National Science Foundation

Part 2: Computing and Networking Capacity
(for research and instructional activities)

FY 2011 Survey of Science and Engineering Research Facilities

Who should be contacted if clarification of Part 2 answers is necessary?

	Contact 1	Contact 2
Name:		
Title/position:		
Telephone:		
Email address:		

Please complete the questionnaire and submit it according to the arrangements you made with your institutional coordinator named in the label above. You may complete this questionnaire online at www.facilitiessurvey.org. You will need to click on "Part 2" and then enter the survey ID and password printed on the label above.

If you have a question, please contact [Name] via e-mail at [Contractor email box] or call 1-888-XXX-XXXX. The survey director at the National Science Foundation is Dr. Leslie Christovich.

If you do not have exact figures for any part of this questionnaire, please provide estimates.

Thank you for your participation.

OMB #3145-0101

Changes from previous survey cycle

- **Question 1 on total bandwidth** has been modified to include bandwidth to the commodity internet (Internet1), Internet2, the National LambdaRail (NLR), and federal government research networks.
- **Question 4 on federal government research networks** has been added.
- **Question 11 on centrally administered high-performance computing (HPC) architectures** has been modified to include graphics processing unit (GPU) computing.
- **Three questions from the last survey cycle have been deleted** (question numbers shown below refer to those appearing in the FY 2009 survey):
  - Commodity internet bandwidth (Question 4)
  - High performance network connections (Question 6)
  - Conditioned machine room space for centrally administered HPC (Question 23)

Question 1: Total bandwidth

1. At the end of your FY 2011, what was your institution's total bandwidth including the commodity internet (Internet1), Internet2, the National LambdaRail (NLR), and federal government research networks? What is your estimate of this total for your institution at the end of your FY 2012?

   Bandwidth is the amount of data that can be transmitted in a given amount of time, measured in bits per second.

   Commodity internet (Internet1) is the general public, multiuse network often called the "Internet."

   Internet2 is a high-performance hybrid optical packet network. The network was designed to provide next-generation production services as well as a platform for the development of new networking ideas and protocols.

   National LambdaRail (NLR) is an advanced optical network infrastructure for research and education. NLR enables cutting-edge exploration in the sciences and network research.

   Federal government research networks are high performance networks which provide access to federal research facilities and computing resources (e.g. Department of Energy's ESnet, NASA's NREN).

   Please do <u>not</u> include:

   - Redundant connections, which are not normally active but available if a failure occurs with the active connection; or
   - Burstable bandwidth.

   Please include networking capacity for research, instruction, and residence halls.

Total bandwidth

(Mark one "X" for each column.)

Speed	At end of FY 2011	Estimated at end of FY 2012
a. 10 megabits/second or less	☐	☐
b. 11 to 45 megabits/second	☐	☐
c. 46 to 99 megabits/second	☐	☐
d. 100 megabits/second	☐	☐
e. 101 to 155 megabits/second	☐	☐
f. 156 to 622 megabits/second	☐	☐
g. 623 to 999 megabits/second	☐	☐
h. 1 to 2.4 gigabits/second	☐	☐
i. 2.5 to 9 gigabits/second	☐	☐
j. 10 gigabits/second	☐	☐
k. 10.1 to 20 gigabits/second	☐	☐
l. More than 20 gigabits/second	☐	☐
m. Other *(Please specify.)*	☐	☐

_____

_____

Question 2: Internet2 bandwidth

Questions 2–10 include networking capacity for: research, instruction, and residence halls.

2. At the end of your FY 2011, what was your institution's bandwidth to Internet2? What is your estimate of the bandwidth to Internet2 at the end of your FY 2012?

Bandwidth is the amount of data that can be transmitted in a given amount of time, measured in bits per second.

Internet2 is a high-performance hybrid optical packet network. The network was designed to provide next-generation production services as well as a platform for the development of new networking ideas and protocols.

Please do <u>not</u> include redundant connections. A redundant connection is not normally active but is available if a failure occurs with the active connection.

