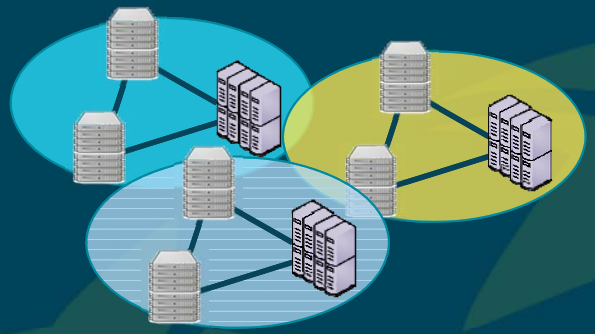


“Testbeds as a Service”
Building Future Networks
A view into a new GN3Plus Service

Jerry Sobieski (NORDUnet)

GLIF 2013

4 Oct 2013 Singapore

From Innovation to Infrastructure

- Network Innovation requires testing to prove out...
  - Testing in live networks can have unintended effects on non-combatants. Other users and network providers don't like being crash test dummies.
  - Network testing is increasingly about scaling – and requires real world fidelity.
  - "Production" environments have the required scale but are *highly* risk averse.

How do we evolve innovations from concept to production with minimal risk to infrastructure already in place providing on-going stable and reliable services?

Networking R&D Laboratories

- The Network Research community needs networking research “Laboratories” in which to develop novel concepts ...
  - Constructed from stable underlying infrastructure
  - Allow high risk experiments to be carried out...
  - Yet prevent unexpected or errant behaviour from interfering with production services or other testing.
  - Provide reliable and effective work environment for the researcher
  - Enable a broad range of innovation – not focused on one particular idea – indeed architecturally technology agnostic
  - Fast: Ability to rapidly prototype new ideas
  - Flexible: The test kit/prototype and/or the test regimen can be easily modified based on analysis of the test data
  - Scalable: Ability to construct large scale test environments
  - These laboratories must be able to duplicate real world scenarios such that research results are useful and valid
- We need [network] crash test dummies...

SA2: “Testbeds as a Service”

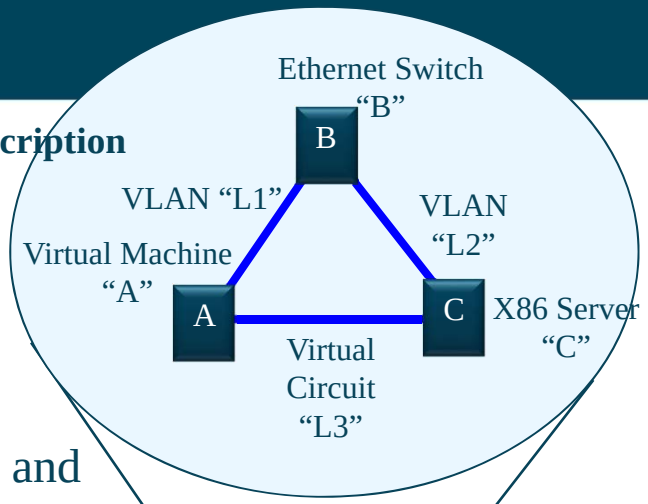
GN3+SA2 “Testbeds as a Service”

- **SA2 will deliver two key Testbed Services:**
  - **Dynamic “Packet” Testbeds** – ***dynamically allocated, virtualized networks*** provisioned over packet oriented transport and switching infrastructure with a pan-European footprint.
    - *Under control of the researcher*
    - *Insulated to prevent collateral damage to other services*
    - *Flexible network topologies that can morph as necessary*
    - *Extensible to support novel hardware*
  - **“Dark Fiber” Testbeds** –photonic testbeds over dark/dim fiber along long haul routes between a limited set of major EU metro areas.
    - *Virtualization of these resources is hard...but we’ll see...*

- **SA2 is a GEANT *Production Service***
  - The test beds it creates are expected to be reliable and available.
  - Which means the SA2 management and control processes/protocols must be stable and secure
  - The virtualized resources must be such that they can be effectively isolated to contain rabid behaviour.
  - This does not mean the user cannot or will not cause the virtual resources to fail in some way – just that the resources must be recoverable and not subject to user actions inadvertently causing problems below the virtuaization layer.

