WATER-BASED DATA CENTER

TECHNICAL FIELD

[0001] This document discusses water-based data centers, including systems that may be powered by the motion of water.

BACKGROUND

[0002] Public use of the internet continues to grow, with millions of people now accessing the global network. The bandwidth demanded by each of those users also continues to grow substantially—moving from simple e-mails, to graphical web pages, to full streaming video at very high resolutions. In addition, with so-called Web 2.0 applications, more data is needed to support traditional computing applications over the internet. As a result, many information providers are building large computing facilities, known as data centers, that can provide various services to internet users. Sometimes, these data centers can contain thousands of networked computers mounted in a large number of racks.

[0003] The internet backbone also needs to grow to support the additional demand from all these new users and new services. Such growth is expensive, however, because backbone routers are huge, complex machines, and running of cross-country fibers costs very much money. In addition, cross-country communication can introduce latency to communications—both because of increased distances, and because of the increased chance of losing and retransmitting packets that are sent through many routers and through long distances.

[0004] Thus, it can be beneficial to distribute computing power closer to users. As such, data centers may be moved closer to users, with relevant content sent from a central facility out to regional data centers only once, and further transmissions occurring over shorter regional links. As a result, every request from a user need not result in a transmission cross-country and through the internet backbone—network activity may be more evenly balanced and confined to local areas. Also, transient needs for computing power may arise in a particular area. For example, a military presence may be needed in an area, a natural disaster may bring a need for computing or telecommunication presence in an area until the natural infrastructure can be repaired or rebuilt, and certain events may draw thousands of people who may put a load on the local computing infrastructure. Often, such transient events occur near water, such as a river or an ocean. However, it can be expensive to build and locate data centers, and it is not always easy to find access to necessary (and inexpensive) electrical power, high-bandwidth data connections, and cooling water for such data centers.

SUMMARY

[0005] This document describes systems and methods that may be employed to provide data center (e.g., computing, telecommunications, or other similar services) support in an area quickly and flexibly. In general, computing centers are located on a ship or ships, which are then anchored in a water body from which energy from natural motion of the water may be captured, and turned into electricity and/or pumping power for cooling pumps to carry heat away from computers in the data center. In particular examples, the water-powered devices for generating electricity are depicted as so-called Pelamis machines. The data centers may also be on shore and receive power and/or cooling water from floating systems.

[0006] In one implementation, a system is disclosed that comprises a floating platform-mounted computer data center comprising a plurality of computing units, a sea-powered electrical generator in electrical connection with the plurality of computing units, and one or more sea-water cooling units for providing cooling to the plurality of computing units. The computing units may be mounted in a plurality of crane-removable modules. The sea-powered electrical generator may comprise a wave-powered generator system, and may further include a plurality of motion-powered machines arranged in a grid and wired together. The wave-powered electrical generator system may likewise comprise one or more Pelamis machines.

[0007] In some aspects, the sea-powered electrical generator may comprise a tide-powered generator system. Also, the cooling units of the system may comprise a plurality of sea-powered pumps and one or more seawater-to-freshwater heat exchangers. In addition, the sea-water cooling units may comprise one or more water-to-water heat exchangers. Moreover, the system may further comprise one or more rectifiers for producing direct current supply power from power supplied by the electrical generator, and the rectifiers may provide power directly to components in the plurality of computing units without further AC-to-DC or DC-to-AC conversion. A plurality of step-down transformers may also be provided to convert the direct current power to a voltage usable by the components in the plurality of computing units.

[0008] In another implementation, a method of maintaining a computer data center is disclosed, and comprises generating electrical power using the wave, tidal, or current motion of water adjacent a data center, providing the generated electrical power to the data center, and circulating the water adjacent the data center through a heat exchanger to produce cooling for the data center equipment. The electrical power may be generated by the force of a floating device against moving waves. Also, the data center equipment may comprise a large plurality of computer boards mounted in rack arrays.

[0009] In yet another implementation, a system for maintaining a computer data center is disclosed. The system includes a data center located on or near an ocean or ocean extension, a cooling system for providing cooling to the data center using seawater, and a means for providing electrical power for use by the data center.

[0010] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

[0011] FIG. **1***a* is a top view of a floating data center system using an array of motion-powered machines.

[0012] FIG. **1***b* is a top view of a floating data center system using a pair of motion-powered machines.

[0013] FIG. **1***c* is a top view of a floating data center system powered by a tidal power system.

[0014] FIG. **2** is a side view of a floating data center system.

[0015] FIG. **3** is a cross-section of a floating power generation apparatus.

[0016] FIG. **4** is a side view of a floating power generation and pumping apparatus.

[0017] FIG. **5** is a top view of a floating data center system, showing cooling and electrical components.