Large Scale Networking (LSN)

NITRD Agencies: NSF, DARPA, OSD and DoD Service research organizations, NIH, DOE/SC, NSA, NASA, NIST, AHRQ, DOE/NNSA, NOAA
Other Participants: USGS

LSN members coordinate Federal agency networking R&D in leading-edge networking technologies, services, and enhanced performance, including programs in new network architectures, heterogeneous multimedia testbeds, network security, mobile wireless networks, infrastructure, middleware, end-to-end performance measurement, networks for disaster response, and advanced network components; grid and collaboration networking tools and services; and engineering, management, and use of large-scale networks for scientific and applications R&D. The results of this coordinated R&D, once deployed, can help assure that the next generation of the Internet will be scalable, trustworthy, and flexible.

President's 2009 Request

Strategic Priorities Underlying This Request
Federal Plan for Advanced Networking Research and Development: Solicit and incorporate comments
    from university, Federal lab, industry, and other experts to finalize, publish strategic plan for Federal R&D
Ad hoc, secure, mobile wireless technology: Identify current and future research needed to incorporate
    secure mobile wireless networking into heterogeneous networking capabilities
Troubleshooting heterogeneous, multimedia, multidomain, end-to-end networking: Identify methods,
    tools, resources, and needed research for isolating, fixing, and repairing faults and failures affecting
    applications over end-to-end heterogeneous networks

Highlights of Request
Advanced testbeds: Investigate federation, agile circuit-switching, interdomain resource sharing, security,
    and management of heterogeneous networks to support research applications (e.g., NSF's Underwater
    Community Testbed) using VINI, DRAGON, Emulab, DOE/SC's Next Generation Testbed; coordinate
    with OMNInet, Optiputer, TeraGrid, Internet2Net, National LambdaRail, and regional ONTs – NSF,
    DARPA, DOE/SC
Innovative architectures: Develop network architecture concepts to enable robust, secure, flexible, dynamic,
    heterogeneous future networking capabilities, (e.g., NSF's NETS and FIND program, virtualization,
    DOE/SC's OSCARs) – NSF, DARPA, OSD, DOE/SC, NASA
Network security research: Develop technologies for detection of anomalous behavior, quarantines;
    standards, modeling, and measurement to achieve end-to-end security over heterogeneous, multidomain
    networks and infrastructure supporting multimedia open science applications (e.g., DOE/SC's SciDAC,
    NSF's CDI); critical infrastructure protection; trustworthy networking; privacy, confidentiality,
    authentication, policy, cryptography, and quantum communication – NSF, DARPA, OSD, DOE/SC,
    NASA, NIH, NIST
Federated networks and network management: Develop protocols for agile networking, resource
    reservation, security, and management across multidomain hybrid networks – NSF, DARPA, OSD,
    DOE/SC, NASA
Wireless and sensor networking: Advance standards, capabilities, and management (e.g., power, data
    fusion, heterogeneous interfaces, spectrum constraints) for robust, secure, dynamic, and mobile networks
    (wireless, radio, sensor); sensing and control systems – NSF, DARPA, OSD, NASA, NIST
Applications over advanced networks: Work with users to implement sharing of resources for open science
    communities; enable international science cooperation over networks – NSF, DOE/SC, NIH, NIST, NOAA
Community testbeds, grid access to resources: Develop technologies, protocols, and tools to enable
    heterogeneous, dynamic users to securely share resources for large-scale science cooperation (e.g., NIH's
    BIRN, caBIG) and disaster response – NSF, DARPA, OSD, NIH, DOE/SC
Disaster response and management: Disaster Information Management Research Center – NIH (NLM)
Large-scale data flows: Develop and test terabit-plus transport protocols and capabilities (e.g., Coronet,
    ORCA, SATCOM-CX, InfiniBand single-stream flows over WANs) – NSF, DARPA, OSD, DOE/SC,
    NASA, NOAA
Delay-tolerant networking: Develop protocols and methods for interoperability with intermittent
    connectivity – NSF, DARPA, OSD, NSA, NASA
Theoretical foundations of networking: Develop fundamental methods for modeling networks as complex
    autonomous, and dynamic systems – NSF, DARPA, OSD, NASA, NIST
End-to-end performance monitoring and measurement: Develop methods, tools, and testbed capabilities –
    NSF, OSD, DOE/SC, NSA, NASA, NIST
IPv6 and cyber security: Develop and implement near-term mandated capabilities – OSD, NIST

