

**Introduction:**

Multicast UDP connectivity across the NPS campus offers tremendous opportunity to link simulations and conduct experiments without need of consolidating resources in a central location. As such, the purpose of this study was to verify that multiple clients, located in various buildings across the NPS campus, could broadcast and receive packets to and from each other. The goals, methodology, and results of this proof-of-concept experiment are contained herein; however, the overall conclusion is that the cross-campus multicast UDP connectivity is excellent.

**Goals:**

1. Measure the effectiveness of multicast UDP connectivity via wired/wireless connection throughout the NPS campus.
2. Document the results of UDP connectivity and identify any discrepancies for correction.

**Methodology:**

Laptop computers were the primary platform for testing the UDP connections, with both MacOS and Microsoft Windows operating systems represented. Java programs developed and compiled in NetBeans were used to establish a multicast connection and send UDP packets through a designated address (239.1.2.15 ) and port number (1718). All administrative communication was conducted over a Microsoft Teams message thread.

Prior to executing the experiment across NPS campus, a test trial was conducted in Watkins Hall, room 275. During this initial test trial, it was determined that laptops running Microsoft Windows were unable to send or receive packets. After troubleshooting, it was found that Windows and third-party antivirus firewalls were blocking incoming and outgoing traffic to the desired port. As such, firewall port settings for Windows users required updating, and the multicast address and port were added to the authorized list on the firewall. The following link aided in the process of editing these firewall settings:

<https://smarthelp.mcafee.com/help/mcafee/17.9/ui/total%20protection/en-us/GUID-3B88DF90-973D-4680-97C1-B4937B043727.html>

Once all laptops were confirmed to be able to send and received UDP packets, team members moved to various locations across campus, to include academic building, administrative areas, and outside locations. All locations tested are listed in table 1 below.

After verifying all team members were in position via Microsoft Teams, the Java programs responsible for sending and receiving packets were ran. One designated team member remained in Watkins Hall, room 275 to serve as the primary receiver and recorder. When all locations of interest had been tested, the broadcast and receiving programs for all team members were terminated. Appendix B is a reference to the multicast sender Java source code and Appendix C is a reference to the multicast receiver Java source code.

**Execution:**

Appendix A contains the output for the code execution, as recorded in Watkins Hall, room 275. Note that each line identifies entity sending information and the location it was sent from.

## Results:

Table 1 below summarizes the results of the experiment. Of note, most of the laptop computers used in testing did not support an ethernet cable connection. Consequently, only one LAN port was checked for connectivity. While not explicitly a multicast connection issue, it took several minutes for the computer to obtain an IP address after physically connecting to the port.

Location	Wireless	LAN
Watkins Hall, Room 210	Checked/Works	Not checked
Watkins Hall, Room 267	Checked/Works	Not checked
Watkins Hall, Room 273	Checked/Works	Not checked
Watkins Hall, Room 275/285	Checked/Works	Checked/Obtaining IP takes 2 minutes
Herman Hall, Lobby	Checked/Works	Not checked
Dudley Knox Library	Checked/Works	Not checked
Glasgow Hall, Courtyard	Checked/Works	Not checked
Bullard Hall, Lobby	Checked/Works	Not checked
King Hall, Lobby	Checked/Works	Not checked
Spanagel Hall, Lobby	Checked/Works	Not checked
Herman Hall, Trident Room	Checked/Works	Not checked
Tennis Court	Checked/Works	Not checked
VPN	Checked/Does Not Work	Not checked

Table 1: Locations Tested and Respective Results

Location	Address	Subnet	Label
Watkins 275	Teachers Desk (Not explicitly labeled)	169.254.0.0/ after 2 Minutes 172. ...	

Table 2: Ethernet Ports Tested

## Conclusions:

We were satisfied with the ability to conduct multicast connectivity in all test locations throughout the NPS campus. The ability to transfer messages from as far away as the tennis courts is a notable capability and testament to the strength of the network.

## Recommendations:

None at this time. Future work may include re-testing locations using LAN and ethernet connections (if supported).

## Appendix A

ant -f

C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples

-Djavac.includes=UdpMulticastHttpExamples/MulticastReceiver.java -

Dnb.internal.action.name=run.single -Drun.class=UdpMulticastHttpExamples.MulticastReceiver run-

single

init:

Deleting:

C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\

built-jar.properties

deps-jar:

Updating property file:

C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\

built-jar.properties

Compiling 1 source file to

C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\

classes

compile-single:

run-single:

MulticastReceiver started...

