

Getting to know the concepts



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Glossary

*Familiarize yourself with
the basic concepts*

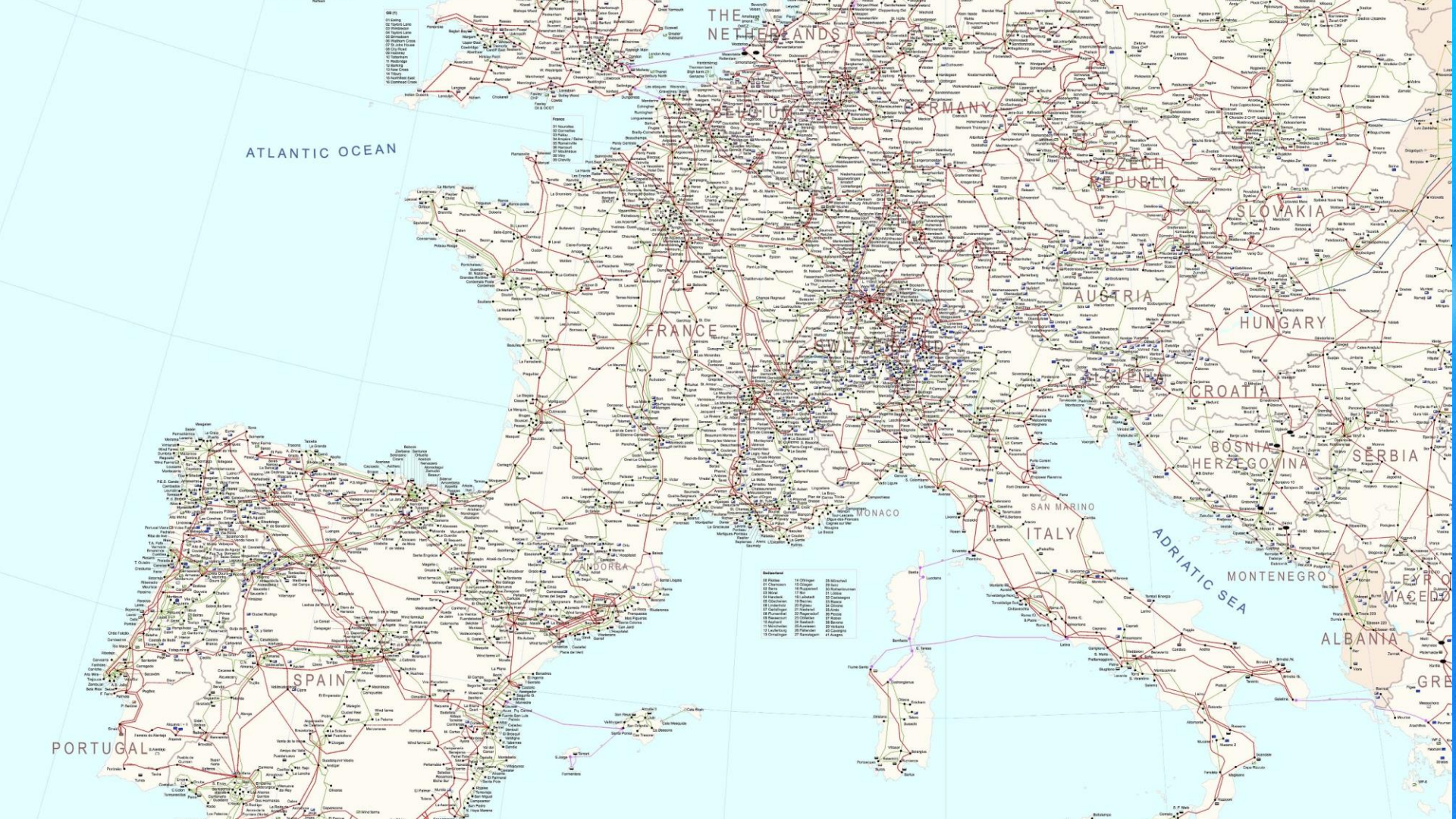




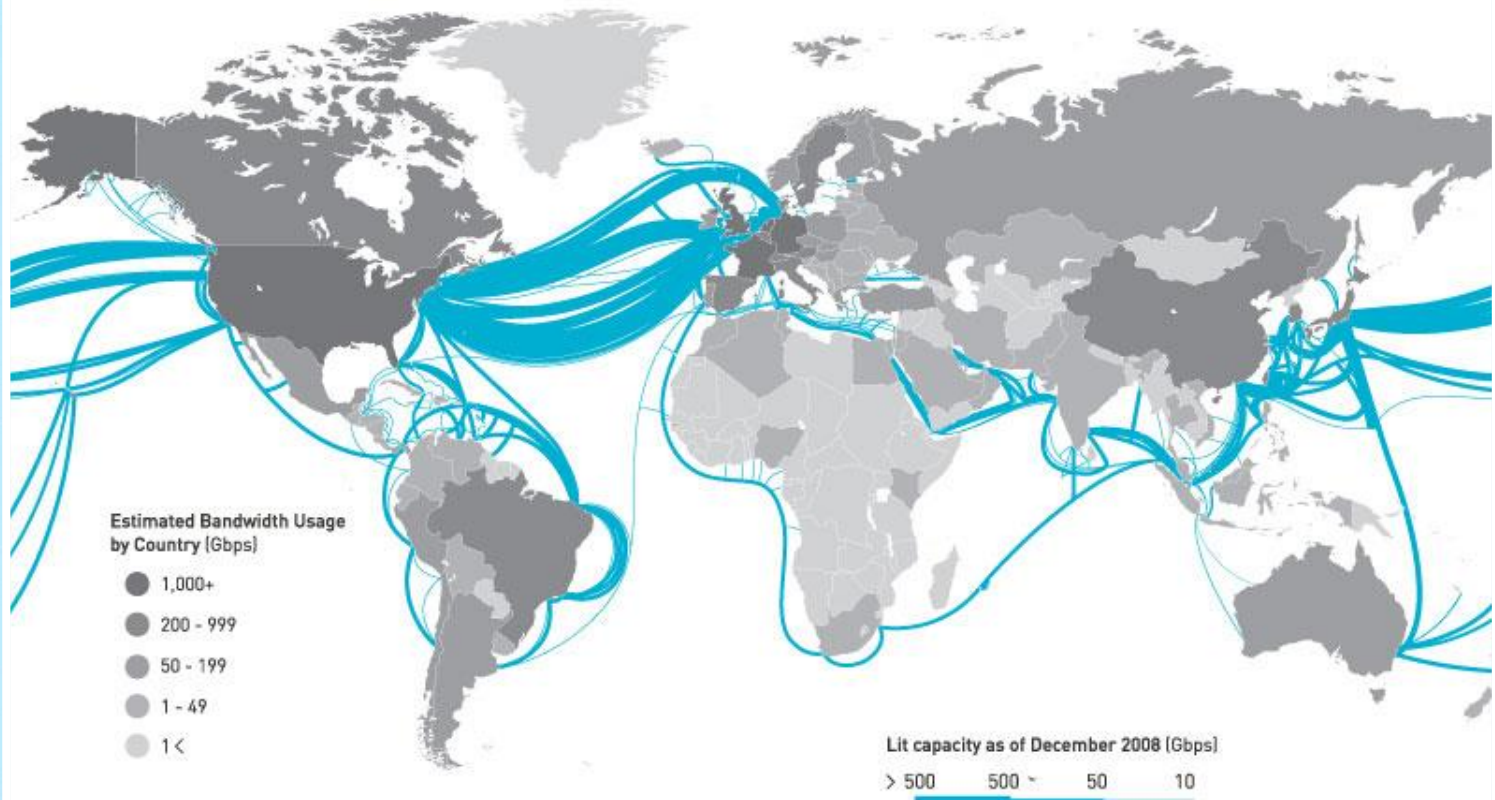


Useful definition of infrastructure





GLOBAL LIT SUBMARINE CABLE CAPACITY



Physical reality

- Megastructures of modern time
- Complex physical networks
- Engineering knowledge

Social reality

- Millions of interconnected users
- System of connected producers and consumers
- Physical **and** Social reality