Dynamic Packet Testbed- How it works

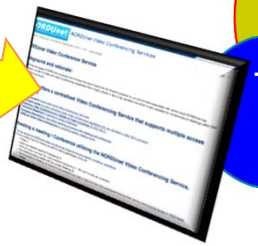
Testbed "Alpha" Description



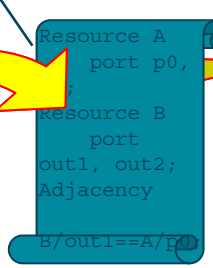
Network testbed concept to test novel idea

Researcher has a brilliant idea

User logs in, and builds a testbed description via a web GUI frontend to their Testbed Control Agent

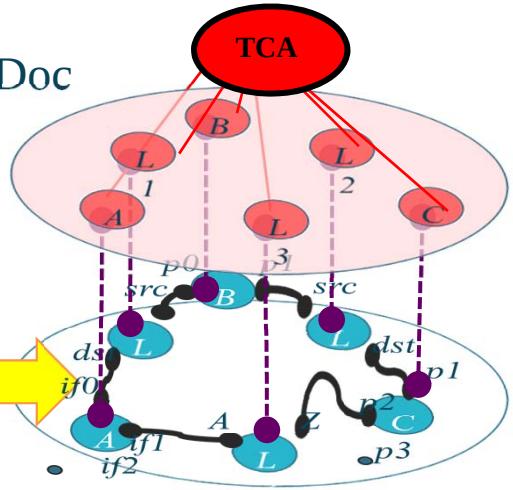


TC A



Testbed Description Doc fed to RM

RM



Resource Manager
Allocates resources and sets up the testbed control plane

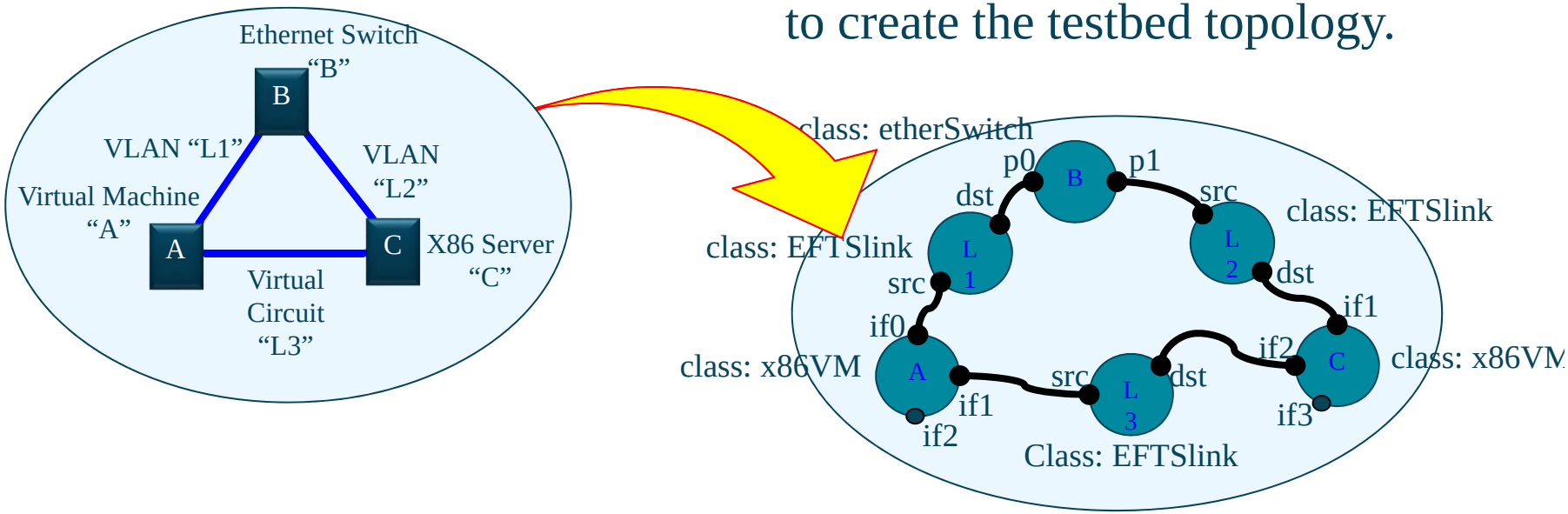
Testbed is activated and user controls it via the TCA

A Brief Dive into the Internals:

The TaaS Architecture treats all [testbed] networks as *graphs*

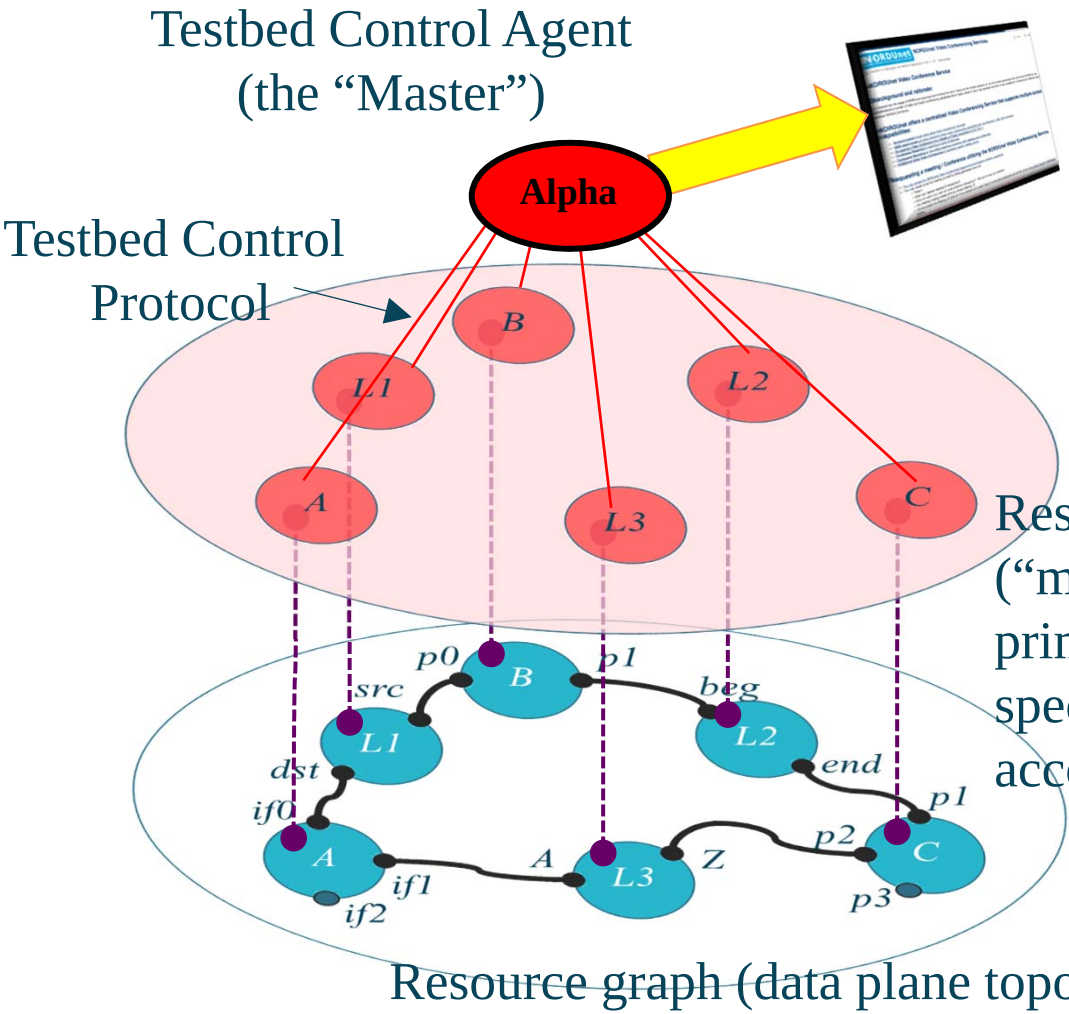
Internally, TaaS represent both nodes and links as generalized “resources” connected via virtualized data ports to create the testbed topology.

Testbed “Alpha” Description



Data plane resource graph

Standing it up ... Testbed instantiation



Resource graph (data plane topology)