Multicast address/port: 239.1.2.15/1718

Multicast packets received log:

1. "jonathanboron in Spanagel Hall: MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

2. "jonathanboron in Spanagel Hall: MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

3. "jonathanboron in Spanagel Hall: MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0

Logfile from Receiver in WA-285:

MulticastReceiver loop complete.

4. "jonathanboron in Spanagel Hall: MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

5. "jonathanboron in Spanagel Hall: MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

6. "jonathanboron in Spanagel Hall: MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

7. "jonathanboron in Spanagel Hall: MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0

MulticastReceiver loop complete.

ant -f

C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples

-Djavac.includes=UdpMulticastHttpExamples/MulticastReceiver.java -

Dnb.internal.action.name=run.single -Drun.class=UdpMulticastHttpExamples.MulticastReceiver run-single  
init:  
Deleting:  
C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\  
built-jar.properties  
deps-jar:  
Updating property file:  
C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\  
built-jar.properties  
Compiling 1 source file to  
C:\Users\ljmm1\OneDrive\Documents\NetBeansProjects\NetworkedGraphicsMV3500\examples\build\  
classes  
compile-single:  
run-single:  
MulticastReceiver started...  
Multicast address/port: 239.1.2.15/1718  
Multicast packets received log:  
1. "jonathanboron in Spanagel Hall: MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
2. "jonathanboron in Spanagel Hall: MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
3. "jonathanboron in Spanagel Hall: MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
4. "jonathanboron in Spanagel Hall: MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
5. "jonathanboron in Spanagel Hall: MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
6. "jonathanboron in Spanagel Hall: MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
7. "jonathanboron in Spanagel Hall: MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
8. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
9. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
10. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

11. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

12. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

13. "Colton sending from library with Thomas by my side. MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

14. "Colton sending from library with Thomas by my side. MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

15. "Colton sending from library with Thomas by my side. MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

16. "Colton sending from library with Thomas by my side. MulticastSender packet 12;" index=12, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

17. "Colton sending from library with Thomas by my side. MulticastSender packet 14;" index=14, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

18. "Colton sending from library with Thomas by my side. MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

19. "Colton sending from library with Thomas by my side. MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

20. "Colton sending from library with Thomas by my side. MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

21. "Colton sending from library with Thomas by my side. MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

22. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

23. "jonathanboron in Spanagel Hall: MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

24. "jonathanboron in Spanagel Hall: MulticastSender packet 2;" index=2, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

25. "jonathanboron in Spanagel Hall: MulticastSender packet 3;" index=3, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

26. "jonathanboron in Spanagel Hall: MulticastSender packet 4;" index=4, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

27. "jonathanboron in Spanagel Hall: MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

28. "jonathanboron in Spanagel Hall: MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

29. "jonathanboron in Spanagel Hall: MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

30. "jonathanboron in Spanagel Hall: MulticastSender packet 8;" index=8, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

31. "jonathanboron in Spanagel Hall: MulticastSender packet 9;" index=9, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

32. "jonathanboron in Spanagel Hall: MulticastSender packet 10;" index=10, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

33. "jonathanboron in Spanagel Hall: MulticastSender packet 11;" index=11, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

34. "jonathanboron in Spanagel Hall: MulticastSender packet 12;" index=12, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

35. "jonathanboron in Spanagel Hall: MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

36. "jonathanboron in Spanagel Hall: MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

37. "jonathanboron in Spanagel Hall: MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

38. "Bert is sending from WA 210 (Lab)MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

39. "Bert is sending from WA 210 (Lab)MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

40. "Bert is sending from WA 210 (Lab)MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

41. "jonathanboron in Spanagel Hall: MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

42. "Bert is sending from WA 210 (Lab)MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

43. "jonathanboron in Spanagel Hall: MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

44. "Bert is sending from WA 210 (Lab)MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

45. "jonathanboron in Spanagel Hall: MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

46. "Bert is sending from WA 210 (Lab)MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

47. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

48. "Bert is sending from WA 210 (Lab)MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

49. "Colton sending from library with Thomas by my side. MulticastSender packet 0;" index=0,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

50. "Bert is sending from WA 210 (Lab)MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

51. "Colton sending from library with Thomas by my side. MulticastSender packet 1;" index=1,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

52. "Bert is sending from WA 210 (Lab)MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

53. "Colton sending from library with Thomas by my side. MulticastSender packet 2;" index=2,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

54. "Bert is sending from WA 210 (Lab)MulticastSender packet 8;" index=8, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

