

Software Defined Optical Networking

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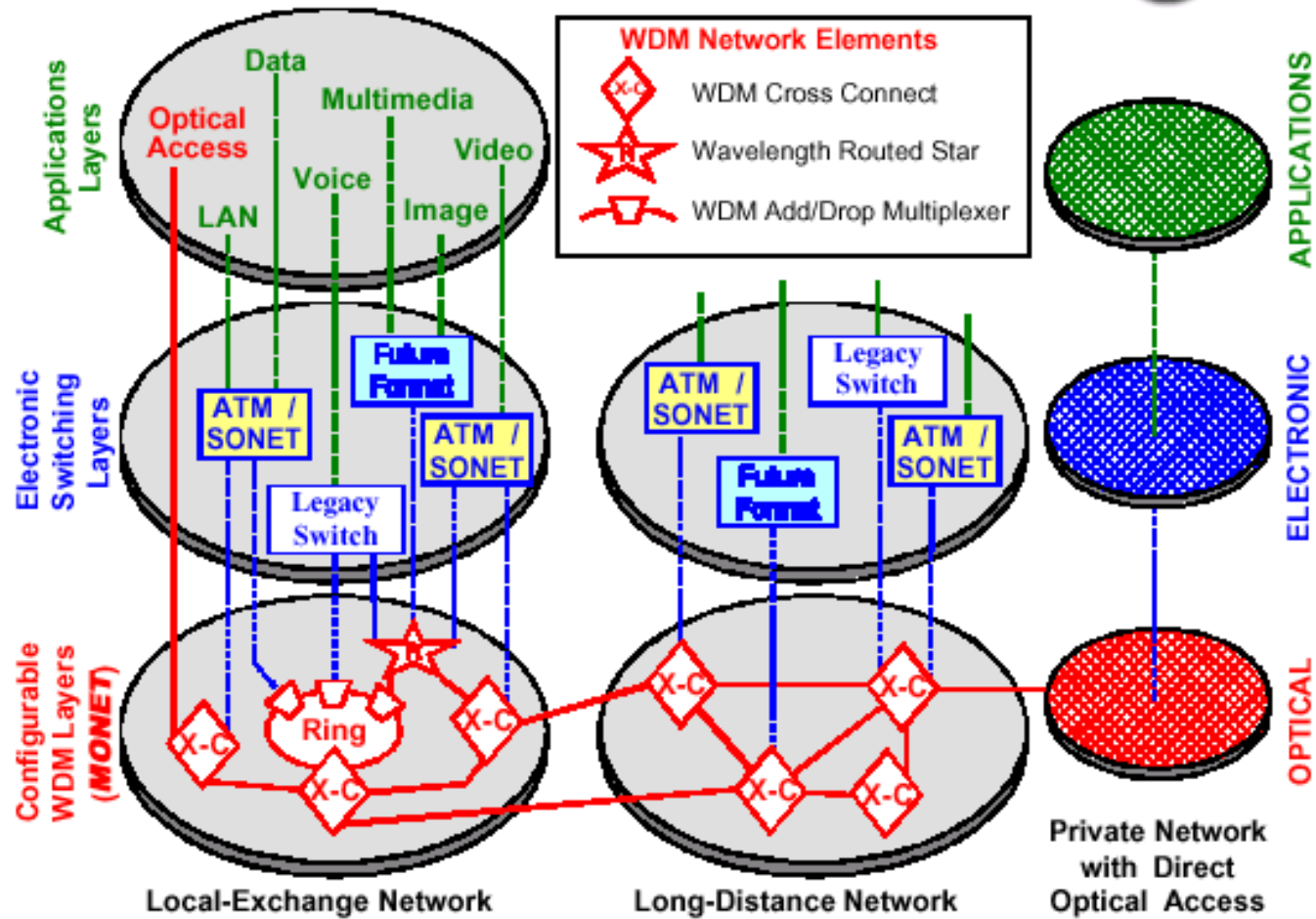
Software Defined Networks

- **Separation of Control Plane and Data Plane**
- **Separation of Forwarding functions and Routing functions**
- **Virtualization of Lower Layer Functions**

