

**A quick peek  
behind the  
curtain**

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# Software Stack

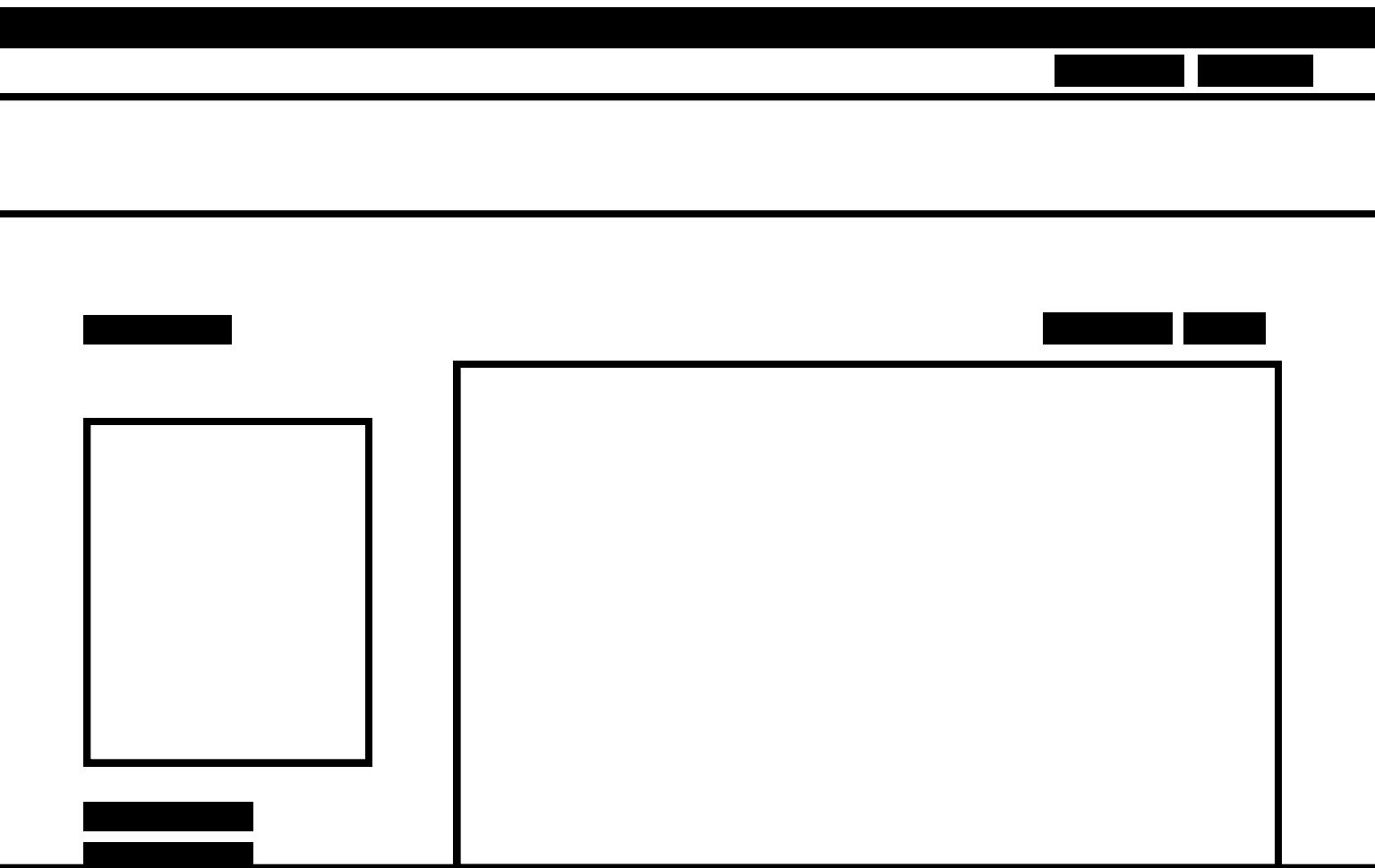
Electron application with a  
Vue frontend and a Node  
backend.

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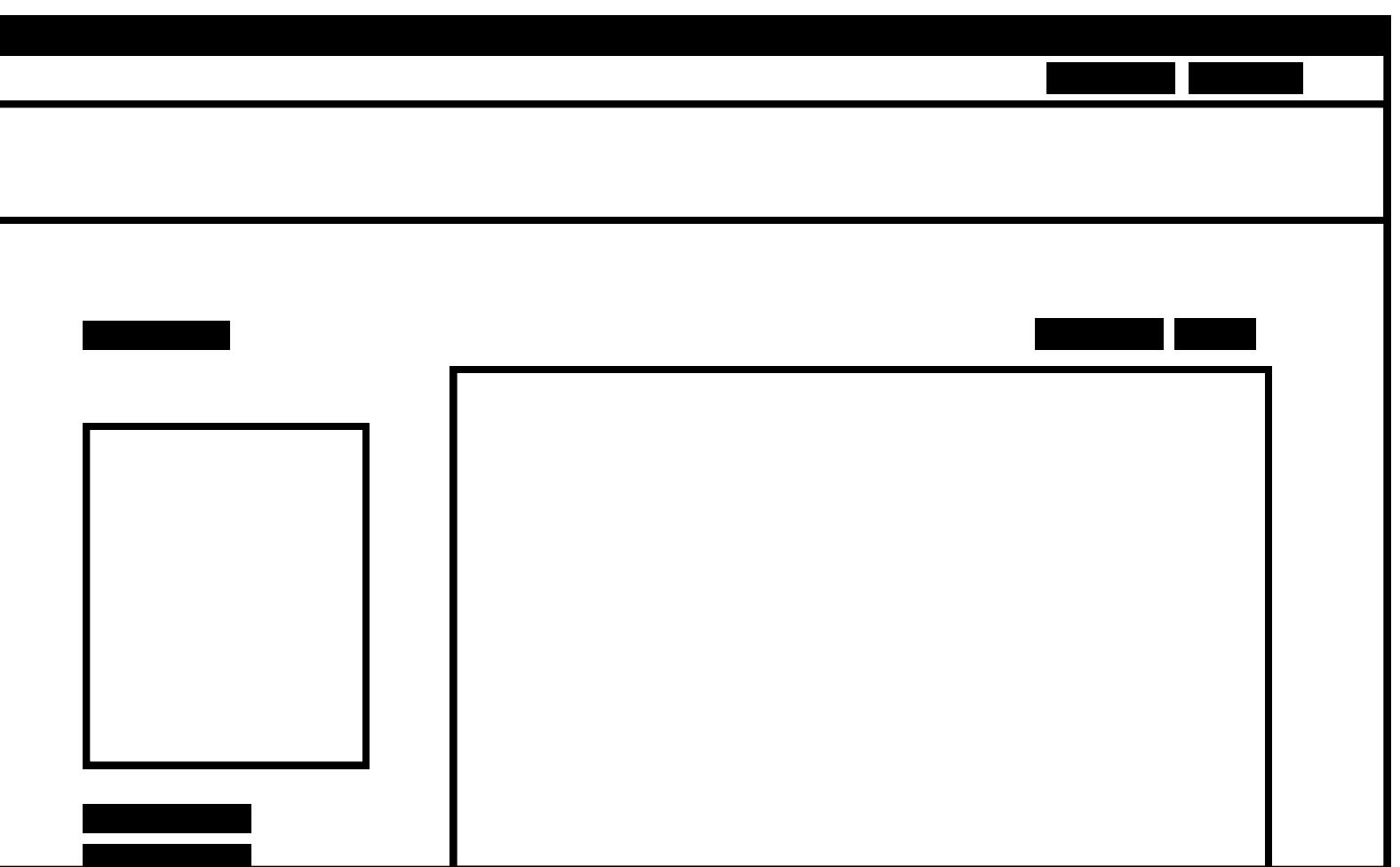


# Electron

Open-source JavaScript framework for building cross-platform desktop applications using web technologies (e.g. HTML, CSS, JS)



Electron's **Renderer** process *renders* content (e.g. buttons, text, code editor, canvas) that the user interacts with. The code run in this process is primarily HTML, CSS, and JS.