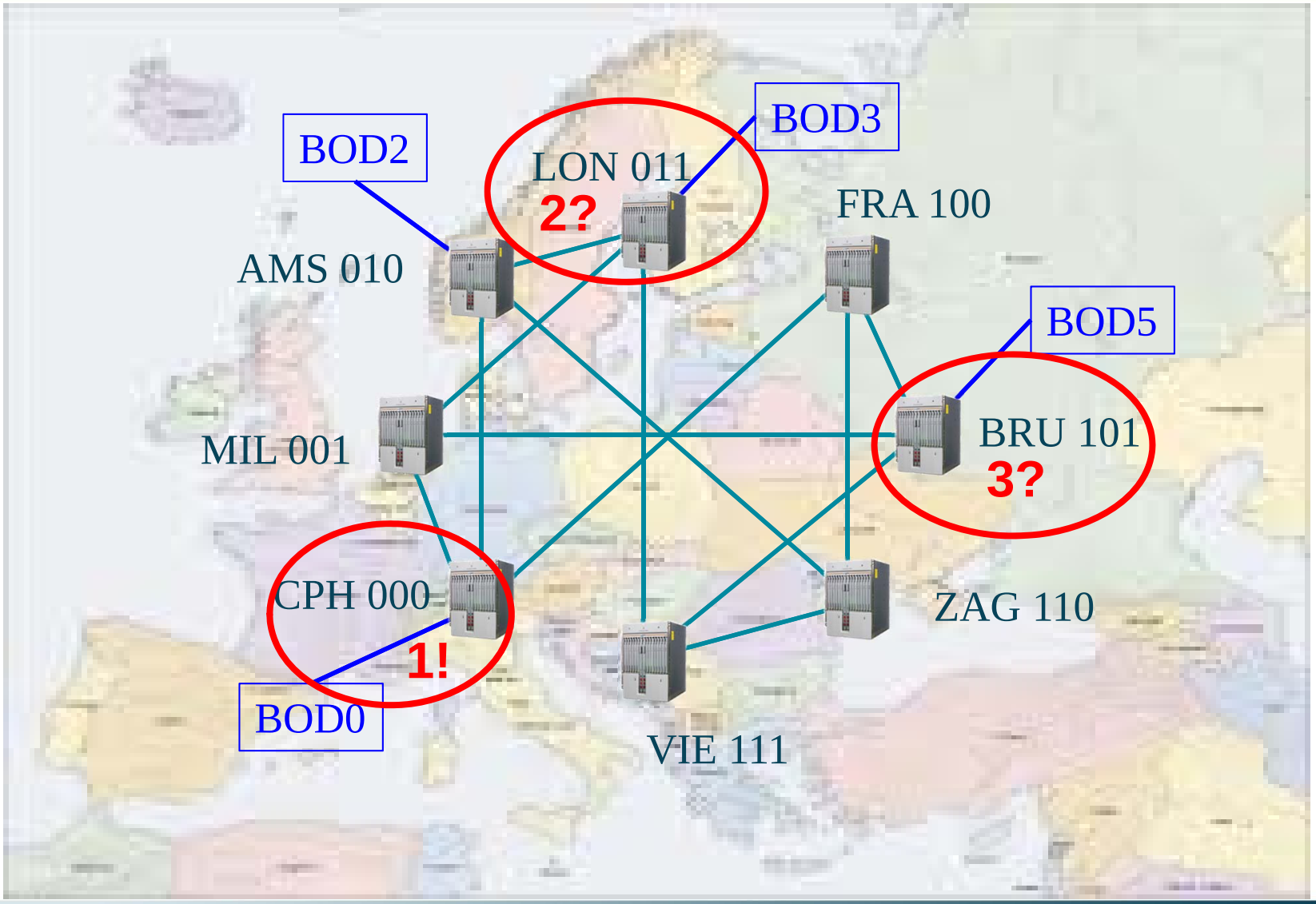
SA2 will provide a master agent that incorporates an interactive web based GUI for defining, reserving, and instantiating testbeds and resources.

Resource Control Agents ("minions") translate TaaS control primitives (methods) into resource specific command sequences that accomplish the requested action.