Challenges

- **High-Speed Reconfigurable Software Defined Optical Networks?**
- **Scalable Mobile Software Defined Networks?**
- **Scalable Heterogeneous Multidomain Software Defined Networks?**
- **Integration of Applications and Networks?**

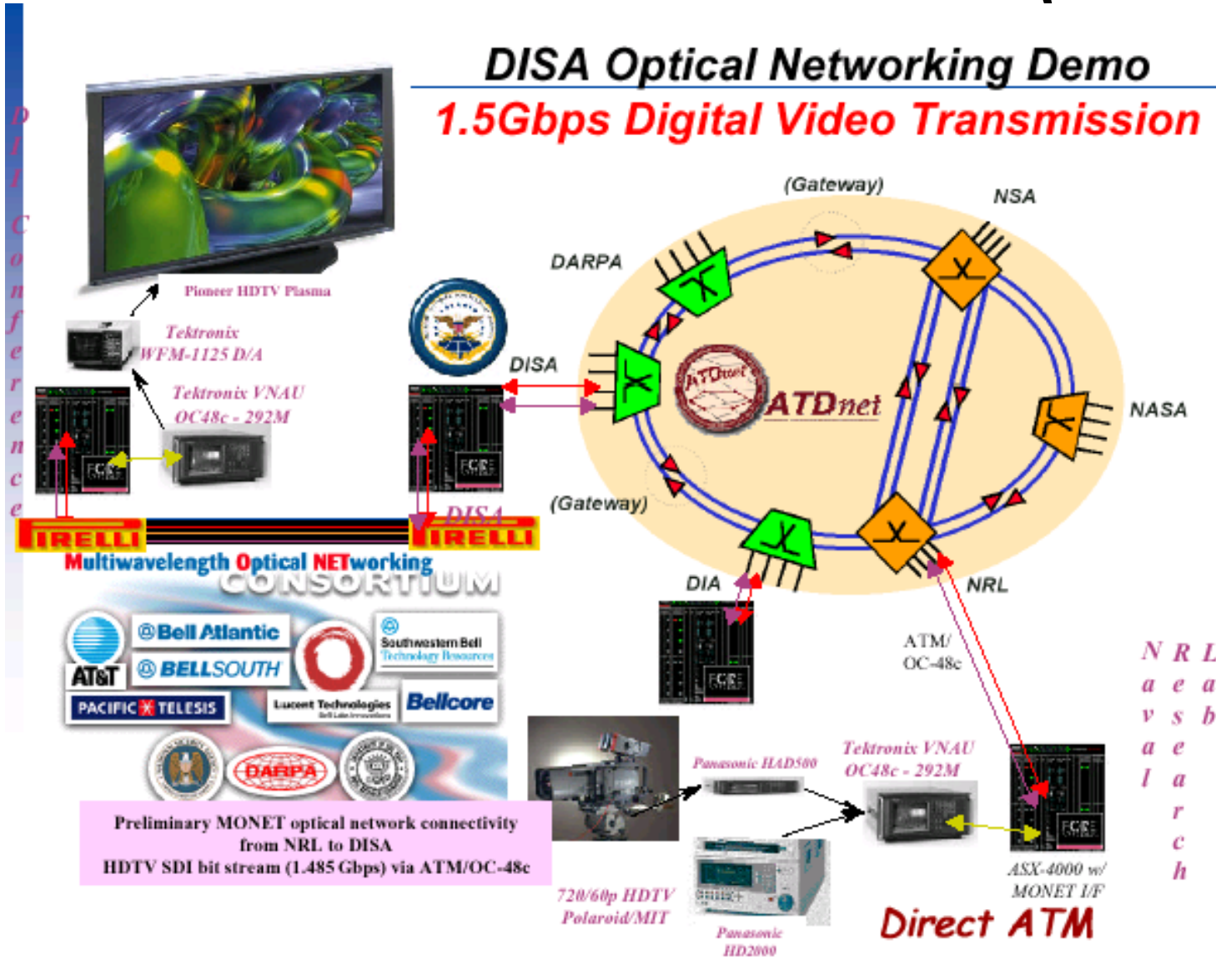
MONET (1993-1999)



