Fermilab

Between You and your Data

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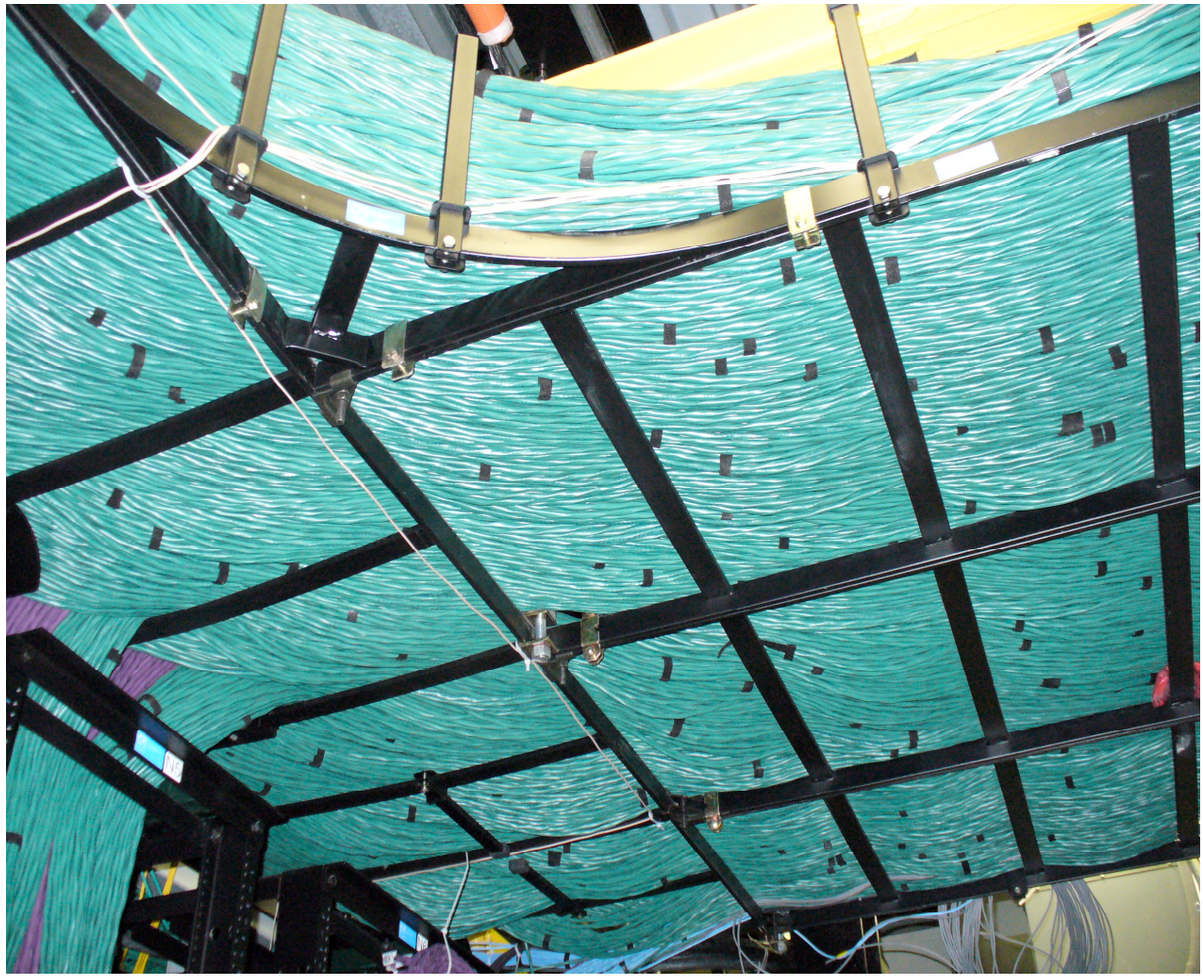
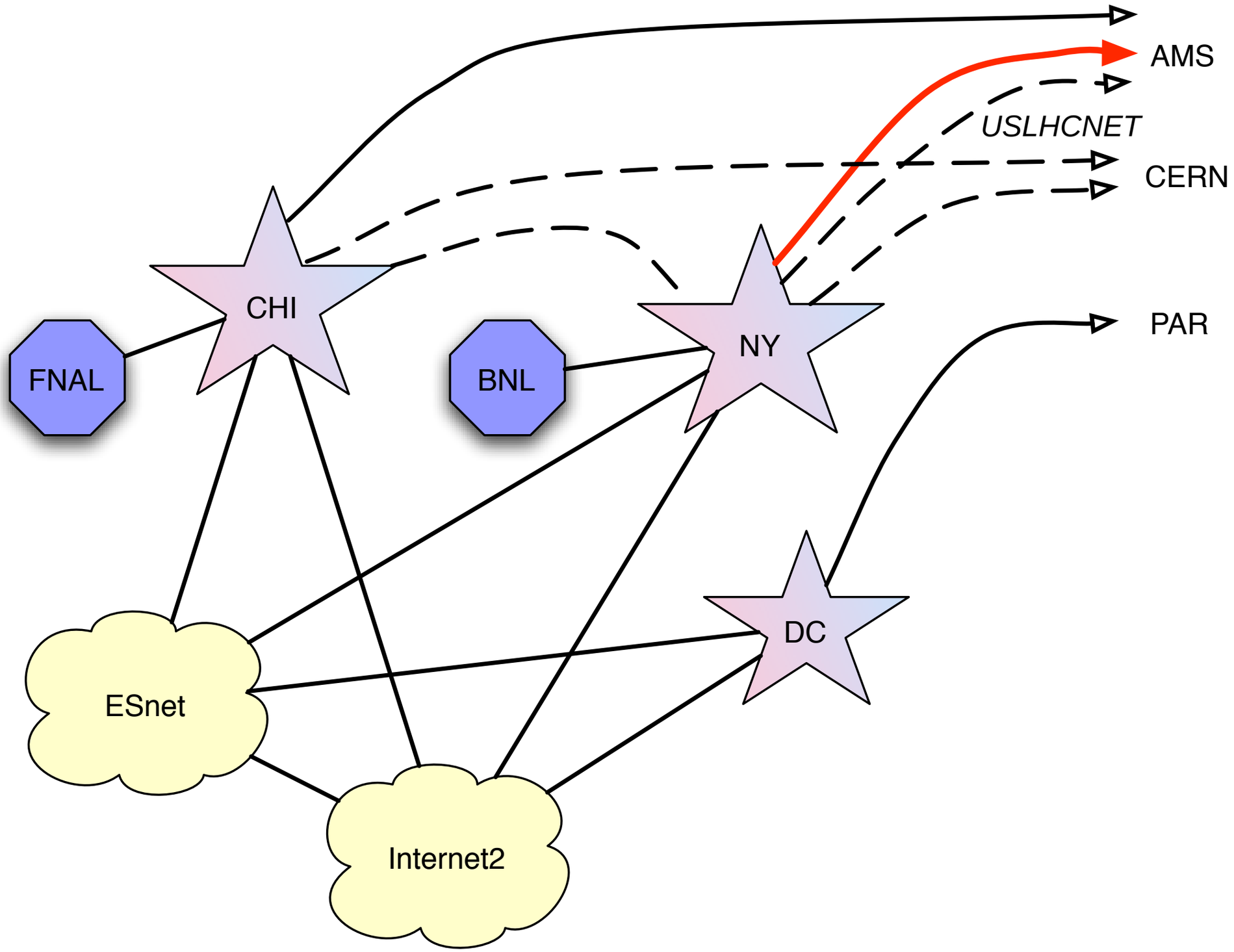
... are the networks

