LHCONE

January 31, 2012

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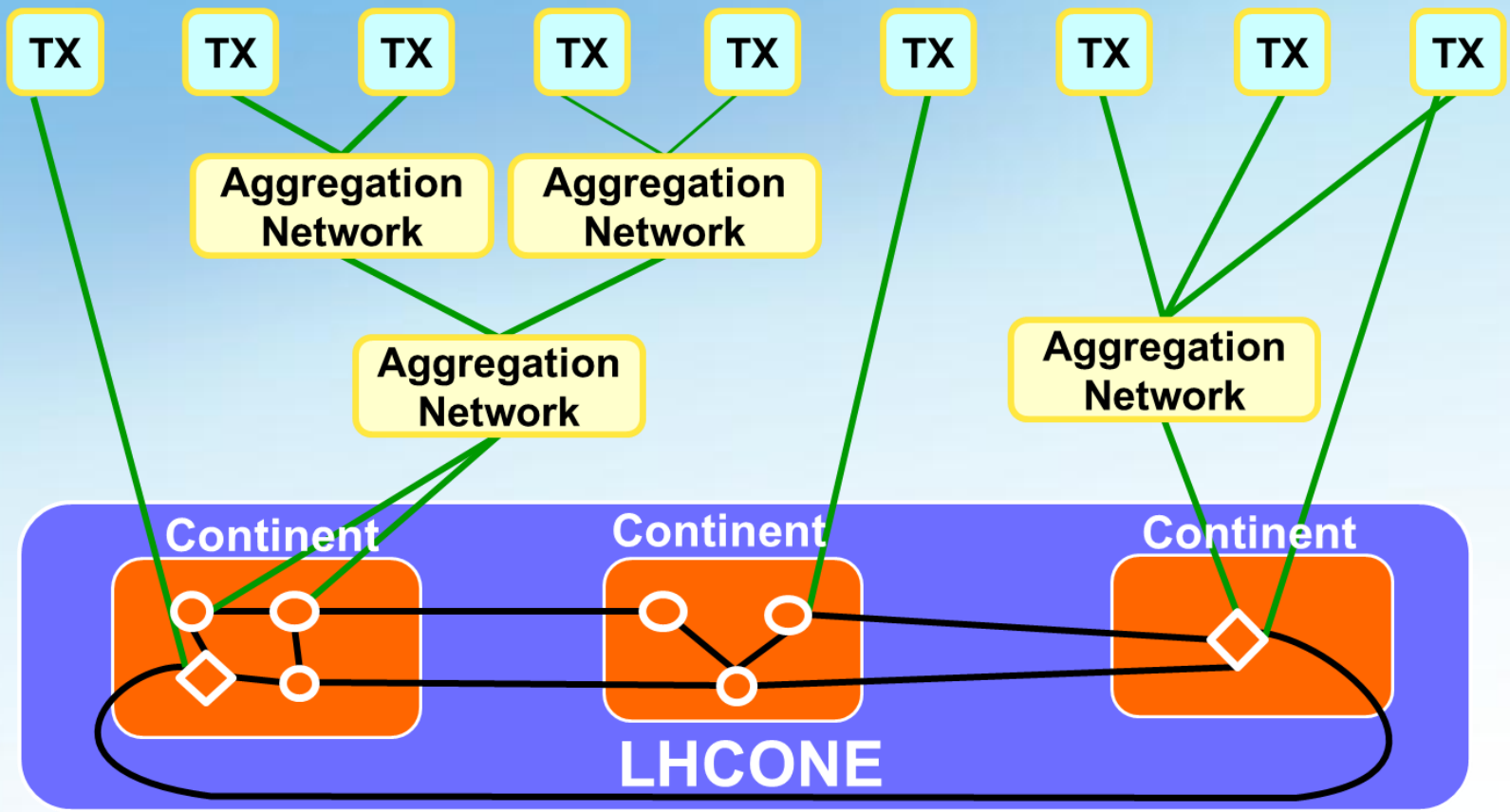
LHCONE POINT-TO-POINT SERVICE