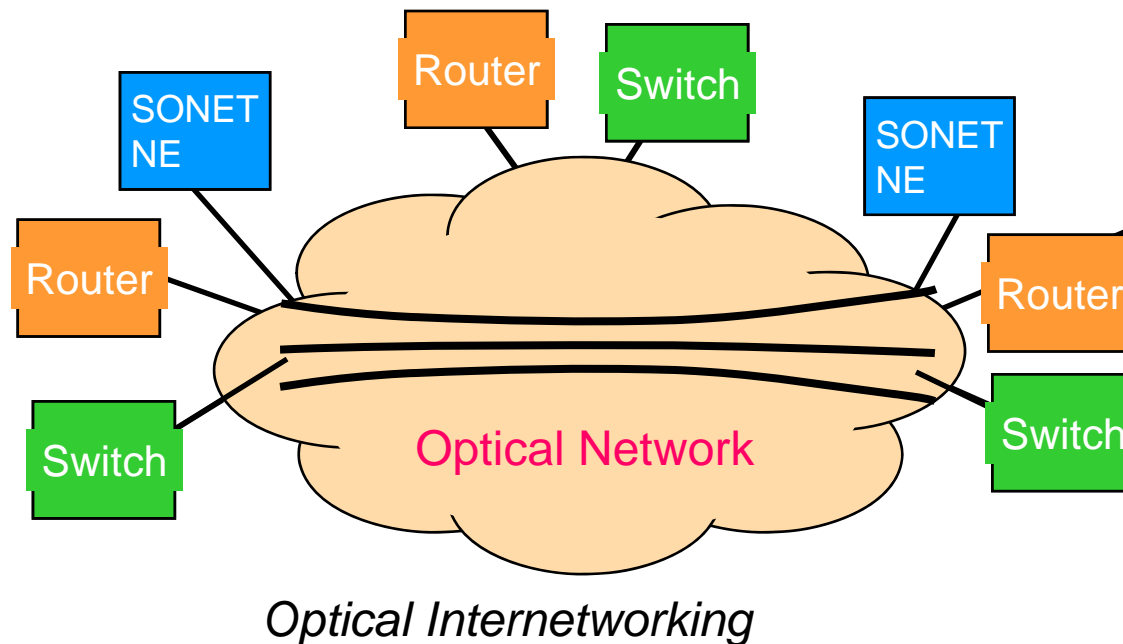
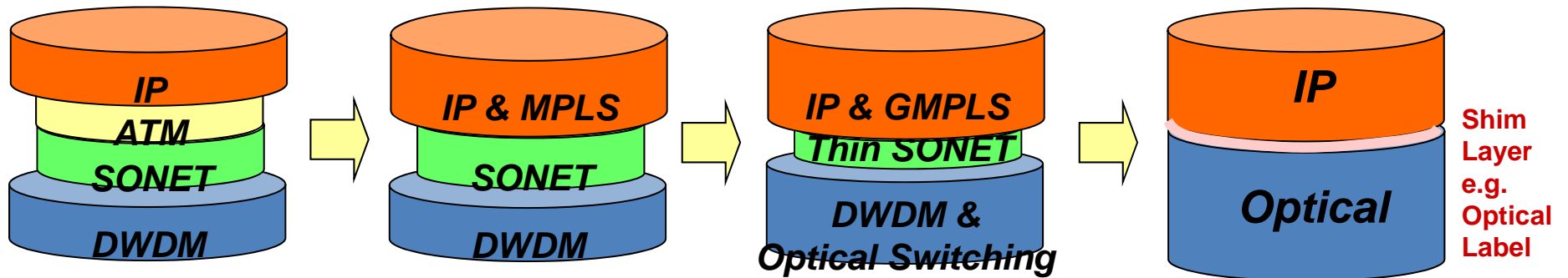
MONET New Jersey Testbed at Bellcore



