

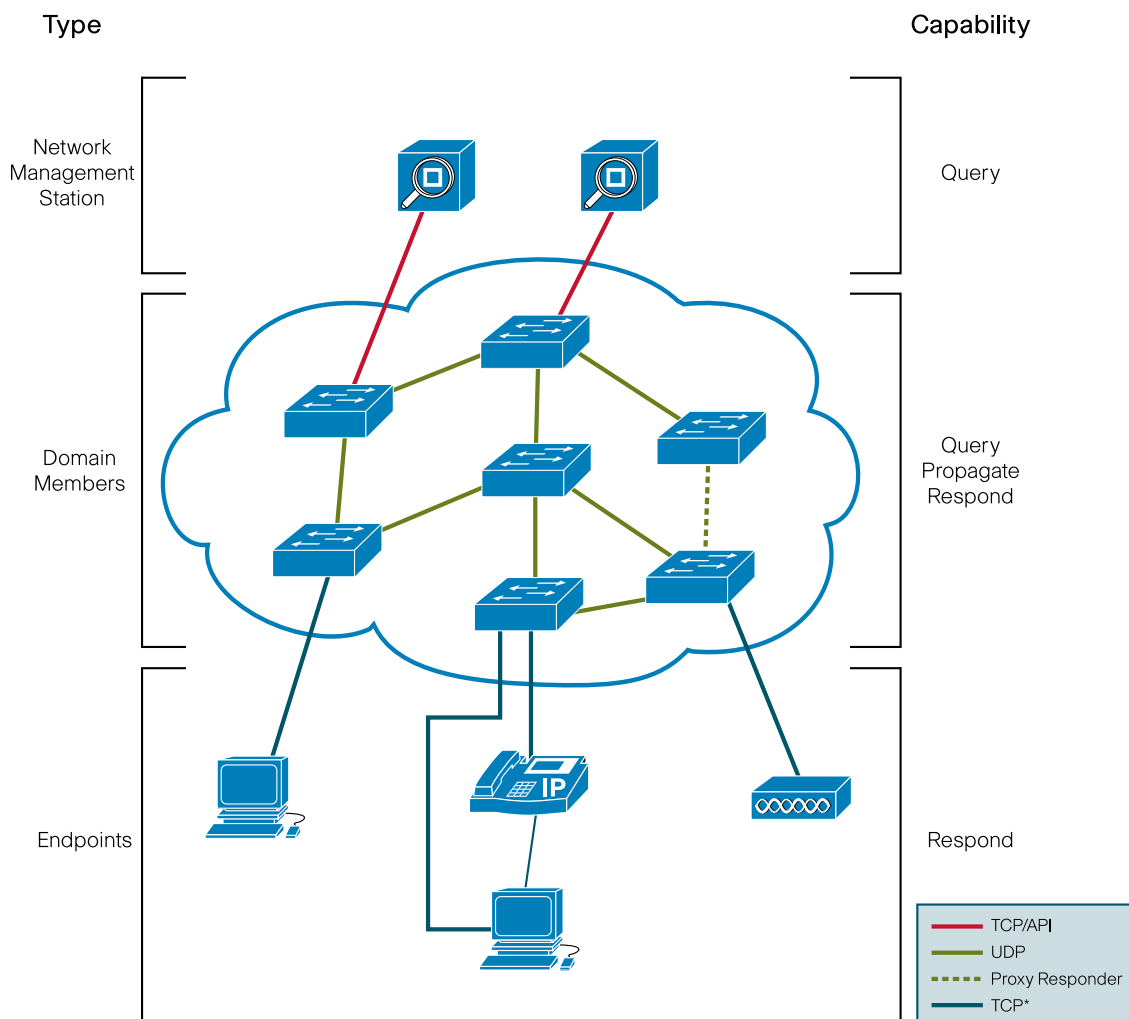
## Cisco EnergyWise: Summary and Concepts

Cisco® EnergyWise lets your Cisco network act as a platform that can measure, monitor, and manage the way your devices consume energy.