Specifically, Illuminations uses the following JS frameworks and libraries:

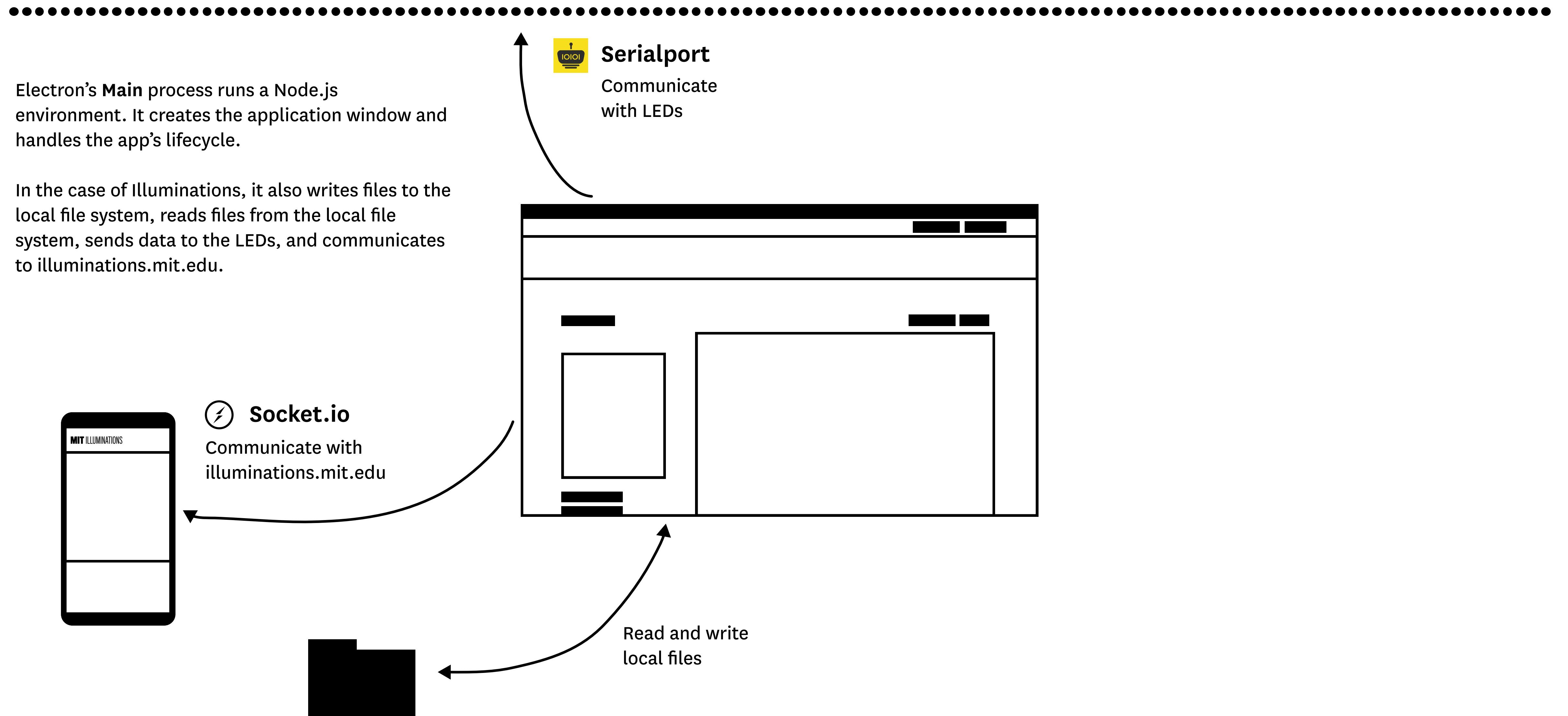
 **Vue.js**

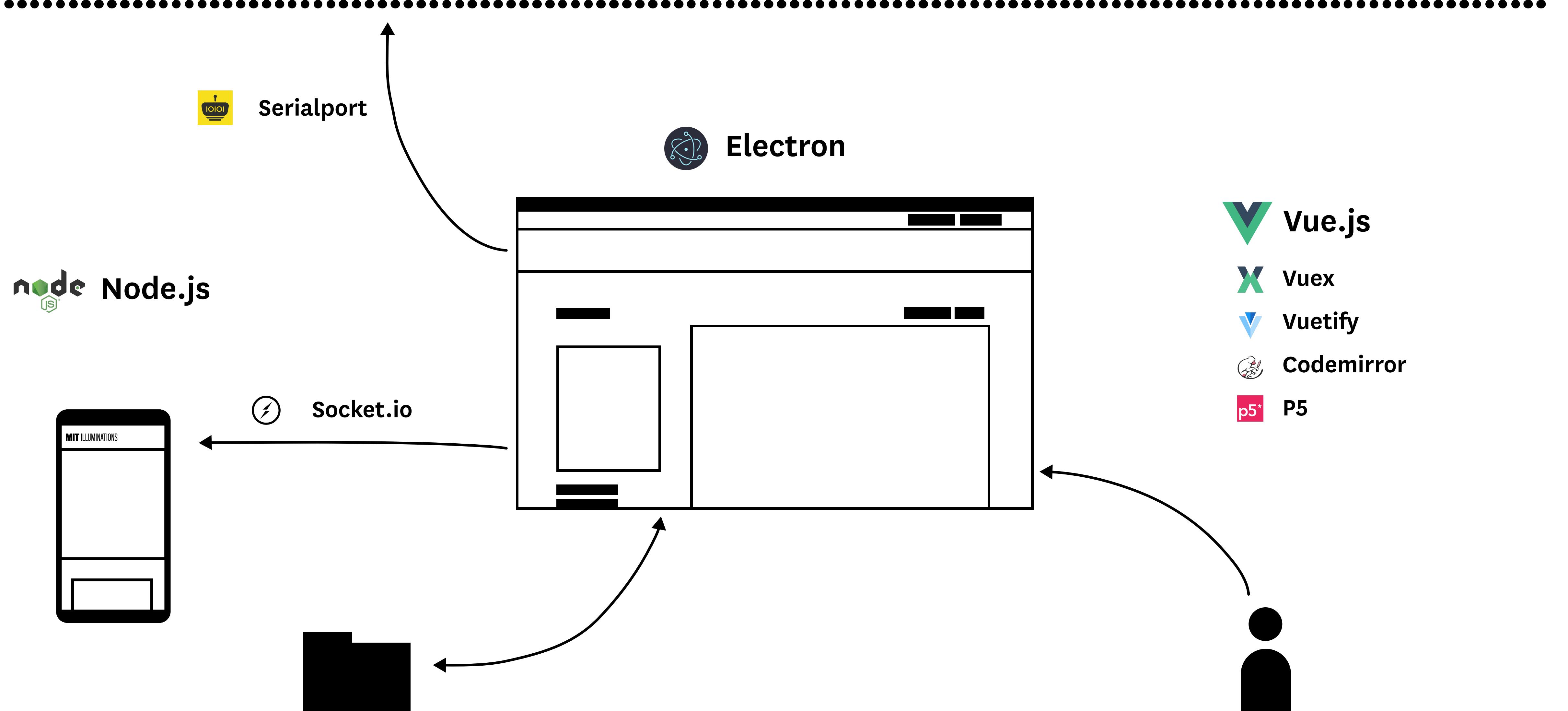
 **Vuex**

 **Vuetify**

 **Codemirror**

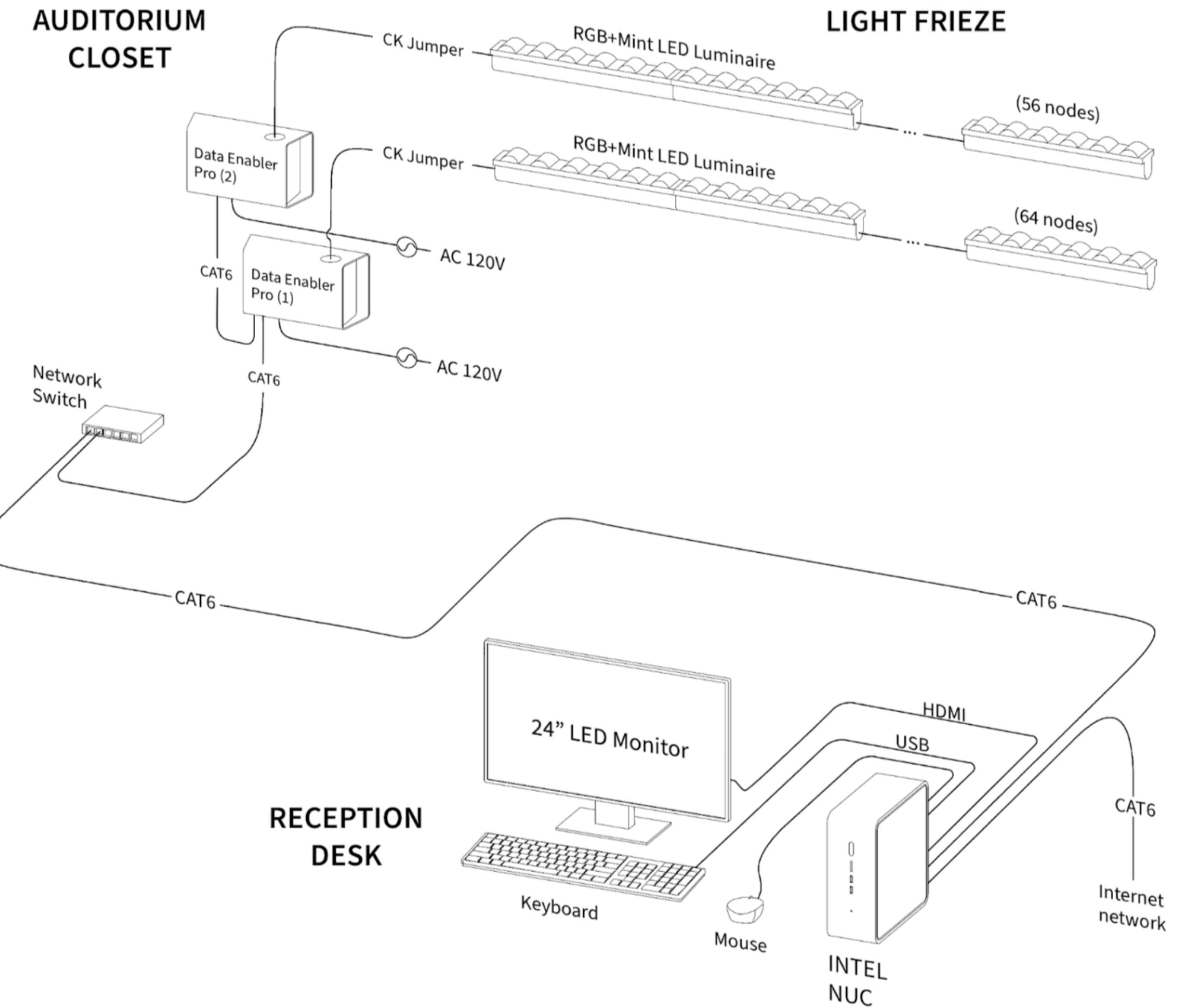