Speed	**Bandwidth for Internet2** *(Mark one "X" for each column.)* At end of FY 2011	Estimated at end of FY 2012
a. ***No bandwidth to Internet2***	☐	☐
b. 10 megabits/second or less	☐	☐
c. 11 to 45 megabits/second	☐	☐
d. 46 to 99 megabits/second	☐	☐
e. 100 megabits/second	☐	☐
f. 101 to 155 megabits/second	☐	☐
g. 156 to 622 megabits/second	☐	☐
h. 623 to 999 megabits/second	☐	☐
i. 1 to 2.4 gigabits/second	☐	☐
j. 2.5 to 9 gigabits/second	☐	☐
k. 10 gigabits/second	☐	☐
l. 10.1 to 20 gigabits/second	☐	☐
m. More than 20 gigabits/second	☐	☐
n. Other *(Please specify.)*	☐	☐

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Question 3: National LambdaRail (NLR) bandwidth

3. At the end of your FY 2011, what was your institution's bandwidth to National LambdaRail (NLR)? What is your estimate of the bandwidth to National LambdaRail at the end of your FY 2012?

Bandwidth is the amount of data that can be transmitted in a given amount of time, measured in bits per second.

National LambdaRail (NLR) is an advanced optical network infrastructure for research and education. NLR enables cutting-edge exploration in the sciences and network research.

Please do <u>not</u> include redundant connections. A redundant connection is not normally active but is available if a failure occurs with the active connection.

Speed	Bandwidth for National LambdaRail (Mark one "X" for each column.) At end of FY 2011	Estimated at end of FY 2012
a. ***No bandwidth to National LambdaRail***	☐	☐
b. 10 megabits/second or less	☐	☐
c. 11 to 45 megabits/second	☐	☐
d. 46 to 99 megabits/second	☐	☐
e. 100 megabits/second	☐	☐
f. 101 to 155 megabits/second	☐	☐
g. 156 to 622 megabits/second	☐	☐
h. 623 to 999 megabits/second	☐	☐
i. 1 to 2.4 gigabits/second	☐	☐
j. 2.5 to 9 gigabits/second	☐	☐
k. 10 gigabits/second	☐	☐
l. 10.1 to 20 gigabits/second	☐	☐
m. More than 20 gigabits/second	☐	☐
n. Other *(Please specify.)* _____ _____	☐	☐

Question 4: Federal government research network connections

4. At the end of your FY 2011, did your institution have connections to any federal government research networks? Do you expect to have connections to any of these networks at the end of your FY 2012?

   Federal government research networks are high performance networks which provide access to federal research resources (e.g. Department of Energy's ESnet, NASA's NREN).

   (Mark one "X" for each row.)

Fiscal year	Yes	No
a. Connections at the end of FY 2011.....	☐	☐
b. Connections at the end of FY 2012.....	☐	☐

Question 5: Bandwidth through consortia

5. At the end of your FY 2011, did your institution obtain any of its bandwidth through a consortium? Do you expect to obtain bandwidth through a consortium at the end of your FY 2012?

   A **consortium** is a collaboration of any combination of educational institutions (e.g., university system, regional collaboration), state and local agencies, network infrastructure operators (e.g., Internet2), vendors, health care organizations, or non-profit organizations with the purpose of coordinating and facilitating networking activities.

   Bandwidth is the amount of data that can be transmitted in a given amount of time, measured in bits per second.

   (Mark one "X" for each row.)

Fiscal year	Yes	No
a. Bandwidth through consortia at the end of FY 2011.....	☐	☐
b. Bandwidth through consortia at the end of FY 2012.....	☐	☐

Please provide the names of all consortia through which you expect to obtain bandwidth at the end of your FY 2012.

Question 6: Desktop port connections

6. At the end of your FY 2011, what percentage of your institution's desktop ports had hardwire connections at each of the speeds listed below? What percentage do you estimate will be at these speeds at the end of your FY 2012? If your answer is between 0 and 1 percent, please round to 1 percent.

   Please report on the ***capacity of the ports themselves*** and not the speed of the workstations connected to them. Also, ***do <u>not</u> include servers*** when determining your responses.

Speed of connection	**Percentage of desktop ports** At end of FY 2011	Estimated at end of FY 2012
a. 10 megabits/second or less	_____ %	_____ %
b. 100 megabits/second	_____ %	_____ %
c. 1 gigabit/second	_____ %	_____ %
d. 10 gigabits/second or more	_____ %	_____ %
e. Other *(Please specify.)* _____	_____ %	_____ %
Total	**100%**	**100%**

Question 7: Dark fiber

7. At the end of your FY 2011, did your institution own any dark fiber to your institution's internet service provider (ISP) or between your institution's buildings? Do you plan to acquire any dark fiber to your ISP or between your institution's buildings during your FY 2012?

