Software Defined Networks
An IETF update for UKNOF 21
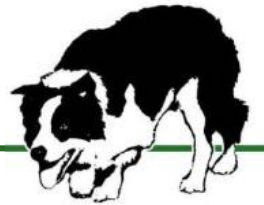
Old Dog Consulting
Daniel King - daniel@olddog.co.uk
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Dan & Adrian

- **Adrian Farrel**
  - Formerly co-chair of CCAMP, PCE, and L1VPN IETF Working Groups.
  - IETF Routing Area Director (funded by Juniper).
  - Author of >40 RFCs across multiple technologies.

- **Daniel King**
  - Secretary of CCAMP, PCE, ROLL and L3VPN IETF Working Groups.
  - Editor and author on numerous IETF Internet-Drafts and RFCs related to path computation, IP, MPLS, GMPLS and network optimization.

- **Together**
  - Have an unhealthy obsession with the Evolution of the Internet.
  - Responsible for >50 IETF RFCs and currently have >10 active drafts.
  - Founded path computation and network optimisation specialists Aria Networks.
  - Work for Old Dog Consulting.
    - Standardisation, Product Management, Network Planning, Protocol and Control Plane Software.
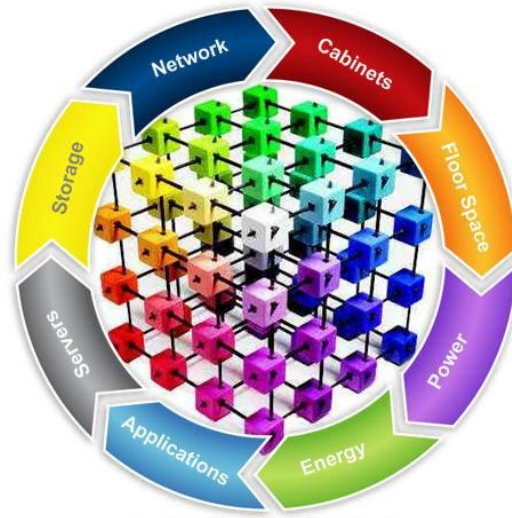   - IP routing, GMPLS/ASON, MPLS and MPLS-TP, PCE.
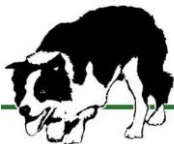
Objectives for SDNs & Data Centers

- Include…
  - Reduced Complexity of Network Operation.
  - Increased Robustness.
  - Minimise Layer "Disconnection".
  - Maximise Network Resources and Efficiency.
  - Faster Time to Revenue for New Applications and Services.

Data Centre Complexity

- Data centres are already complex, and they continue to grow at unprecedented rates.

- Data centres are built using a variety of complex protocol stacks, interfaces, and proprietary management systems.

- Virtualization (Cloud) is built using distributed systems within the data centre.
  - Managing change and replication (scaling) of virtualized resources adds additional complications.
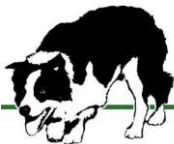
Data Centre Robustness