Socio –technical systems

Physical dimension &

Social dimension

Importance of infrastructures

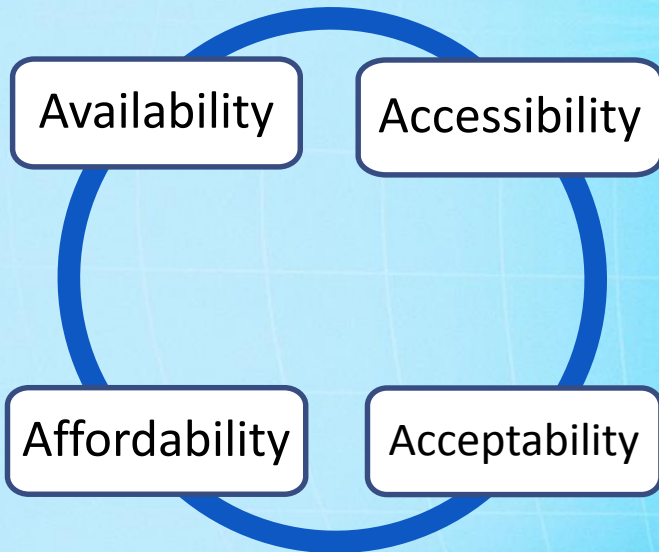
Supply public services

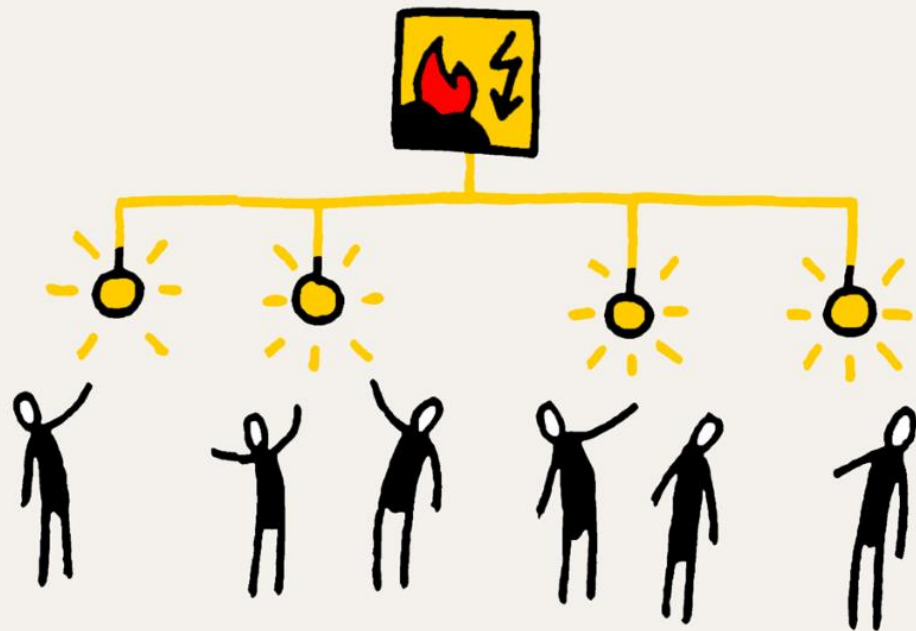
Examples:

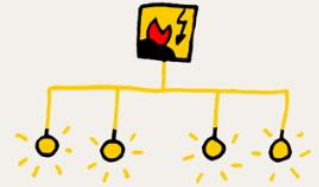
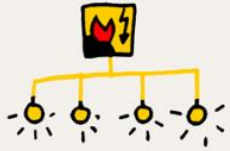
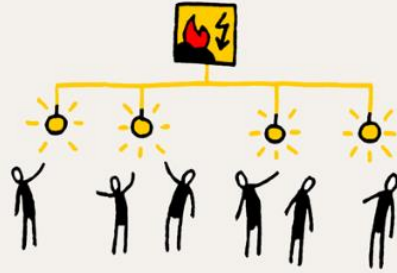
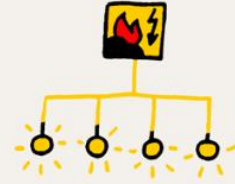
- Energy
- Transport of People and Goods
- Information and Telecommunication
- Water supply
- Waste (water) removal

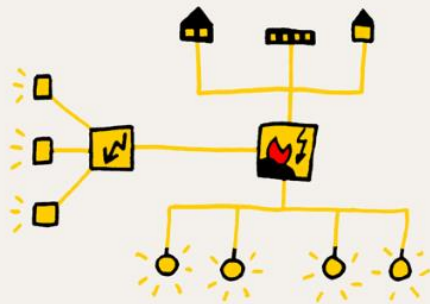
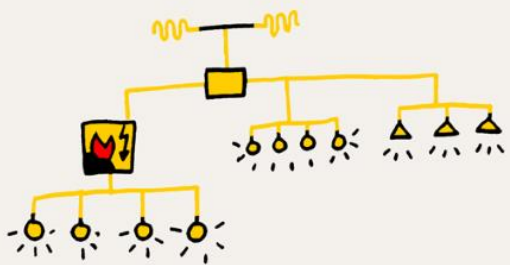
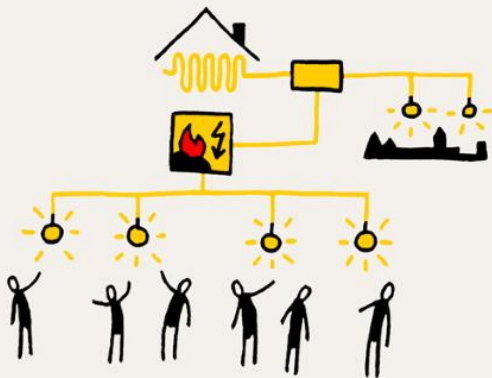
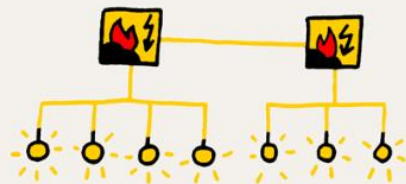
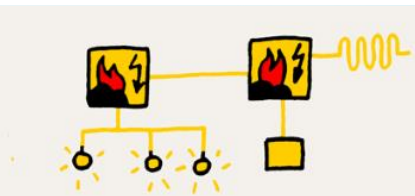
Importance of infrastructures

