LHCONE
moving forward

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Where are we now ?
Lets look at the next steps

- European T2s are already relying on LHCONE-GEANT/NRENs and wish to access sites in US
  - NRENs have made national investments to support their users, according to their needs
  - LHC arch group have a responsibility to users & NRENs to provide & operable a reliable network.

- Need to review what is in place now.
- Need to fully support the services that LHC users are using now
  - Needs to be stable, robust, manageable, scalable

- Take a look at future needs and discuss how they can be met
  - Users need to play a prominent role alongside operators
  - Look at emerging technologies/services starting 2012/2013, experiment with them cant wait until 2014

Review what we have: stabilise it and make it more manageable

- Interconnected Interoperable domains, each domain must be independent
  - Faults need to stay within a domain
  - Cannot have a fragile infrastructure
    – single user cant kill the whole network
- Must be able to have more available paths for all services, combining both general purpose(shared) and dedicated capacity
  - *Being inclusive of what stakeholders have to offer*
- European users have asked for – and obtained - a separate infrastructure, based on national VPNs with dedicated capacity
  - There is a clear need to reach other European and US Tier-x sites
- We must recognise that some users want multipoint, some want point to point (dynamic or static) and some want both
  - Some operators can support one or the other, some both

Connectivity requirements of LHC users collected by the NRENs

- US sites European T2s want to reach with multipoint service
  - T2_US_MIT: CMSAF.MIT.EDU
  - T2_US_UCSD: ucsd.edu
  - T2_US_Vanderbilt: its.vanderbilt.edu
  - T2_US_Purdue: itns.purdue.edu
  - T2_US_Caltech: caltech.edu
  - T2_US_Nebraska: unl.edu
  - T2_US_Wisconsin: hep.wisc.edu
  - T2_US_Michigan: umich.edu
  - T2_US_SLAC : SLAC
  - T2_US_Florida : UFlorida-PG, UFlorida-IHEPA, UFlorida-HPC
  - US-MWT2 - Chicago University
  - US-AGLT2 - Michigan University
  - US-SWT2 - Arlington University e Oklahoma University
  - US-NET2 - Boston University

