

# Blending SDN with PCE for Scalable Data Center Service Deployment

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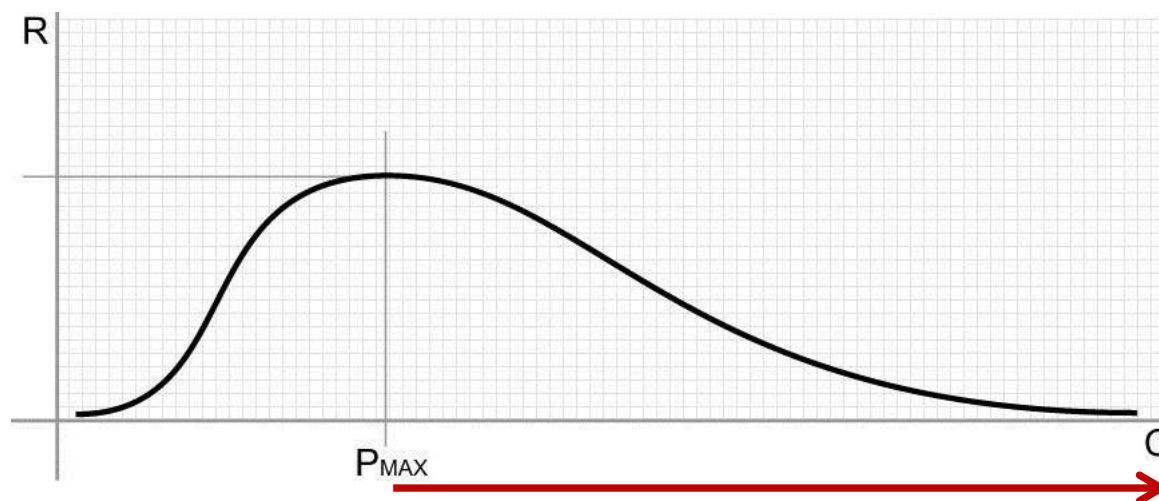
# Objectives for SDNs & Data Centers

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- 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.