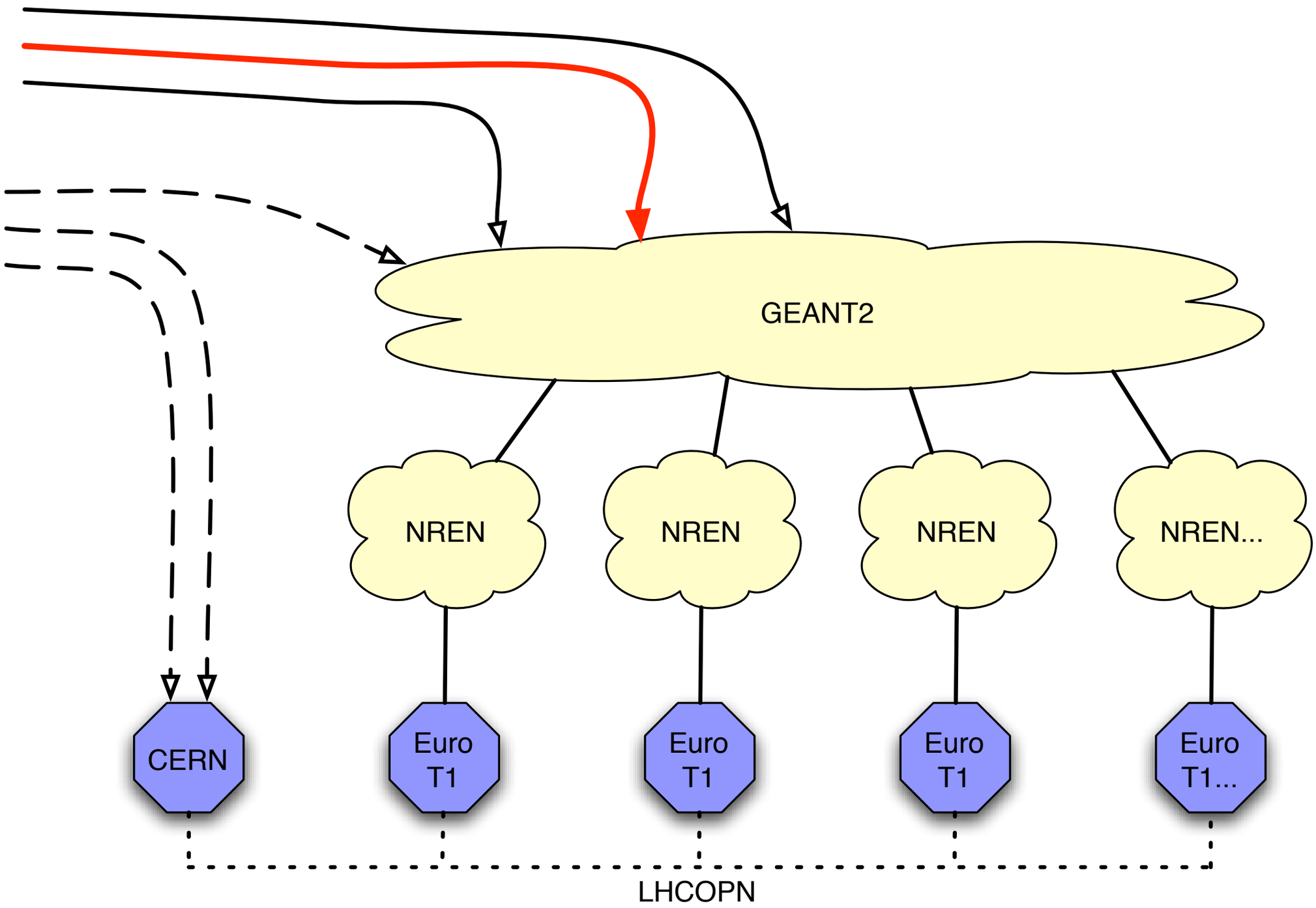
- LHCOPN
- USLHCNET
- Regional Networks
- Internet2
- ESnet
- Site networks