- Enterprise "Systems" View.
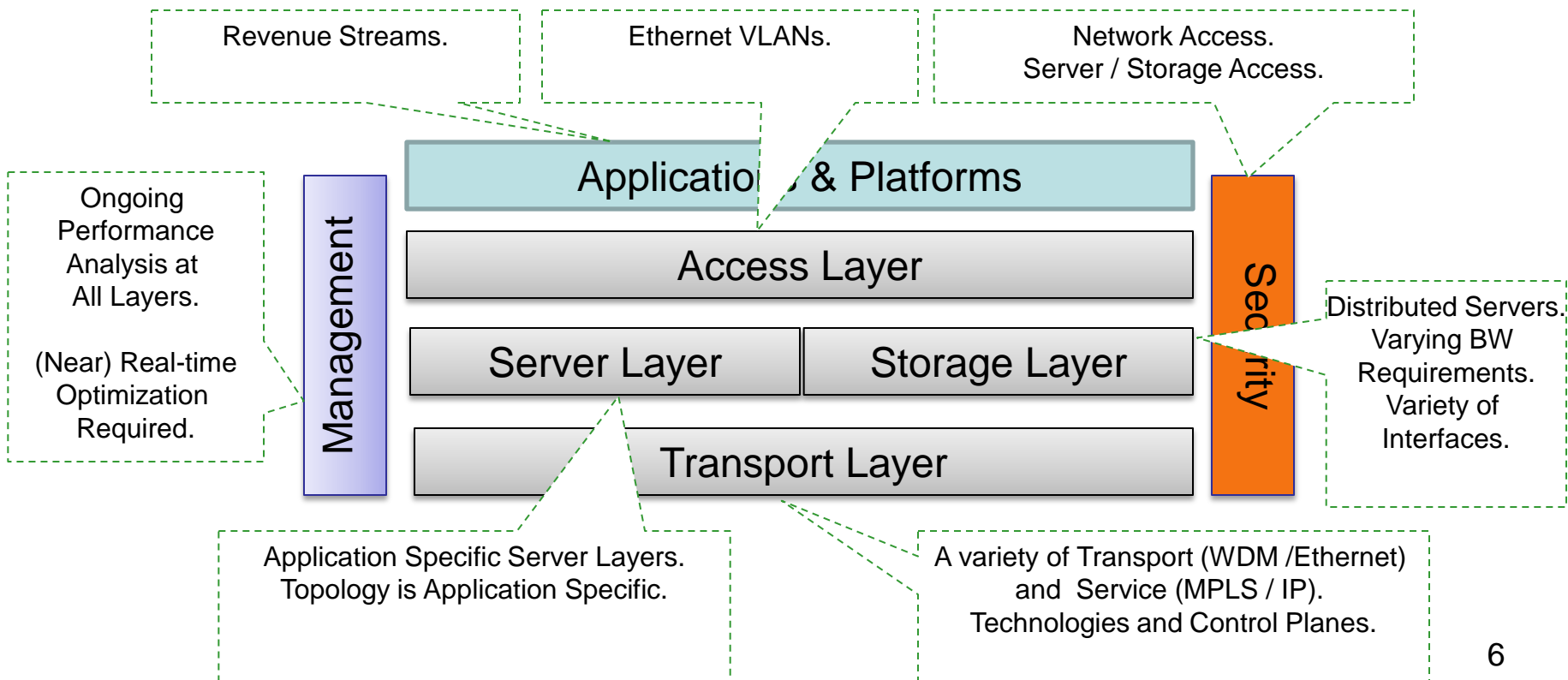- Network Robustness versus Complexity.
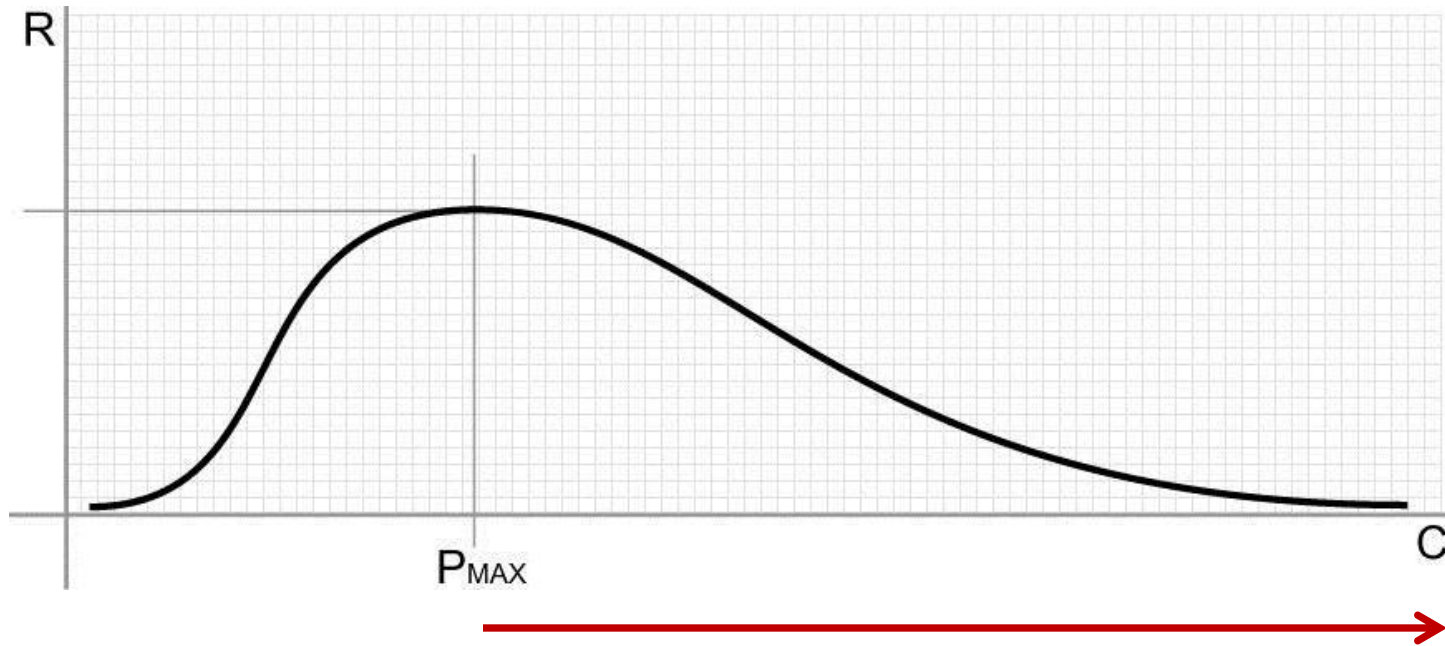
Increasing number of devices, protocols, configurations and interactions.

