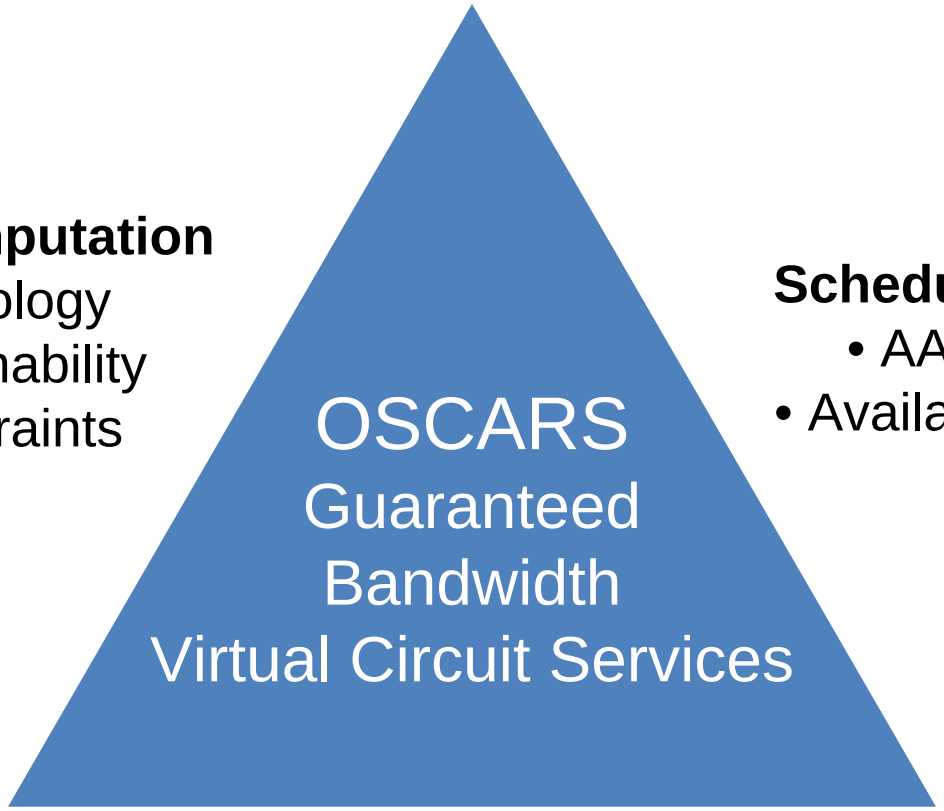

# ESnet OSCARS

**Chin Guok**

***Supporting Advanced Scientific Computing Research • Basic Energy Sciences • Biological and Environmental Research • Fusion Energy Sciences • High Energy Physics • Nuclear Physics***


