

RoadMap for Production, Testbed, and R&D Networks

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Executive Summary

The programs of the Office of Science would benefit from the formation of an integrated networking provisioning model that provided the elements of:

- Production Level Networking in support of traditional program requirements
- Networking Resources in support of critical DOE applications including those that require capability networking or advanced services
- Networking Resources that are easily separable in support of needed networking research

In order for such an integrated program to be successful, it would require:

1. a RoadMap that expressed the future of all three elements in the context of shared networking vision across the MICS networking program
2. the fostering of a Federal DOE Networking Initiative that resulted in needed additional dollars, using the SCIDAC Initiative as a model
3. a governance model that allowed:
 - a. for the planning, management, resource allocation, and support across its elements in the context of the integrated program, with particular emphasis on resources that are needed for integrating all these efforts across the elements
 - b. for the participation of SC programs in the planning and prioritization of network offerings with sufficient regard for the mission of all three elements

All of the above requires a high priority examination of possible business models. The goal is to provide a flexible network infrastructure (e.g. lambda-based) providing a more dynamic provision of networking infrastructure for all three elements

THREE ELEMENTS

The programs of the Office of Science would benefit from the formation of an integrated networking provisioning program that integrated the elements of:

1. Production Level Networking
in support of traditional program requirements. This element provides the capabilities and capacity required by existing DOE applications and research teams.
2. Networking Resources for high impact DOE Science Areas
including Application and Grid Research, especially in those areas that require capability networking or advanced services. Associated requirements generally motivate bandwidth or services that are not provided by the Production Level Networking element. The nature of the research served by this element might include computer science requirements or application/tools/middleware development requirements that are difficult or impossible to do with production networks today.
3. Networking Resources for Networking Research
that are easily separable in support of needed networking research.

1.1 Observations

An integrated network provisioning strategy would benefit from a process of planning, coordination, funding, and implementation that encompasses all three elements. Each of these elements generates a requirement for a suite of needed capabilities and enabling networking services that must be met by a network provider(s).

The three element approach is consistent with the segmenting of the networking management responsibilities into its current components that underly internal element planning and management.

However, an integrated network provisioning strategy could help overcome a number of challenges inherent in this separation:

- there exists a migration barrier at their boundaries, that is both technical and resource related (e.g. how do we migrate an application and supporting services from element 2 to element 1 -- given all the challenges associated with moving development effort into full production support, and which program pays for this)
- it is currently somewhat difficult to move funding across the boundaries, thereby making it difficult for the networking requirements of one element to be satisfied by the provisioning of another element
- advancements that are moved from development into production require one-time funding for that migration, and also ongoing funding for its support
- a shared vision of success must be motivated -- any measurement of success must be across all three elements

It is the observation of the authors that there are insufficient resources to bring each of these elements to a level that could/would accelerate DOE Science

1.2 Findings:

The authors of this section consist of a combination of network visionaries, managers and technologists, some of whose perspective is based on long term interactions with the MICS suite of network related programs, and others with an intimate familiarity with a breadth of agency and university networking programs. We provide here a set findings that we think are useful for the MICS program management to consider.

- a shared networking provisioning effort would benefit the MICS Networking Programs Elements with increased interaction, improved responsiveness across the elements to each other, potential integration, and a shared focus. This would benefit from a high-level strategy that guides how these programs are integrated into a coherent roadmap, and could motivate changes in Governance (see below).
- specific funding is needed to bridge the Tiers -- that is to help move R&D and Advanced Applications and Technologies into common usage (infrastructure) in support of Science.
- additional Funding is needed to move prioritization decisions from "either/or thinking" toward allowing alternate approaches to be investigated across all three tiers. Networking technologies and approaches have been and will continue to radically change, and the Networking Program must position itself to be agile and not too firmly rooted into any one networking provisioning model.
- additional funding is need to support what will be the growth of production services that have migrated into production from the R&D community. This is the cost of success.
- as grids/applications are moved into production, the modeling of service providing, inherent in supporting a growing production infrastructure, needs to be revisited. That is, as time goes by, more and more services will hopefully move into production, and the service model will need to become increasingly distributed as we stretch the service beyond the DMZ., into end-to-end support.
- the business model may affect the manner in which network is provisioned to the program elements.