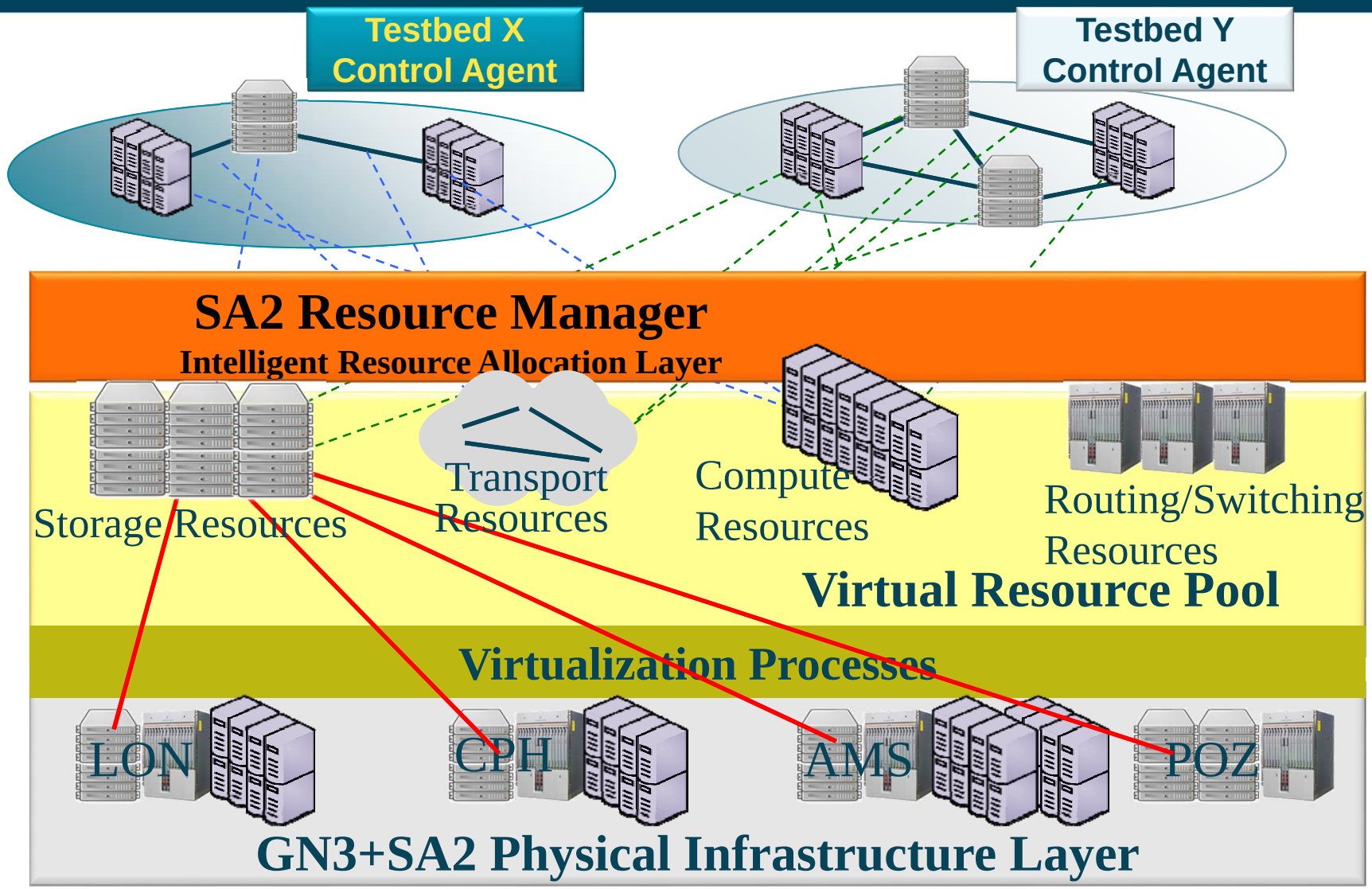
Integrated Services Approach

- The SA2 leverages other GN3Plus services:
  - SA1/SA6 Core Eng/Ops – A fully functional routed IP core is essential for the SA2 service access and control plane functions, and for user access to the testbed resources
  - SA3 Bandwidth on Demand will supply the multi-domain virtual circuits and inter-domain transport provisioning via NSI and AutoBAHN
  - SA7 Cloud Services will be exploring the delivery of large scale cloud resources to the GN3+ community – TaaS hopes to influence those efforts, and also to use them to scale up.
  - SA? Identity Management. TaaS will rely on existing and emerging AAI conventions for users and projects and accounting.
- TaaS leverages “Virtualization” in the extreme
  - “Virtual” does not mean “imaginary” (!) - these are *very real* resources and real networks