55. "Colton sending from library with Thomas by my side. MulticastSender packet 3;" index=3,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

56. "Bert is sending from WA 210 (Lab)MulticastSender packet 9;" index=9, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

57. "Colton sending from library with Thomas by my side. MulticastSender packet 4;" index=4,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

58. "Bert is sending from WA 210 (Lab)MulticastSender packet 10;" index=10, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

59. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

60. "Bert is sending from WA 210 (Lab)MulticastSender packet 11;" index=11, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

61. "Colton sending from library with Thomas by my side. MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

62. "Bert is sending from WA 210 (Lab)MulticastSender packet 12;" index=12, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

63. "Colton sending from library with Thomas by my side. MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

64. "Bert is sending from WA 210 (Lab)MulticastSender packet 13;" index=13, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

65. "Colton sending from library with Thomas by my side. MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

66. "Bert is sending from WA 210 (Lab)MulticastSender packet 14;" index=14, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

67. "Colton sending from library with Thomas by my side. MulticastSender packet 9;" index=9, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

68. "Bert is sending from WA 210 (Lab)MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

69. "Colton sending from library with Thomas by my side. MulticastSender packet 10;" index=10, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

70. "Bert is sending from WA 210 (Lab)MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

71. "Colton sending from library with Thomas by my side. MulticastSender packet 11;" index=11, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

72. "Bert is sending from WA 210 (Lab)MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

73. "Colton sending from library with Thomas by my side. MulticastSender packet 12;" index=12, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

74. "Bert is sending from WA 210 (Lab)MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.



75. "Colton sending from library with Thomas by my side. MulticastSender packet 13;" index=13, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

76. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

77. "Colton sending from library with Thomas by my side. MulticastSender packet 14;" index=14, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

78. "Colton sending from library with Thomas by my side. MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

79. "Colton sending from library with Thomas by my side. MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

80. "Colton sending from library with Thomas by my side. MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

81. "Colton sending from library with Thomas by my side. MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

82. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

83. "tobia: SirTobi Trident Room MulticastSender packet 0;" index=0, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

84. "tobia: SirTobi Trident Room MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

85. "tobia: SirTobi Trident Room MulticastSender packet 2;" index=2, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

86. "tobia: SirTobi Trident Room MulticastSender packet 3;" index=3, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

87. "tobia: SirTobi Trident Room MulticastSender packet 4;" index=4, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

88. "tobia: SirTobi Trident Room MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

89. "tobia: SirTobi Trident Room MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

90. "tobia: SirTobi Trident Room MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

91. "tobia: SirTobi Trident Room MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

92. "tobia: SirTobi Trident Room MulticastSender packet 9;" index=9, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

93. "tobia: SirTobi Trident Room MulticastSender packet 10;" index=10, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

94. "tobia: SirTobi Trident Room MulticastSender packet 11;" index=11, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

95. "tobia: SirTobi Trident Room MulticastSender packet 12;" index=12, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

96. "tobia: SirTobi Trident Room MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

97. "tobia: SirTobi Trident Room MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

98. "tobia: SirTobi Trident Room MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

99. "Colton sending from library with Thomas by my side. MulticastSender packet 1;" index=1,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

100. "tobia: SirTobi Trident Room MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

101. "Colton sending from library with Thomas by my side. MulticastSender packet 2;" index=2,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

102. "tobia: SirTobi Trident Room MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

103. "Colton sending from library with Thomas by my side. MulticastSender packet 3;" index=3,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

104. "tobia: SirTobi Trident Room MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

105. "Colton sending from library with Thomas by my side. MulticastSender packet 4;" index=4,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

Received sentinel "QUIT QUIT QUIT!"

106. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

107. "Colton sending from library with Thomas by my side. MulticastSender packet 5;" index=5,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

108. "jonathanboron in Spanagel Hall: MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

109. "Colton sending from library with Thomas by my side. MulticastSender packet 6;" index=6,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

110. "jonathanboron in Spanagel Hall: MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

111. "Colton sending from library with Thomas by my side. MulticastSender packet 7;" index=7,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

112. "jonathanboron in Spanagel Hall: MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

113. "Colton sending from library with Thomas by my side. MulticastSender packet 8;" index=8,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

114. "jonathanboron in Spanagel Hall: MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

115. "Colton sending from library with Thomas by my side. MulticastSender packet 9;" index=9,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

116. "jonathanboron in Spanagel Hall: MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

117. "Colton sending from library with Thomas by my side. MulticastSender packet 10;" index=10,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