Per service views of architecture
Suggested next steps

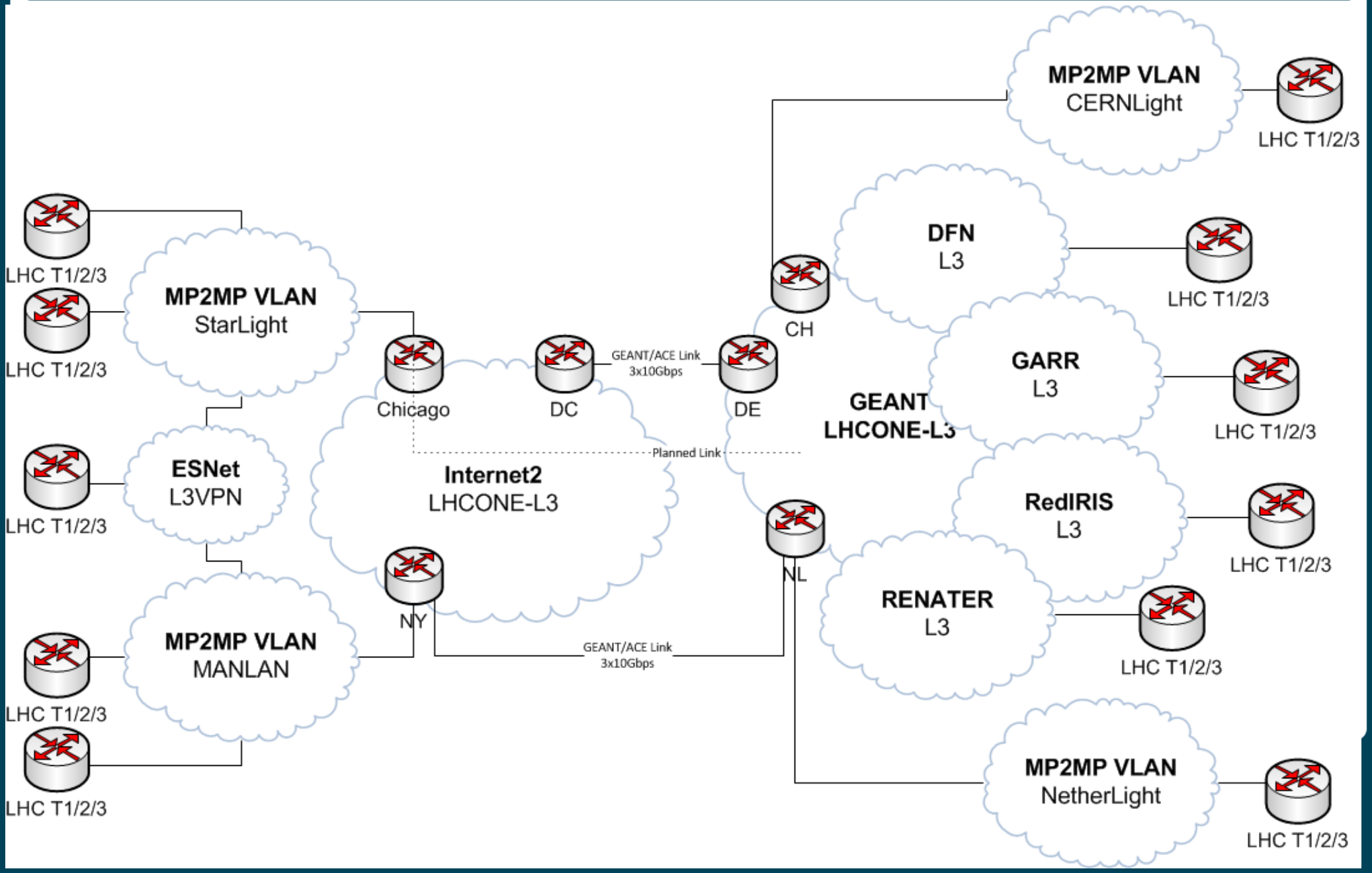
- A new Pilot to provide the multi-point service
  - Meet an immediate needs of LHC users
  - Domain independence
  - Inter-domain stability
  - Make it simpler to operate & understand how it works
  - Be inclusive of what resources the parties have to offer

- Kick off a Pilot to focus on Point-to-Point and BoD services
  - Be inclusive of what resources the parties have to offer
  - Work to help support users & end sites
  - Aim for integration of BoD into LHC tools
    - transfer by transfer
    - longer term for multiple bulk transfers