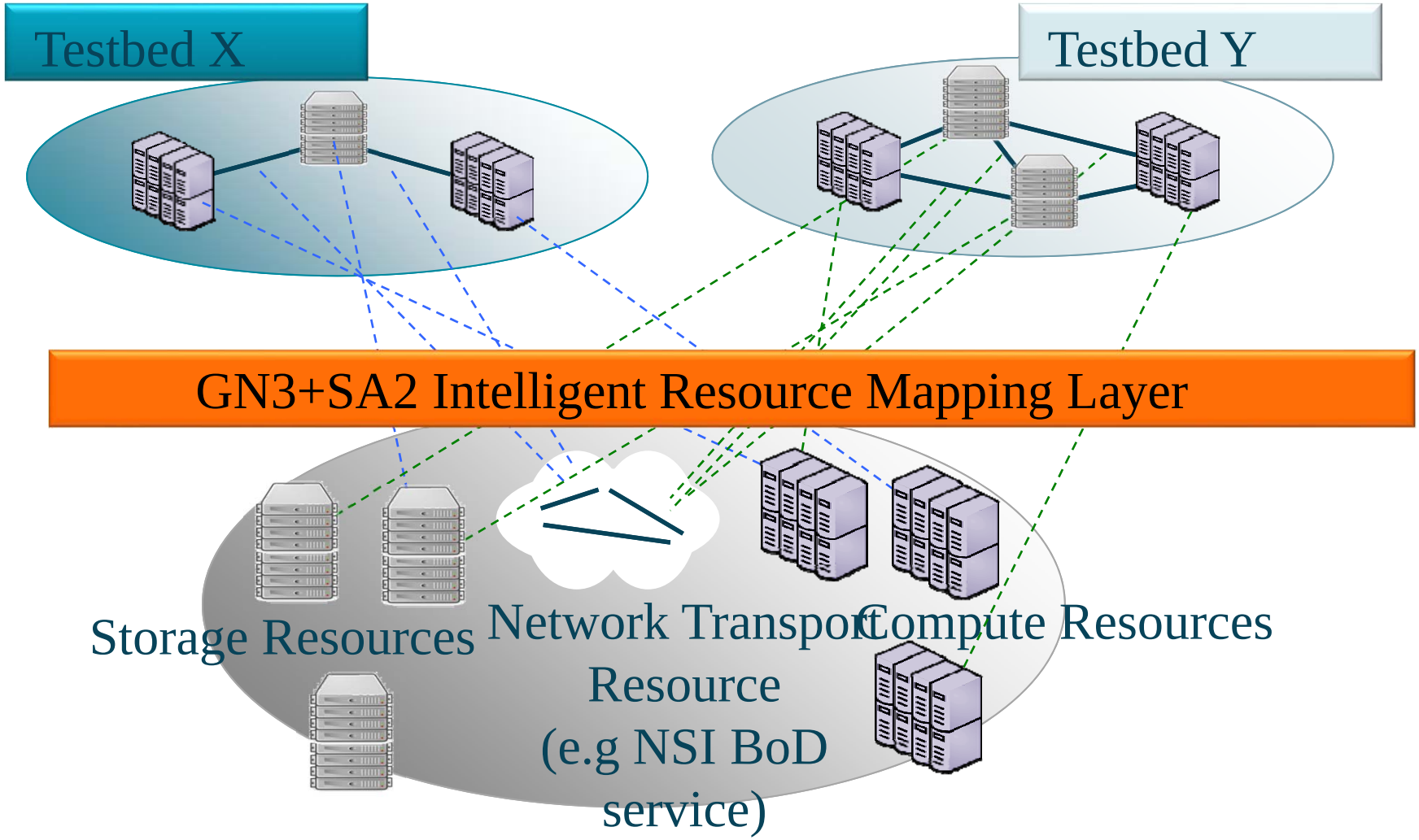
TaaS Deployment Planning
(draft) Dec 2013