U.S. DEPARTMENT OF ENERGY | Office of Science

# OSCARS Overview




**Path Computation**
- Topology
- Reachability
- Contraints

**Scheduling**
- AAA
- Availability

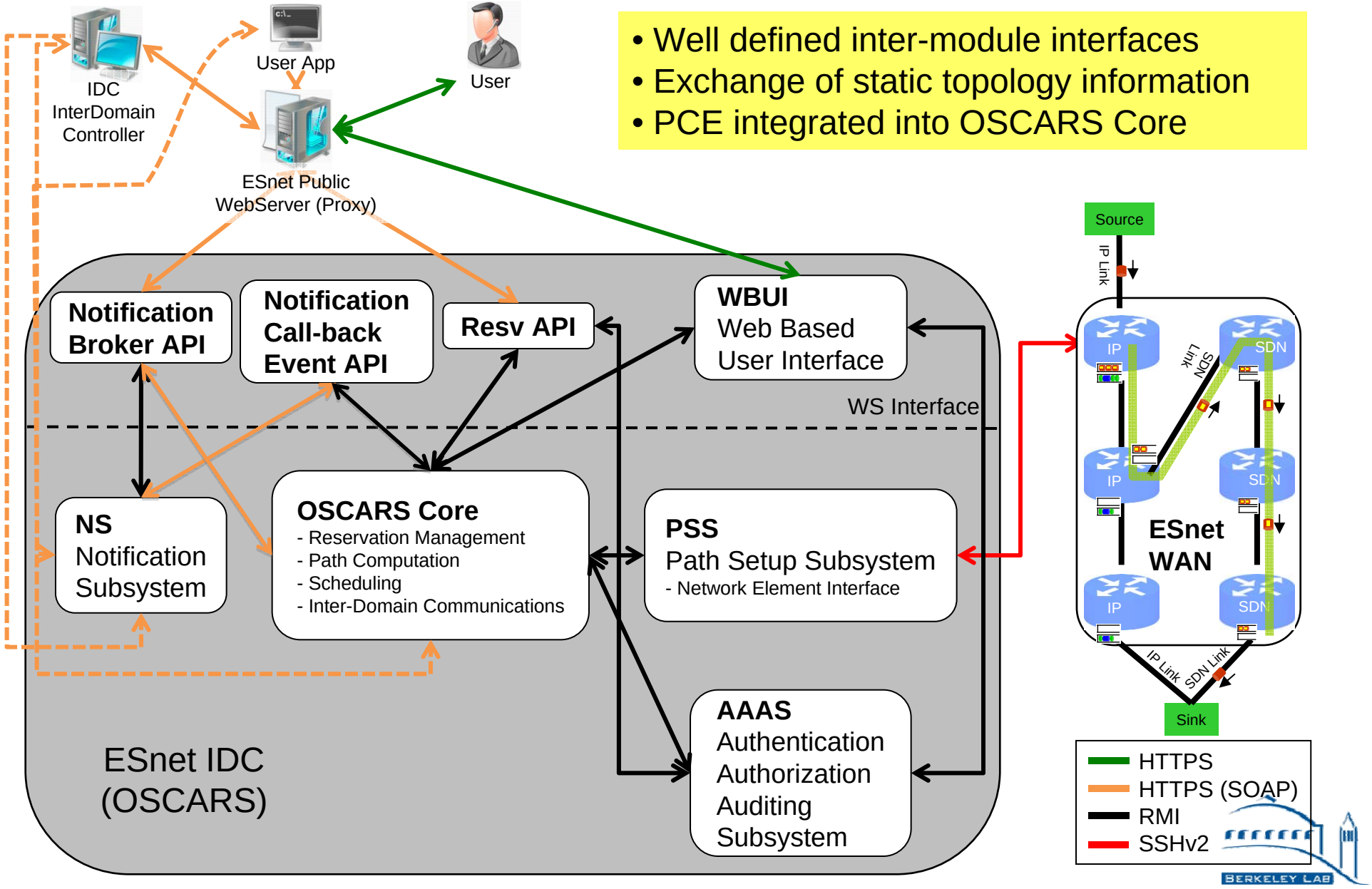
**Provisioning**
- Signaling
- Security
- Resiliency/Redundancy