Planning and Coordination Supporting Request

Interagency research agenda: Collaborative development of vision and draft Federal Plan for Advanced Networking R&D including matrix of R&D priorities pointing to the middle of the next decade – LSN agencies

Cooperative R&D efforts: Networking research projects (NSF, DARPA, DOE/SC); efficiency and security of electric power networks (NSF, DARPA); Internet Infrastructure Protection Program (DARPA, NIST)

Workshops: Planning for April 2008 workshop on Critical Challenges for Optical Networking; NSF workshop on cooperation with the OECD; DOE/SC workshop on ESnet R&D, with NSF; NSF workshop on Cyber Defense Initiative Biological and Environmental Research Requirements

Coordination by LSN Teams
– **Joint Engineering Team (JET): NSF, OSD (HPCMP), NIH, DOE/SC, NSA, NASA, NIST, NOAA, USGS, with participation by academic organizations (CAIDA, CENIC, Internet2, ISI, MAX, NLANR, StarLight), a national lab (ANL), supercomputing centers (ARSC, MCNC, PSC), universities (FIU, IU, UIC, UMd, UNC, UU, UW), and vendors** – Advanced networking testbeds, coordination of end user requirements, engineering of research testbeds (JETnets); security best practices, applications testbeds (DNSSec, IPv6, IPv6 multicast, performance measurement); interdomain and end-to-end metrics and monitoring; tool sharing and exchange; international coordination; transit and services cooperation
– **Middleware And Grid Infrastructure Coordination (MAGIC) team: NSF, NIH, DOE/SC, NIST, NOAA, with participation by academic organizations (EDUCAUSE, Internet2, ISI, UCAR), national labs (ANL, LANL, LBNL, PNL), universities (UIUC, UMd, UNC, UWisc) and vendors** – Middleware and grid tools and services; grid standards and implementation status (TeraGrid, OSG, caBIG, BIRN), grid security and privacy (e.g., coordinated certificate authorities); international coordination
– **Information exchange**: Multiagency participation in review panels, informational meetings, principal investigator (PI) meetings; tactical coordination among program managers with common interests; coordination of JET meetings with DOE ESSC and Internet2 Joint Techs Meetings; GMPLS forum coordinating development of standards for interdomain signaling in agile optical networks

Additional 2008 and 2009 Activities by Agency

NSF: Global Earth Observation System of Systems (GEOSS); distributed, mobile, and embedded systems; theoretical foundations of networking and communications, including SING program

DARPA: Radio networking in challenging environments (network-centric radio systems, power and spectrum management, interface multiple access, brood of spectrum supremacy, LANdroids, wireless electronic protect/attack); data fusion and management (e.g., SAPIENT); dynamic quarantine of worms; collective technology for dynamic teams, software agents, and sensors

OSD (HPCMP): Network monitoring tools; security (IPsec, VPN portals, attack-detection tools, filters, encryption); network high-speed access to Hawaii and Alaska

DoD Service research organizations: Battlefield airborne communications node; rapid attack information dissemination execution relay; airborne network gateway programs; satellite communications; coalitions joint spectrum management planning tool

NIH: Computational grids for biomedical research, bio-informatics, clinical needs; focus on QoS, security, medical data privacy, disaster response, network management, and collaboratory infrastructure technologies

DOE/SC: Interdomain dynamic circuit reservation and management; multidomain hybrid networking; 100 Gbps optical overlay; DANTE, Internet2, CANARIE, ESnet evolution and cooperation (Internet2, DICE)

NSA: Delay-tolerant and ad hoc networking; optical receiver

NASA: Space, planetary wireless, ubiquitous, and high-performance networking (high throughput with security); bandwidth on demand; agile lambda switching

NIST: Public safety communication (e.g., P25 standards); ubiquitous information technologies for health care; indoor communications and localization; broadband quantum key distribution

AHRQ: Statewide and regional demonstrations of health information exchange networks, integration with the National Health Information Network architecture

NOAA: Integration of and access to HPC centers; high-data-rate testbed