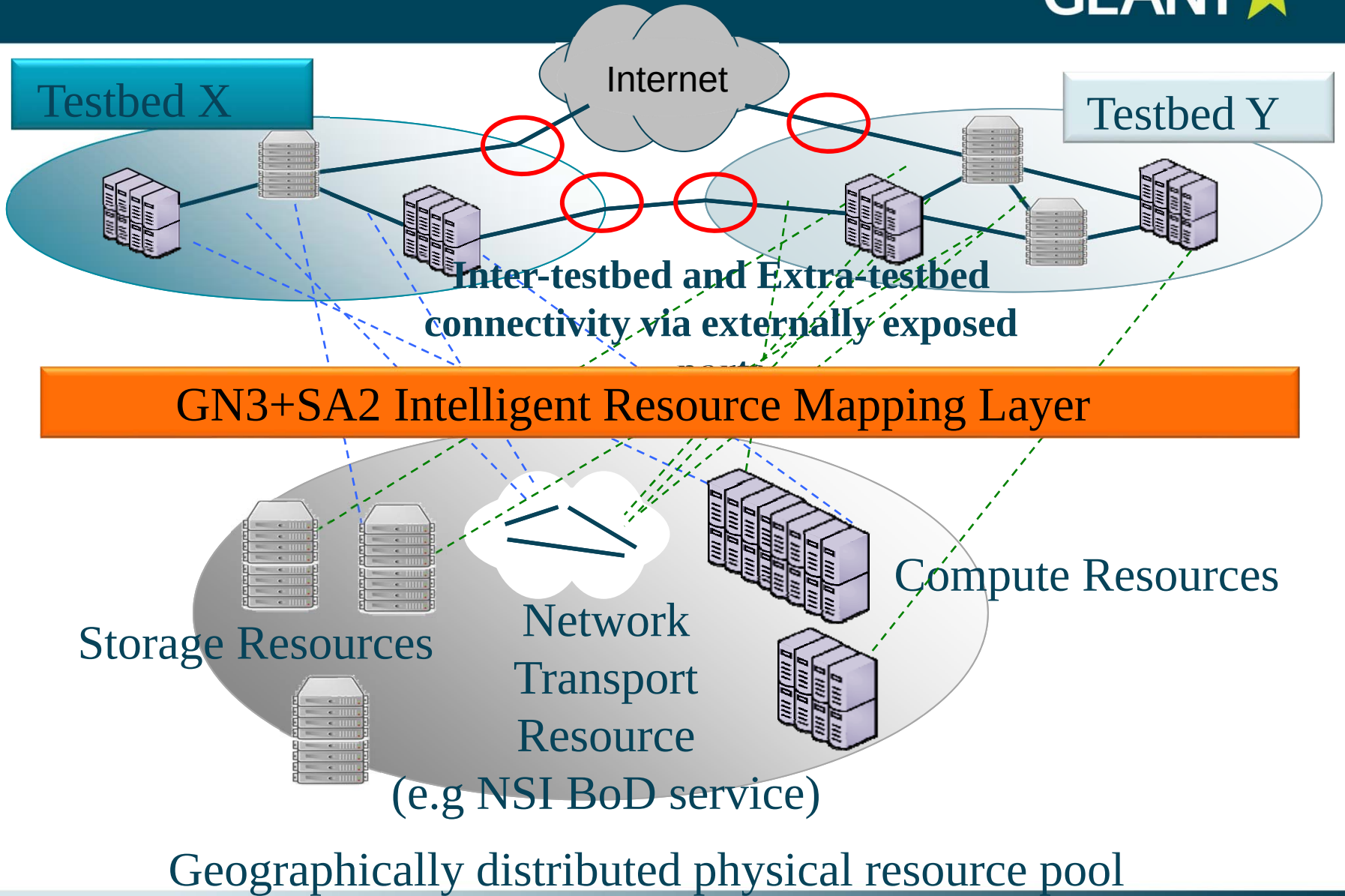
SA2 Testbeds Phase 1



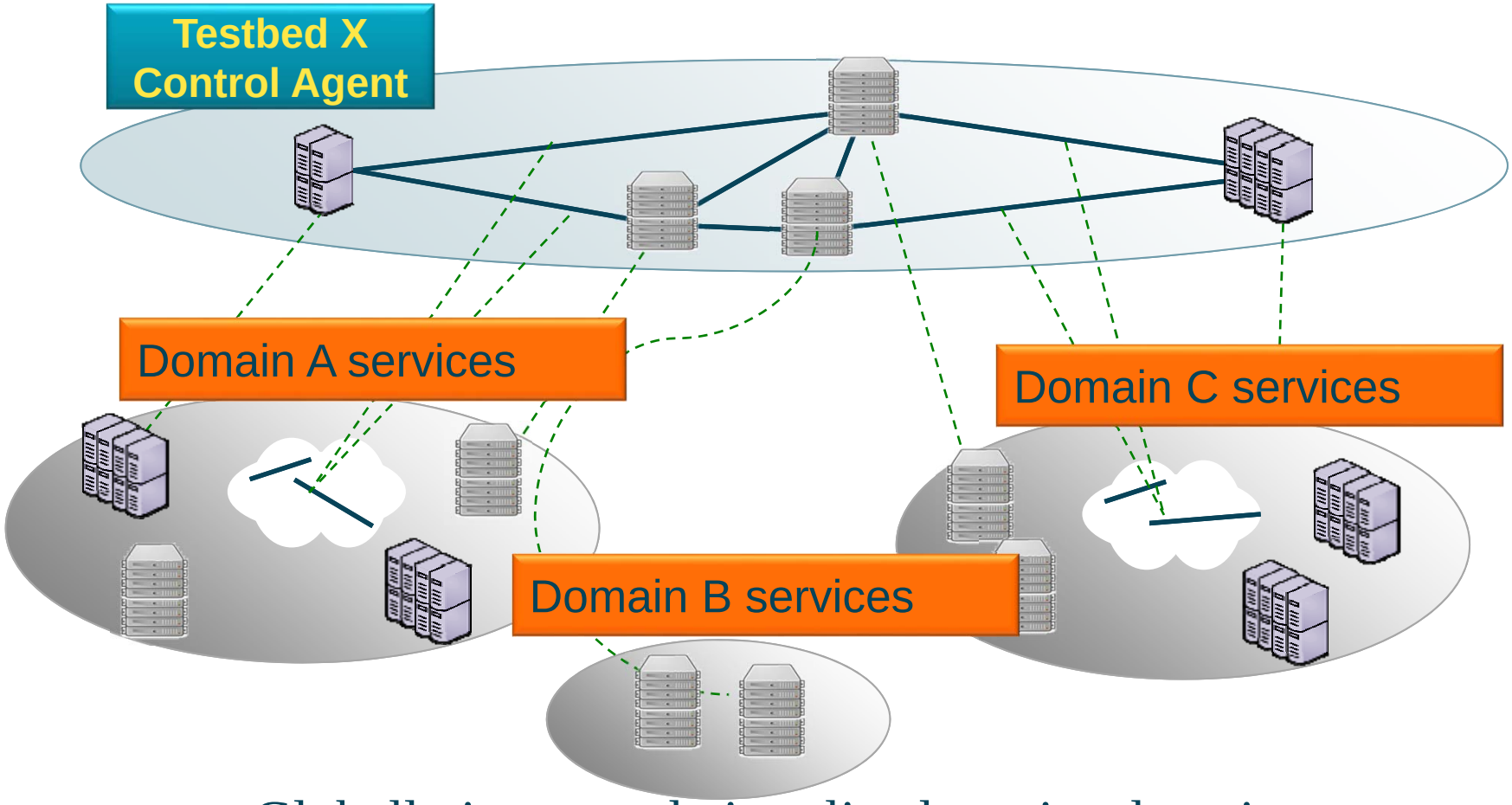
SA2 Testbeds Phase 1



SA2 Testbeds Phase 1plus



SA2 Testbeds Phase 2



Globally integrated virtualized service domain
(e.g. global virtual SDN domain..?)

Timeline

- ✓ **M1: May 1, TaaS Service Definition - Complete**
- ✓ **M2: Aug 30, TaaS Architecture and Engineering Plan - Complete**
- ✓ **M3: Sept 33rd – Internal "First Look" - Complete (if you squint...)**
  - Many complications/limits/surprises, but basics are beginning to work.(!)
- LOTS of SW development happening
- HW ordering, staging, and **deployment...**
- User and Resource support
- **Dec 31, 2013 – TaaS v1.0 production service Phase 1**

- 2014 – scaling up
  - Begin migration from FED/GOFF -> SA2 TaaS:
  - Training/Seminars/Workshops
  - Richer selection of resources/attributes
  - Scaling (target: n x 10^3 VMs, n x 10^3 VCs)
  - Reach: Inter-domain multi-domain interoperability (and scaling)

SA2 Conspirators:

- GARR
- PSNC
- TERENA
- DANTE

- RedIRIS
- DFN
- CESnet
- RENETER
- HEAnet
- NORDUnet

...Beyond the GEANT Core

- **SA2 would like the NRENs to participate in the TaaS service architecture**
  - Initially, this means offering up infrastructure and resources according to the SA2 Architecture
  - The NRENs can be our first experimental test of multi-domain interoperability - mid 2014 ...
- Ultimately, we want the SA2 TaaS architecture and service model to be an existence proof that large scale, dynamically allocated, multi-domain virtual networks are viable
  - And the TaaS' architecture is able to do this eefectively at scale.
- By End of GN3plus (i.e. GN4 launch) we would like there to be open consensus emerging for inter-domain virtual resource management architevture and protocol(s) so that such capabilities can be extended seamlessly and globally.

- Stay tuned... Now the real work begins...

The End