Data Centre Disconnection

- Generally data center applications and platforms do not have knowledge of underlying network layers, conditions and devices.
  - Limited cooperation between applications, access network, storage servers and network layer switches and routers.

Revenue Streams.

Ethernet VLANs.

Network Access.
Server / Storage Access.

Ongoing Performance Analysis at All Layers.

(Near) Real-time Optimization Required.

Management

Application & Platforms

Access Layer

Server Layer

Storage Layer

Transport Layer

Security

Distributed Servers. Varying BW Requirements. Variety of Interfaces.

Application Specific Server Layers. Topology is Application Specific.

A variety of Transport (WDM /Ethernet) and Service (MPLS / IP). Technologies and Control Planes.

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Proposed Solution

- Software Defined Networks (SDN)
  - Lower Layer Network "Abstraction".
  - Partitioning of Resources.
  - Network Automation.
  - Application-to-Network Relationship.
    - Provides access to the forwarding plane of network devices.

- Potential Benefits of SDNs for DCs
  - Reduce data center complexity.
  - Provide more robust resiliency and network flexibility.
  - Optimize the use of the network resources for applications and higher-layer platforms.
  - Accelerate application innovation.

"SDN" Deja Vu

- Partitioning of Network Control and Resources
  - Ipsilon GSMP
  - IETF Forces
 - Soapstone PBTC
  - IETF PCE
  - OpenFlow
  - Plus, many more…

Why This Time is Different

- Momentum being driven by the worlds largest data centers and content providers.

- Both software and hardware vendors have recognised a need to increase network functionality.
  - While simplifying hardware, software, and management.

- OpenFlow standards development organisation (ONF) has been created.