 **P5**





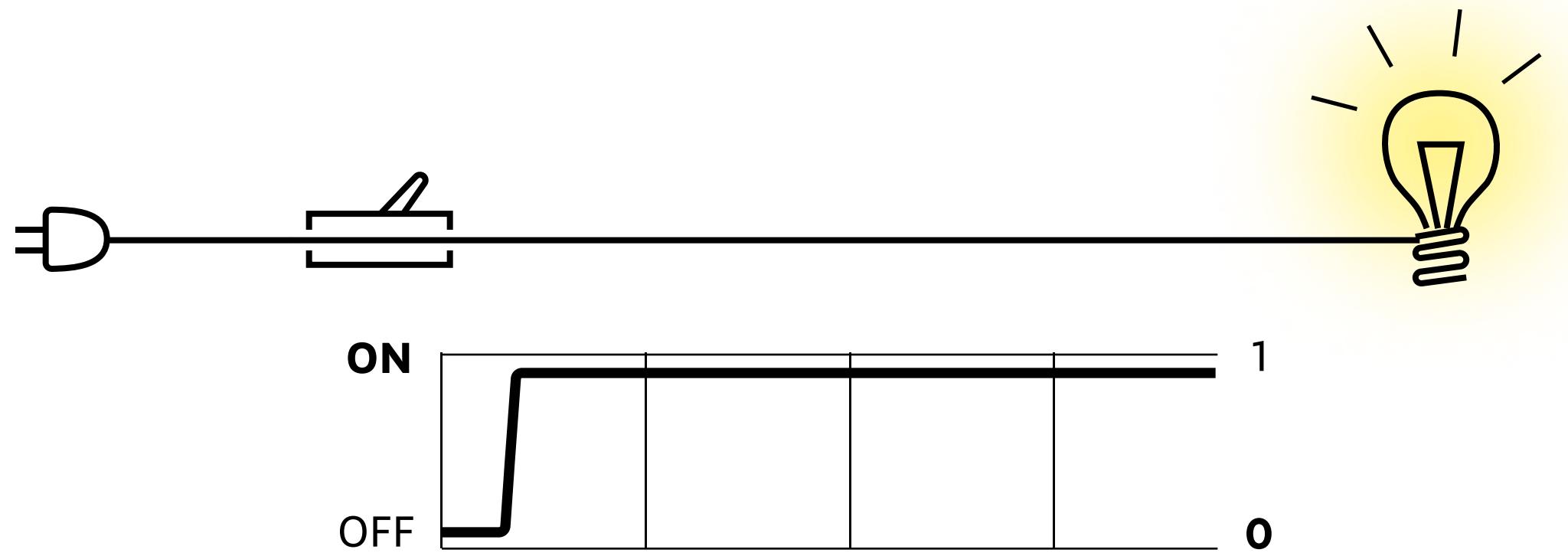
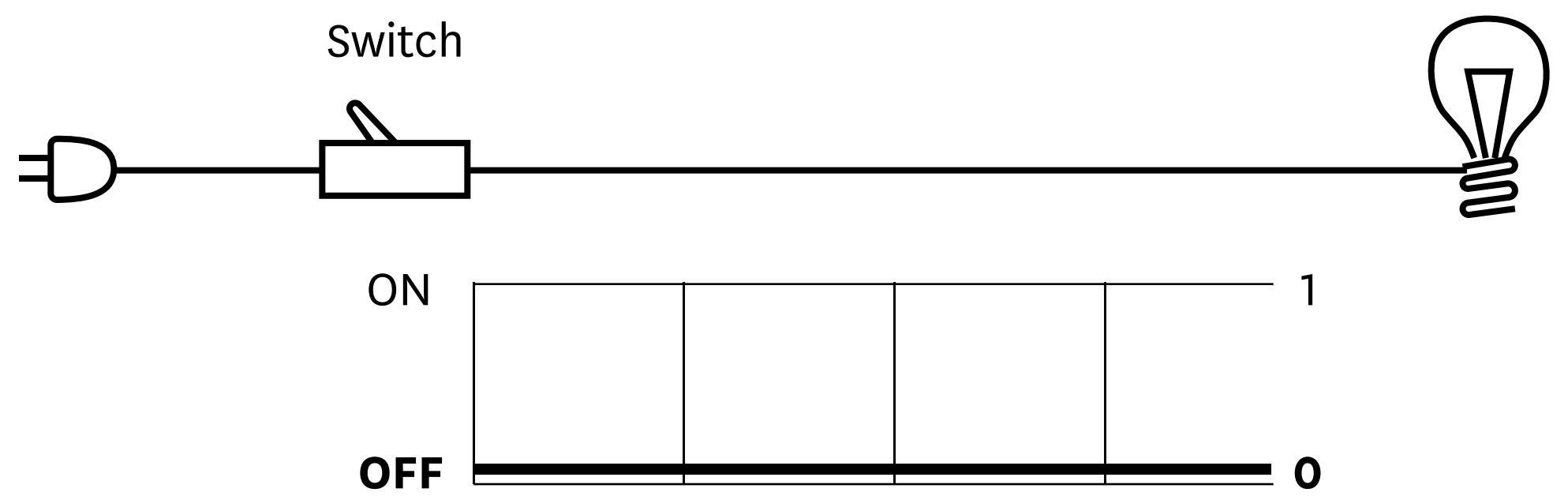
# Hardware Setup

MIT Illuminations is an integrated lighting system based on ColorKinetics technology driven by the MIT Illuminations App