118. "jonathanboron in Spanagel Hall: MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

119. "Colton sending from library with Thomas by my side. MulticastSender packet 11;" index=11,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

120. "jonathanboron in Spanagel Hall: MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

121. "Colton sending from library with Thomas by my side. MulticastSender packet 12;" index=12,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

122. "jonathanboron in Spanagel Hall: MulticastSender packet 8;" index=8, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

123. "Colton sending from library with Thomas by my side. MulticastSender packet 13;" index=13,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

124. "jonathanboron in Spanagel Hall: MulticastSender packet 9;" index=9, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

125. "Colton sending from library with Thomas by my side. MulticastSender packet 14;" index=14,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

126. "Colton sending from library with Thomas by my side. MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

127. "jonathanboron in Spanagel Hall: MulticastSender packet 10;" index=10, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

128. "jonathanboron in Spanagel Hall: MulticastSender packet 11;" index=11, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

129. "Colton sending from library with Thomas by my side. MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

130. "jonathanboron in Spanagel Hall: MulticastSender packet 12;" index=12, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

131. "Colton sending from library with Thomas by my side. MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

132. "jonathanboron in Spanagel Hall: MulticastSender packet 13;" index=13, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

133. "Colton sending from library with Thomas by my side. MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.a

134. "jonathanboron in Spanagel Hall: MulticastSender packet 14;" index=14, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

135. "Colton sending from library with Thomas by my side. MulticastSender packet 19;" index=19, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

136. "jonathanboron in Spanagel Hall: MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

137. "Colton sending from library with Thomas by my side. MulticastSender packet 20;" index=20, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

138. "jonathanboron in Spanagel Hall: MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

139. "Colton sending from library with Thomas by my side. MulticastSender packet 21;" index=21, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

140. "jonathanboron in Spanagel Hall: MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

141. "Colton sending from library with Thomas by my side. MulticastSender packet 22;" index=22, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

142. "jonathanboron in Spanagel Hall: MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

143. "Colton sending from library with Thomas by my side. MulticastSender packet 23;" index=23,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

144. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

145. "Colton sending from library with Thomas by my side. MulticastSender packet 24;" index=24,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

146. "Colton sending from library with Thomas by my side. MulticastSender packet 25;" index=25,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

147. "Colton sending from library with Thomas by my side. MulticastSender packet 26;" index=26,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

148. "Colton sending from library with Thomas by my side. MulticastSender packet 27;" index=27,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

149. "Colton sending from library with Thomas by my side. MulticastSender packet 28;" index=28,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

150. "Colton sending from library with Thomas by my side. MulticastSender packet 29;" index=29,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

151. "Colton sending from library with Thomas by my side. MulticastSender packet 30;" index=30,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

152. "Colton sending from library with Thomas by my side. MulticastSender packet 31;" index=31,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

153. "Colton sending from library with Thomas by my side. MulticastSender packet 32;" index=32,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

154. "Colton sending from library with Thomas by my side. MulticastSender packet 33;" index=33,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

155. "Colton sending from library with Thomas by my side. MulticastSender packet 34;" index=34,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

156. "Colton sending from library with Thomas by my side. MulticastSender packet 35;" index=35,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

157. "Colton sending from library with Thomas by my side. MulticastSender packet 36;" index=36,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

158. "Colton sending from library with Thomas by my side. MulticastSender packet 37;" index=37,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

159. "Colton sending from library with Thomas by my side. MulticastSender packet 38;" index=38,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

160. "Colton sending from library with Thomas by my side. MulticastSender packet 39;" index=39,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

161. "Colton sending from library with Thomas by my side. MulticastSender packet 40;" index=40,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

162. "Colton sending from library with Thomas by my side. MulticastSender packet 41;" index=41,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

163. "Colton sending from library with Thomas by my side. MulticastSender packet 42;" index=42,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

164. "Colton sending from library with Thomas by my side. MulticastSender packet 43;" index=43,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

165. "Colton sending from library with Thomas by my side. MulticastSender packet 44;" index=44,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

166. "Colton sending from library with Thomas by my side. MulticastSender packet 45;" index=45,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

167. "Colton sending from library with Thomas by my side. MulticastSender packet 46;" index=46,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

168. "Colton sending from library with Thomas by my side. MulticastSender packet 47;" index=47,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

169. "Colton sending from library with Thomas by my side. MulticastSender packet 48;" index=48,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

170. "Colton sending from library with Thomas by my side. MulticastSender packet 49;" index=49,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

171. "Colton sending from library with Thomas by my side. MulticastSender packet 50;" index=50,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

