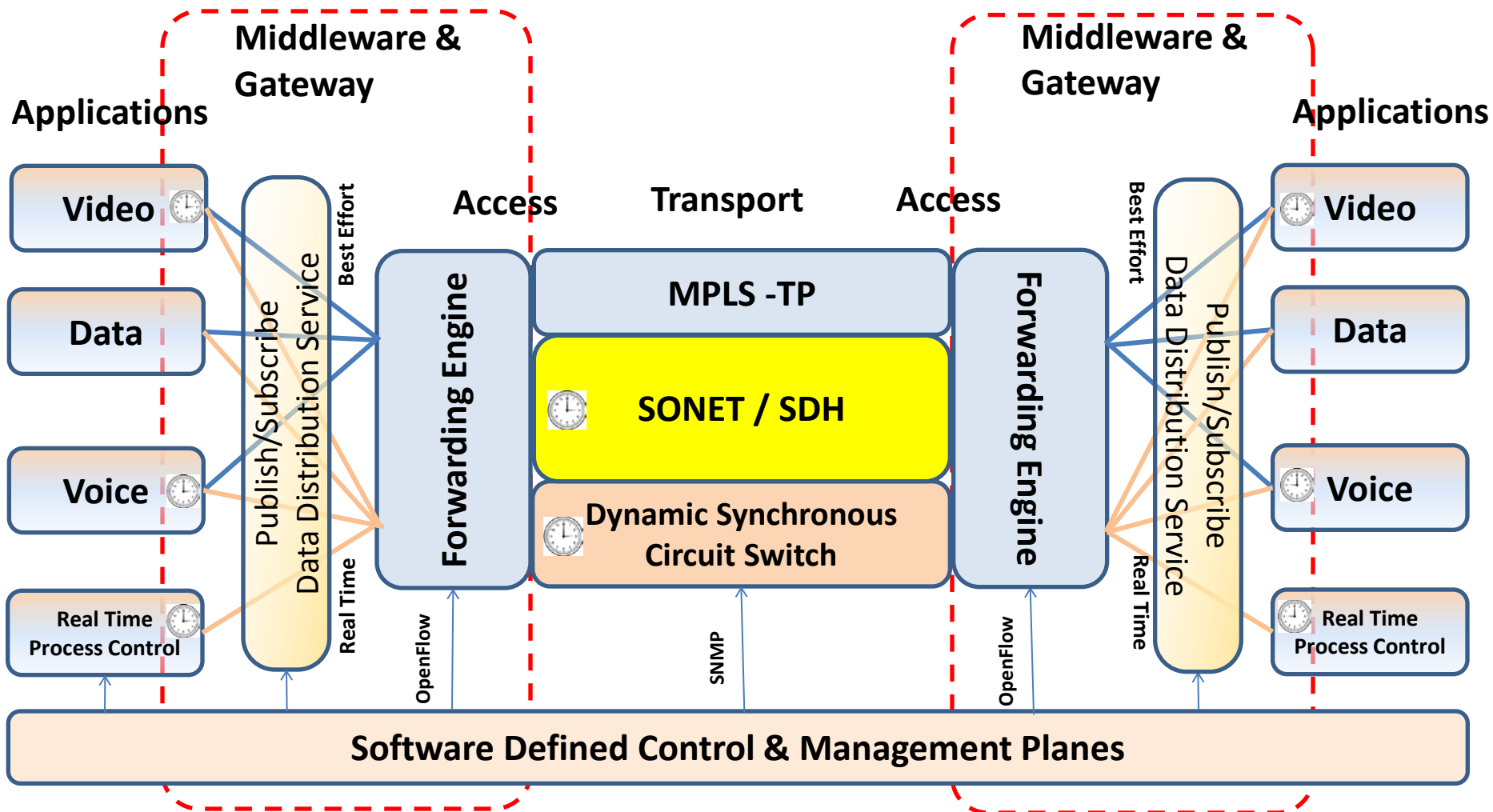
DOVE Network 2

DOVE Network 3

Virtual Network



# Multi-Service Software Defined Networks



# SDN Benefits for Critical Infrastructure

- Simplified network configuration and management
- Dynamic network resource management
- Hardware and infrastructure independence
- Inherent security and high scalability
- Traffic separation and management
- Flexible and open – open source

Questions

**Thank you**