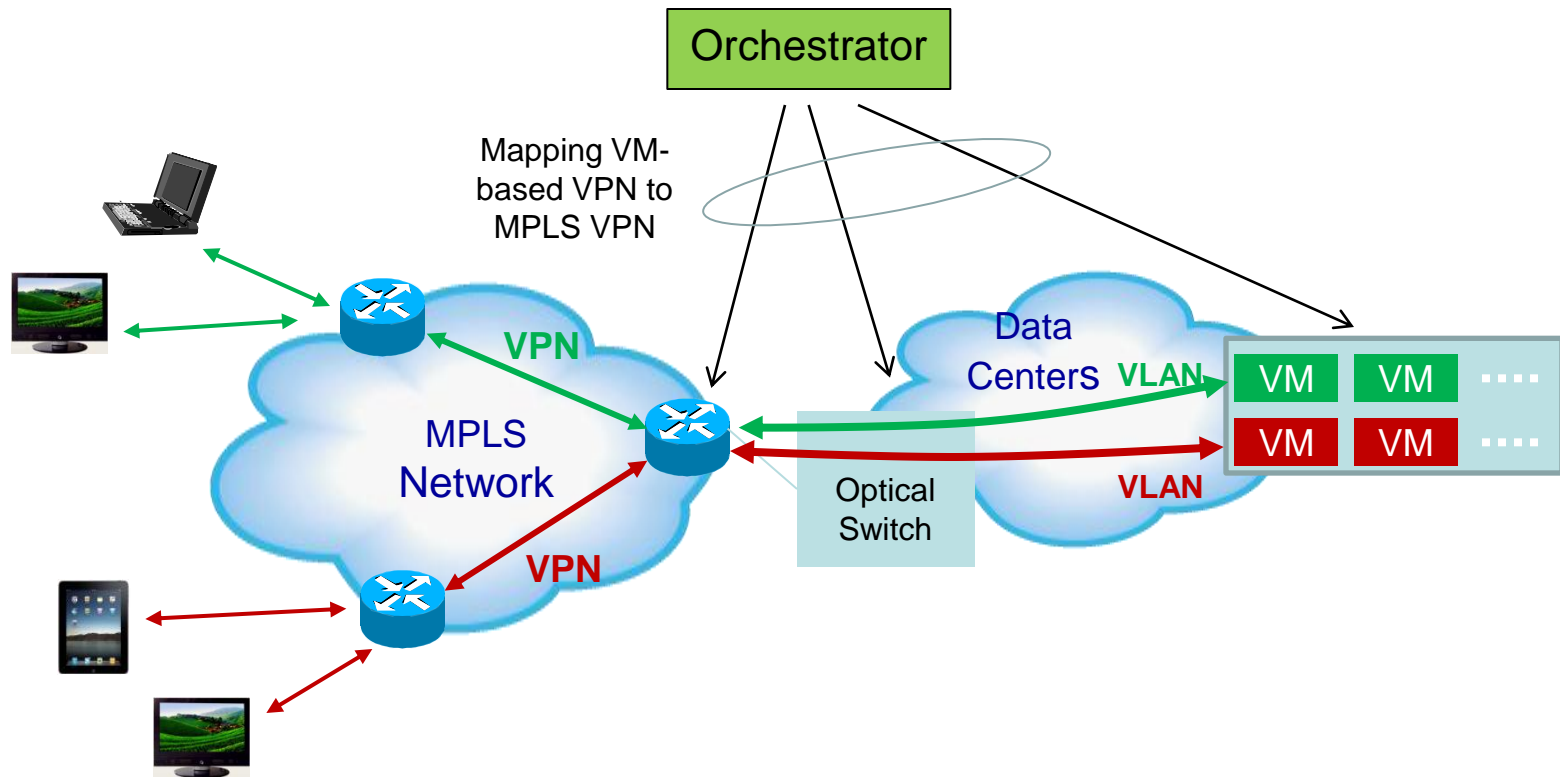- IETF SDN Discussions and Documents.