LHCONE Goals

- Ease of Connection
  - Provide a collection of access locations that are effectively entry points into a network that is private to the LHC T1/2/3 sites.
  - As soon as a T1/2/3 site is connected to LHCONE, it ought to be able to easily exchange data with any other T1/2/3 site over an infrastructure that is sized to accommodate that traffic.
  - LHCONE must accommodate both IP connections and several variations of circuit-based connections.
  - T1/2/3 sites may connect directly or via their network provider (e.g. National Research and Education Network (NREN), US Regional Optical Network (RON), ESnet, etc.).
- Exploitation of Infrastructure
  - Build on the familiar idea of exchange points
  - Provide a mechanism to better utilize available transoceanic capacity.
- Ease of Operation
  - Provide an infrastructure with appropriate operations and monitoring systems to provide the high reliability (in the sense of low error rates) that is essential for the high bandwidth, high volume data transfers of the LHC community
  - Provide a test and monitor infrastructure that can assist in ensuring that the paths from the T1/2/3 sites to LHCONE are also debugged and maintained in the low error rate state needed for LHC traffic

LHCONE High-level Architecture



Single node Exchange Point Distributed Exchange Point

LHCONE Design Considerations

- LHCONE complements the LHCOPN by addressing a different set of data flows.
- LHCONE enables high-volume data transport between T1s, T2s, and T3s.
- LHCONE separates LHC-related large flows from the general purpose routed infrastructures of R&E networks.
- LHCONE incorporates all viable national, regional and intercontinental ways of interconnecting Tier1s, Tier2s, and Tier 3s.
- LHCONE uses an open and resilient architecture that works on a global scale.
- LHCONE provides a secure environment for T1-T2, T2-T2, and T2-T3 data transport.
- LHCONE provides connectivity directly to T1s, T2s, and T3s, and to various aggregation networks, such as the European NRENs, GÉANT, and North American RONs, Internet2, ESnet, CANARIE, etc., that may provide the direct connections to the T1s, T2s, and T3s.
- LHCONE is designed for agility and expandability.
- LHCONE allows for coordinating and optimizing transoceanic data flows, ensuring the optimal use of transoceanic links using multiple providers by the LHC community.