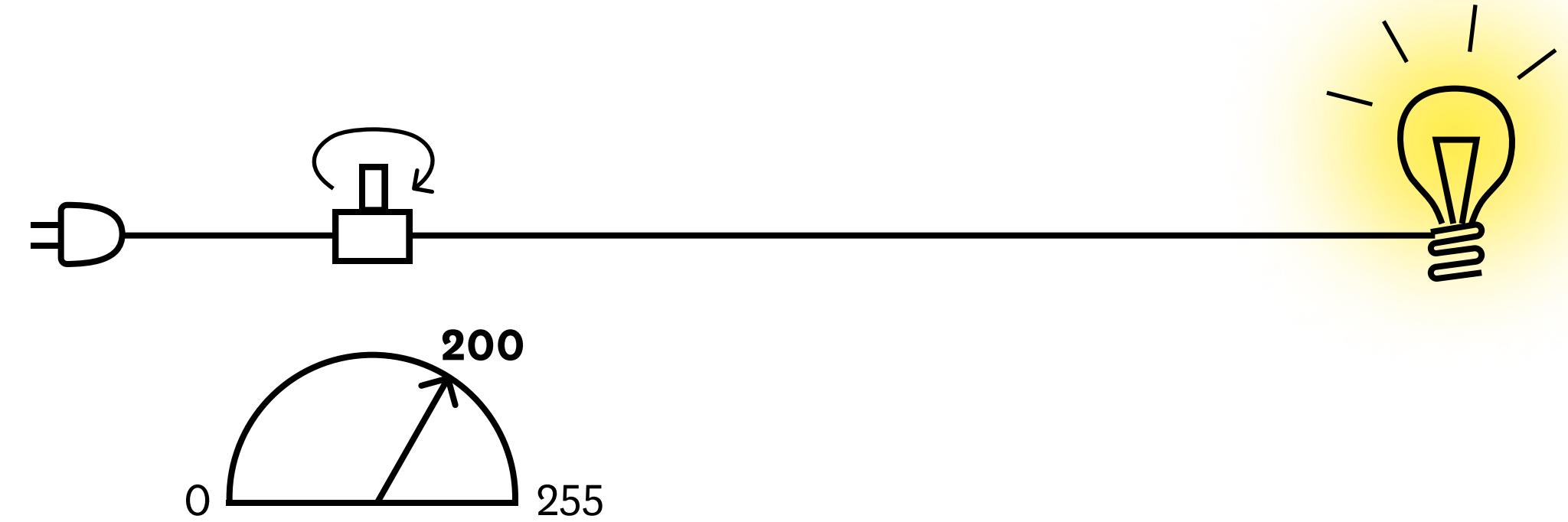
# How to turn on/off a lightbulb

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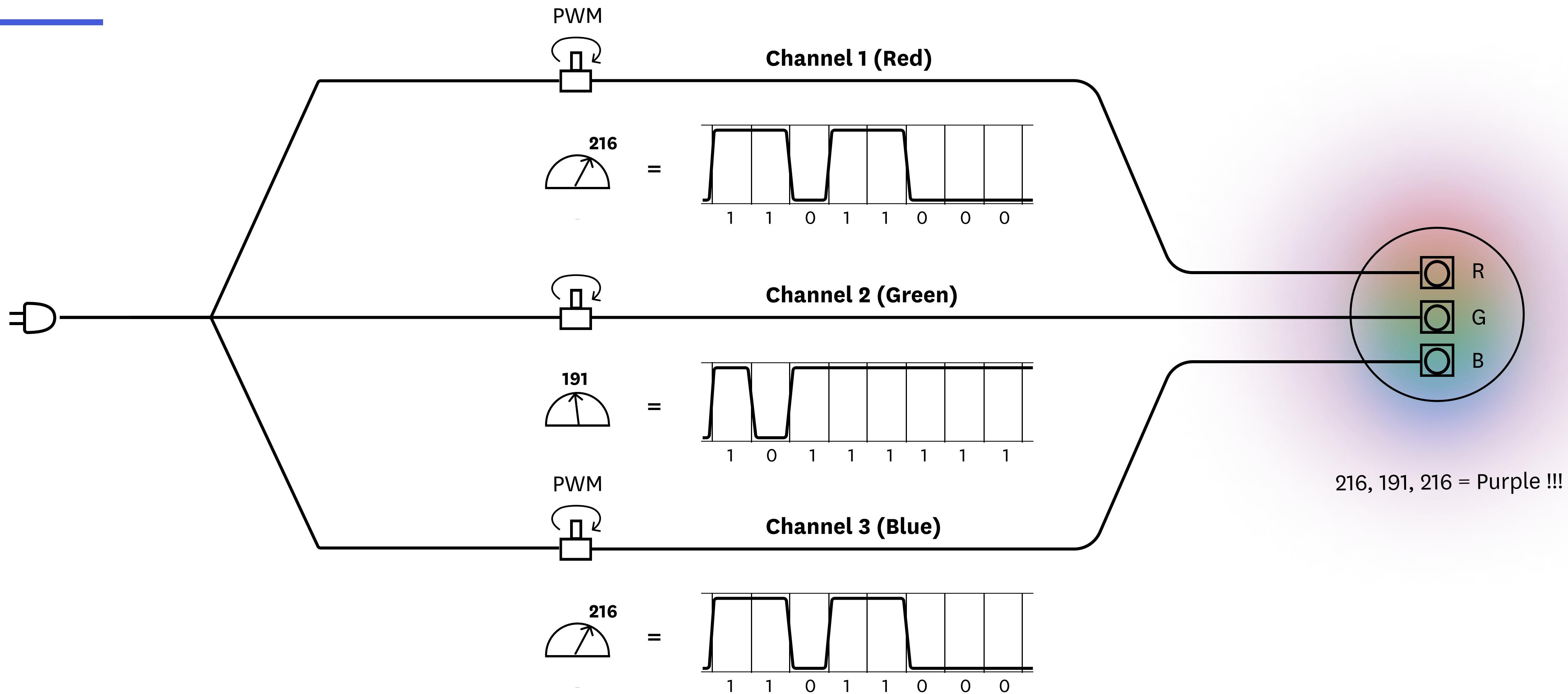


# How to regulate the intensity of a lightbulb

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# How to change the color of an RGB LED light



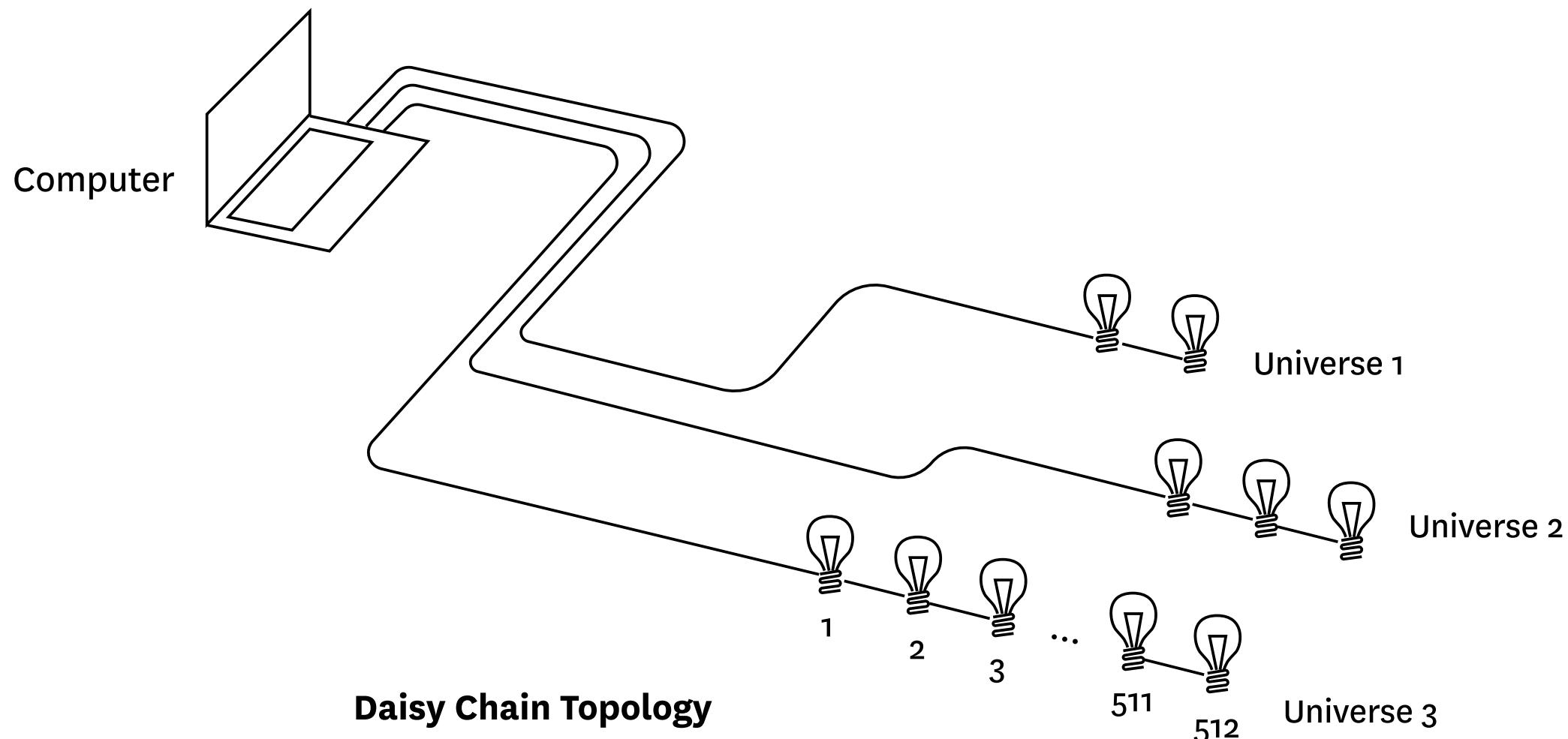
# DMX512 Protocol

DMX512 is a standard protocol for digital communication networks commonly used to control theatrical and architectural lighting.