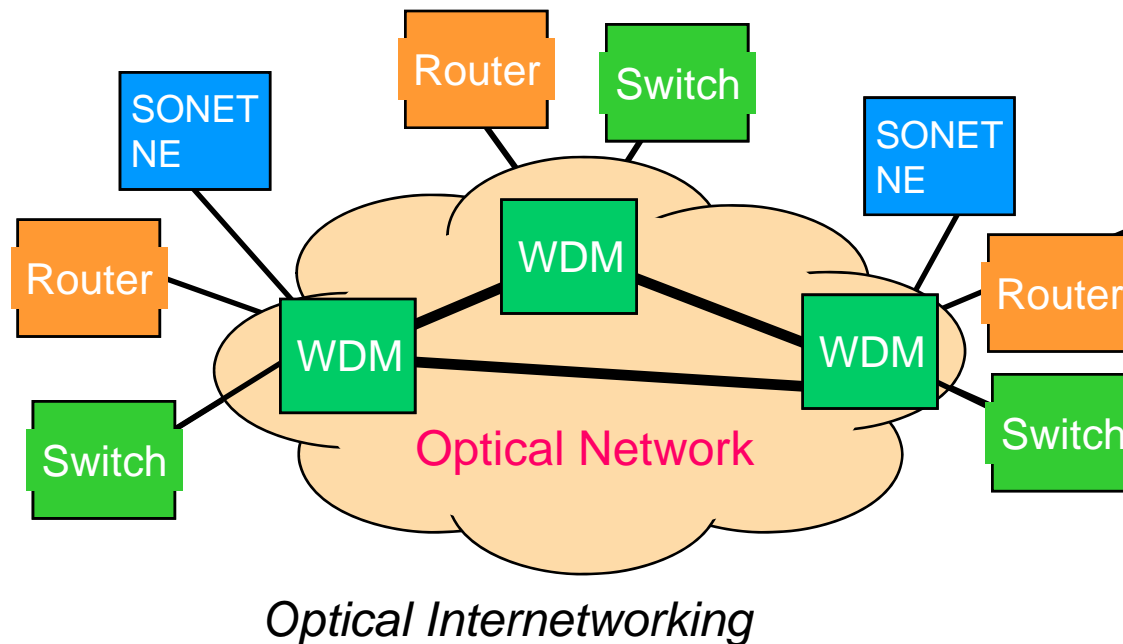
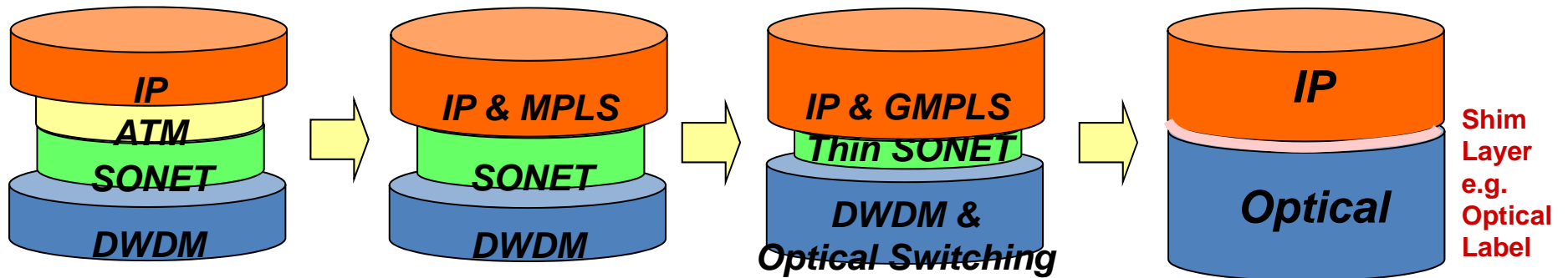
ATD-MONET DC network testbed (1998)