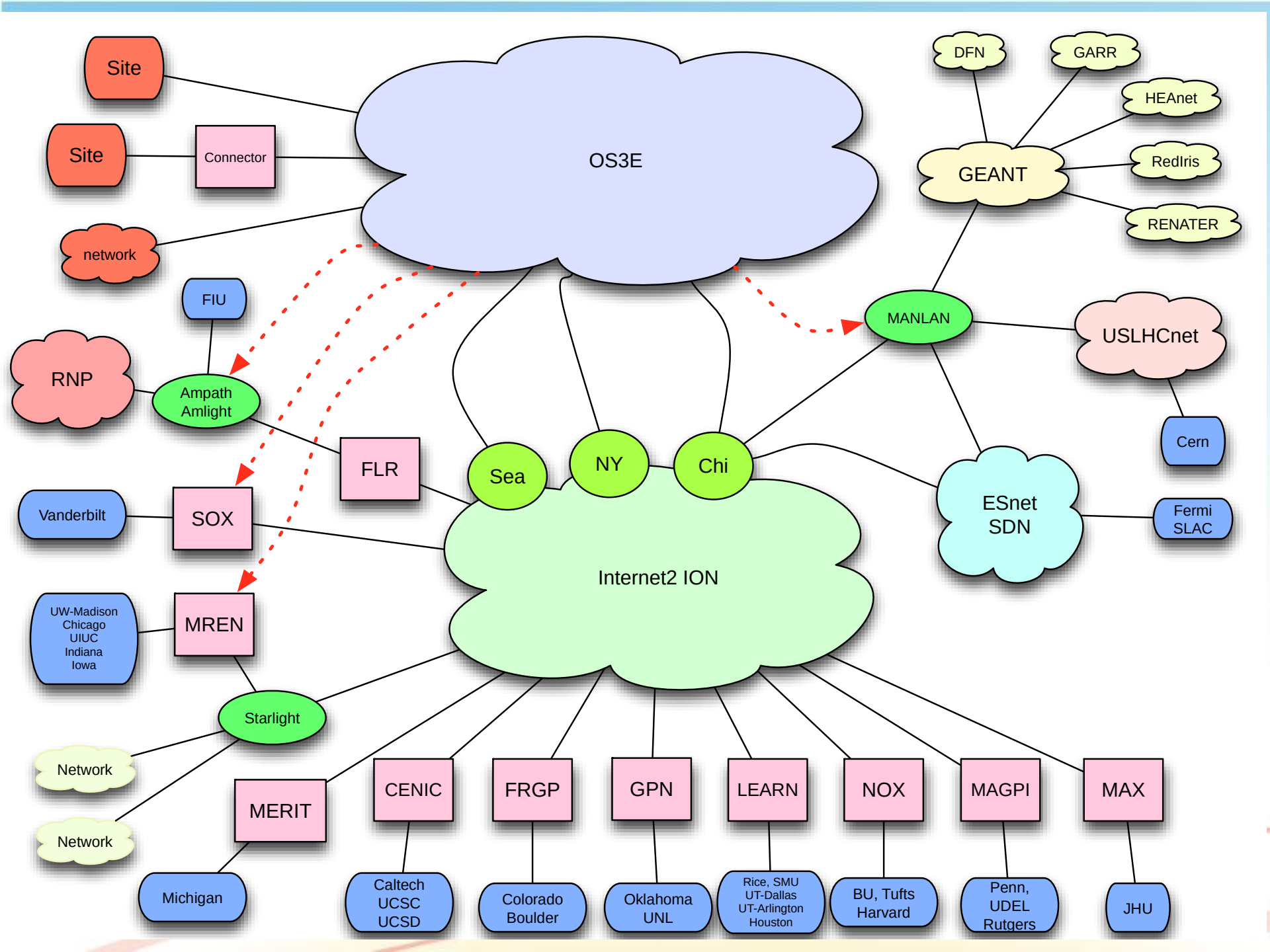
LHCONE Services

- Multipoint Service (YESTERDAY, TODAY)
- Point-to-Point Service (TODAY)
  - With bandwidth guarantees
  - Without bandwidth guarantees
- Diagnostic Service (YESTERDAY)

Current Status of IDC Implementations

- OSCARS and AutoBAHN have interoperable IDC implementations
  - ESnet Science Data Network
  - Internet2 Advanced Layer 2 Services
    - OS3E, ION, DYNES
  - GEANT AutoBAHN
  - European NREN AutoBAHN
  - RNP OSCARS implementation (Name?)
  - USLHCnet
  - JGN-X
  - IRNC-funded links
  - Etc.
- ESnet, GEANT, Internet2, USLHCnet have interoperable point-to-point service definitions
- Same service definition between Internet2 and RNP and between Internet2 and US regionals and campuses