From the Cisco EnergyWise perspective, your network has three kinds of devices:

- **Endpoints:** These are the power consumers. They are typically Power over Ethernet (PoE) and non-PoE devices that connect to the network. Increasingly, this category includes nontraditional network devices such as facility controllers, lighting, heating ventilation and air conditioning (HVAC), and so on.
- **Domain members:** These are the switches, routers, and network controllers that make up the data network proper. They are like endpoints in that they draw power, but they also have the special ability to act together to propagate messages across the network, to form a Cisco EnergyWise domain with other domain members and endpoints. A Cisco EnergyWise domain is much like a community in network management, except that the Cisco EnergyWise domain forms a unit of power management.
- **Managers:** These are the control applications and devices that use Cisco EnergyWise features to measure, monitor, and manage power consumption. Management solutions can use Cisco EnergyWise queries to act as the point of control for one or more Cisco EnergyWise domains.

Figure 1 shows an example Cisco EnergyWise Domain

**Figure 1.** A Cisco EnergyWise Domain

### Setting Up a Cisco EnergyWise Domain

Let's take an example: one building with a core router, 10 access switches, and 400 endpoint devices such as phones, access points, and PCs. We configure the router and switches to be members of a single Cisco EnergyWise domain that we'll call MyBuilding.

As soon as the core router and access switches are configured, the MyBuilding domain self-organizes, using a cloud computing architecture. It does this by automatically setting up neighbor relationships among the domain members. If Cisco Discovery Protocol is available, these devices will use it to establish an overlay network of neighbors. If Cisco Discovery Protocol is not enabled, then Cisco EnergyWise will automatically use User Datagram Protocol (UDP) to discover neighbors. We can also set up static neighbors if an entity is not reachable using Cisco Discovery Protocol or UDP.

Each domain member then sets up a parent/child relationship with any attached endpoints (for example, an IP phone attached to a PoE switch or an air handler attached to an HVAC controller). In our example, the 400 phones, access points, and PCs all become child endpoints of their parent domain members.

The Cisco EnergyWise cloud can contain nontraditional facilities devices such as HVAC and lighting controllers. These devices become part of the domain by running agents that use the upcoming Cisco EnergyWise Software Development Kit (SDK).

Once set up, we have one cloud with all networked devices as components (in our example, 11 domain members and 400 endpoints). We can propagate queries and control messages from any of the domain members to any other member or endpoint in the cloud.

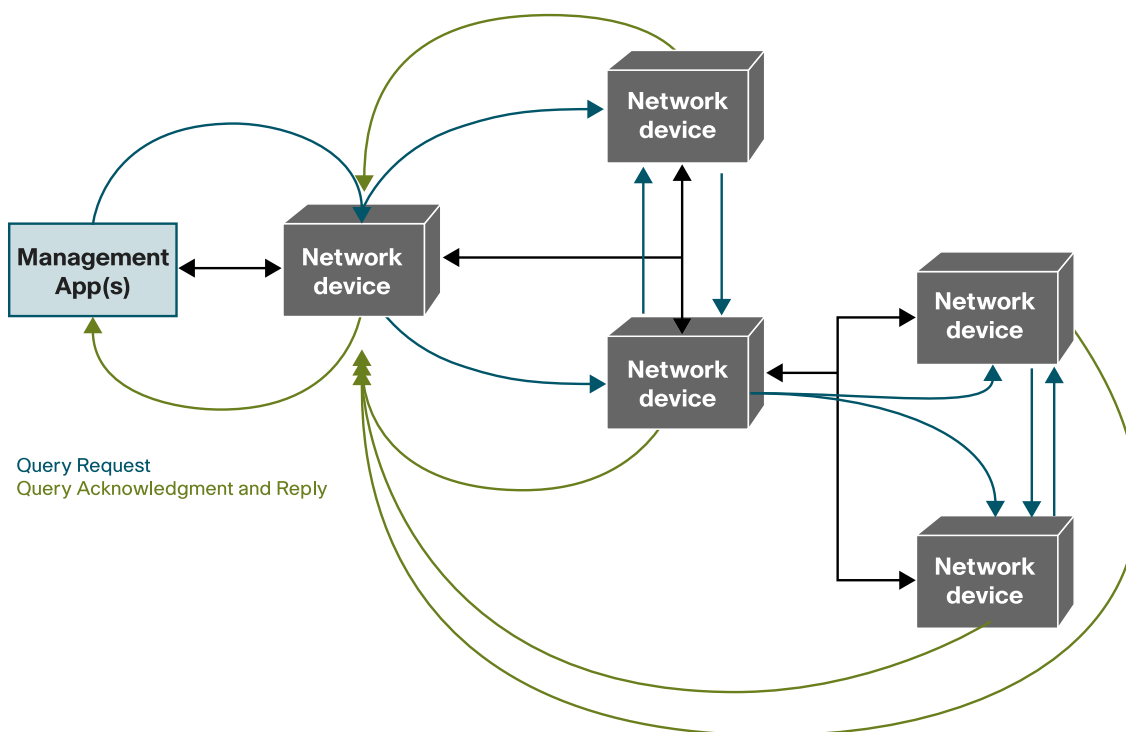
Our cloud is also a virtual, distributed power-information database. Every entity can be queried, using Simple Network Management Protocol (SNMP) or a manager. A query to any domain member in the cloud triggers the network to get or set power consumption information, much like a SQL query into an Open Database Connectivity (ODBC) server. Management applications, servers, or the CLI of a member switch can also define energy policies or provide dashboards and graphic representations of power consumption data gathered from across the network.