   Dark fiber is fiber-optic cable that has already been laid but is not being used. Include only fiber that was dark (i.e., unlit) when it was purchased by your institution.

	(Mark one "X" for each row.) Yes	No
Owned at the end of FY 2011		
a. To your institution's ISP	☐	☐
b. Between your institution's buildings	☐	☐
To be acquired during FY 2012		
c. To your institution's ISP	☐	☐
d. Between your institution's buildings	☐	☐

Question 8: Speed on your network

8. At the end of your FY 2011, what was the ***distribution speed*** (or backbone speed) that a desktop computer on your network could connect to another computer ***on your institution's*** network? What distribution speed will your institution have at the end of your FY 2012?

(Mark one "X" for each column.)

Speed	At end of FY 2011	Estimated at end of FY 2012
a. 10 megabits/second or less	☐	☐
b. 11 to 45 megabits/second	☐	☐
c. 46 to 99 megabits/second	☐	☐
d. 100 megabits/second	☐	☐
e. 101 to 155 megabits/second	☐	☐
f. 156 to 622 megabits/second	☐	☐
g. 623 to 999 megabits/second	☐	☐
h. 1 to 2.4 gigabits/second	☐	☐
i. 2.5 to 9 gigabits/second	☐	☐
j. 10 gigabits/second	☐	☐
k. 10.1 to 20 gigabits/second	☐	☐
l. More than 20 gigabits/second	☐	☐
m. Other *(Please specify.)*	☐	☐

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_____

Question 9: Wireless connections

9. At the end of your FY 2011, what percentage, if any, of your institution's building area was covered by wireless capabilities for network access? What percentage do you estimate will have wireless access at the end of your FY 2012?

   Building area refers to the sum of floor by floor calculations of square footage.

   Please ***do <u>not</u> include rogue*** wireless access points.

Percent of building area	**Wireless coverage for network access** *(Mark one "X" for each column.)* At end of FY 2011	Estimated at end of FY 2012
a. None	☐	☐
b. 1 to 10 percent	☐	☐
c. 11 to 20 percent	☐	☐
d. 21 to 30 percent	☐	☐
e. 31 to 40 percent	☐	☐
f. 41 to 50 percent	☐	☐
g. 51 to 60 percent	☐	☐
h. 61 to 70 percent	☐	☐
i. 71 to 80 percent	☐	☐
j. 81 to 90 percent	☐	☐
k. 91 to 100 percent	☐	☐

Question 10: Comments on networking

10. Please add any comments that you wish to make on your institution's networking below.

Question 11: **Architectures for centrally administered high-performance computing (HPC) of 1 teraflop or faster**

11. At the end of your FY 2011, did your institution provide centrally administered high-performance computing (HPC) of 1 teraflop or faster at peak performance for each type of architecture listed below?

Centrally administered HPC is located within a distinct organizational unit with a staff and a budget and is generally available to the campus community. The unit has a stated mission that includes supporting HPC needs of faculty and researchers.

If some of your high-performance computing systems are slower than 1 teraflop and some are faster, please report only the systems that are 1 teraflop or faster.

	Had at end of FY 2011 *(Mark one "X" for each row.)*	
Centrally administered HPC architectures	Yes	No
a. **Cluster**..... This architecture uses multiple commodity systems with an Ethernet based or high-performance interconnect network to perform as a single system.	☐	☐
b. **Massively parallel processors (MPP)**..... This architecture uses multiple processors within a single system with a high-performance interconnect network. Each processor uses its own memory and operating system.	☐	☐
c. **Symmetric multiprocessors (SMP)**..... This architecture uses multiple processors sharing the same memory and operating system to simultaneously work on individual pieces of a program.	☐	☐
d. **Parallel vector processors (PVP)**..... This architecture uses multiple vector processors sharing the same memory and operating system to simultaneously work on individual pieces of a program.	☐	☐
e. **Graphics Processing Unit (GPU) Computing**..... This architecture uses CPU processors to process the sequential part of a problem and GPU processors to accelerate the computationally intensive part.	☐	☐
f. **Experimental/Emerging architecture** *(Please describe.)*..... This architecture uses technologies not currently in common use for HPC systems (e.g., an accelerator-based architecture). _____	☐	☐
g. **Special purpose architecture** *(Please describe.)*..... This custom-designed architecture uses established technology that supports a special purpose system that is dedicated to a single type of problem. _____	☐	☐

h. **Other architecture** *(Please describe.)*.....