# OSCARS Design Goals

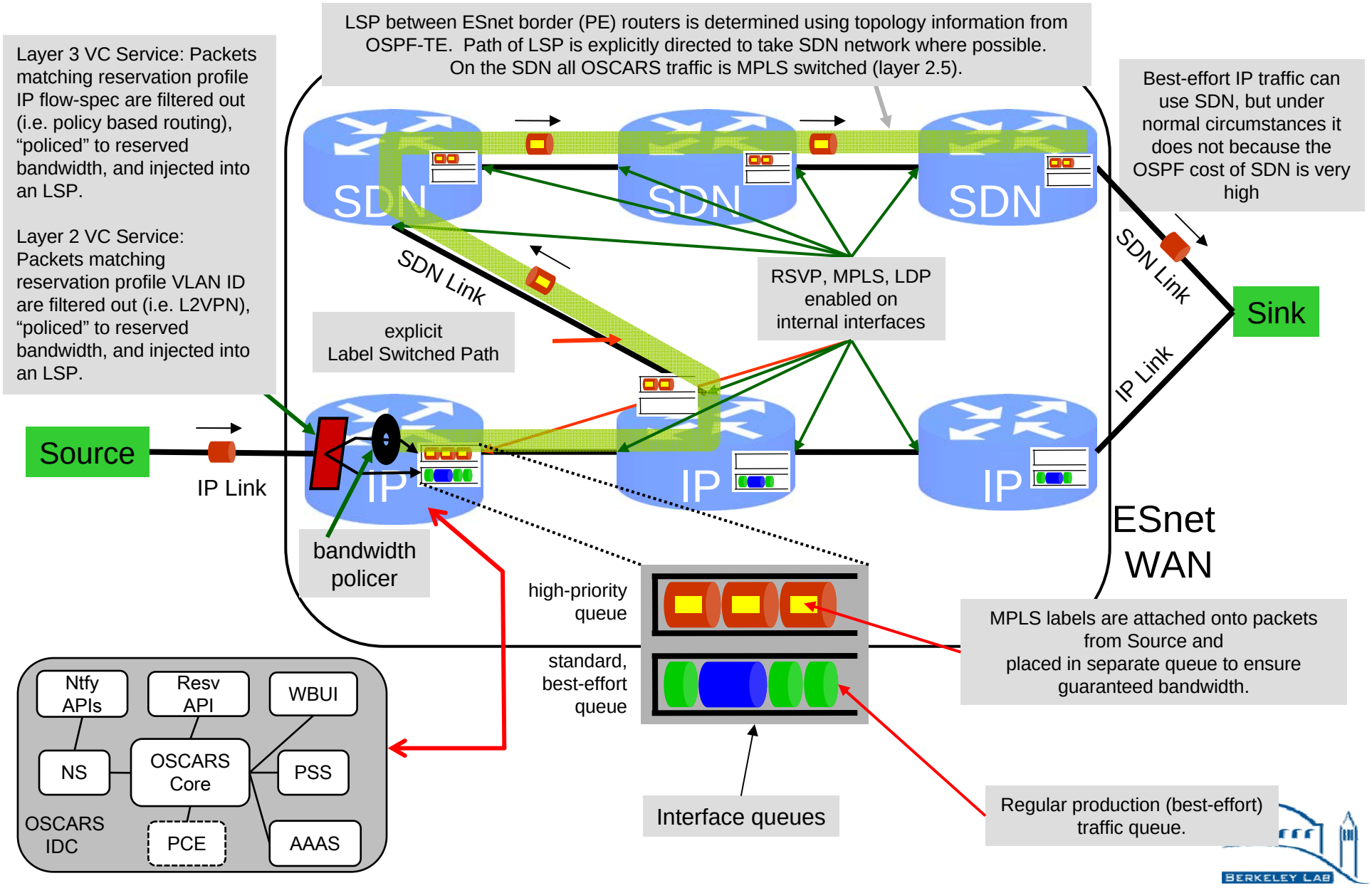
- **Configurable**
  - The circuits must be dynamic and driven by user requirements (e.g. termination end-points, required bandwidth, etc)
- **Schedulable**
  - Premium service such as guaranteed bandwidth will be a scarce resource that is not always freely available and therefore should be obtained through a resource allocation process that is schedulable
- **Predictable**
  - The service should provide circuits with predictable properties (e.g. bandwidth, duration, etc) that the user can leverage.
- **Usable**
  - The service must be easy to use by the target community
- **Reliable**
  - Resiliency strategies (e.g. reroutes) should be largely transparent to the user
- **Informative**
  - The service should provide useful information about reserved resources and circuit status to enable the user to make intelligent decisions
- **Scalable**
  - The underlying network should be able to manage its resources to provide the appearance of scalability to the user
  - The service should be transport technology agnostic (e.g. 100GE, DWDM, etc)
- **Geographically comprehensive**
  - The R&E network community must act in a coordinated fashion to provide this environment end-to-end
- **Secure**
  - The user must have confidence that both ends of the circuit is connected to the intended termination points, and that the circuit cannot be “hijacked” by a third party while in use
- **Provide traffic isolation**
  - Users want to be able to use non-standard/aggressive protocols when transferring large amounts of data over long distances in order to achieve high performance and maximum utilization of the available bandwidth

# OSCARS Current (v0.5) Implementation

- Well defined inter-module interfaces
- Exchange of static topology information
- PCE integrated into OSCARS Core