A Possible SDN Architecture
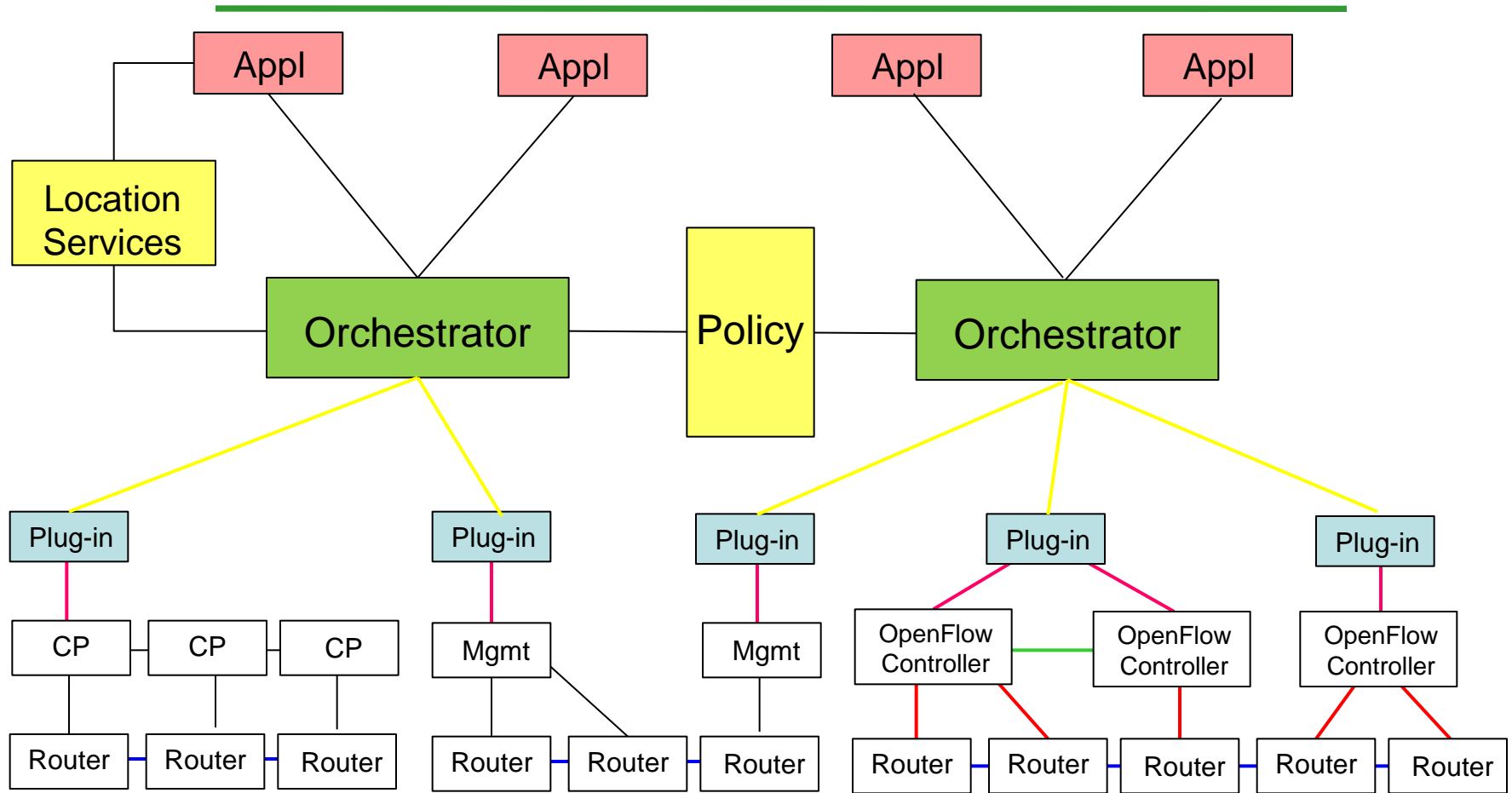
Common Protocol with Data Abstraction — Data Plane — OpenFlow
Control-Specific API — New ONF Protocol?

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Use Case 1:
Inter-Data Center Transport
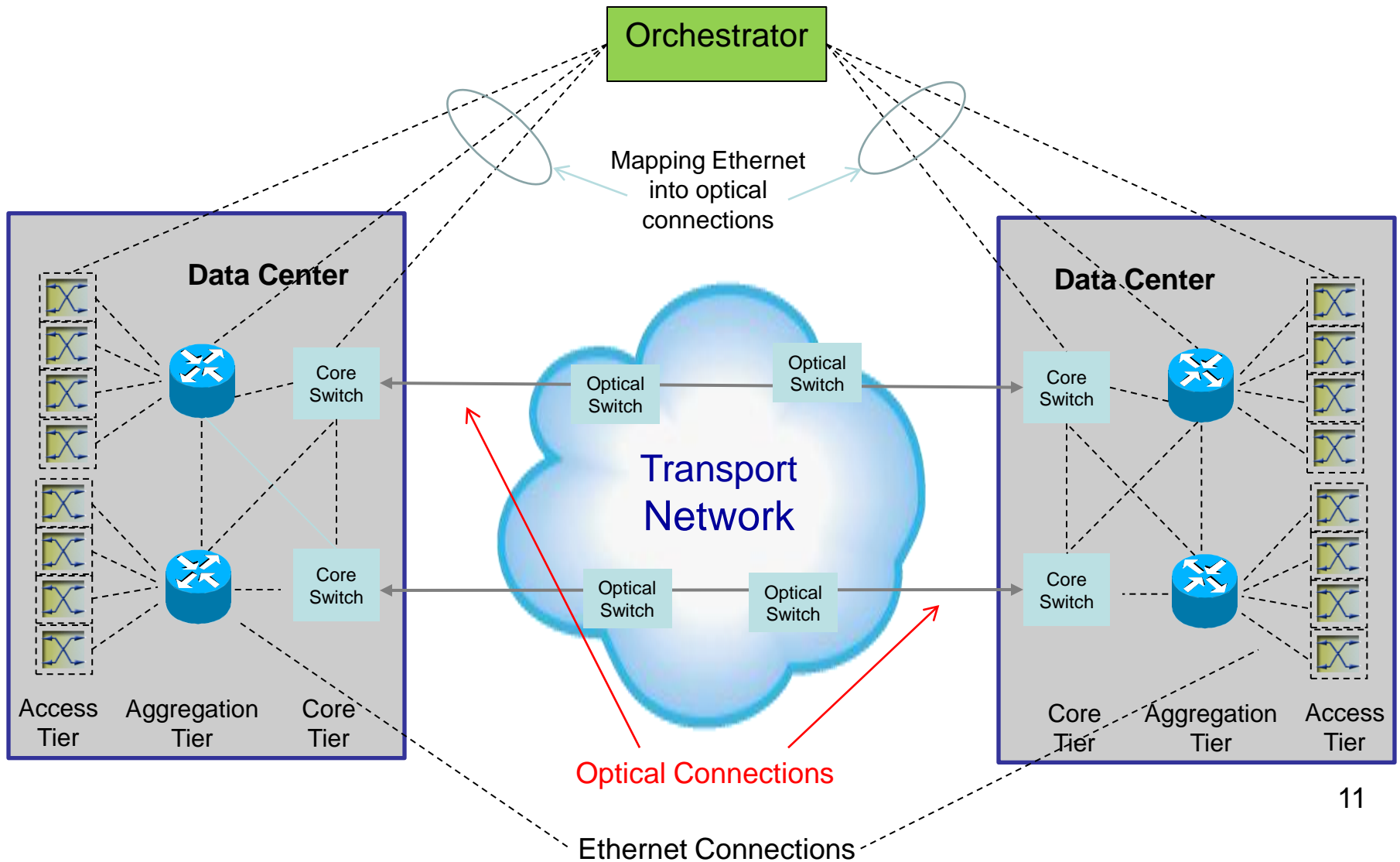
Use Case 2:
App-Network VPN Mapping