INTERNET 2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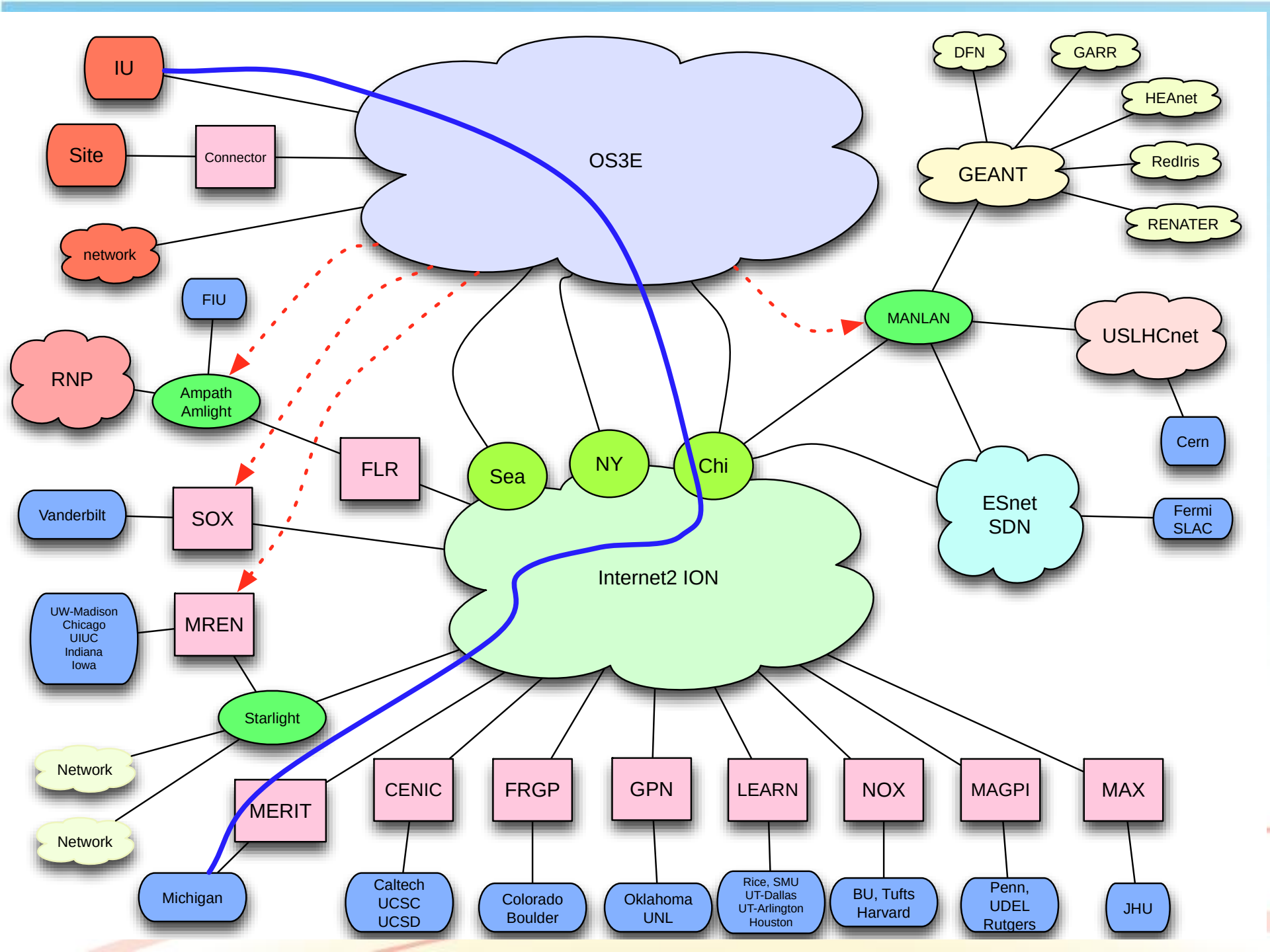