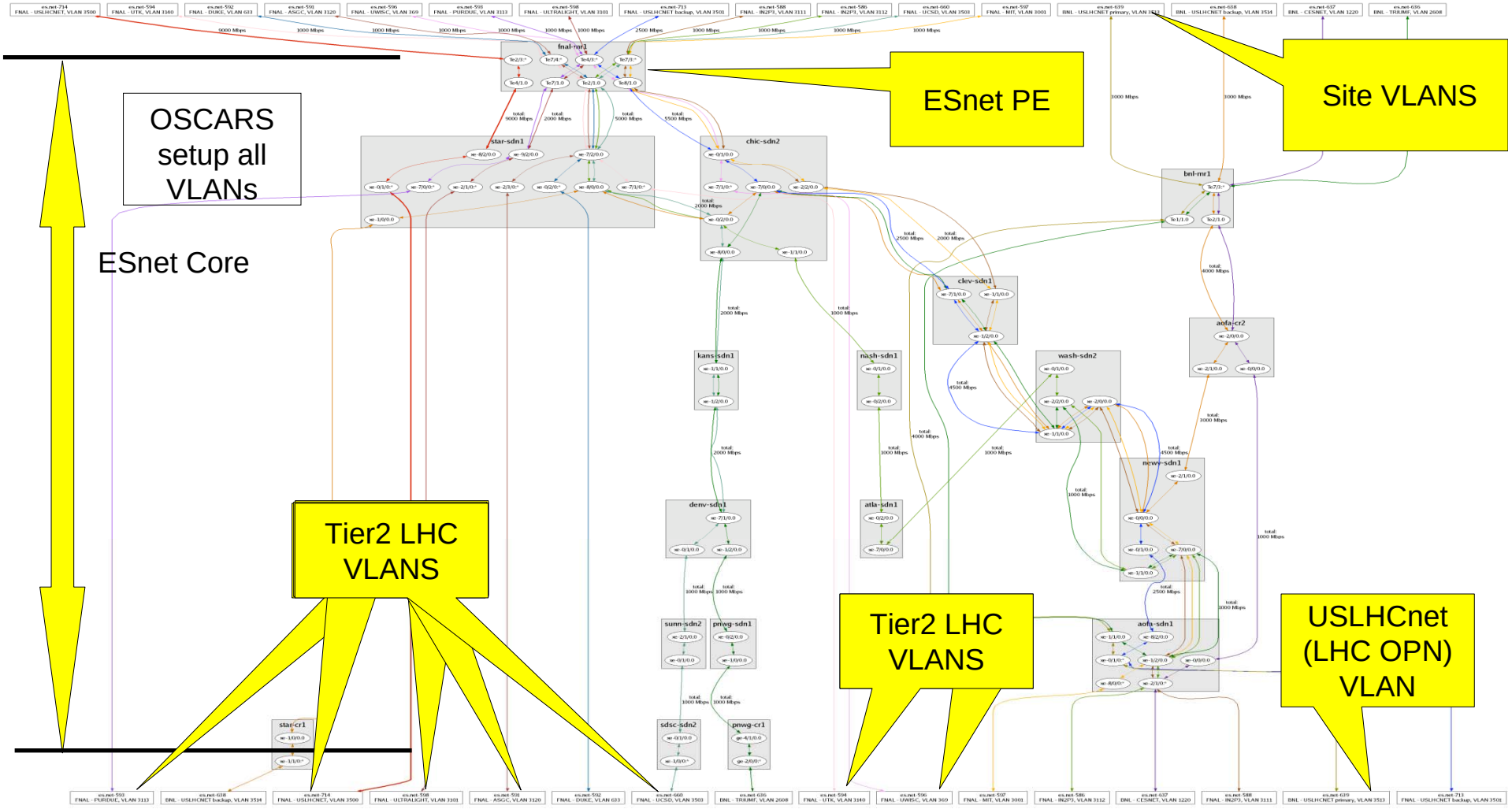
# Network Mechanisms Underlying OSCARS



# Production OSCARS

- Modifications needed by FNAL and BNL
  - Changed the reservation workflow, added a notification callback system, and added some parameters to the OSCARS API to improve interoperability with automated provisioning agents such as LambdaStation, Terapaths and Phoebus.
- Operational VC support
  - As of 12/2/08, there were 16 long-term production VCs instantiated, all of which support HEP
    - 4 VCs terminate at BNL
    - 2 VCs support LHC T0-T1 (primary and backup)
    - 12 VCs terminate at FNAL
    - 2 VCs support LHC T0-T1 (primary and backup)
    - For BNL and FNAL LHC T0-T1 VCs, except for the ESnet PE router at BNL (bnl-mr1.es.net) and FNAL (fnal-mr1-es.net), there are no other common nodes (router), ports (interfaces), or links between the primary and backup VC.
- Short-term dynamic VCs
  - Between 1/1/08 and 12/2/08, there were roughly 2650 successful HEP centric VCs reservations
    - 1950 reservations initiated by BNL using Terapaths
    - 1700 reservations initiated by FNAL using LambdaStation