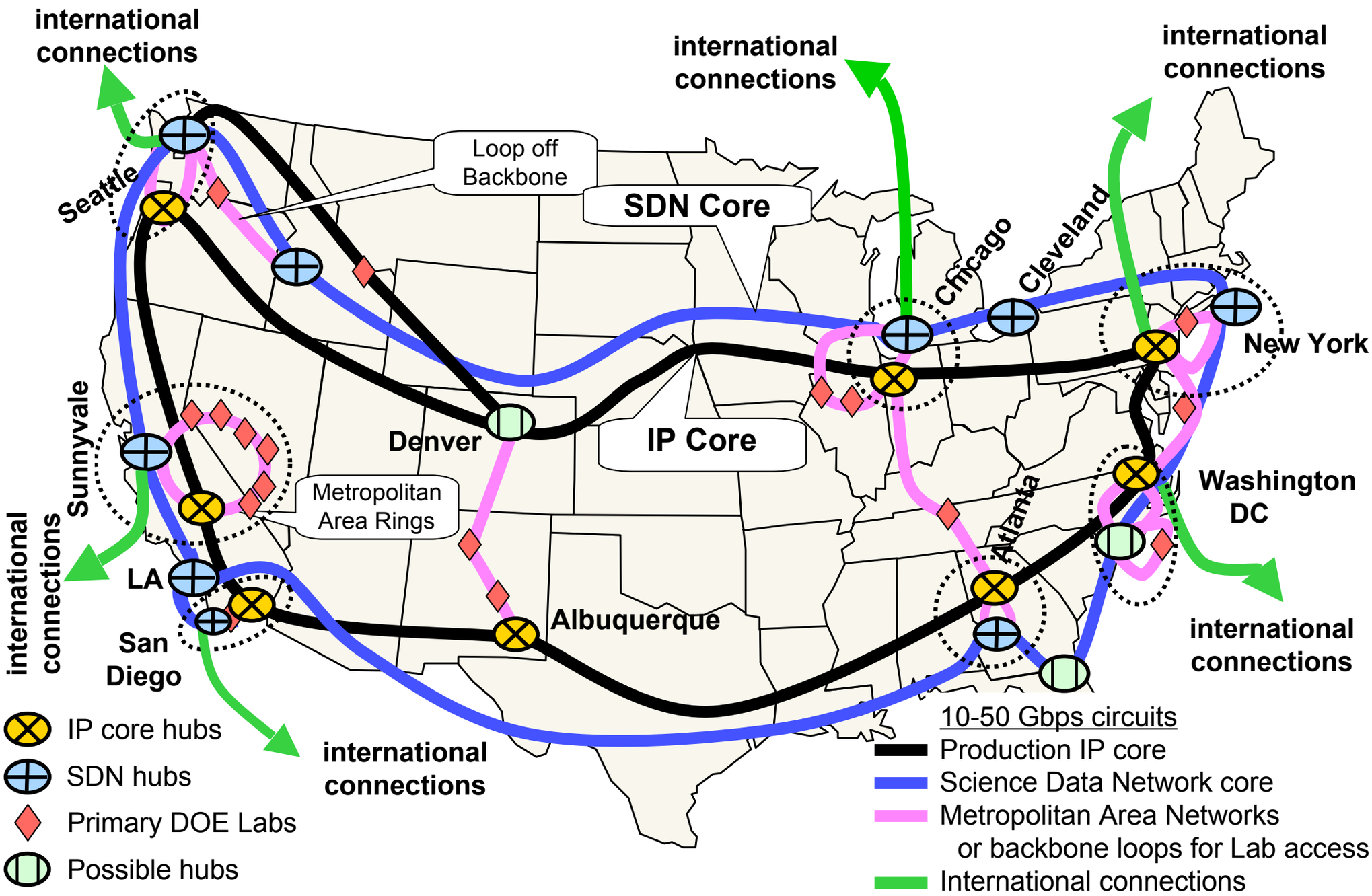
Getting your data



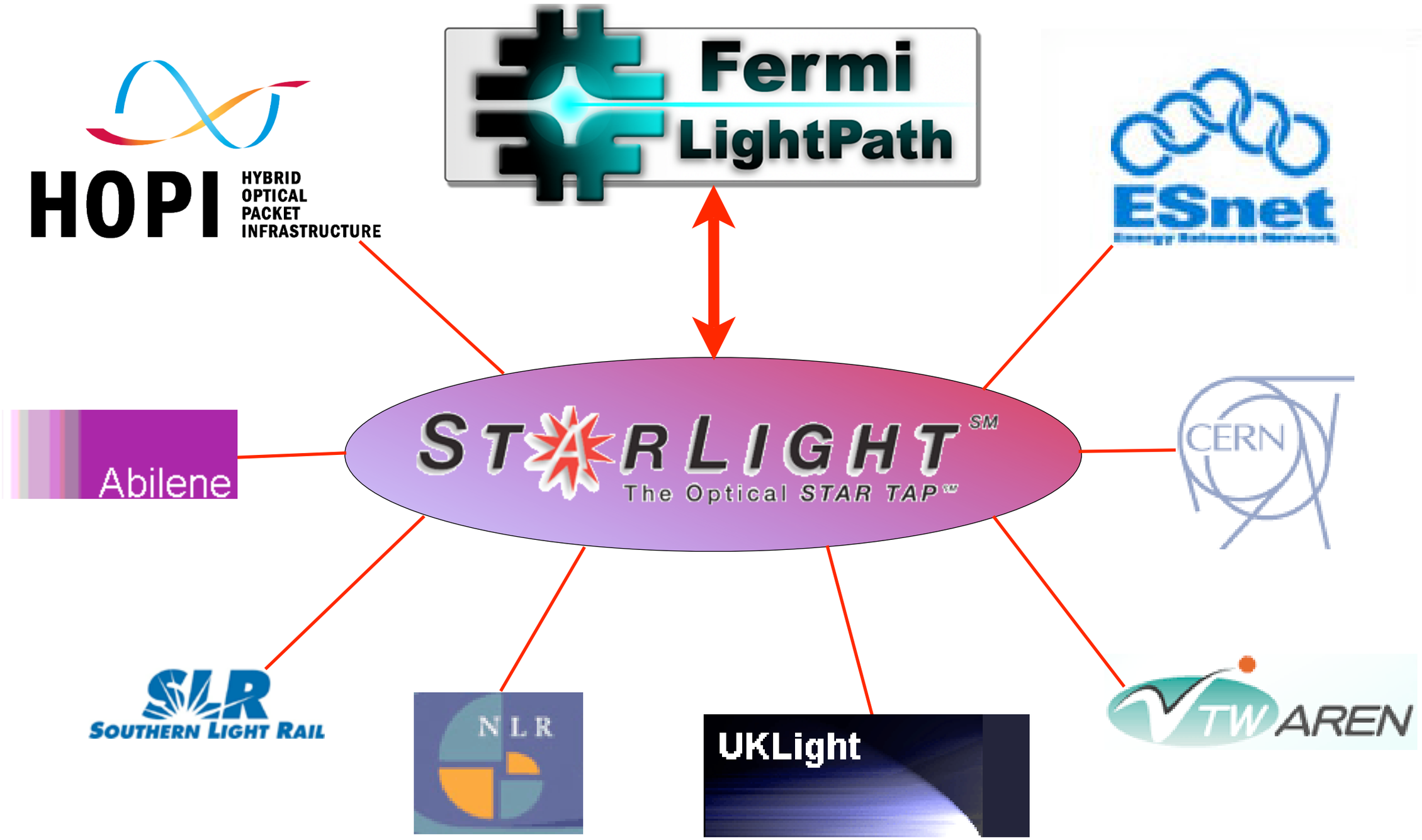
European side



Networks


international connections
international connections
international connections
Loop off Backbone
SDN Core
Seattle
Chicago
Cleveland
New York
Sunnyvale
Denver
IP Core
Metropolitan Area Rings
Washington DC
Atlanta
LA
Albuquerque
San Diego
international connections
international connections
international connections
IP core hubs
SDN hubs
Primary DOE Labs
Possible hubs
10-50 Gbps circuits
Production IP core
Science Data Network core
Metropolitan Area Networks
or backbone loops for Lab access
International connections