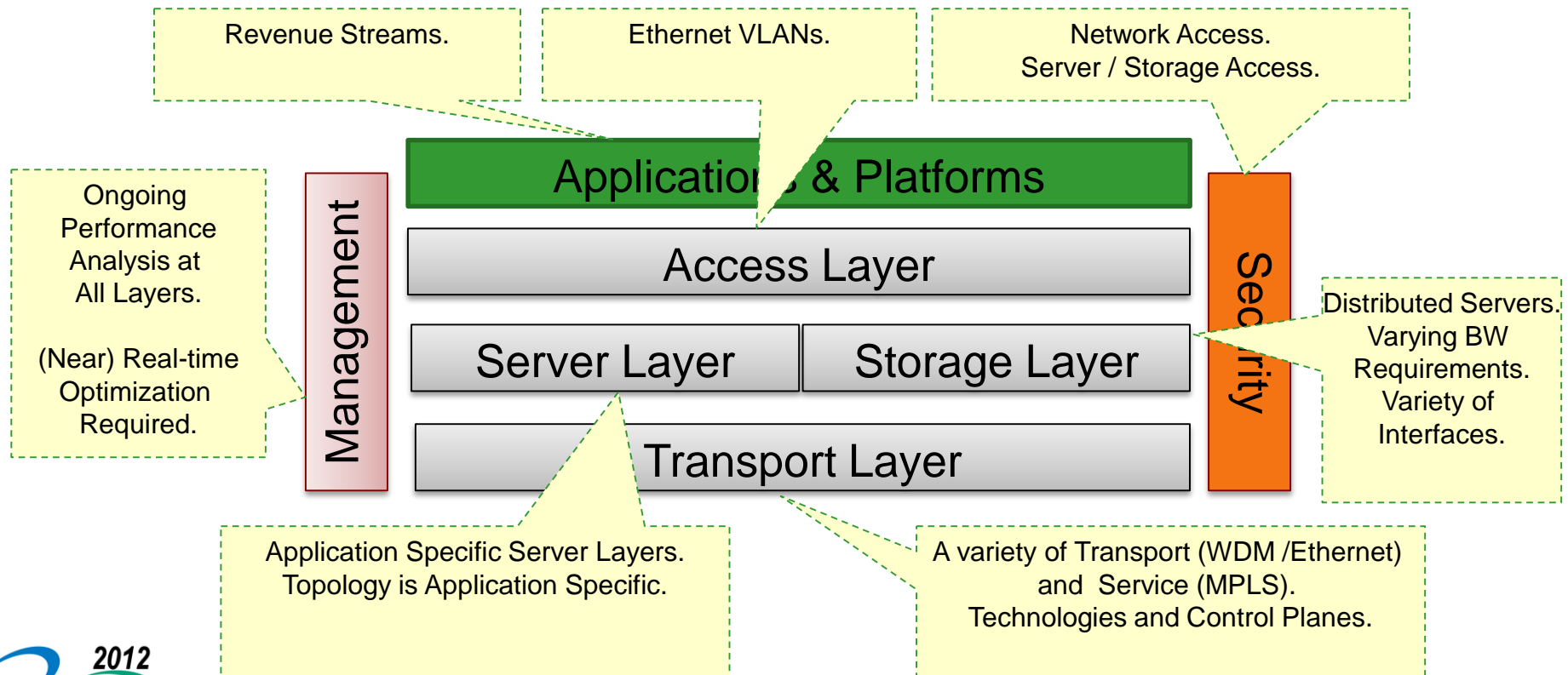
# Data Centre Complexity

- Data centres are already complex, and they continue to grow at unprecedented rates.
- Virtualization (Cloud) is built using distributed systems within the data centre.
- Data centres are built using a variety of complex protocol stacks, interfaces, and proprietary management systems.
  - Increasing number of devices, protocols, configurations and interactions



# The Data Centre Disconnection

- Generally data centre 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.