SDN Standards Development

- Open Networking Foundation (ONF)
  - Founded in March 2011 by Deutsche Telekom, Facebook, Google, Microsoft, Verizon, and Yahoo!, the Open Networking Foundation (ONF) is a non-profit organization.
  - Currently >50 members.
  - ONF is intended to accelerate the delivery and use of Software Defined Networking (SDN) standards, products, services, applications, customers, and users.
  - Continued development of the OpenFlow Specification (OpenFlow v1.2 has been released).
  - OpenFlow implemented by >15 routing and switch vendors. Additionally >10 software implementations exist.

- Internet Engineering Task Force (IETF)
  - Open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.
  - The IETF has a toolkit of existing protocols and architectures, as well as the ability to define requirements and develop new protocols, mechanisms and interfaces.
  - SDN Side meeting at IETF 81.
  - SDN BoF at IETF82.
  - Mailing list created http://www.lucidvision.com/mailman/listinfo/sdnp.

IETF Discussion Documents

- Software Driven Networks Lexicon
  - draft-king-sdn-lexicon-00
- SDN Problem Statement
  - http://tools.ietf.org/html/draft-nadeau-sdn-problem-statement-01
- SDN Use Cases
  - http://tools.ietf.org/html/draft-stiliadis-sdnp-framework-use-cases-01
  - http://tools.ietf.org/html/draft-pan-sdn-bod-problem-statement-and-use-case-01
  - http://tools.ietf.org/html/draft-pan-sdn-dc-problem-statement-and-use-cases-01
  - http://tools.ietf.org/html/draft-mcdysan-sdnp-cloudbursting-usecase-00
- SDN Framework
  - http://tools.ietf.org/html/draft-nadeau-sdn-framework-01
- SDN Solutions
  - http://tools.ietf.org/html/draft-marques-sdnp-flow-spec-00

IETF Status

- SDN side meetings continue in order to identify problem statement and specific use cases.
  - Next session will be at IETF 82 in Paris, March 2012.
  - Hoping for a working-group-forming BoF.
- IETF SDN Mailing List.
  - http://lucidvision.com/mailman/listinfo/sdnp
- Area ADs discussing where the work will ultimately be progressed.
  - Possible candidates include Routing, Application and Operations.
- The SDN "Killer Application"
  - If it exists, what is it?
  - Generic requirements?
- We are missing input from Operators.
  - What are the show-stopper problems in Data Centres?
  - Too much "secret source" in successful DCs?
  - No clear motivation for SDN, but "kind of interesting".