March 20, 2019

Unified system for data center electrical system topology

N/A

Unified system for data center electrical system topology

ABSTRACT

A unified system to store, update, query, and visualize data center electrical power topologies is described. A power topology data application programming interface (API) is provided coupled to a graphical user interface and a data importer. The user interface enables data entry, visualization, and modification of electrical data by users. The system includes a database that stores properties, connections, and inventory of electrical equipment. Mechanisms are provided to ensure valid and consistent database entries. The system includes information about electrical topologies for multiple data center types across provider sites. An RPC/REST service is provided to enable users to query the system for electrical data. The service provides access to power topology and electrical constraint information. The RPC/REST service uses highly available data snapshots and automatically scales to match variable client request demands without contention.

KEYWORDS

- electrical architecture
- electrical topology
- electrical specification
- data center
- server farm
- visualization
- building management

BACKGROUND

Data centers typically house electrical equipment that delivers electric power to servers and other network devices. The electrical equipment is built to various electrical designs and standards. Teams involved in planning, software, and operations benefit from a common representation of electrical equipment properties and connections. The diversity of the equipment in data centers presents a challenge for a single team to maintain electrical inventory and topology data. Furthermore, the requirements for maintaining the dataset are such that a single team may lack a background in electrical engineering and standards compliance to successfully transcribe electrical information to a software-compatible format.

Currently available tools are vendor-specific (i.e., work only with vendor provided hardware) or are limited to a single data center installation. Organizations that operate data centers would benefit from a tool that can meet high data request volumes and that enables multiple users from different geographic locations to access and modify the same dataset.

DESCRIPTION

This disclosure describes a unified system to store, update, query, and visualize data center electrical power topologies in data centers.

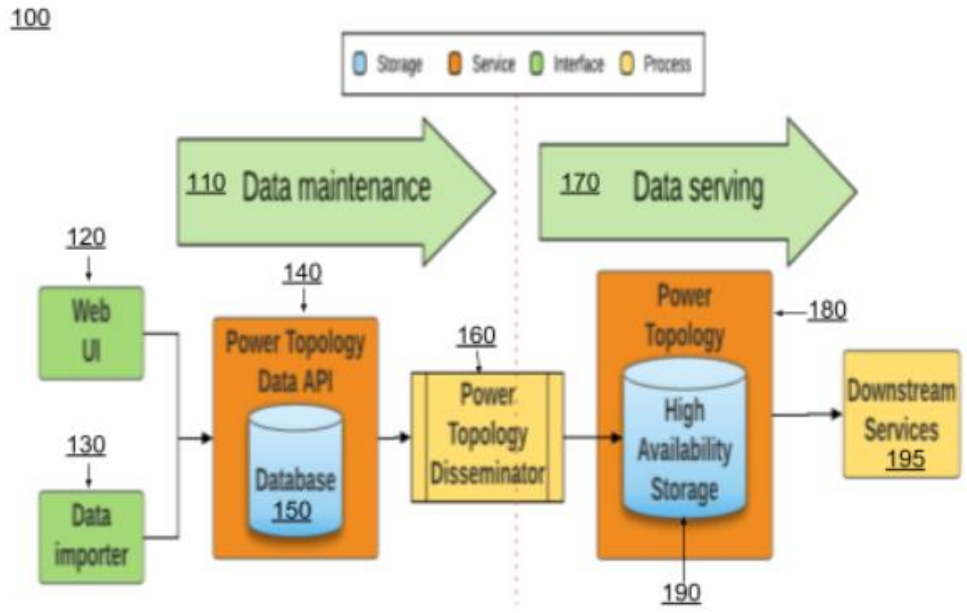

Fig.1: Example system for maintenance and visualization of electrical power topologies

Fig. 1 illustrates an example of a unified system (100) for maintenance and visualization of electrical power topologies. The system supports both data maintenance (110) and data serving/access (170). A power topology data application programming interface (API 140) is provided coupled to a web graphical user interface (120) and a data importer (130). The user interface enables data entry, visualization, and modification of electrical data by users. The data importer enables import of electrical data. The system includes a database (150) that stores properties, connections, and inventory of electrical equipment.

The UI caters to varying roles and personas. For example, the UI allows external vendors that provide equipment or services to a data center to view and edit the subgraph of power topology information for which they are responsible. On the other hand, data center planners are able to view/edit information for any data center.

The system includes information about electrical topologies for multiple data center types across provider sites and includes different electrical architectures and standards. The UI enables recording of electrical aspects of a data center in a universal (common) format.

A power topology disseminator (160) couples the API to high-availability storage, e.g., that stores a snapshot of data, on the data access side. A RPC/REST service (180) is provided that enables users to query the system for electrical data. The service provides users access to power topology and electrical constraint information. Clients of the system can perform advanced queries, e.g., to identify transitive dependencies or power suppliers of power equipment entities within a data center. A high-availability database (190) provides automatic scaling capacity for the RPC/REST service according to a current API request demand from downstream services (195).

Mechanisms are provided to ensure valid and consistent database entries. Standards-conformant names are utilized for power equipment entities. Spatial/geographic locations for power equipment entities are also recorded. Automated rules are provided to ensure the validity of the information entered using the UI and to provide safeguards against entry of malformed power data.

Database changes are tracked over time and database entries and updates are associated with specific users. Access control lists (ACLs) are maintained to regulate user access to the power data via the user interface. For example, ACLs are used to specify read and write access privileges to the data for different users.

Information regarding power topologies for different equipment types at different geographical locations are sourced from users associated with different data centers, e.g., crowdsourced from respective specialized teams. The power topology data are provided in a

universal format to other in-data-center services for higher level functions such as to determine the co-availability of a set of data center resources to facilitate highly available placement of workloads in a data center. Third party software/physical monitoring systems are configured to access this dataset. For example, building management systems access the dataset to help monitor data center electrical aspects.

To alleviate load on the database, the RPC/REST service can use highly available data snapshots instead of sourcing data directly from the main database. Consequently, the RPC/REST service automatically scales to match variable client request demands without database contention.

CONCLUSION

A unified system to store, update, query, and visualize data center electrical power topologies and constraints is described. A power topology data application programming interface (API) is provided coupled to a graphical user interface and a data importer. The user interface enables data entry, visualization, and modification of electrical data by users. The system includes a database that stores properties, connections, and inventory of electrical equipment. Mechanisms are provided to ensure valid and consistent database entries. The system includes information about electrical topologies for multiple data center types across provider sites. An RPC/REST service is provided to enable users to query the system for electrical data. The service provides access to power topology and constraint information. The RPC/REST service uses highly available data snapshots and automatically scales to match variable client request demands without contention.