172. "Colton sending from library with Thomas by my side. MulticastSender packet 51;" index=51,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

173. "Colton sending from library with Thomas by my side. MulticastSender packet 52;" index=52,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

174. "Colton sending from library with Thomas by my side. MulticastSender packet 53;" index=53,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

175. "Colton sending from library with Thomas by my side. MulticastSender packet 54;" index=54,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

176. "Colton sending from library with Thomas by my side. MulticastSender packet 55;" index=55,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

177. "Colton sending from library with Thomas by my side. MulticastSender packet 56;" index=56,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

178. "Colton sending from library with Thomas by my side. MulticastSender packet 57;" index=57,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

179. "Colton sending from library with Thomas by my side. MulticastSender packet 58;" index=58,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

180. "Colton sending from library with Thomas by my side. MulticastSender packet 59;" index=59,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

181. "Colton sending from library with Thomas by my side. MulticastSender packet 60;" index=60,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

182. "Colton sending from library with Thomas by my side. MulticastSender packet 61;" index=61,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

183. "Colton sending from library with Thomas by my side. MulticastSender packet 62;" index=62,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

184. "Colton sending from library with Thomas by my side. MulticastSender packet 63;" index=63,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

185. "Colton sending from library with Thomas by my side. MulticastSender packet 64;" index=64,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

186. "Colton sending from library with Thomas by my side. MulticastSender packet 65;" index=65,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

187. "Colton sending from library with Thomas by my side. MulticastSender packet 66;" index=66,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

188. "Colton sending from library with Thomas by my side. MulticastSender packet 67;" index=67,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

189. "Colton sending from library with Thomas by my side. MulticastSender packet 68;" index=68,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

190. "Colton sending from library with Thomas by my side. MulticastSender packet 69;" index=69,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

191. "Colton sending from library with Thomas by my side. MulticastSender packet 70;" index=70,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

192. "Colton sending from library with Thomas by my side. MulticastSender packet 71;" index=71,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

193. "Colton sending from library with Thomas by my side. MulticastSender packet 72;" index=72,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

194. "Colton sending from library with Thomas by my side. MulticastSender packet 73;" index=73,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

195. "Colton sending from library with Thomas by my side. MulticastSender packet 74;" index=74,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

196. "Colton sending from library with Thomas by my side. MulticastSender packet 75;" index=75,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

197. "Colton sending from library with Thomas by my side. MulticastSender packet 76;" index=76,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

198. "Colton sending from library with Thomas by my side. MulticastSender packet 77;" index=77,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

199. "Colton sending from library with Thomas by my side. MulticastSender packet 78;" index=78,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

200. "Colton sending from library with Thomas by my side. MulticastSender packet 79;" index=79,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

201. "Colton sending from library with Thomas by my side. MulticastSender packet 80;" index=80,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

202. "Colton sending from library with Thomas by my side. MulticastSender packet 81;" index=81,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

203. "Colton sending from library with Thomas by my side. MulticastSender packet 82;" index=82,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

204. "Colton sending from library with Thomas by my side. MulticastSender packet 83;" index=83,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

205. "Colton sending from library with Thomas by my side. MulticastSender packet 84;" index=84,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.



206. "Colton sending from library with Thomas by my side. MulticastSender packet 85;" index=85, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

207. "Colton sending from library with Thomas by my side. MulticastSender packet 86;" index=86, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

208. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

209. "Colton sending from library with Thomas by my side. MulticastSender packet 87;" index=87, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

210. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 2;" index=2, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

211. "Colton sending from library with Thomas by my side. MulticastSender packet 88;" index=88, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

212. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 3;" index=3, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

213. "Colton sending from library with Thomas by my side. MulticastSender packet 89;" index=89, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

214. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 4;" index=4, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

215. "Colton sending from library with Thomas by my side. MulticastSender packet 90;" index=90, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

216. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

217. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

218. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

219. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

220. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 9;" index=9, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

221. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 10;" index=10, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

222. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 11;" index=11, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

223. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 12;" index=12, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

224. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

225. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 0;" index=0, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

226. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

227. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

228. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

229. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

230. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

231. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

232. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

233. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

234. "tobia: SirTobi Herman Hall Lobby MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

235. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

236. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

237. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

238. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

239. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 8;" index=8, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

240. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 9;" index=9, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

241. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 10;" index=10, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

242. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 11;" index=11, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

243. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 12;" index=12, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

244. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

245. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

246. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

247. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

248. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

249. "Bert is sending from WA 267 (Savage Lab)MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

Received sentinel "QUIT QUIT QUIT!"

250. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

251. "jonathanboron in Spanagel Hall: MulticastSender packet 1;" index=1, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

252. "jonathanboron in Spanagel Hall: MulticastSender packet 2;" index=2, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

253. "jonathanboron in Spanagel Hall: MulticastSender packet 3;" index=3, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

254. "jonathanboron in Spanagel Hall: MulticastSender packet 4;" index=4, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

255. "jonathanboron in Spanagel Hall: MulticastSender packet 5;" index=5, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

256. "jonathanboron in Spanagel Hall: MulticastSender packet 6;" index=6, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

257. "jonathanboron in Spanagel Hall: MulticastSender packet 7;" index=7, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

258. "jonathanboron in Spanagel Hall: MulticastSender packet 8;" index=8, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

259. "jonathanboron in Spanagel Hall: MulticastSender packet 9;" index=9, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

260. "jonathanboron in Spanagel Hall: MulticastSender packet 10;" index=10, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

261. "jonathanboron in Spanagel Hall: MulticastSender packet 11;" index=11, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

262. "jonathanboron in Spanagel Hall: MulticastSender packet 12;" index=12, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

263. "jonathanboron in Spanagel Hall: MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

264. "jonathanboron in Spanagel Hall: MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

265. "jonathanboron in Spanagel Hall: MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

266. "jonathanboron in Spanagel Hall: MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

267. "jonathanboron in Spanagel Hall: MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.

268. "jonathanboron in Spanagel Hall: MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

269. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

270. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 1;" index=1,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

271. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 2;" index=2,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

272. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 3;" index=3,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

273. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 4;" index=4,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

274. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 5;" index=5,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

275. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 6;" index=6,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

276. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 7;" index=7,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

277. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 8;" index=8,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

278. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 9;" index=9,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

279. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 10;" index=10,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

280. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 11;" index=11,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

281. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 12;" index=12,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

282. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 13;" index=13,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

283. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 14;" index=14,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

284. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 15;" index=15,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

285. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 16;" index=16,  
firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

286. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

287. "Bert is sending from WA 273 (Conference Room)MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"

288. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.

289. "jonathanboron in King Auditorium: MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

290. "jonathanboron in King Auditorium: MulticastSender packet 2;" index=2, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

291. "jonathanboron in King Auditorium: MulticastSender packet 3;" index=3, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

292. "jonathanboron in King Auditorium: MulticastSender packet 4;" index=4, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

293. "jonathanboron in King Auditorium: MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

294. "jonathanboron in King Auditorium: MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

295. "jonathanboron in King Auditorium: MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

296. "jonathanboron in King Auditorium: MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

297. "jonathanboron in King Auditorium: MulticastSender packet 9;" index=9, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

298. "jonathanboron in King Auditorium: MulticastSender packet 10;" index=10, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

299. "jonathanboron in King Auditorium: MulticastSender packet 11;" index=11, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

300. "jonathanboron in King Auditorium: MulticastSender packet 12;" index=12, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

301. "jonathanboron in King Auditorium: MulticastSender packet 13;" index=13, firstFloat=17.0 secondFloat=23.0  
MulticastReceiver loop complete.

302. "jonathanboron in King Auditorium: MulticastSender packet 14;" index=14, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

303. "jonathanboron in King Auditorium: MulticastSender packet 15;" index=15, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

304. "jonathanboron in King Auditorium: MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

305. "jonathanboron in King Auditorium: MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

306. "jonathanboron in King Auditorium: MulticastSender packet 18;" index=18, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

Received sentinel "QUIT QUIT QUIT!"

307. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0

MulticastReceiver loop complete.

308. "Glasgow Courtyard: MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

309. "Glasgow Courtyard: MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

310. "Glasgow Courtyard: MulticastSender packet 1;" index=1, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

311. "Glasgow Courtyard: MulticastSender packet 2;" index=2, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

312. "Glasgow Courtyard: MulticastSender packet 3;" index=3, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

313. "Glasgow Courtyard: MulticastSender packet 4;" index=4, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

314. "Glasgow Courtyard: MulticastSender packet 5;" index=5, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

315. "Glasgow Courtyard: MulticastSender packet 6;" index=6, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

316. "Glasgow Courtyard: MulticastSender packet 7;" index=7, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

317. "Glasgow Courtyard: MulticastSender packet 8;" index=8, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

Problem with MulticastReceiver, see exception trace:

java.io.EOFException

MulticastReceiver finally block, complete.

