



Module 1 | **Lesson 5**



# Digital Buildings Ontology (DBO)



# Before you get started

This learning module has interactive features and activities that enable a self-guided learning experience. To help you get started, here are two tips for viewing and navigating through the content.

## 1 View this content outside of GitHub.

- For the best learning experience, you're encouraged to download a copy so links and other interactive features will be enabled.
- To download a copy of this lesson, click **Download** in the top-right corner of this content block.
- After downloading, open the file in your preferred PDF reader application.

## 2 Navigate by clicking the buttons and links.

- For the best learning experience, using your keyboard or mouse wheel to navigate is discouraged. However, this is your only option if you're viewing from GitHub.
- If you're viewing this content outside of GitHub:
  - Click the **Back** or **Next** buttons to go backward or forward in the deck. Moving forward, you'll find them in the bottom corners of every slide.
  - Click [blue text](#) to go to another slide in this deck or open a new page in your browser.

Ready to get started?

Let's go!

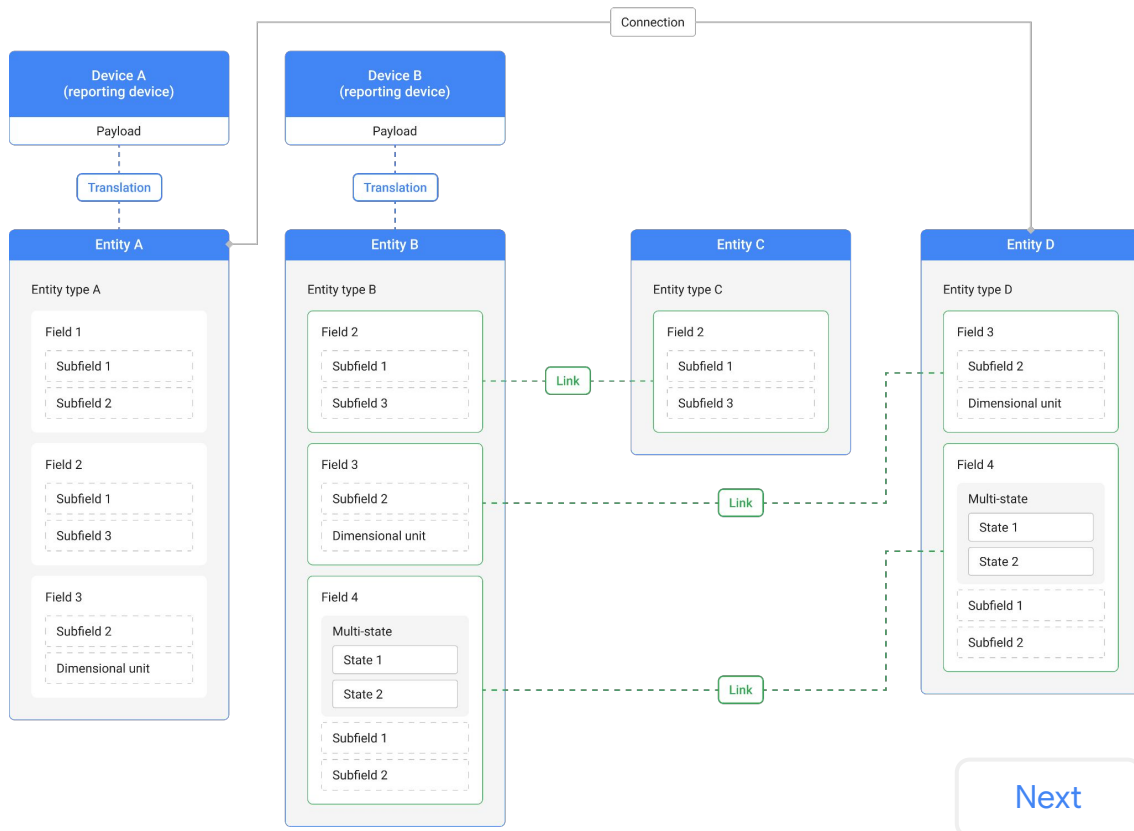
# Conceptual model revisited

Here's another look at the DBO conceptual model from Lesson 2.