Exchange Points

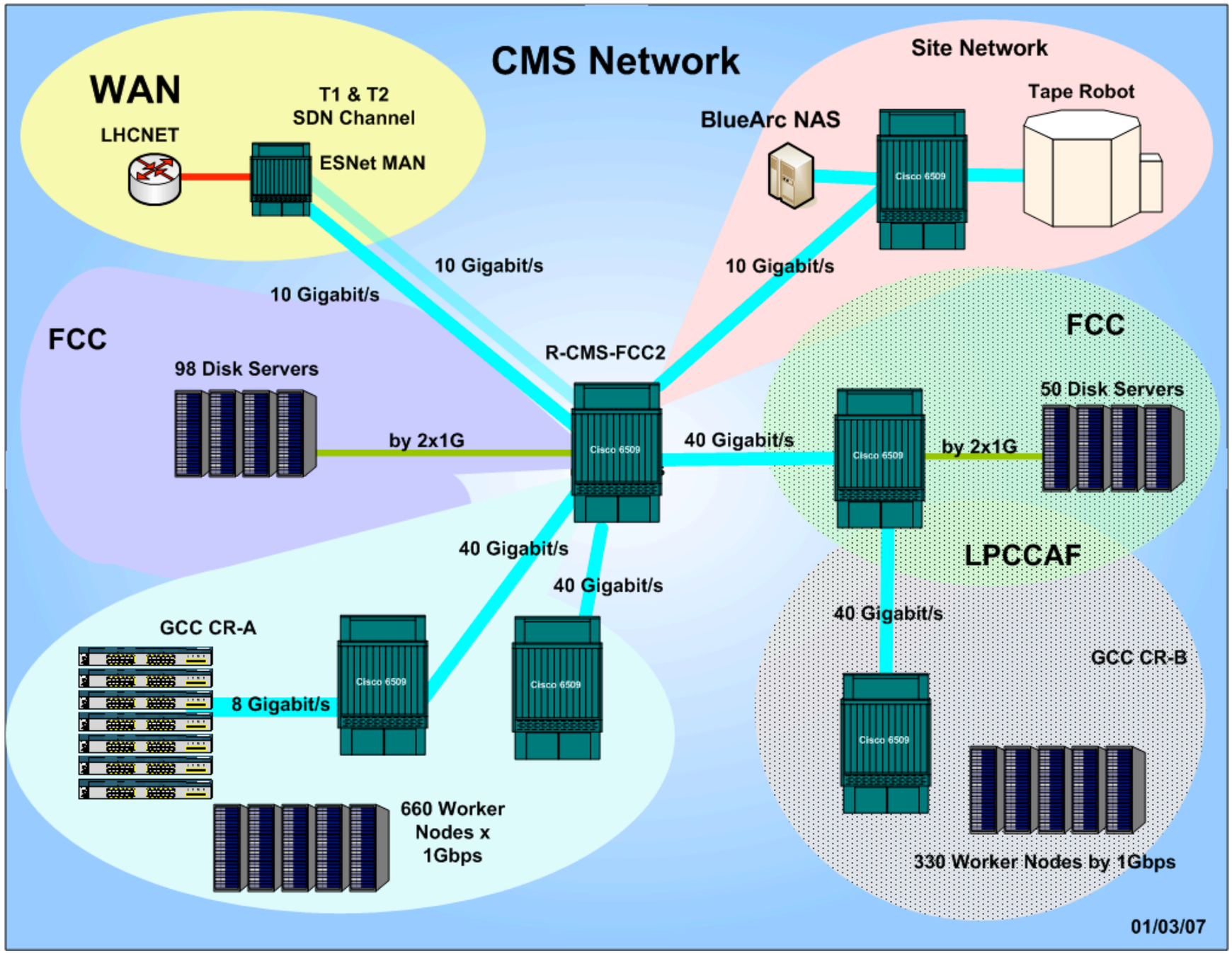


... and many, many others ...

Circuits

Remote Site	Experiment	Transit Provider(s)	Max B .W.	Status
UCL. UK	CDF	UKLight	1 Gb/s	Moderate use
CERN (LHC)	CMS	US-LHCnet	10 Gb/s	LHCOPN
Caltech	R & D	UltraScience Network	1 & 10 Gb/s	Intermittent use
Simon Fraser	D0	CAnet4; WestGrid (BC)	1 Gb/s	decommissioned
Caltech	CMS	UltraLight	10 Gb/s	T1/T2 data
Apache Pt (NM)	SDSS	ESnet (MPLS)	<< 1Gb/s	decommissioned
Sinica, Taiwan	CDF	ASnet	2.5 Gb/s	Intermittent use
Florida	CMS	UltraLight; FLR	10 Gb/s	T1/T2 data
McGill	CDF / D0	CAnet4	1 Gb/s	Intermittent use
NCHC, Taiwan	SDSS	Twaren	1 Gb/s	Intermittent use
IoP; Prague, Cz	D0	Surfnet; CESnet	1 Gb/s	Intermittent use
UCSD	CMS	ESnet (MPLS & SDN)	< 10Gb/s	T1/T2 data
Wisconsin	CMS	WISnet	10 Gb/s	T1/T2 data
Purdue	CMS	Purdue	10 Gb/s	T1/T2 data
IN2P3 , France	D0 (CMS?)	ESnet,HOPI,GEANT	Two x 1Gb/s	#1 – Intermittent use #2 – Moderate use