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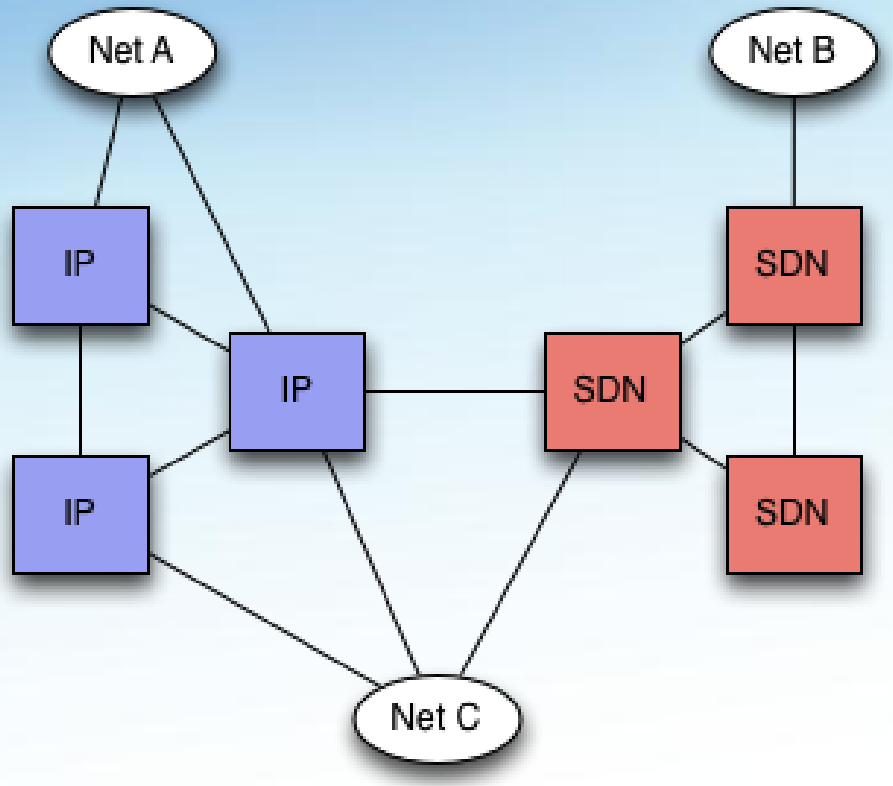