# OSCARS is a Production Service



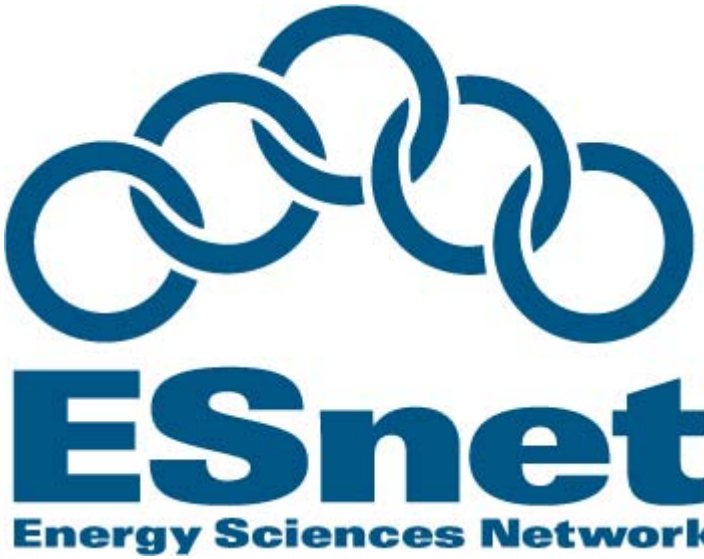

OSCARS generated and managed virtual circuits at FNAL – one of the US LHC Tier 1 data centers. This circuit map (minus the yellow callouts that explain the diagram) is automatically generated by an OSCARS tool and assists the connected sites with keeping track of what circuits exist and where they terminate.

# OSCARS Collaborative Efforts

- Development of a community approach that will support end-to-end virtual circuits in the R&E environment is coordinated by the DICE (Dante, Internet2, Caltech, ESnet) working group
  - Each organization potentially has their own InterDomain Controller approach (though the ESnet/Internet2 OSCARS code base is used by several organizations (flagged OSCARS/DCN)
  - The DICE group has developed a standardized InterDomain Control Protocol (IDCP) for specifying the set up of segments of end-to-end VCs
    - While there are several very different IinterDomain Controller implementations, they all speak IDCP and support compatible data plane connections
  - The following organizations have *implemented/deployed systems which are compatible with the DICE IDCP*:
    - Internet2 Dynamic Circuit Network (OSCARS/DCN)
    - ESNet Science Data Network (OSCARS/SDN)
    - GÉANT2 AutoBahn System
    - Nortel (via a wrapper on top of their commercial DRAC System)
    - Surfnet (via use of above Nortel solution)
    - LHCNet (OSCARS/DCN)
    - Nysernet (New York RON) (OSCARS/DCN)
    - LEARN (Texas RON) (OSCARS/DCN)
    - LONI (OSCARS/DCN)
    - Northrop Grumman (OSCARS/DCN)
    - University of Amsterdam (OSCARS/DCN)
    - DRAGON (U. Maryland/MAX)Network
  - The following "higher level service applications" have adapted their existing systems to communicate via the user request side of the IDCP:
    - LambdaStation (FermiLab)
    - TeraPaths (Brookhaven)
    - Phoebus (Umd)

# OSCARS Roadmap

- Service extensions
  - Extend VC capabilities to layer 1
  - Research multi-layer vertically integrated VCs (e.g. Ethernet VLAN over SONET over DWDM)
- Framework for production and research
  - Cleanly separate functional modules and define standard interface methods (e.g. WS, RMI, etc)
- Dynamic topology information
  - Extend time dimension to existing topology exchange (OGF NML-WG schema)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