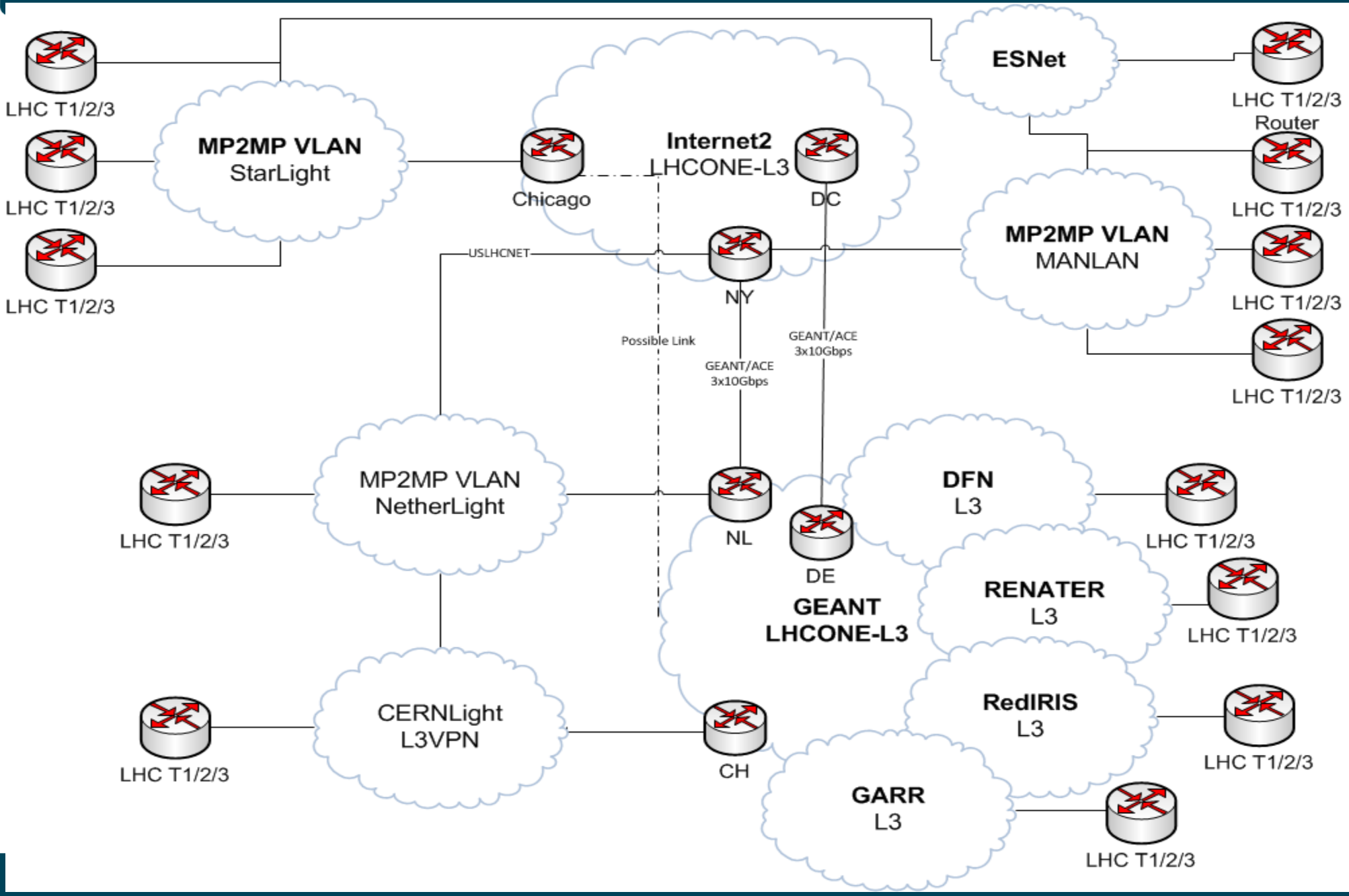
Multipoint service: architecture highlights

- Based on Local L2 broadcast domains, or L3 domains, interconnected at L3
- Allows multihoming
- Distributed management, just like the internet: no need to invent anything different
- Connectors can use a multitude of techniques/services to reach a LHCONE node
- It is a VPN interconnected using available connectivity transatlantic, shared (with general R&E) and dedicated