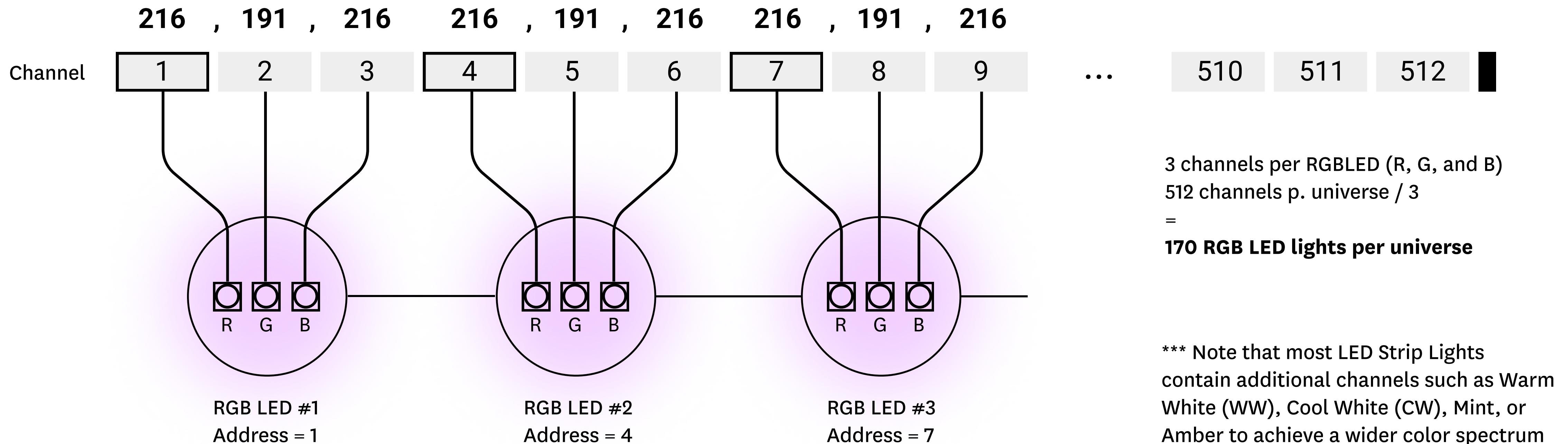
5 PIN XLR style connector (XLR-5)

- DMX512 uses a multi-drop bus topology (**daisy-chain nodes**)
- A DMX network is called a **universe**
- It provides **512 channels** for control per universe
- Every channel carries an **8-bit** message (0-255)

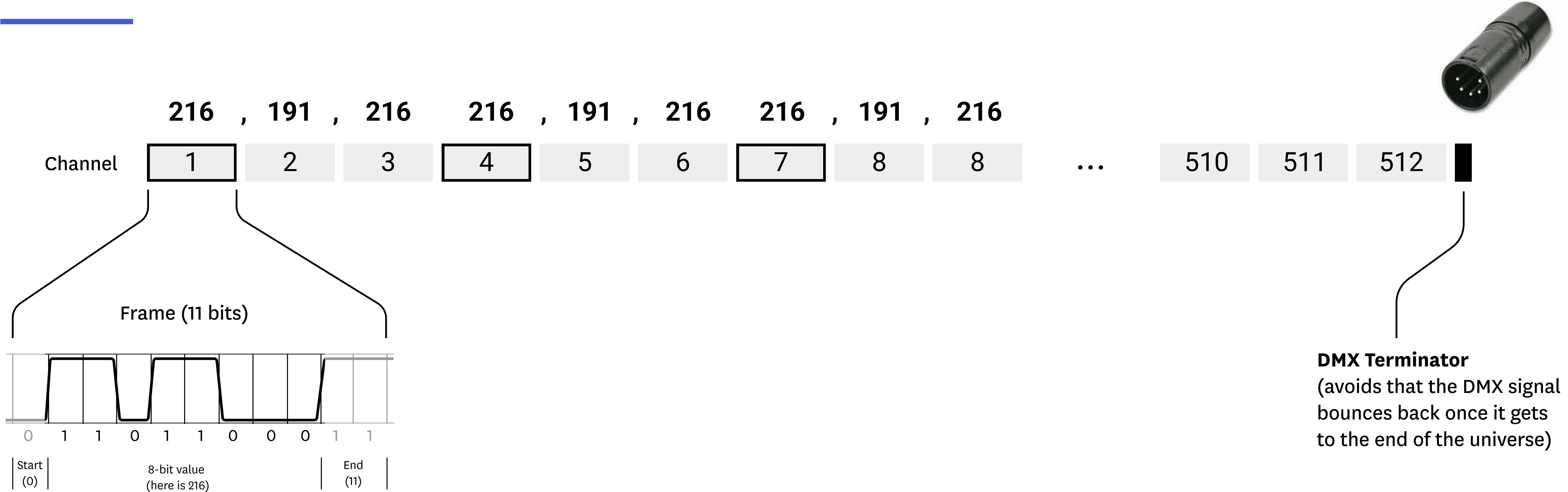


# DMX Channels

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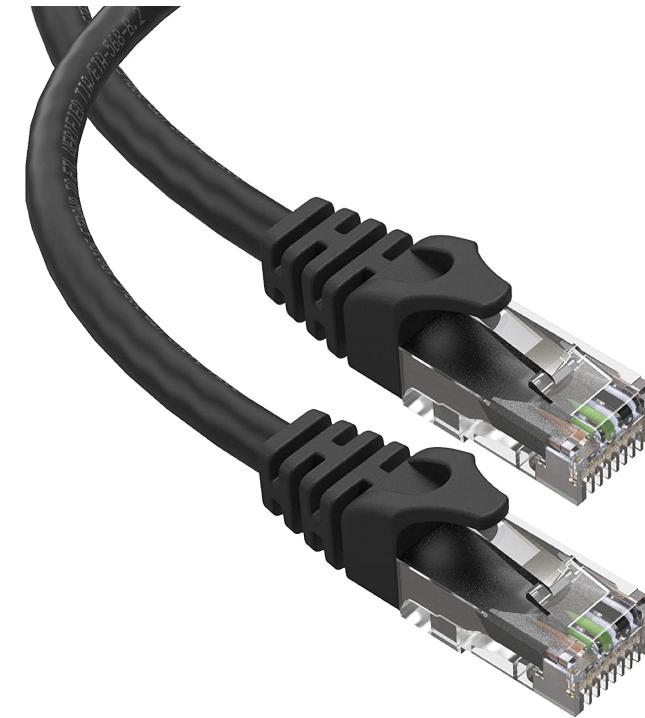
# DMX Package



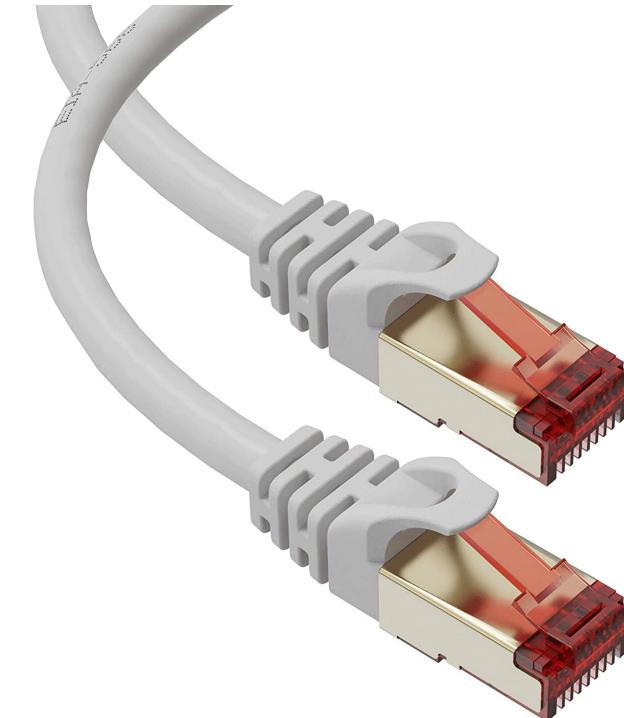
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# EtherNet Protocol

Ethernet is a communication standard to connect computers and devices to a local area network (LAN).