Alternate Models

The articulation of three sets of capability requirements has traditionally suggested three networks or three types of networks, and that may be overly constraining and/or confusing. One can imagine (but not safely forecast) that in a flexible network infrastructure (e.g. lambda-based) that all three elements could receive that networking infrastructure from a common resource that might be reallocated more easily.

2. Governance Model

An integrated networking provisioning strategy that attempts to meet all the needs of the existing programs will require the revisiting of the Governance Model. The governance model includes its DOE program management components, its Lab/University project management components, as well forums for input (e.g. standing steering committees, workshops, etc.).

2.1 Observations

Currently DOE has no overall network governance model.

ESnet (for its production network services) has a governance structure that, in addition to the Program Office, relies on a group of representatives from SC constituencies (ESnet Steering Committee). The ESnet Steering Committee has an admirable long-term history as a champion and prioritization forum representing a community with increasing network demands with a single network provider.

The ESnet Steering Committee has created a subgroup of technologists (ESnet Coordinating Committee). They have served well to ensure needed coordination of production networking across the Labs and to identify and investigate technological opportunities and issues that cross the Laboratory community. The ESnet Coordinating Committee is really more a part of the service provisioning model than the governance structure.

A production service requires high-inertia to protect services, and this is normally well represented by its existing users. However, an existing-user based process of gathering requirements is not generally conducive to ensuring the risks are taken where necessary for disruptive technology development and evaluation.

In order to achieve management of an integrated high performance networking program, complete with production, testbeds, and R&D, an integrated governance model makes sense. We believe that a steering structure should be an inherent part of the Governance and that this must include a breadth of representation across the SC, encompassing the three elements of networking requirements, including using PIs, R&D PIs, network project managers, technical staff from the Labs. This will generate a productive friction between traditional network utilization and advanced requirements. This friction will result in an encompassing overview of requirements for the network provisioning efforts as well as a mechanism for their prioritization and resolution. We recognize that this has implications within the MICS office which we have not addressed.

This group has observed an SC-wide dilemma in regard to network resources. We believe that there exists a vision that DOE-funded Labs and PIs at universities are an enterprise furthering the DOE Mission. However, this vision does not presently benefit from an enterprise perspective that guides decisions concerning the enterprise-wide components that are needed to realize this vision. (e.g. should networking be included in network-intensive proposals initiated by other SC program offices).

The Networking approach for requirements generation has not matured to the level of computing requirements generation. SC PIs who require a significant amount of a computing resources are familiar with the grant requesting process whereby allocation is requested on a high performance computer. As part of the grant process, these PIs have learned to scope and predict their requirements. We believe that the networking program

(especially the latter two elements) would benefit from a similar approach. This would have benefits to:

- long term network planning
- short term network resource allocation
- ensuring that SC programs understand the demands they are making from the network and the resulting benefits, hopefully motivating increased support of the MICS networking program across the breadth of the SC programs.

2.2 Findings

The governance model for integrated network provisioning must allow for the management of each element's requirements in a context that is highly influenced by opportunities/risks that face the other two elements. For example, as networking advances are developed and become critical to support a scientific processes there must be a prioritized and managed transfer of these network advances into the production networking environment (e.g. global discovery and scheduling, uniform computer data access, authentication, collaboration support etc).

Shared network provisioning will encourage increased interaction throughout the Governance Model. We believe benefits will result well beyond shared networking provisioning. In the ideal, the Governance Model for all networking programs (both at DOE and in the Field) will foster the creation of a well articulated vision for all the elements, integrated goal setting process, shared strategies across the programs that are mutually understood and shared.

We believe that the three programs and the associated networking provisioning strategy would benefit from increased support from other offices in SC as well as the infusion of increased financial resources

- Network initiative is probably necessary to break the 'zero sum game' in networking that has faced the community for many years, limiting what can be done. We believe that SCIDAC initiative model is worth considering, allowing for the ownership of the Initiative and its resulting efforts across the office of science.