# “SDN” Deja Vu

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

# Proposed Solution

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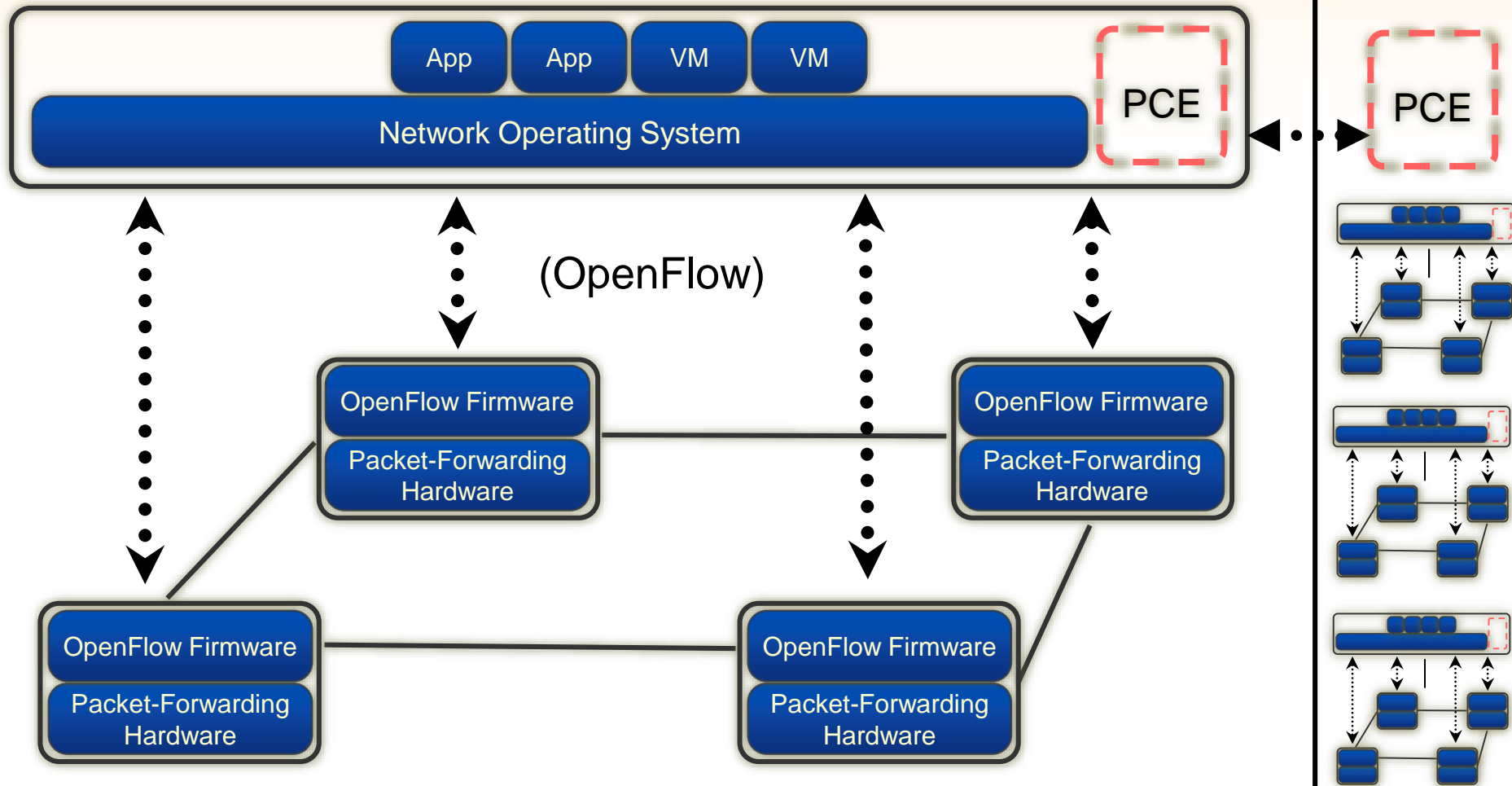
- Software Defined Networks (SDN)
  - Lower Layer Network “Abstraction”.
  - Partitioning of Resources
  - Application-to-Network Relationship.
    - Provides access to the forwarding plane of network devices.
- Path Computation Element (PCE)
  - Inter-domain and Complex Path Computation
  - Network Automation, Pre-Planned and Near Real-time.
  - Well Defined Technology
- Benefits of PCE-enabled 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.
  - Maintain path computation continuity.
  - Accelerate application innovation.

# Why This Time it May Be Different?

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- 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 continue and documents exist.
- IETF PCE is mature.