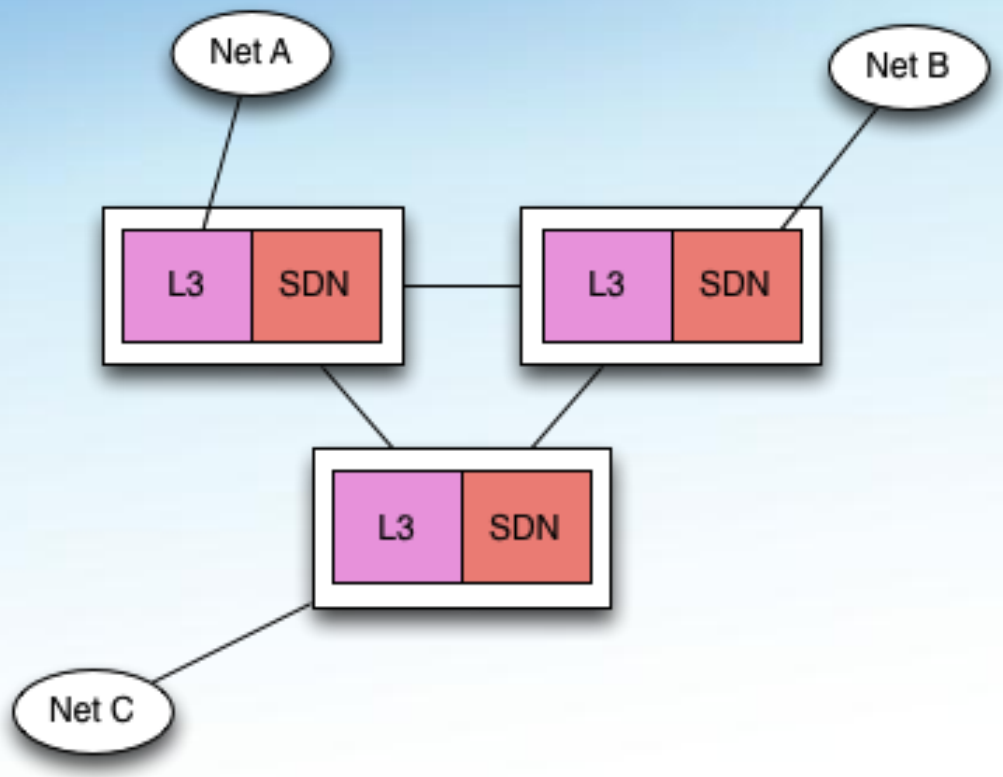
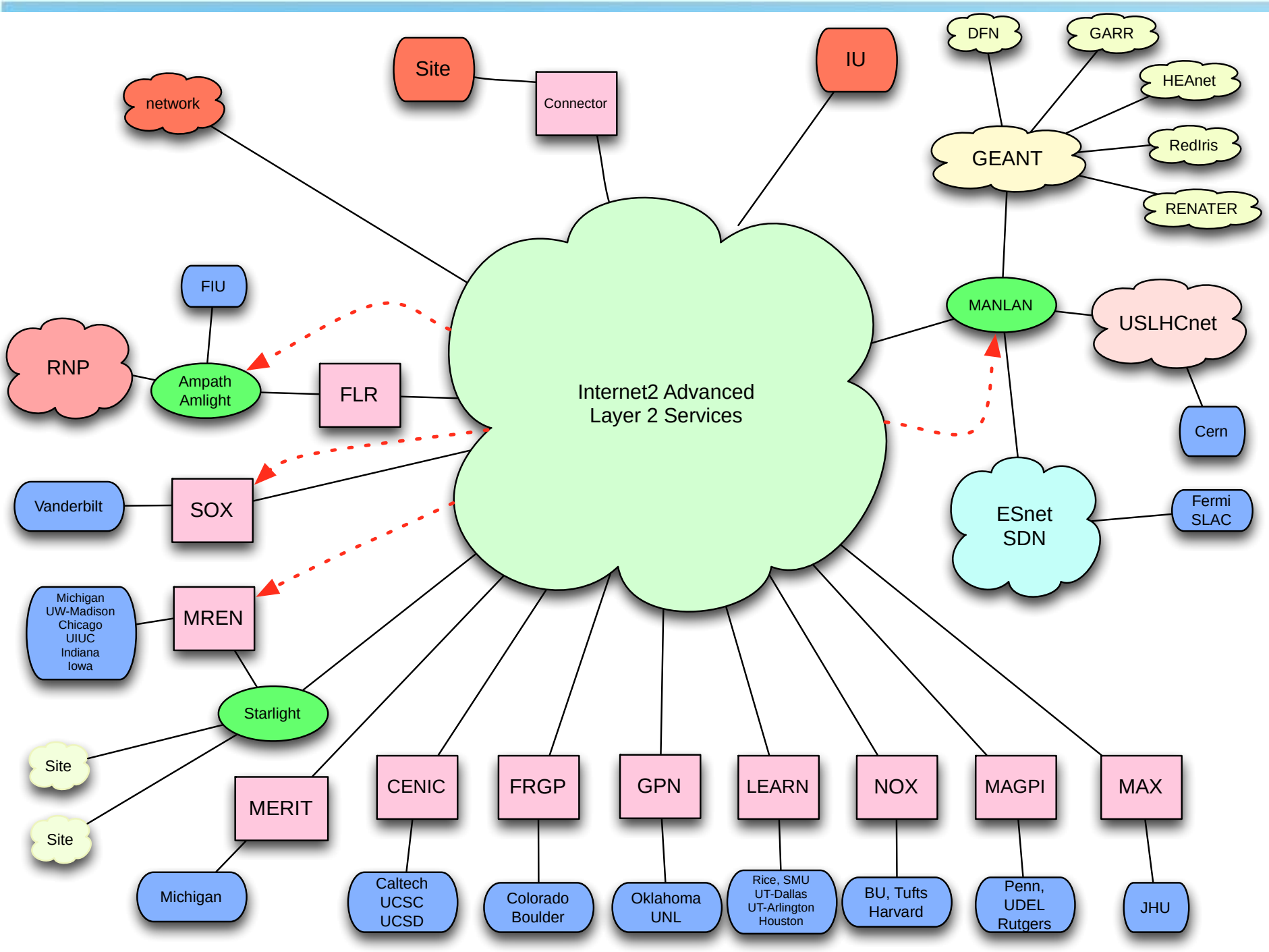
Separate Infrastructure: What we do today