BUILD SUCCESSFUL (total time: 14 minutes 59 seconds)

25. "jonathanboron from Bullard Hall: MulticastSender packet 16;" index=16, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

26. "jonathanboron from Bullard Hall: MulticastSender packet 17;" index=17, firstFloat=17.0 secondFloat=23.0

MulticastReceiver loop complete.

27. "jonathanboron from Bullard Hall: MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"  
28. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.  
29. "Bert is sending from Spanagel Hall (ME)MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
Received sentinel "QUIT QUIT QUIT!"  
30. "QUIT QUIT QUIT!;" index=0, firstFloat=0.0 secondFloat=0.0  
MulticastReceiver loop complete.  
31. "Bert is sending from Tennis Curt. MulticastSender packet 13;" index=13, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
32. "Bert is sending from Tennis Curt. MulticastSender packet 14;" index=14, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
33. "Bert is sending from Tennis Curt. MulticastSender packet 15;" index=15, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
34. "Bert is sending from Tennis Curt. MulticastSender packet 16;" index=16, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
35. "Bert is sending from Tennis Curt. MulticastSender packet 17;" index=17, firstFloat=17.0  
secondFloat=23.0  
MulticastReceiver loop complete.  
36. "Bert is sending from Tennis Curt. MulticastSender packet 18;" index=18, firstFloat=17.0  
secondFloat=23.0



## Appendix B

### Multicast Sender Code

```
package UdpMulticastHttpExamples;

import java.io.*;
import java.net.*;

/**
 * Looks a lot like UdpSender. Start this after launching MulticastReceiver.
 *
 * Privacy note: this sender advertises your user name as part of the multicast packet message
 *
 * @author mcgredo
 * @author brutzman
 */
public class MulticastSender {

    // reserved range for all IPv4 multicast: 224.0.0.0 through 239.255.255.255
    // https://en.wikipedia.org/wiki/Multicast_address
    // https://www.iana.org/assignments/multicast-addresses/multicast-addresses.xhtml

    public static final String MULTICAST_ADDRESS = "239.1.2.15"; // within reserved multicast address range
    public static final int DESTINATION_PORT = 1718;

    /** Time to live: how many router-decrement levels can be crossed */
    public static final int TTL = 10;

    /** How many packets to send prior to termination */
    public static final int LOOP_SIZE = 20; // 20000

    public static final String QUIT_SENTINEL = "QUIT QUIT QUIT!";

    @SuppressWarnings("SleepWhileInLoop")
    public static void main(String[] args)
    {
        try
        {
            System.out.println("MulticastSender started...");
            // This is a java/IPv6 problem. You should also add it to the
            // arguments used to start the app, eg -Djava.net.preferIPv4Stack=true
            // set in the "run" section of preferences. Also, typically
            // netbeans must be restarted after these settings.
            // https://stackoverflow.com/questions/18747134/getting-cant-assign-requested-address-java-net-
            socketexception-using-ehcache
            System.setProperty("java.net.preferIPv4Stack", "true");

            // multicast group we are sending to--not a single host
            MulticastSocket multicastSocket = new MulticastSocket(DESTINATION_PORT);
            multicastSocket.setTimeToLive(TTL); // time to live reduces scope of transmission
            InetAddress multicastAddress = InetAddress.getByName(MULTICAST_ADDRESS);
```

```

        System.out.println("Multicast address/port: " + multicastAddress.getHostAddress() + "/" +
DESTINATION_PORT);
        // Join group useful on receiving side
        multicastSocket.joinGroup(multicastAddress);
        // You can join multiple groups here

        for (int index = 0; index < LOOPSIZE; index++)
        {
            // Put together a message with binary content. "ByteArrayOutputStream"
            // is a java.io utility that lets us put together an array of binary
            // data, which we put into the UDP packet.
            ByteArrayOutputStream baos = new ByteArrayOutputStream();
            DataOutputStream dos = new DataOutputStream(baos);

            // Put together an updated packet to send
            if (index < LOOPSIZE - 1)
            {
                // Put together an updated packet to send
                dos.writeChars(System.getProperty("user.name") + ": ");
                dos.writeChars("MulticastSender packet " + Integer.toString(index) +
";"); // string chars for readability
                dos.writeInt (index); // arbitrary data, needs Java or byte-alignment
                dos.writeFloat(17.0f); // arbitrary data, needs Java or byte-alignment
                dos.writeFloat(23.0f); // arbitrary data, needs Java or byte-alignment
            }
            else dos.writeChars(QUIT_SENTINEL + ";"); // note string must include ;
            // semicolon as termination sentinel

            byte[] buffer = baos.toByteArray();
            DatagramPacket packet = new DatagramPacket(buffer, buffer.length,
multicastAddress, DESTINATION_PORT);

            multicastSocket.send(packet);
            System.out.println("Sent multicast packet " + index + " of " + LOOPSIZE);

            // How fast does this go? Does UDP try to slow it down, or does
            // this cause network problems? (hint: yes for an unlimited send
            // rate, unlike TCP). How do you know on the receiving side
            // that you haven't received a duplicate UDP packet, out of
            // order packet, or dropped packet? Necessary considerations.
            Thread.sleep(1000); // Send 100, one per second
        }
        System.out.println("MulticastSender complete.");
    }
    catch(IOException | InterruptedException e)
    {
        System.out.println("Problem with MulticastSender, see exception trace:");
        System.out.println(e);
    }
}