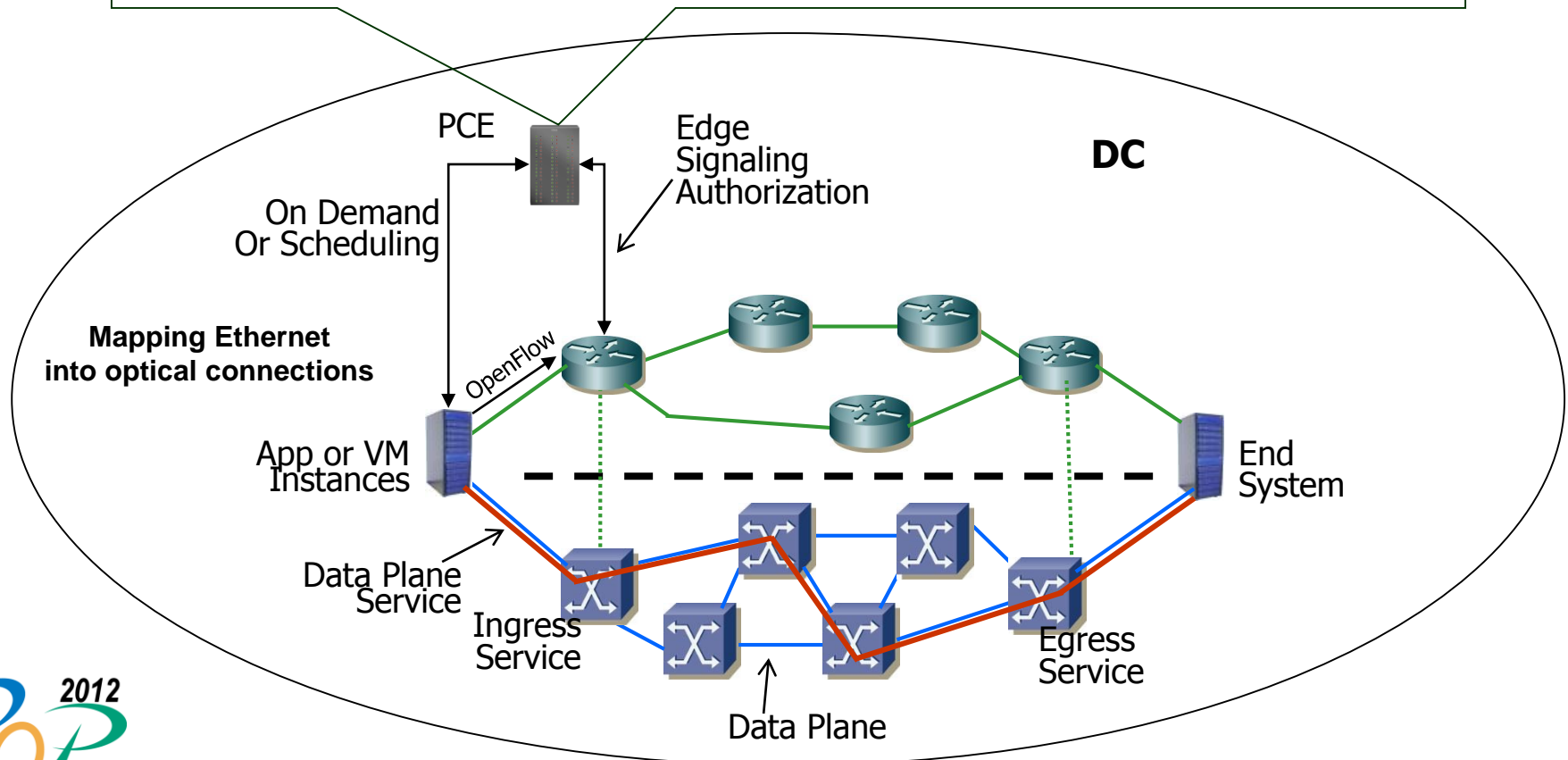
# Simple Architecture





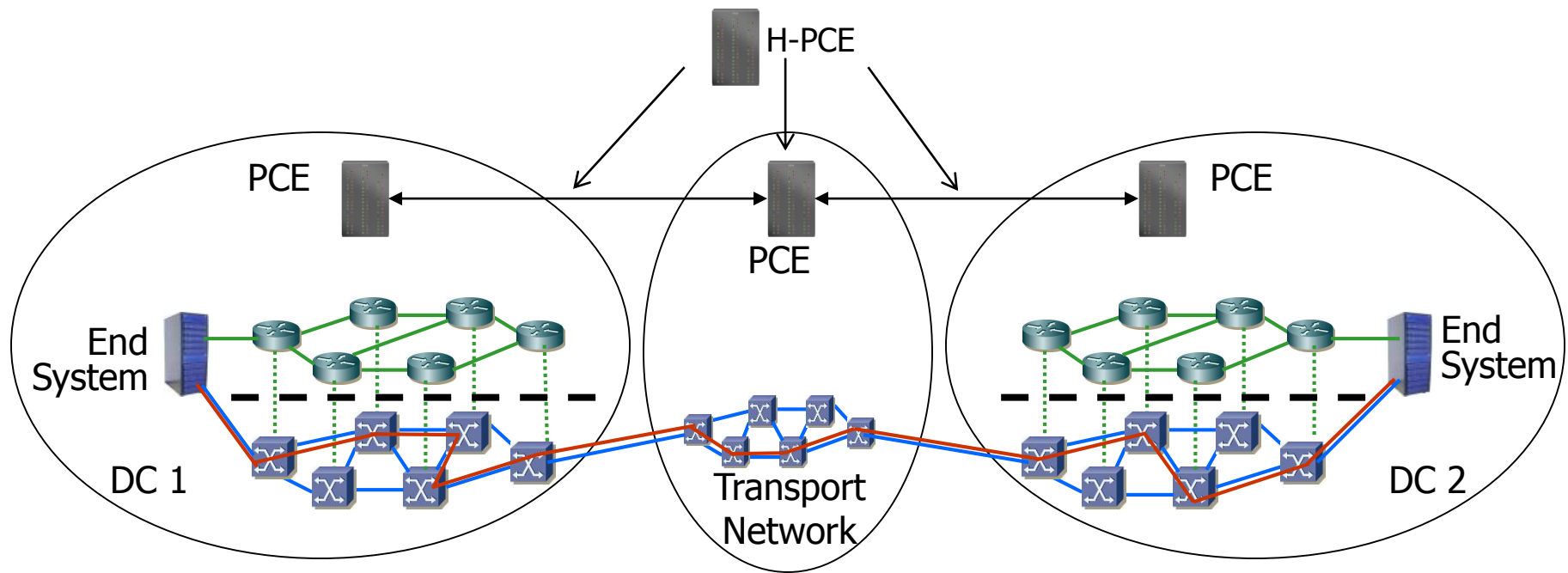
# Data Center Connectivity

- TED built using inventory or IGP
- Path Computation
- Scheduling
- Authentication
- Accounting
- Authorization (flexible policy based)



# Use Case 2: Inter-Data Center Connectivity

- Inter-domain PCE Scenario
  - Domain could be AS or switching type.
  - H-PCE, BRPC or Per Domain may be applied to compute paths.



# Relevant IETF PCE Standards and Drafts

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- PCE architecture and PCE protocol (RFCs 4655 and 5440)
- PCE Policy-Enabled Path Computation Framework (RFC 5394)
- PCE Preserving Topology Confidentiality (RFC 5520)
- PCE Route Exclusions (RFC 5521)
- PCE Support of Global Concurrent Optimization (RFC 5557)
- PCE Point-to-Multipoint Traffic Engineering (RFC 6006)
- PCE Synchronized Dependent Path Computations (RFC6007)
- PCE Hierarchical Path Computation (draft-ietf-pce-hierarchy-fwk)
- Stateful PCE (draft-ietf-pce-stateful-pce)

# SDN Standards Development

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- 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 SDN Discussion Documents

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- Software Driven Network 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-sdn-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-sdn-cloudbursting-usecase-00>
- SDN Framework
  - <http://tools.ietf.org/html/draft-nadeau-sdn-framework-01>
- SDN Solutions
  - <http://tools.ietf.org/html/draft-marques-sdn-flow-spec-00>

# IETF SDN Status

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- Currently looking for the SDN “Killer Application”
  - We need to define the motivation for SDN.
  - If it exists, what is it?
  - Generic requirements?
- SDN side meetings continue in order to identify problem statement and specific use cases.
  - Next session will be at IETF 84 in Vancouver, July 2012.
  - Not likely to be 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.
- We are missing input from Operators.
  - What are the show-stopper problems in Data Centres?
  - Too much “secret source” in successful DCs?