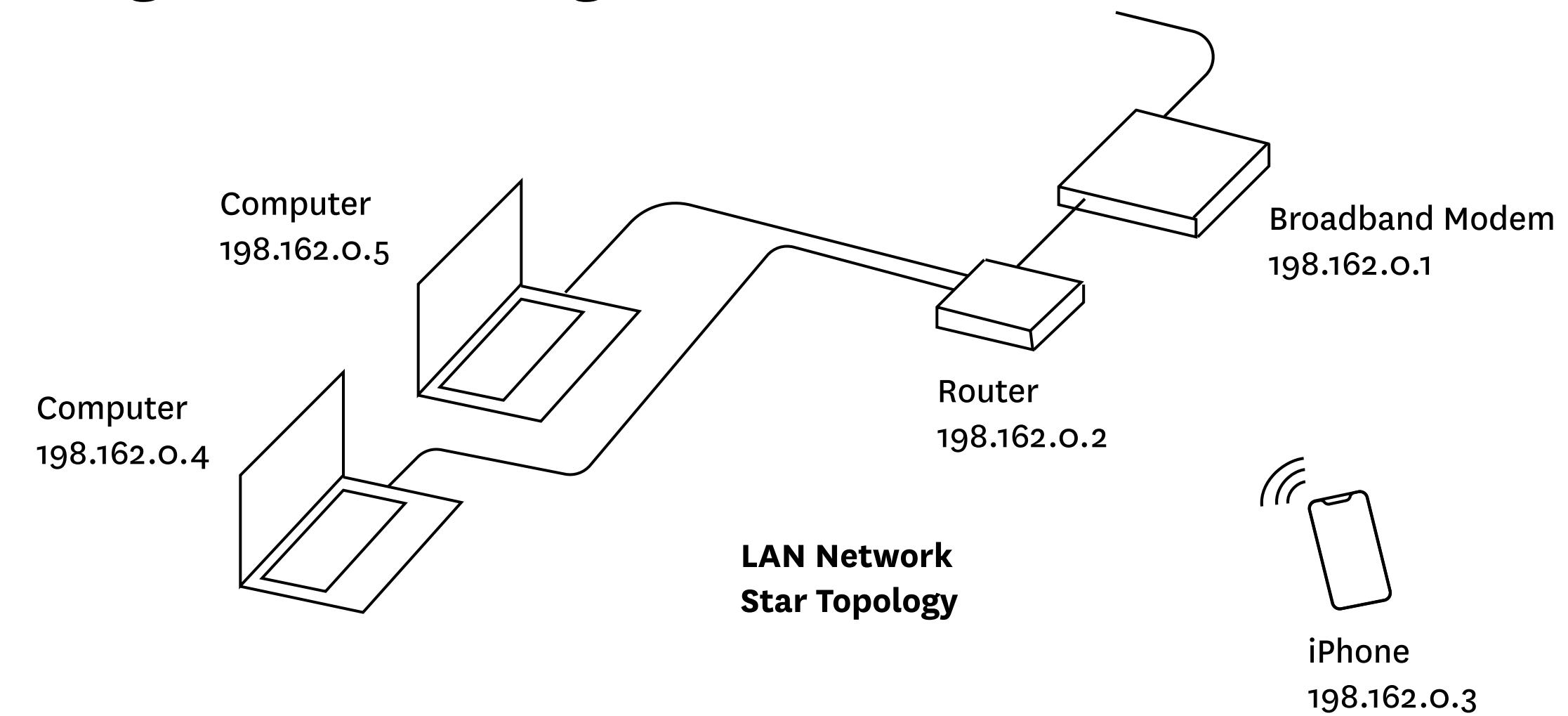


CAT 6 Cable with RJ45 Termination  
(Bandwidth 1 Gbps)



CAT 6a or CAT 7 Cable with RJ45 Term.  
(Bandwidth 10 Gbps)

- Ethernet is a **layer protocol** that ensures the complete delivery of data through a network.
- Ethernet networks often use **twisted pair copper cables with RJ45 connectors** for local networks and fiber optic cables for transmitting data over long distances.



# EtherNet Model

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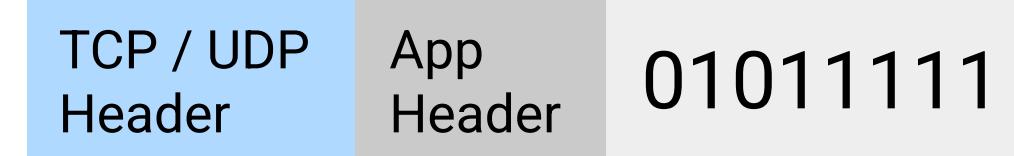
Each layer adds the necessary information to ensure the exchange of the data.

Layers

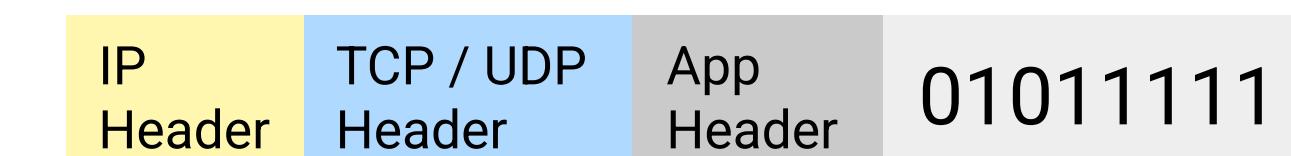
Application



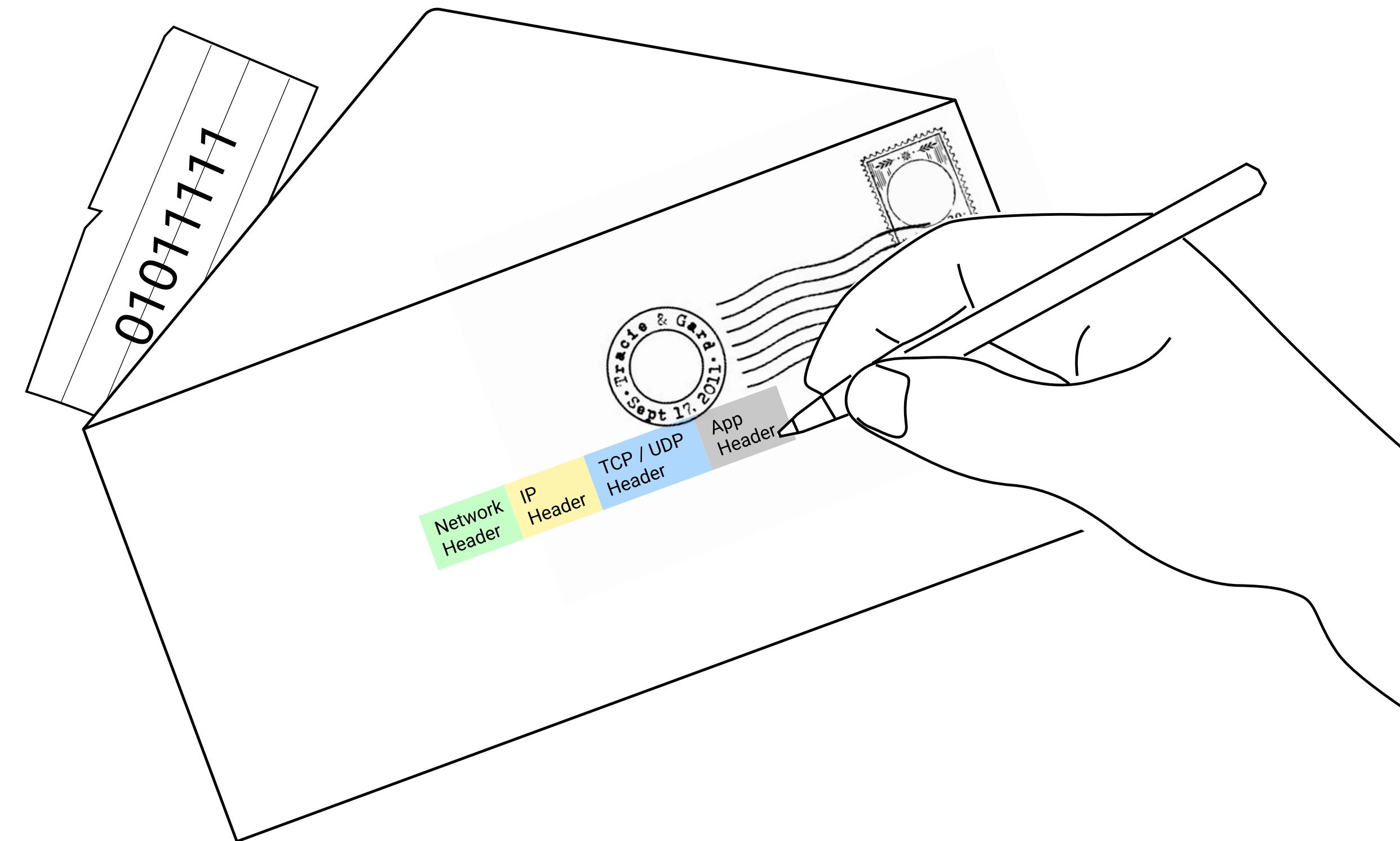
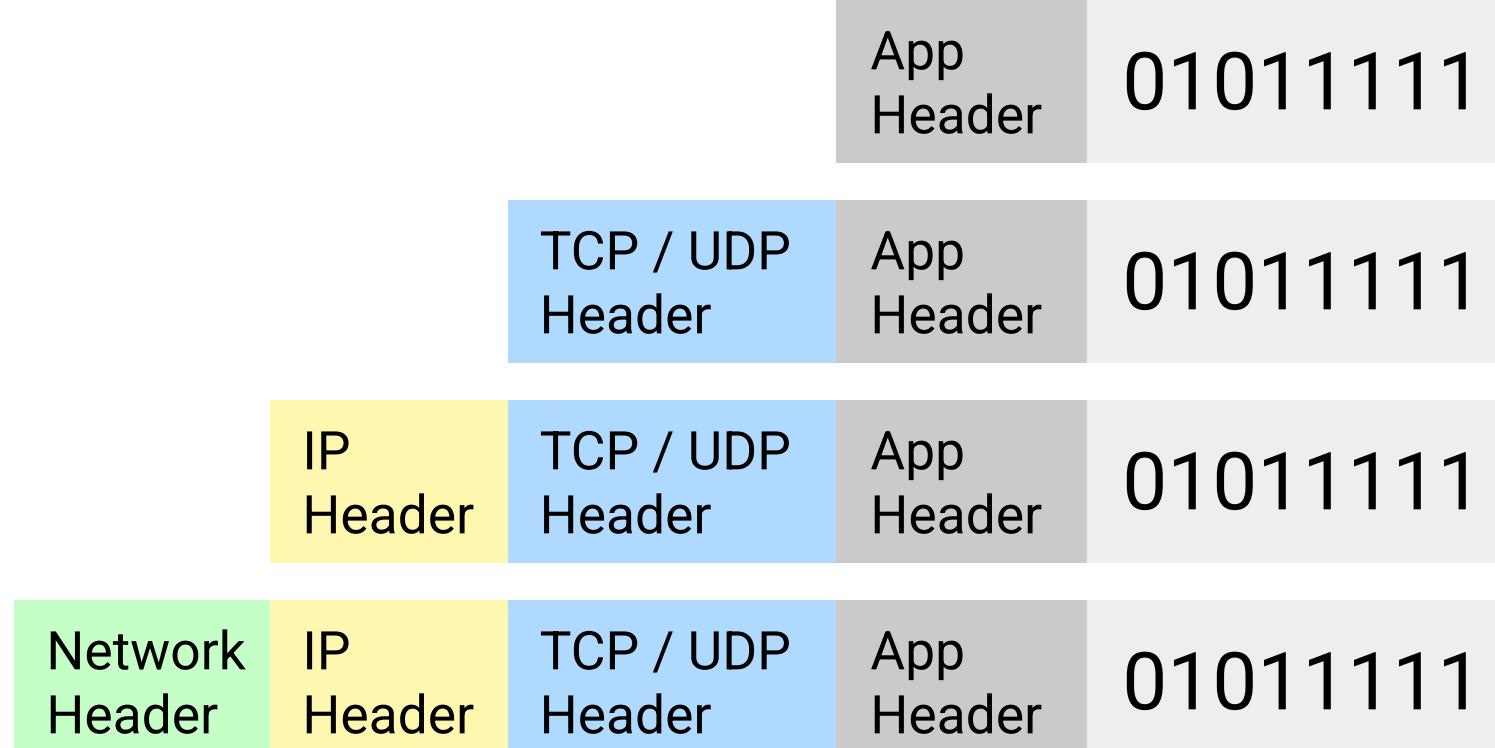
Transport