Site network – CMS T1



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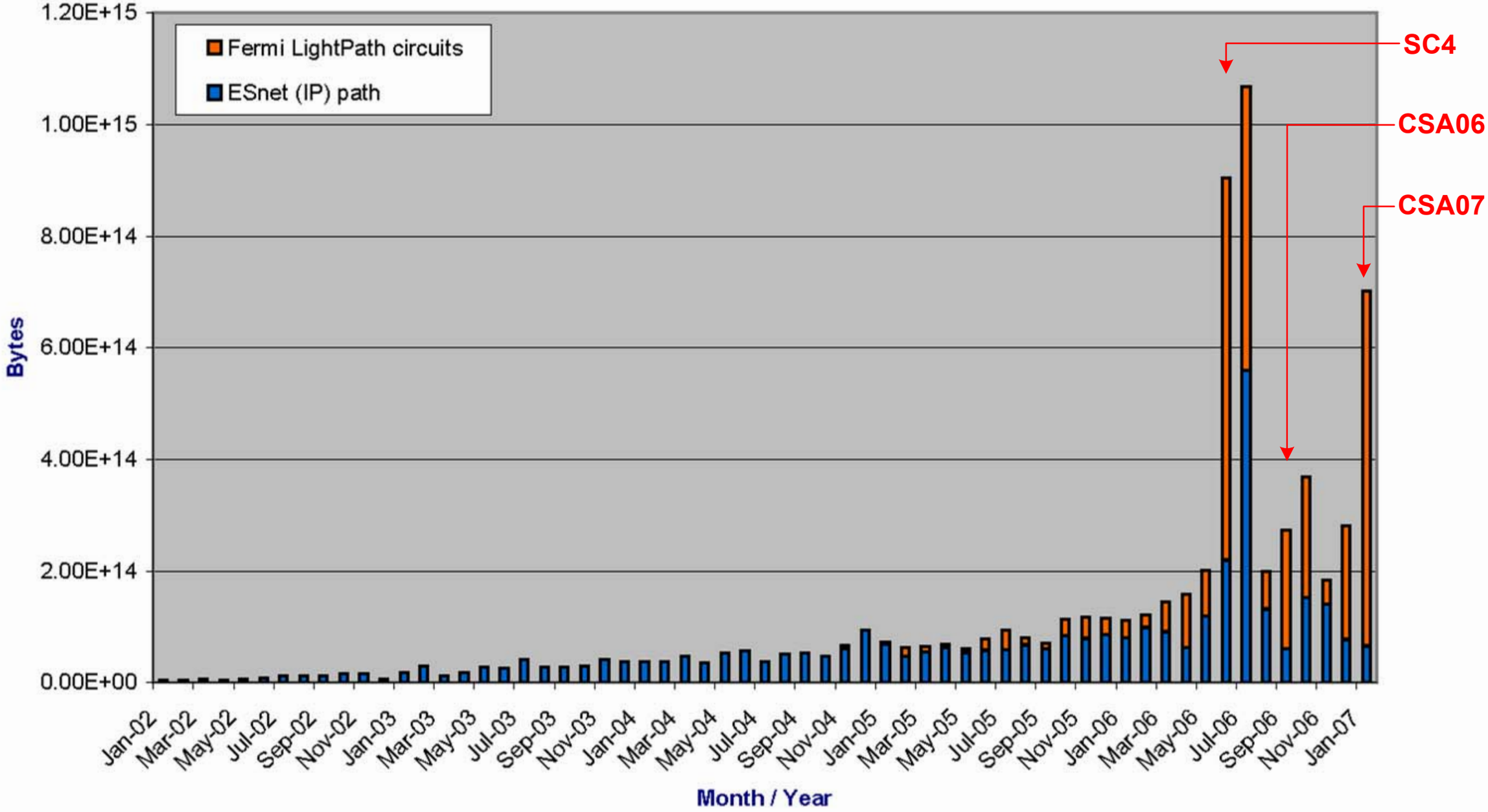
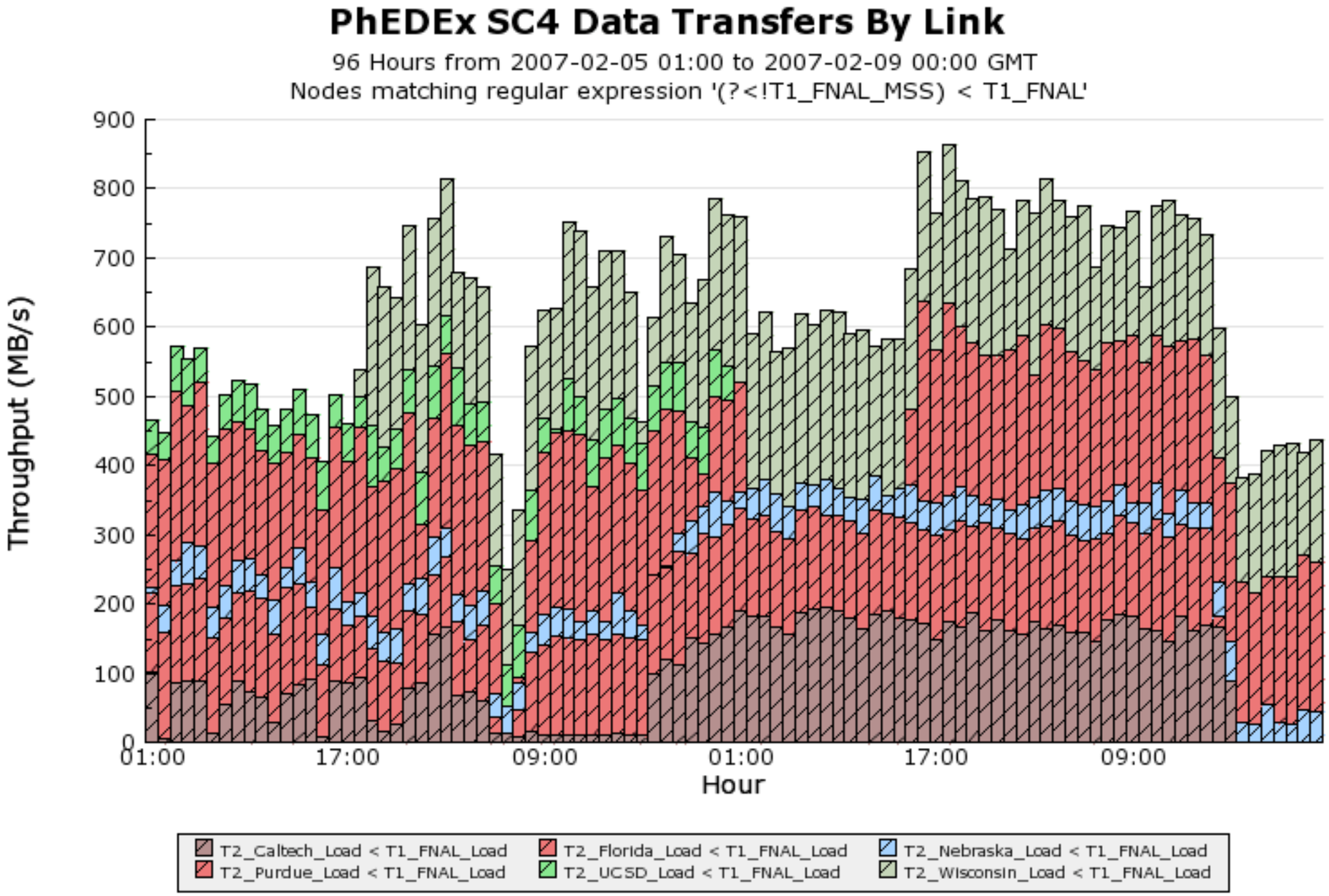
FNAL Outbound Traffic



Time to Upgrade!



Making it work

- The CMS computing model makes no concession to geography – all T2/T3 centers take data from any T1 centers.
- Round-trip time is the enemy of throughput.
- Fermilab is committed to making the model work. We view giving good service to Euro-T2s as a condition of requiring good service from Euro-T1s.
- Excellent service to US sites is a given.

System factors

- Linux has problems.
- We are researching, testing, and contributing kernel fixes.
- Network research feeds into dCache/SRM (and now, gridFTP) development.

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Call us

- Storage developers
- Tier-1 center managers (CMS)
- Network engineers
- OS performance