In this lesson, you'll explore one modeling concept from the abstract model. Remember, abstract modeling concepts are used to describe the properties of an entity. Abstract concepts include:

- Subfields
- Fields
- States and multi-states
- Entity types

Do you see these concepts in the diagram?



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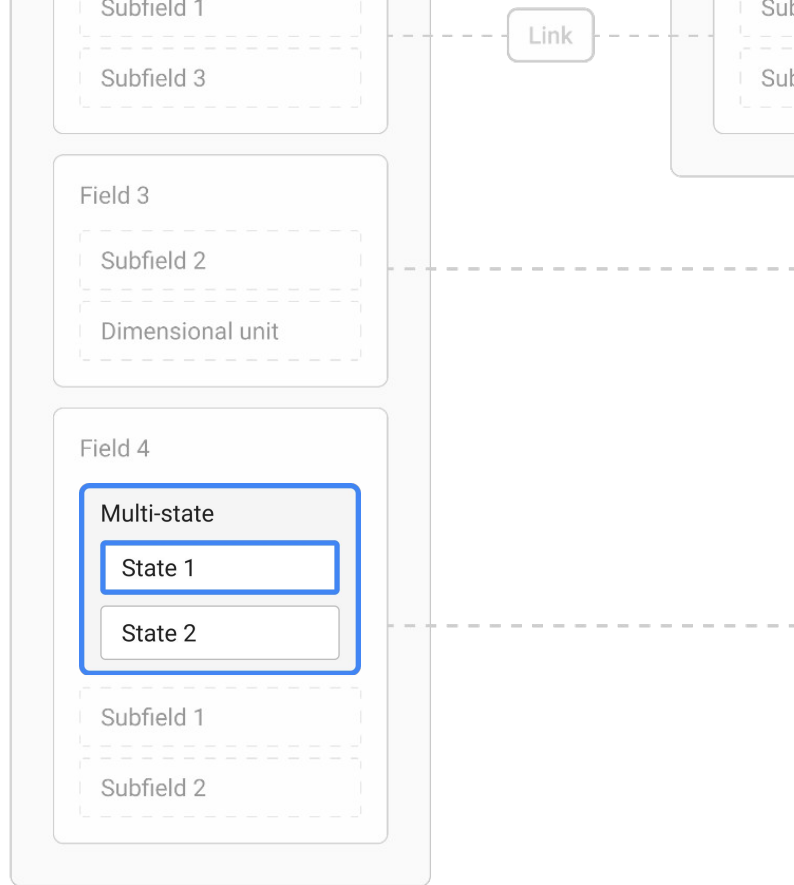
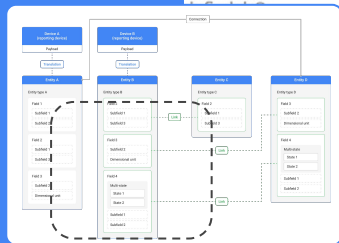
# States and multi-states

What you'll learn about:

- States
- Multi-states
- State and multi-state constraints

By the end of this lesson, you'll be able to:

- Describe the concepts of a state and multi-state.
- Identify a multi-state in source code.
- Understand the rules and constraints for multi-states.



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# What's a state?

A state is a single word or string that describes a device's condition, status, setting, position, mode, etc.

Similar to subfields, each state also consists of a specific, human-readable definition.