IP



Network



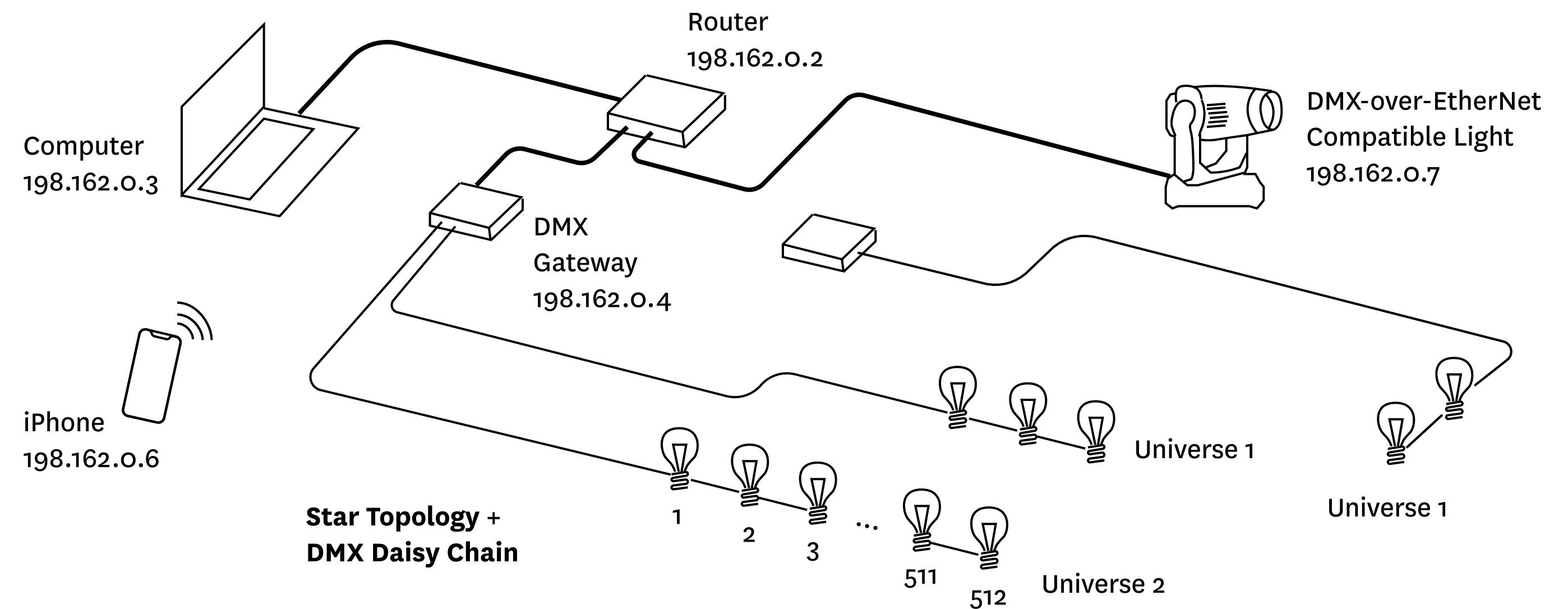
# DMX over EtherNet

DMX can be used over an EtherNet network using several protocols such as sACN, ArtNet, or Kinet.



etherCON Neutrik Cable  
with RJ45 Connector

- DMX over Ethernet uses a more reliable network **star topology**
- It uses a **UDP protocol** (receiver does not acknowledge the received data)
- Every device (**node**) in the network requires an **IP Address**



# Art-Net

Art-Net 4

- Allows up to 32,768 universes across an EtherNet network.
- Compatible with older gear.
- Broadcast and unicast-able.

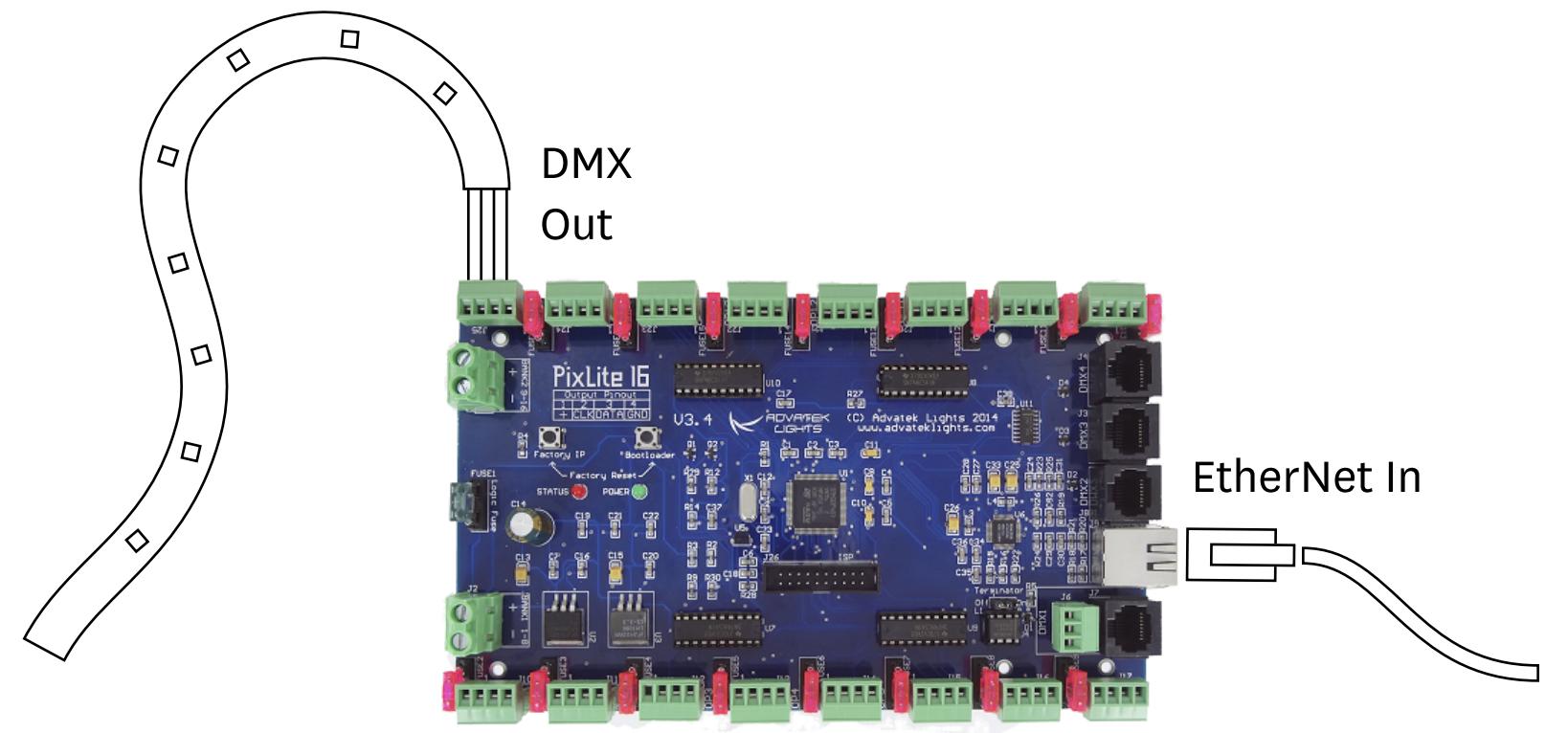


ENTTEC Art-Net to DMX Converter

# sACN

Streaming Architecture for Control Networks

- Allows up to 63,999 universes across an EtherNet network.
- More efficient data transfer.
- Unicast and multicast-able.