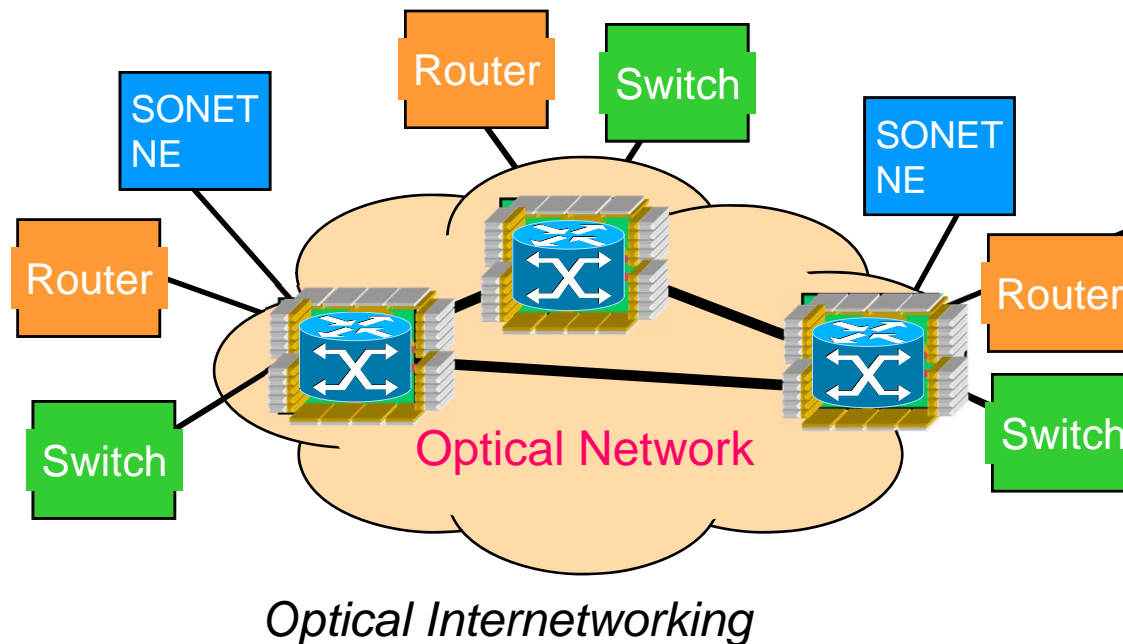
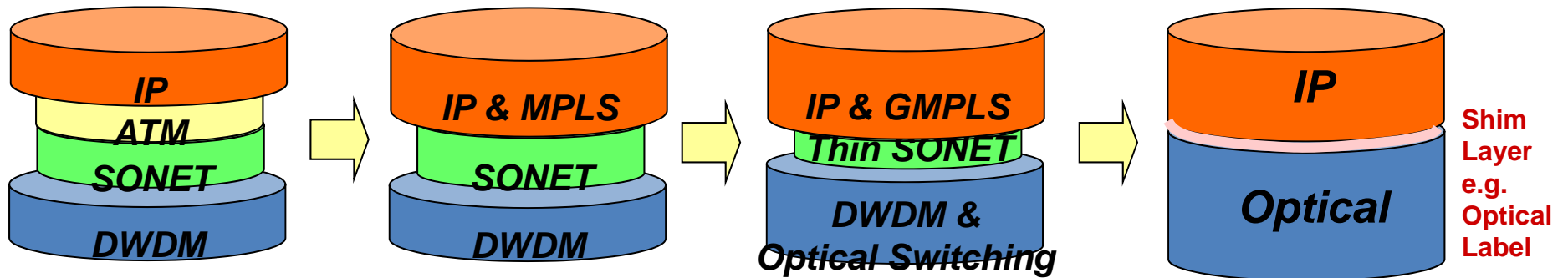
Evolution of Optical Networking