```

```
}
```

## Appendix C

### Multicast Receiver Code

```
package UdpMulticastHttpExamples;

import java.io.*;
import java.net.*;

/**
 * Looks a lot like UdpReceiver. Start this before launching MulticastSender.
 *
 * @author mcgredo
 * @author brutzman
 */
public class MulticastReceiver {

    // reserved range for all IPv4 multicast: 224.0.0.0 through 239.255.255.255
    // https://en.wikipedia.org/wiki/Multicast_address
    // https://www.iana.org/assignments/multicast-addresses/multicast-addresses.xhtml

    public static final String MULTICAST_ADDRESS = "239.1.2.15";
    public static final int DESTINATION_PORT = 1718;
    /** Time to live: how many router-decrement levels can be crossed */
    public static final int TTL = 10;

    final private static boolean infiniteReadLoop = true;

    public static void main(String[] args)
    {
        try
        {
            System.out.println("MulticastReceiver started...");

            // This is a java/IPv6 problem. You should also add it to the
            // arguments used to start the app, eg -Djava.net.preferIPv4Stack=true
            // set in the "run" section of preferences. Also, typically
            // netbeans must be restarted after these settings.
            // https://stackoverflow.com/questions/18747134/getting-cant-assign-requested-address-java-net-
            socketexception-using-ehcache
            System.setProperty("java.net.preferIPv4Stack", "true");

            MulticastSocket multicastSocket = new MulticastSocket(DESTINATION_PORT);
            multicastSocket.setTimeToLive(TTL);
            InetAddress multicastAddress = InetAddress.getByName(MULTICAST_ADDRESS);
            // Join group useful on receiving side
            multicastSocket.joinGroup(multicastAddress);
            // You can join multiple groups here
            System.out.println("Multicast address/port: " + multicastAddress.getHostAddress() + "/" +
            DESTINATION_PORT);
            System.out.println("Multicast packets received log:");
```

```

int count = 0; // initialize

while(true)
{
    byte[] packetArray = new byte[1500]; // note use of typical MTU value
    DatagramPacket packet = new DatagramPacket(packetArray, packetArray.length);

    multicastSocket.receive(packet);
    count++;

    ByteArrayInputStream bais = new ByteArrayInputStream(packet.getData());
    DataInputStream dis = new DataInputStream(bais);
    String firstCharacters = new String();
    char nextChar = ' ';
    while (nextChar != ';') // read and build string until terminator ; found
    {
        nextChar = dis.readChar();
        firstCharacters += nextChar;
    }
    if (firstCharacters.contains(MulticastSender.QUIT_SENTINEL))
    {
        System.out.println("Received sentinel \"" +
MulticastSender.QUIT_SENTINEL + "\"");
        if (!infiniteReadLoop)
            break; // exit out of reading loop
    }
    int index = dis.readInt();
    float firstFloat = dis.readFloat();
    float secondFloat = dis.readFloat();

    if (count < 10) System.out.print(" "); // prettier output formatting
    System.out.print(count + ". \"" + firstCharacters + "\" "); // wrap string in quote marks
    System.out.println("index=" + index + ", firstFloat=" + firstFloat + " secondFloat=" + secondFloat);

    System.out.println("MulticastReceiver loop complete.");
}
}
catch(IOException e)
{
    System.out.println("Problem with MulticastReceiver, see exception trace:");
    System.out.println(e);
}

finally // clean up after exit condition
{
    // socket/database/completion cleanup code can go here, if needed.
    System.out.println("MulticastReceiver finally block, complete.");
}
}
}

```