CLAIMS

What is claimed is:

1. An edge micro data center for a communications network, comprising:

an antenna subsystem to communicate with a satellite network, the antenna subsystem including at least one antenna and an antenna controller to control beamforming of the at least one antenna;

wherein the antenna controller is configured to preemptively switch from communicating with a first satellite in the satellite network to a second satellite in the satellite network in response to a forecasted weather-based disruption;

a terrestrial network interface to facilitate a mesh network with other local edge micro data centers;

a radio access network (RAN) controller to control radio communications with end-user devices in an open radio access network (O-RAN);

a multi-access edge computing (MEC) controller to:

implement adaptive mesh management of distributed compute resources and storage resources of the edge micro data center in the mesh network of edge micro data centers connected via the terrestrial network interface, and

implement virtual network routing to manage virtual networks that include end-user devices connected to the RAN controller; and

a control interface to receive command and control instructions via the satellite network to modify the implementation of the adaptive mesh management and virtual network routing of the MEC controller.

2. The edge micro data center of claim 1, wherein the antenna subsystem is configured to communicate with the satellite network via Ka-band frequencies.

3. The edge micro data center of claim 1, wherein the terrestrial network interface comprises a microwave link interface.

4. The edge micro data center of claim 1, wherein the terrestrial network interface comprises at least one of: a fiber optic interface and a coaxial cable interface.

5. The edge micro data center of claim 1, wherein the RAN controller is configured to control radio communications with end-user devices connected to at least one of: a 5G Node B cell site and a Wi-Fi access point.

6. The edge micro data center of claim 1, wherein the at least one antenna comprises a planar antenna.

7. The edge micro data center of claim 6, wherein the planar antenna comprises an electronically tunable metasurface antenna.

8. The edge micro data center of claim 6, wherein the planar antenna comprises at least one of:

an electronically steerable antenna array,

a phased array of antenna elements, and

an antenna architecture utilizing at least one Luneburg lens.

9. The edge micro data center of claim 6, wherein the antenna controller is configured to preemptively switch from communicating with the first satellite in the satellite network to the second satellite in the satellite network in response to the forecasted weather-based disruption by modifying a beamforming of the planar antenna.

10. An edge micro data center, comprising:

an antenna subsystem to communicate with a satellite network, the antenna subsystem including at least one antenna and an antenna controller to control beamforming of the at least one antenna;

wherein the antenna controller is configured to switch between a highly elliptical orbit (HEO) satellite in the satellite network and a medium earth orbit (MEO) satellite in the satellite network based on a latency prioritization associated with a data packet;

a terrestrial network interface to facilitate a mesh network with other local edge micro data centers;

a radio access network (RAN) controller to control radio communications with end-user devices in an open radio access network (O-RAN);

a multi-access edge computing (MEC) controller to:

implement adaptive mesh management of distributed compute resources and storage resources of the edge micro data center in the mesh network of edge micro data centers connected via the terrestrial network interface, and

implement virtual network routing to manage virtual networks that include end-user devices connected to the RAN controller; and

a control interface to receive command and control instructions via the satellite network to modify the implementation of the adaptive mesh management and virtual network routing of the MEC controller.

11. The edge micro data center of claim 10, wherein the antenna subsystem is configured to communicate with the satellite network via Ka-band frequencies.

12. The edge micro data center of claim 10, wherein the terrestrial network interface comprises a microwave link interface.

13. The edge micro data center of claim 10, wherein the terrestrial network interface comprises at least one of: a fiber optic interface and a coaxial cable interface.

14. The edge micro data center of claim 10, wherein the RAN controller is configured to control radio communications with end-user devices connected to at least one of: a 5G Node B cell site and a Wi-Fi access point.

15. The edge micro data center of claim 10, wherein the at least one antenna comprises a planar antenna.

16. The edge micro data center of claim 15, wherein the planar antenna comprises an electronically tunable metasurface antenna.

17. The edge micro data center of claim 15, wherein the planar antenna comprises at least one of:

an electronically steerable antenna array,

a phased array of antenna elements, and

an antenna architecture utilizing at least one Luneburg lens.