Question 12: HPC centrally administered resources

12. In Question 11 (a–h), did you report having any centrally administered high-performance computing of 1 teraflop or faster at the end of your FY 2011?

Yes (Check this box and go to Question 13)..... ☐
No (Check this box and go to Question 22)..... ☐

Question 13: Centrally administered clusters of 1 teraflop or faster

13. At the end of your FY 2011, what was the peak theoretical performance of (a) your ***fastest*** computing cluster of 1 teraflop or faster, and (b) ***all*** your computing clusters of 1 teraflop or faster (including the fastest one)? Include only clusters that are centrally administered.

A computing cluster uses multiple commodity systems with an Ethernet based or high-performance interconnect network to perform as a single system.

If some of your cluster systems for high-performance computing are slower than 1 teraflop and some are faster, please report only the systems that are 1 teraflop or faster.

If you have only one cluster that is 1 teraflop or faster, report the same number for rows a and b.

If your institution did not administer any such clusters, check this box and go to Question 14..... ☐

	Number of teraflops
a. Fastest cluster of 1 teraflop or faster.....	_____
b. All computing clusters of 1 teraflop or more (including the fastest cluster).....	_____

Question 14: Centrally administered MPP of 1 teraflop or faster

14. At the end of your FY 2011, what was the peak theoretical performance of (a) your ***fastest*** MPP system of 1 teraflop or faster, and (b) ***all*** your MPP systems of 1 teraflop or faster (including the fastest one)? Include only MPP systems that are centrally administered.

Massively parallel processing (MPP) systems use multiple processors within a single system with a high-performance interconnect network. Each processor uses its own memory and operating system.

If some of your MPP systems for high-performance computing are slower than 1 teraflop and some are faster, please report only the systems that are 1 teraflop or faster.

If you have only one system that is 1 teraflop or faster, report the same number for rows a and b.

If your institution did not administer any such MPP systems, check this box and go to Question 15..... ☐

Number of teraflops

a. Fastest MPP system of 1 teraflop or faster....._____
b. All MPP systems of 1 teraflop or more (including the fastest system)....._____

Question 15: Centrally administered SMP of 1 teraflop or faster

15. At the end of your FY 2011, what was the peak theoretical performance of (a) your ***fastest*** SMP system of 1 teraflop or faster, and (b) ***all*** your SMP systems of 1 teraflop or faster (including the fastest one)? Include only SMP systems that are centrally administered.

Symmetric multiprocessing (SMP) systems use multiple processors sharing the same memory and operating system to simultaneously work on individual pieces of a program.

If some of your SMP systems for high-performance computing are slower than 1 teraflop and some are faster, please report only the systems that are 1 teraflop or faster.

If you have only one system that is 1 teraflop or faster, report the same number for rows a and b.

If your institution did not administer any such SMP systems, check this box and go to Question 16..... ☐

Number of teraflops

a. Fastest SMP system of 1 teraflop or faster....._____
b. All SMP systems of 1 teraflop or more (including the fastest system)....._____

Question 16: Centrally administered experimental/emerging computing systems of 1 teraflop or faster

16. At the end of your FY 2011, how many experimental/emerging computing systems of 1 teraflop or faster did your institution administer? Include only systems that are centrally administered.

Experimental/Emerging computing systems use technologies not currently in common use for HPC systems (e.g., an accelerator-based architecture).

If your institution did not administer any such systems, check this box and go to Question 17..... ☐

Number of **systems** of 1 teraflop or faster....._____ systems

Question 17: Centrally administered special purpose computing systems of 1 teraflop or faster

17. At the end of your FY 2011, how many special purpose computing systems of 1 teraflop or faster did your institution administer? Include only systems that are centrally administered.

Special purpose computing systems use a custom-designed architecture using established technology that supports a special purpose system that is dedicated to a single problem.