### Queries, Communication, and Security

Cisco EnergyWise communicates over Layer 3 using a Cisco EnergyWise defined packet format for message encapsulation. Query events retrieve power information from the domain. They are delivered, hop by hop, through the domain using the established neighbor information. Authentication is by the domain's shared secret, and only authenticated queries can be sent to endpoints.

Figure 2 shows how Cisco EnergyWise messages are propagated across an EnergyWise domain

**Figure 2.** EnergyWise Message Propagation



Cisco EnergyWise supports various kinds of queries, including:

- **Set** changes or turns off power usage levels.
- **Collect** retrieves power usage information (in watts) from the cloud.
- **Sum** aggregates power information across multiple members and endpoints.
- **Delta** runs “what if “calculations.

## Consistent Management Language

A Cisco EnergyWise domain is a heterogeneous collection; not all devices come from the same manufacturer. To manage power consistently, Cisco EnergyWise provides a set of 11 power levels in three categories. (See Table 1.)

Each power level indicates the state of an entity. Actions in response to a Cisco EnergyWise power-level change request are interpreted by the entity locally. These responses can vary by manufacturer, because each device knows best how to provide a requested level.

**Table 1.** EnergyWise Power Levels

| Category            | Color     | Code   | Color  | Level  | Label   |
|---------------------|-----------|--------|--------|--------|---------|
| Operational (1)     | Red       | FF0000 | Red    | 10     | Full    |
|                     |           |        |        | 9      | High    |
|                     | Yellow    | FFFF00 | Yellow | 8      | Reduced |
|                     |           |        |        | 7      | Medium  |
| Green               | 00FF00    | Green  | 6      | Frugal |         |
|                     |           |        | 5      | Low    |         |
| Standby (0)         | Blue      | 0000FF | Blue   | 4      | Ready   |
|                     |           |        |        | 3      | Standby |
|                     |           |        |        | Brown  | A52A2A  |
| 1                   | Hibernate |        |        |        |         |
| Nonoperational (-1) | Black     | 000000 | Black  | 0      | Shut    |

## Filtering Within the Domain

If we can communicate with all the entities in the domain, we also need to be able to address subsets of these entities. We can do this by filtering on attributes such as importance, role, name, and arbitrary keywords (tags).

We can assign an importance, ranging from 1 through 100, to any entity. Managers can set an entity's importance to their business. For example: A common desk phone will have lower importance than a business-critical emergency phone. An entity's role can also be set to the exact business function it supports, such as "teller," "trader," or "executive." A name can be used to address or identify a specific entity anywhere in the cloud.

One of the most powerful features of Cisco EnergyWise is tagging with keywords. Managers can tag entities in the domain with arbitrary keywords and then search - and act on - them using the keyword. For example, we can issue a query that will turn off all unimportant lobby devices while making sure emergency devices stay on:

```
energywise query importance 20 keyword lobby set level 0
```

This query turns off any entity tagged with the keyword "lobby" that has an importance of 20 or less.

## Power for Power Management

Using cloud computing, tagging, search, queries, and a consistent language for power control, Cisco EnergyWise can turn your network into a platform for energy management.

Cisco EnergyWise will be released first on the Cisco Catalyst<sup>®</sup> 2000 and 3000 lines. Support for more product lines will come in later releases.

## For More Information

For more information about Cisco EnergyWise, visit <http://www.cisco.com/go/energywise> or contact your local Cisco partner or account representative.



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