Combined Infrastructure: What we might do tomorrow

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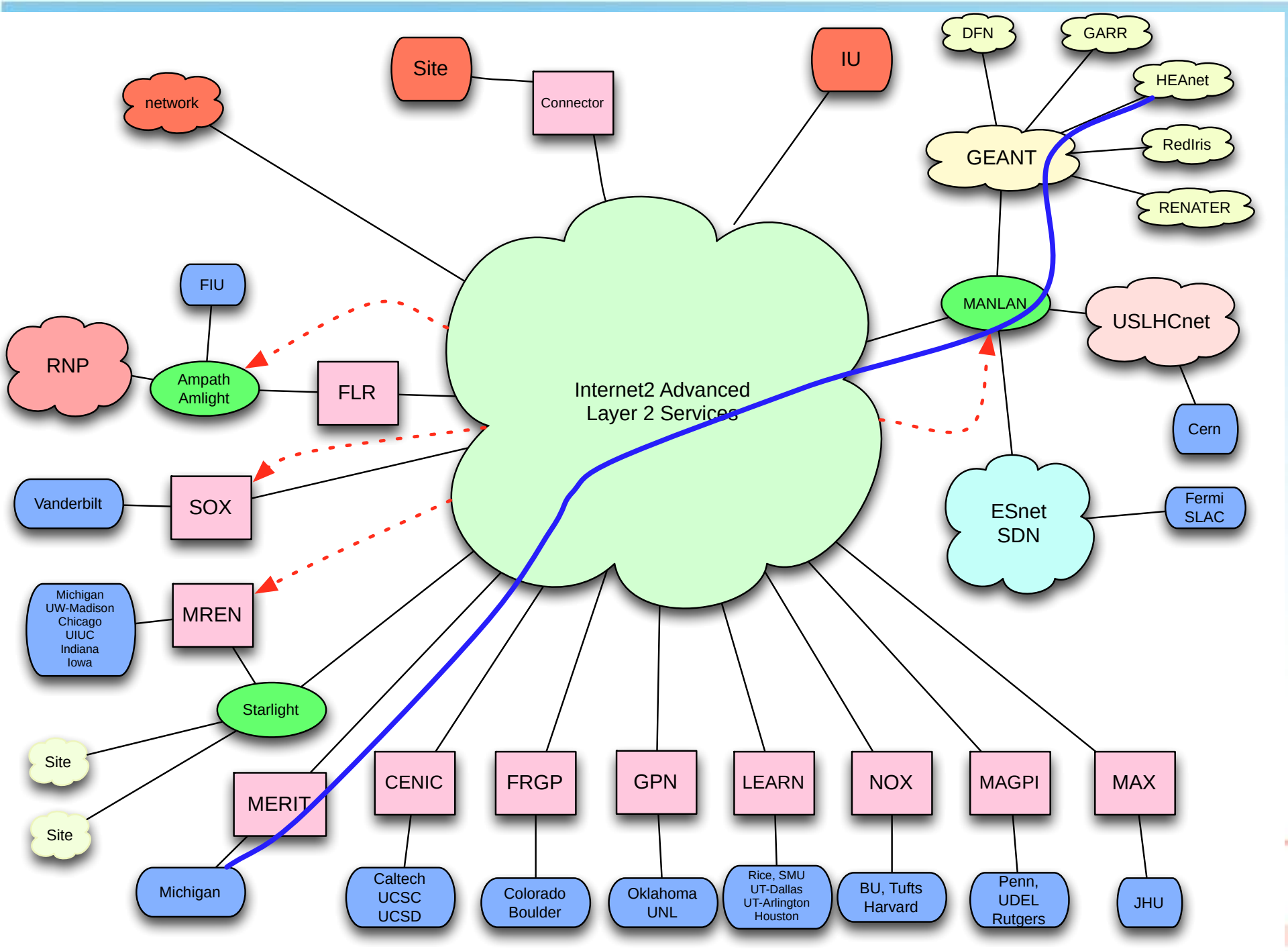
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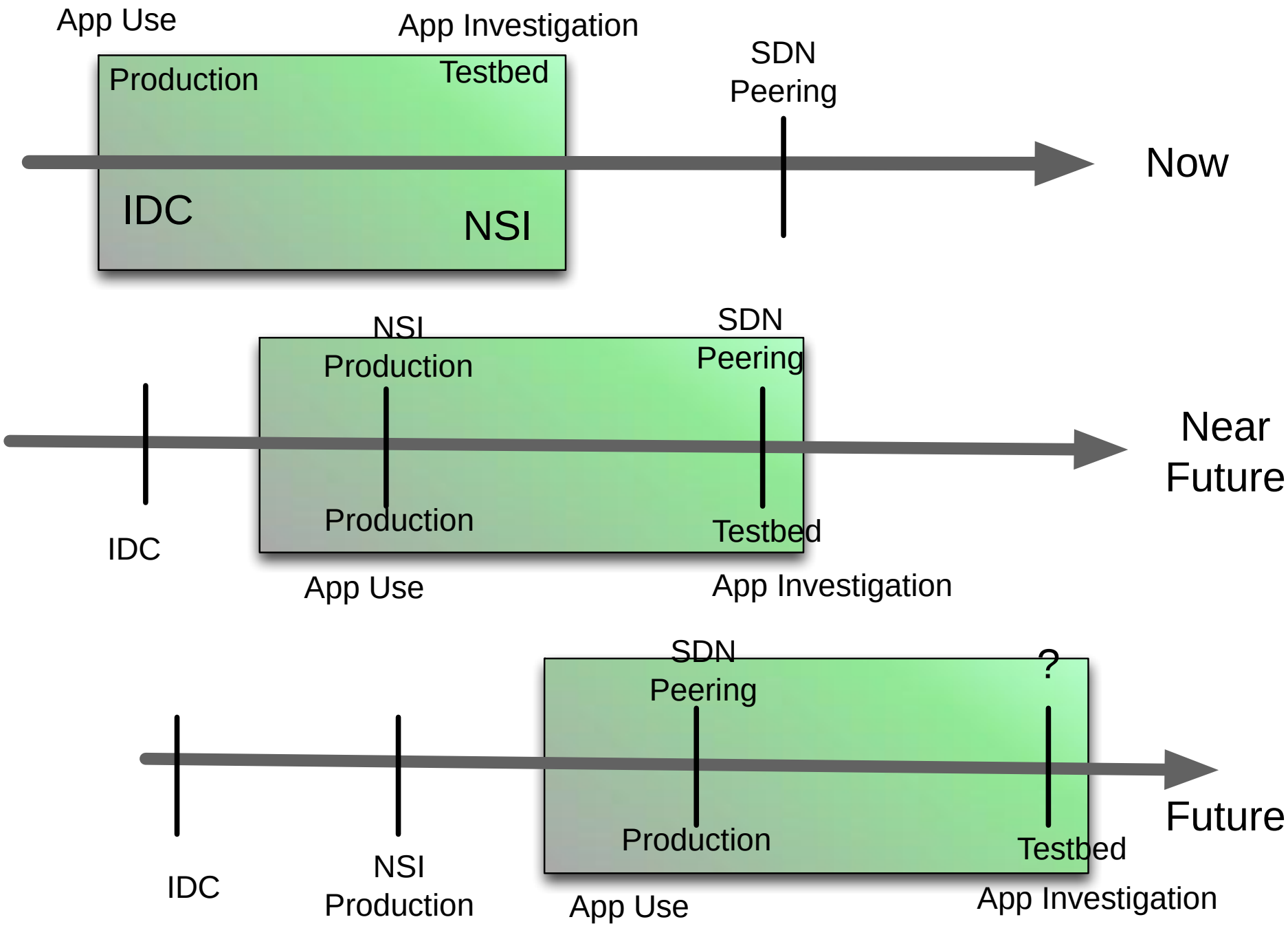
IDC, OGF NSI and GLIF

- OGF NSI WG is in the process of defining a standard protocol that builds on and improves upon IDC protocol
- GLIF has implemented a low-bandwidth testbed implementing NSI protocol
- Early stages of investigating Software Defined Networking "Peering" underway
- Observation: We will always have "production technology", "experimental technology", and "envisioned technology".

INTERNET 2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App Investigation

Proposal

- LHCONE should start using interoperable production service deployments (e.g. Esnet Science Data Network, GEANT AutoBAHN, Internet2 Advanced Layer 2 Services, Open DRAC, etc.) now
- LHCONE should experiment with testbed service deployments (e.g. GLIF deployment of NSI) now
- LHCONE should migrate along with ineroperable production service deployments over time

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For more information, visit http://www.internet2.edu/nddi