Evolution of Optical Networking

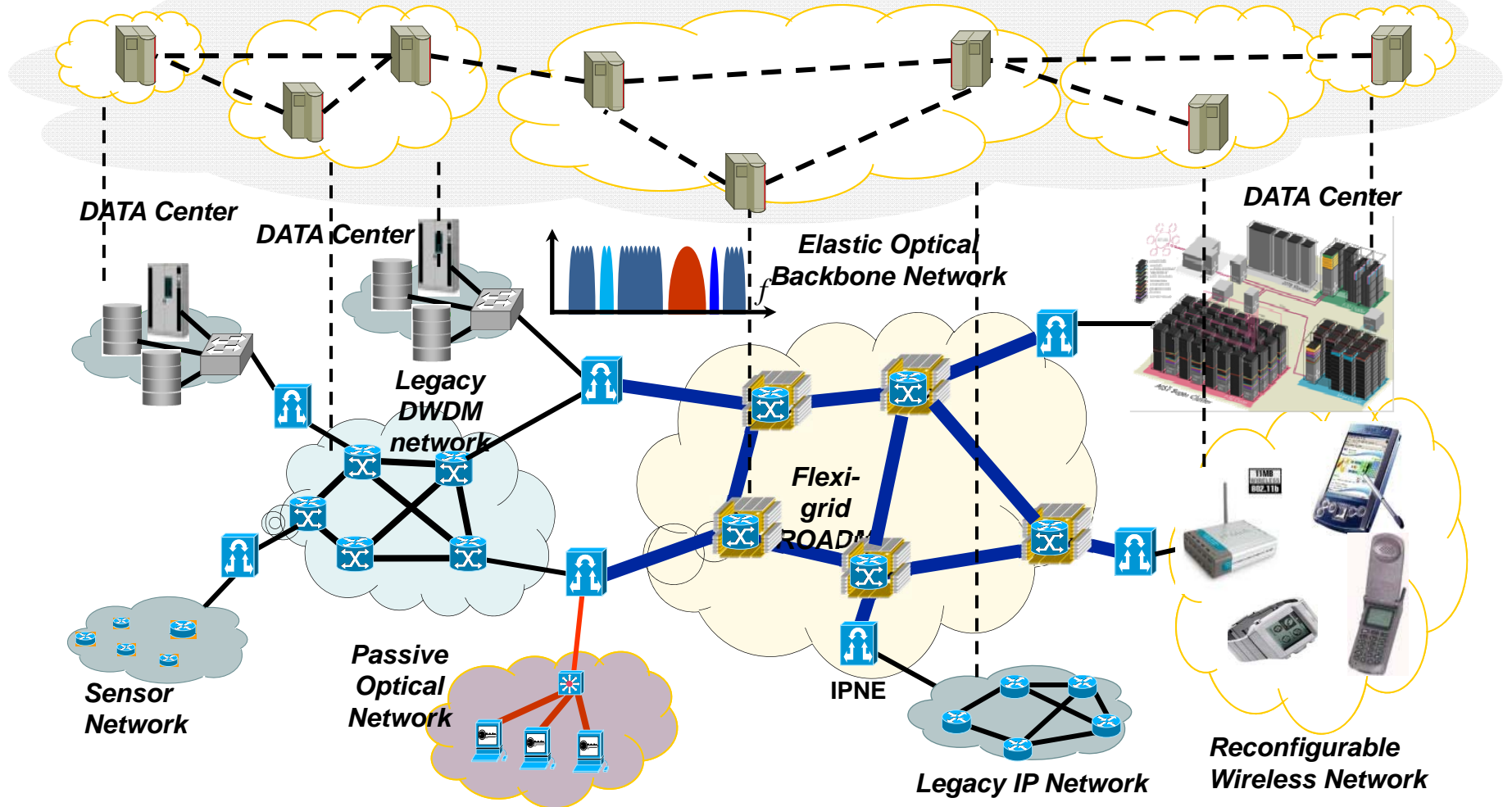


Evolution of Optical Networking



Heterogeneous Networking

Cloud of Software Defined Network Control & Management Systems in multiple administrative domains



Some things to Think About

- 1. Why is optics important in future cyberinfrastructures?**
- 2. What is US government doing to promote research, development, and deployment of optical SDN? What about other countries?**
- 3. How would IP and optics work together?**
- 4. How does cloud computing and data center change the landscape of optical SDN?**
- 5. Can you get the best of both worlds--- mobility and high-throughput (end-to-end)-- with wireless + optical SDN?**
- 6. Can you virtualize optical network sufficiently?**
- 7. If there is GENI2, how would you do this differently? (This is in reference to the fact that there were a lot of optical discussions at the beginning of GENI but almost forgotten or ignored for a long time)**
- 8. What are the challenges and what do we need to do to overcome them?**

Agenda

Activity	Speaker
Overview: Optical Networking, SDN, and GENI	Ben Yoo (UCDavis)
International SDN Across the Globe	J. Mambretti (iCAIR)
SDN/Openflow optical network on JGN-X testbed	Hiroaki Harai (NiCT)
Optical Cyberinfrastructure and GENI	J. Bryan Lyles (NSF)
Multilayer Multidomain Optical SDN	Inder Monga (ESnet/DOE)
Optical and Wireless SDN	Vishnu Shukla (Verizon)
Optical Service Chaining by combining optics, SDN, and NFV	Ming Xia (Ericsson)
SDN Data Centers, Optical Networks	Loukas Paraschis (Cisco)
Panel Discussions	All: (moderated by Ben Yoo)