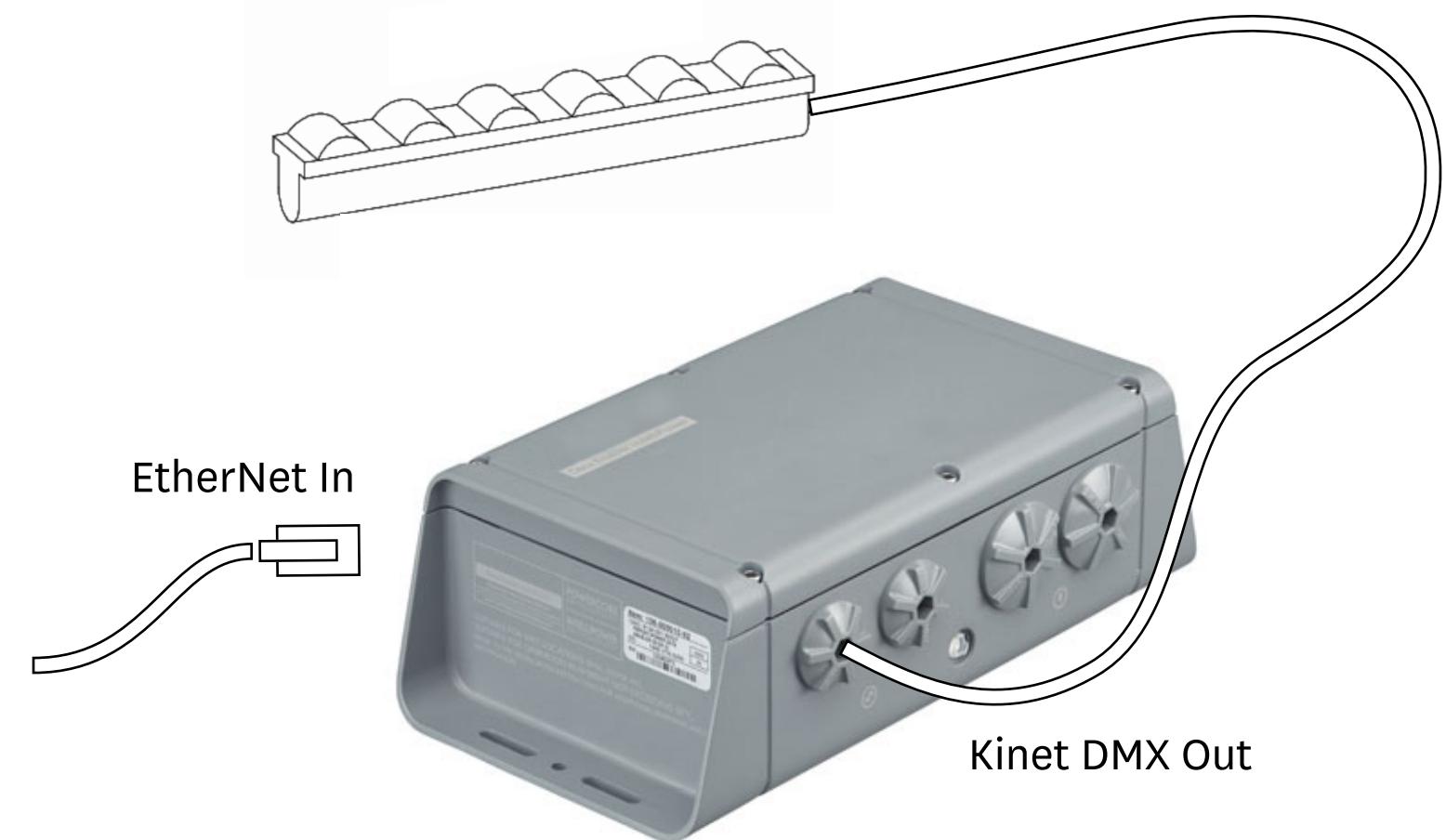


Advatek sACN LED Controller

# Kinet

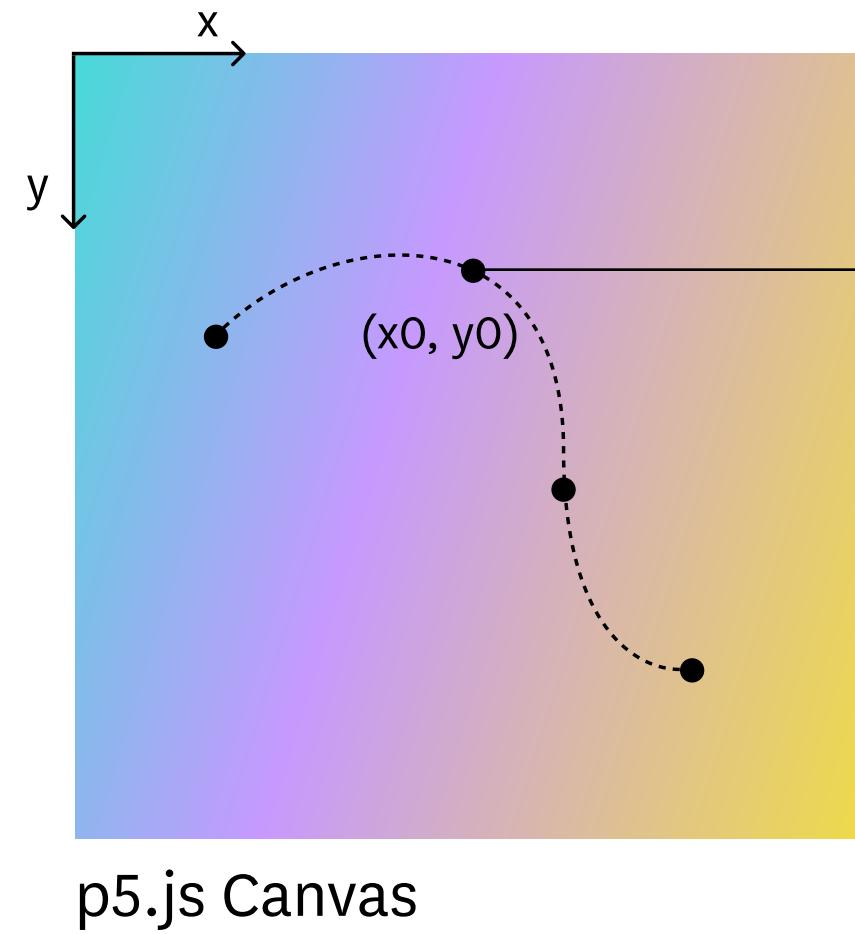
Color Kinetics proprietary lighting protocol (Phillips)

- Lightweight data transfer
- Data sent in RGB triples (CK controller adapts data to light specs)



Color Kinetics Data Enabler Pro

# p5-KINET



```
RGBvalue = get(x0, y0);
data.concat(RGBvalue);
kinet.sendKinetStrands(data);
```

Kinet v2  
Header

Payload

`data = [ 216, 198, 216,`

**200, 150, 128 ... ]**

UDP Packet

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Engineering Specification Document

## 3 KiNET v2

### 3.1 PORTOUT Packet

#### 3.1.1 Packet Diagram

KTYPE\_PORTOUT (0x0108)

Total Len	Dest MAC			Source MAC			Type	Len	DS							
	ID	F	Offset	TTL	Prot	Header Chks	Source IP	Dest IP								
Dest IP	Source Port	Dest Port	Length	Checksum	Magic			Version								
Type	Sequence Num			Universe			Port	Pad	Flags							
Start Code	Payload						Length									
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

#### 3.1.2 Packet Capture

0000	00	0a	c5	44	15	f2	00	12	3f	38	bb	9e	08	00	45	00
0010	02	34	0f	e7	00	00	80	11	3d	da	0a	01	d5	de	0a	00
0020	01	21	0a	8d	17	96	02	20	13	44	04	01	dc	4a	01	00
0030	08	01	00	00	00	00	00	00	00	00	01	00	00	00	00	02
0040	f0	ff	ff	00	00	ff	00									
0050	00	ff	00	00												
0060	ff	00	00	ff												
0070	00	00	ff	00												

#### 3.1.3 Field Definitions

##### 3.1.3.1 KiNET Header

Field Name	Bytes	Offset	UDP Offset	Value	Notes
Magic Number	4	42	0	0x4ADC0104	
Version	2	46	4	0x0002	Latest version of KiNET protocol is V2.0. Older supplies may support KiNET V1.0 only.
Type	2	48	6	0x0108	Set to KiNET packet type. For PORTOUT, packet type is 0x0108.
Sequence Number	4	50	8		Can be used for ordering/numbering of packets. Not implemented on most supplies. Should be set to 0.
Total Size	12				

(trailer)

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# Thank you!

If you enjoy Illuminations, or are curious about other SOSO projects and opportunities, we'd love to hear from you!

<https://www.sosolimited.com/contact/>

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