CLAIMS

What is claimed is:

1. A distributed refrigeration system comprising a pre-cooling system configured to be thermally coupled to two or more cryogenic devices and to provide a first cooling stage to the two or more cryogenic devices, wherein:

the distributed refrigeration system is configured to be integrated into one or more server racks,

the pre-cooling system is integrated into a first server rack, and

the two or more cryogenic devices are integrated into second server racks different than the first server rack.

2. The distributed refrigeration system of claim 1, further comprising the two or more cryogenic devices thermally coupled to the pre-cooling system.

3. The distributed refrigeration system of claim 1, wherein the two or more cryogenic devices comprise at least one dilution refrigerator.

4. The distributed refrigeration system of claim 1, wherein the two or more cryogenic devices comprise two or more of a dilution refrigerator, a low-temperature microscopy system, a ^{3}He refrigeration system, and/or a superconducting CMOS system.

5. The distributed refrigeration system of claim 1, wherein the first cooling stage has a temperature at or below 5 K.

6. The distributed refrigeration system of claim 5, wherein the pre-cooling system comprises a cryocooling system.

7. The distributed refrigeration system of claim 6, wherein the cryocooling system comprises a pulse tube.

8. The distributed refrigeration system of claim 6, wherein the cryocooling system comprises a Brayton cryocooler.

9. The distributed refrigeration system of claim 6, wherein the cryocooling system comprises a helium liquefier system.

10. The distributed refrigeration system of claim 5, wherein the two or more cryogenic devices comprise a dilution refrigerator having a second cooling stage configured to reach a temperature at or below 1 K.

11. The distributed refrigeration system of claim 10, wherein the second cooling stage is configured to reach a temperature at or below 100 mK.

12. The distributed refrigeration system of claim 1, wherein:
the two or more cryogenic devices comprise a dilution refrigerator.

13. The distributed refrigeration system of claim 1, further comprising thermal coupling components configured to transfer heat from the two or more cryogenic devices to the pre-cooling system.

14. The distributed refrigeration system of claim 13, wherein the thermal coupling components comprise one or more fill lines.

15. The distributed refrigeration system of claim 13, wherein the thermal coupling components comprise one or more heat pipes.

16. The distributed refrigeration system of claim 15, wherein the one or more heat pipes comprise one or more pulsed heat pipes.

17. The distributed refrigeration system of claim 13, wherein the thermal coupling components comprise a superfluid loop.

18. The distributed refrigeration system of claim 13, wherein the thermal coupling components comprise one or more vacuum insulated pipes.