Proposed Setup 1



Proposed Setup 2

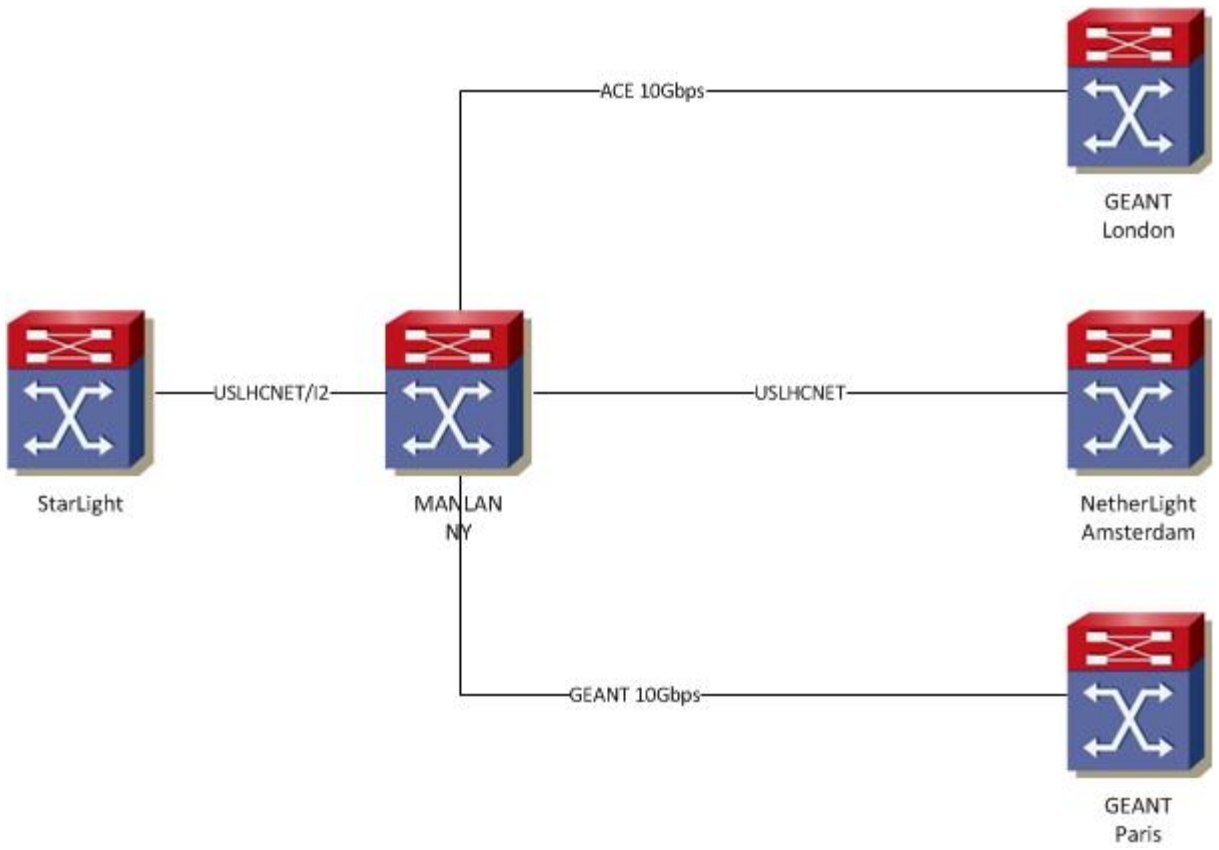


Point to point service: static vs dynamic

- Static
  - In Europe,a cross GEANT, static circuits have been available for several years now: GEANTPlus. These continue to be available across all NRENs following established technical, operational and business processes
  - Extension across atlantic to US and worldwide

- Dynamic
  - AutoBAHN about to become operational across GEANT, but not yet in all NRENs relevant to LHCONE.
  - Strong co-operation with DICE IDC for multidomain operation
  - Investing in NSI (co-chair from GN3)

LAYOUT for P2P service



Supporting both services

- We believe it is possible for some domains to support both services
  - GEANT can already support both services
  - But two separate overlays over GEANT

- Can both services be supported with the same resources?
  - At present for GEANT they are separate
  - The new equipment resulting from GEANT tender is spec'd to support both

Conclusions so far

- Meet an immediate need of users
- Be inclusive of what parties have to offer
- Domain independence
- Inter-domain stability
- Proven management model

- Fix now and operate for foreseeable future
  - 2 options for multipoint service
  - P2P service already there

Future innovation

- Mission of R&E networks is also to experiment with innovative technology and services.
  - Supporting HEP is clearly an opportunity
- During 2012 identify which technologies, services and architectures will be relevant for HEP community and experiment with them when the technologies become available.
- Some obvious technolgies are related to dynamic services, technologies to support interdomain multipoint services
- Should also consider the impact of the expected wide availability of 100Gbps (and more)

Questions?

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