## Examples

**ON:** Powered on.

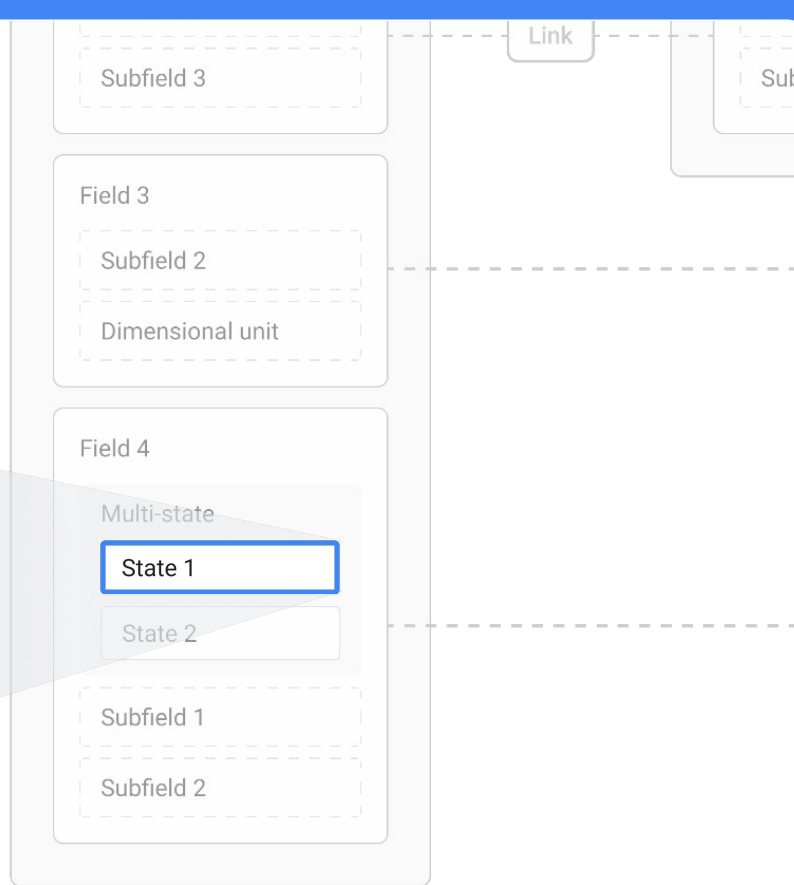
**OFF:** Powered off.

**LOW:** Low speed or output setting.

**MEDIUM:** Medium speed or output setting.

**HIGH:** High speed or output setting.

See [states.yaml](#) in the Digital Buildings Project GitHub repo for a list of all available states.



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**Note:** Remember, a field is a semantic definition of an abstract concept. Abstract concepts are associated with an entity, which is the concrete instance of the device to be modeled.

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# What's a multi-state?

A multi-state is any field that sends states.

Each multi-state field consists of a list of allowed states that can describe a device's condition, status, setting, position, mode, etc. Multi-states are defined on a field-by-field basis.

## Examples

`supply_fan_failed_alarm:`

- ACTIVE
- INACTIVE

`battery_charge_status:`

- CHARGING
- DISCHARGING
- STANDBY

`control_mode:`

- AUTO
- MANUAL
- OFF

`schedule_run_command:`

- ON
- OFF

Subfield 3

Field 3

Subfield 2

Dimensional unit

Field 4

Multi-state

State 1

State 2

Subfield 1

Subfield 2

Link

Sub

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**Note:** All allowed states for a field across all devices are listed. However, individual devices may or may not use all states.

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# State and multi-state constraints

Remember the following constraints when working with states and multi-states.

## State constraints

States should:

- Always have a specific definition that's the same wherever it's used.
- Normally apply globally wherever possible.
- Rarely be defined only within a namespace.

## Multi-state constraints

A field is considered a multi-state field if one of the following is true:

- The point type subfield is `alarm`, `status`, or `mode`.
- The point type subfield is `command`, and it doesn't have a measurement subfield.

### Examples

```
supply_fan_failed_alarm:
```

- ACTIVE
- INACTIVE

```
control_mode:
```

- AUTO
- MANUAL
- OFF

```
battery_charge_status:
```

- CHARGING
- DISCHARGING
- STANDBY

```
schedule_run_command:
```

- ON
- OFF

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## Lesson 5

# Knowledge check



**Let's take a moment to reflect on what you've learned so far.**

- The next slides will have questions about the concepts that were introduced in this lesson.
- Review each question and select the correct response.

**If there are more than two answer options, you won't be able to move forward until the correct answer is selected.**

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Click **Next** when you're ready to begin.

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# Knowledge check 1

A state consists of a single \_\_\_\_\_ or string that describes a device's condition, status, setting, position, mode, etc.

## Fill in the blank.

*Select the best answer from the options listed below.*

enum

word

field

subfield



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# Knowledge check 1

A state consists of a single \_\_\_\_\_ or string that describes a device's condition, status, setting, position, mode, etc.