If your institution did not administer any such systems, check this box and go to Question 18..... ☐

Number of **systems** of 1 teraflop or faster....._____ systems

Question 18: External users of centrally administered HPC of 1 teraflop or faster

18. During your FY 2011, which types of external users listed below used any of your institution's centrally administered HPC of 1 teraflop or faster?

Type of external user	Used your HPC during FY 2011 (Mark one "X" for each row.) Yes	No	Uncertain
a. **Colleges and universities**..... Include public and private academic institutions and systems.	☐	☐	☐
b. **Governments**..... Include local, state, and regional jurisdictions.	☐	☐	☐
c. **Non-profit organizations**..... Include legal entities chartered to serve the public interest and that are exempt from most federal taxation.	☐	☐	☐
d. **Industry**..... Include for-profit companies, either publicly or privately held.	☐	☐	☐
Other *(Please describe.)*..... _____ _____	☐	☐	☐

Question 19: Usable online storage for centrally administered HPC of 1 teraflop or faster

19. At the end of your FY 2011, what was the total **usable** online storage available for centrally administered HPC of 1 teraflop or faster?

Usable storage is the amount of space for data storage that is available for use after the space overhead required by file systems and applicable RAID (redundant array of independent disks) configurations is removed.

Online storage includes all storage providing immediate access for files and data from your HPC systems (of at least 1 teraflop). Storage can be either locally available to specific HPC systems or made available via the network. For example, storage may be available via SAN (storage area network) or NAS (network attached storage) environments.

(Mark one "X")

a. None..... ☐
b. Less than 1 terabyte..... ☐
c. 1 to 5 terabytes..... ☐
d. 6 to 10 terabytes..... ☐
e. 11 to 25 terabytes..... ☐
f. 26 to 50 terabytes..... ☐
g. 51 to 100 terabytes..... ☐
h. 101 to 250 terabytes..... ☐
i. 251 to 500 terabytes..... ☐
j. 501 to 1,000 terabytes..... ☐
k. 1,001 or more terabytes *(Please specify.)*..... ☐

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Question 20: Usable shared storage for centrally administered HPC of 1 teraflop or faster

20. At the end of your FY 2011, how much of the usable online storage reported in Question 19 was shared storage?

Usable storage is the amount of space for data storage that is available for use after the space overhead required by file systems and applicable RAID (redundant array of independent disks) configurations is removed.

Online storage includes all storage providing immediate access for files and data from your HPC systems (of at least 1 teraflop). Storage can be either locally available to specific HPC systems or made available via the network. For example, storage may be available via SAN (storage area network) or NAS (network attached storage) environments.

Shared storage includes the portion of online storage that is available simultaneously to multiple HPC systems (of at least 1 teraflop) via a network making use of SAN, NAS, file system mounting, or similar technologies.

(Mark one "X")

a. None..... ☐
b. Less than 1 terabyte..... ☐
c. 1 to 5 terabytes..... ☐
d. 6 to 10 terabytes..... ☐
e. 11 to 25 terabytes..... ☐
f. 26 to 50 terabytes..... ☐
g. 51 to 100 terabytes..... ☐
h. 101 to 250 terabytes..... ☐
i. 251 to 500 terabytes..... ☐
j. 501 to 1,000 terabytes..... ☐
k. 1,001 or more terabytes *(Please specify.)*..... ☐

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Question 21: Archival storage for centrally administered HPC of 1 teraflop or faster

21. At the end of your FY 2011, what was the total archival storage available specifically for centrally administered HPC of 1 teraflop or faster? ***Do not*** include backup storage.

Archival storage can be either on-line or off-line. It is typically long-term storage for files and data and does not support immediate access from your HPC resources.

(Mark one "X")

a. None..... ☐
b. Less than 100 terabytes..... ☐
c. 101 to 250 terabytes..... ☐
d. 251 to 500 terabytes..... ☐
e. 501 to 750 terabytes..... ☐
f. 751 to 1,000 terabytes..... ☐
g. 1,001 to 5,000 terabytes..... ☐
h. 5,001 to 10,000 terabytes..... ☐
i. 10,001 or more terabytes *(Please specify.)*..... ☐

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Question 22: Comments on HPC

22. Please add any comments you may wish on your institution's HPC below.

Thank you. This is the end of Part 2. Please submit this part of the survey according to the arrangements you made with your institutional coordinator (named on the label on the front cover of the survey questionnaire).