## Fill in the blank.

Select the best answer from the options listed below.

enum

word

field

subfield

Close... but not quite right! 🤔

Try again

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# Knowledge check 1

A state consists of a single \_\_\_\_\_ or string that describes a device's condition, status, setting, position, mode, etc.

## Fill in the blank.

Select the best answer from the options listed below.

enum

word

field

subfield

That's right! 🎉

Like a subfield, a state is simply a **word** or string and its definition.

### Examples

**ON:** Powered on.

**OFF:** Powered off.

**LOW:** Low speed or output setting.

**MEDIUM:** Medium speed or output setting.

**HIGH:** High speed or output setting.

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# Knowledge check 1

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Close... but not quite right! 🤔

Try again

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# Knowledge check 1

A state consists of a single \_\_\_\_\_ or string that describes a device's condition, status, setting, position, mode, etc.

## Fill in the blank.

Select the best answer from the options listed below.

enum

word

field

subfield

Close... but not quite right! 🤔

Try again

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# Knowledge check 2

A field is considered \_\_\_\_\_ if it sends states.

## Fill in the blank.

*Select the best answer from the options listed below.*

an enum

a device

multi-state

an entity type



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# Knowledge check 2

A field is considered \_\_\_\_\_ if it sends states.

## Fill in the blank.

Select the best answer from the options listed below.

an enum

a device

multi-state

an entity type

Close... but not quite right! 🤔

Try again

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# Knowledge check 2

A field is considered \_\_\_\_\_ if it sends states.

## Fill in the blank.

*Select the best answer from the options listed below.*

an enum

a device

multi-state

an entity type

Close... but not quite right! 🤔

Try again

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# Knowledge check 2

A field is considered \_\_\_\_\_ if it sends states.

## Fill in the blank.

*Select the best answer from the options listed below.*

an enum

a device

multi-state

an entity type

That's right! 🎉

A **multi-state** is a list of allowed states that can describe a device's condition, status, setting, position, mode, etc.

You can tell if a field is multi-state if one of the following is true:

- The point type subfield is **alarm**, **status**, or **mode**.
- The point type subfield is **command**, and it doesn't have a measurement subfield.

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# Knowledge check 2

A field is considered a/an \_\_\_\_\_ if it sends states.

## Fill in the blank.

Select the best answer from the options listed below.

enum

device

multi-state

entity type

Close... but not quite right! 🤔

Try again

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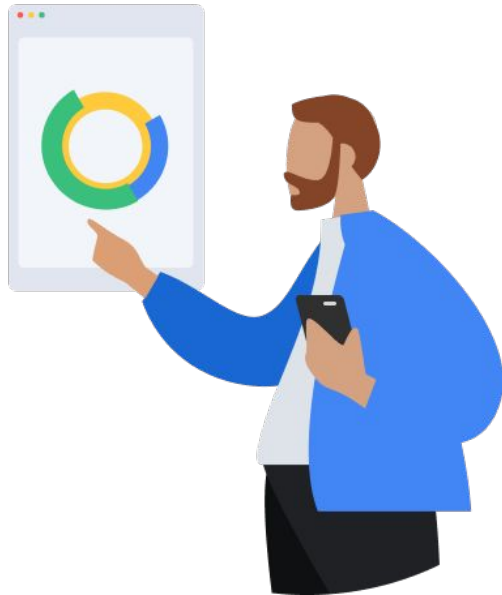
# Lesson 5 summary

Let's review what you learned about:

- States
- Multi-states
- State and multi-state constraints

Now you should be able to:

- Describe the concepts of a state and multi-state.
- Identify a multi-state in source code.
- Understand the rules and constraints for multi-states.



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# You completed Lesson 5!

Now's a great time to take a quick break before starting Lesson 6.

Ready for Lesson 6?

Let's go!

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## Helpful resources

For future reference, keep these resources easily accessible for technical and procedural questions.

- [Digital Buildings Project GitHub](#)  
Contains source code, tooling, and documentation for the DBO.
- [states.yaml](#)  
Contains all of the available states.
- [digitalbuildings / ontology](#)  
Contains the documentation and configuration files for the DBO.
- [Ontology Overview](#)  
Provides an overview of the structure and principles of the ontology.
- [Model](#)  
Describes the conventions used in the DBO abstract model.