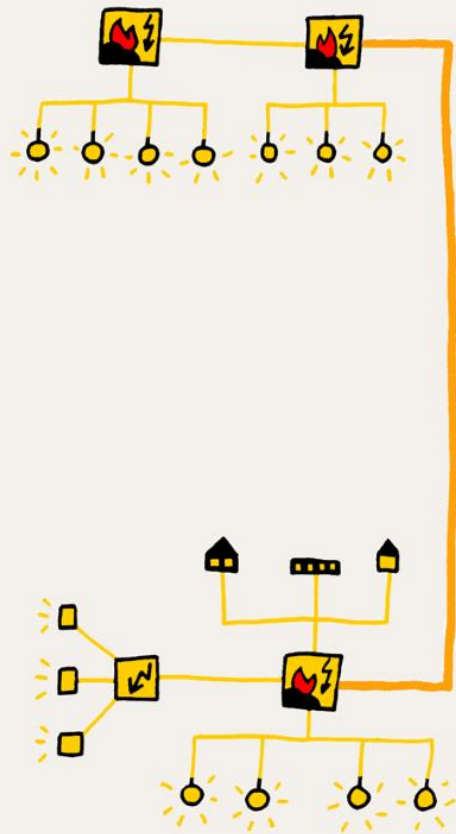
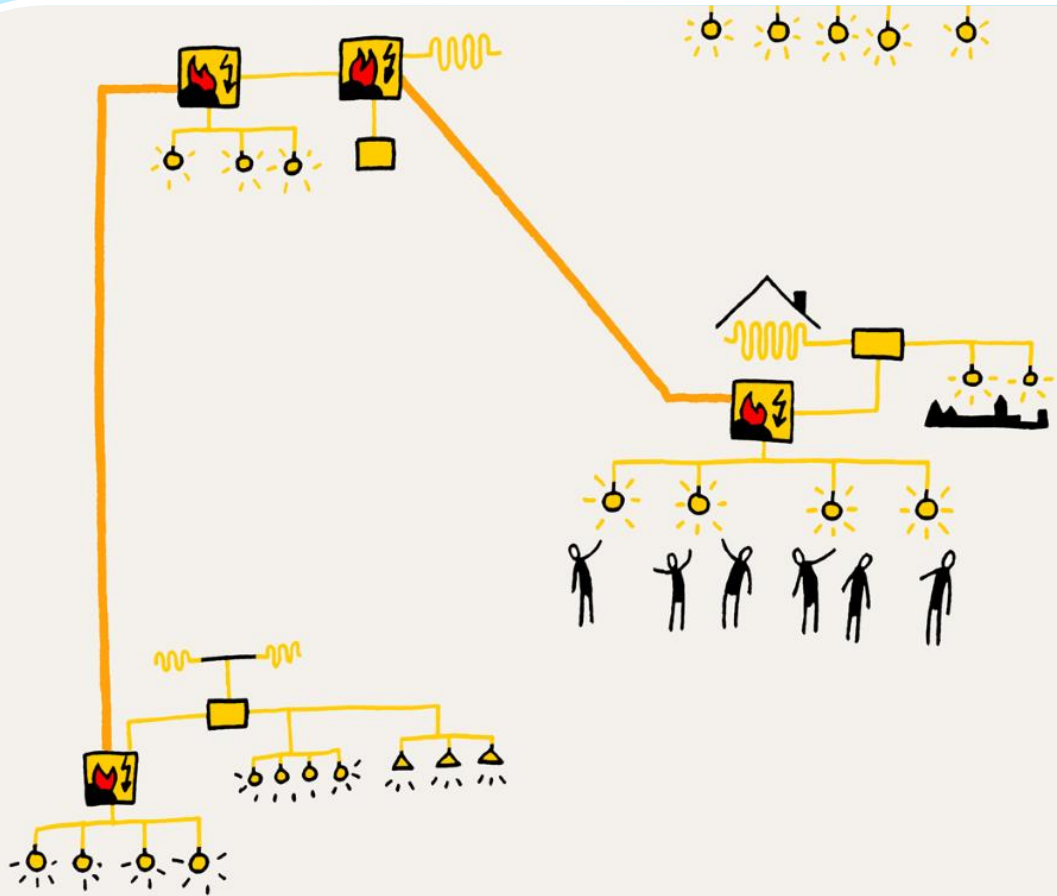
Criteria for 'good' infrastructures:

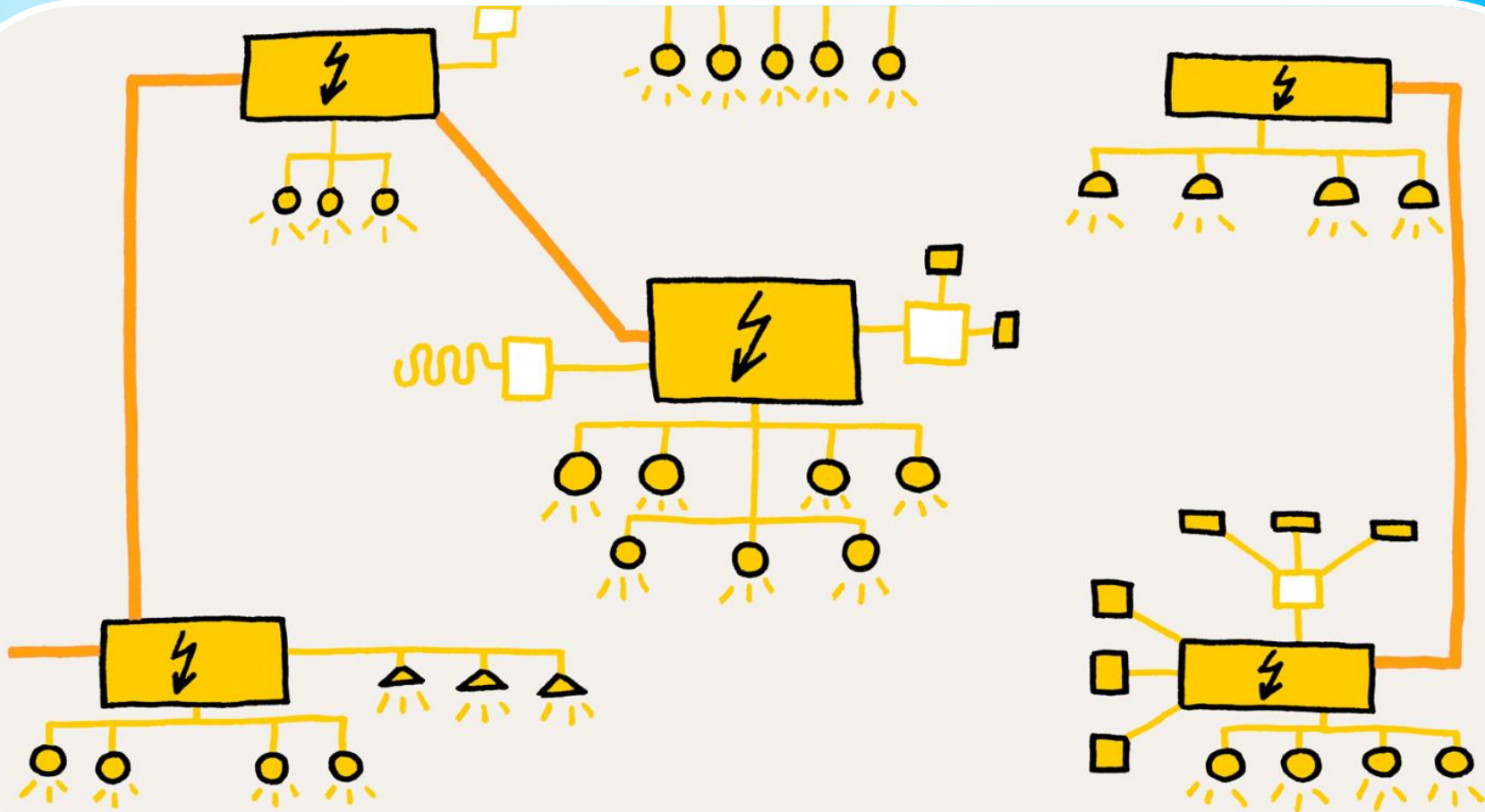


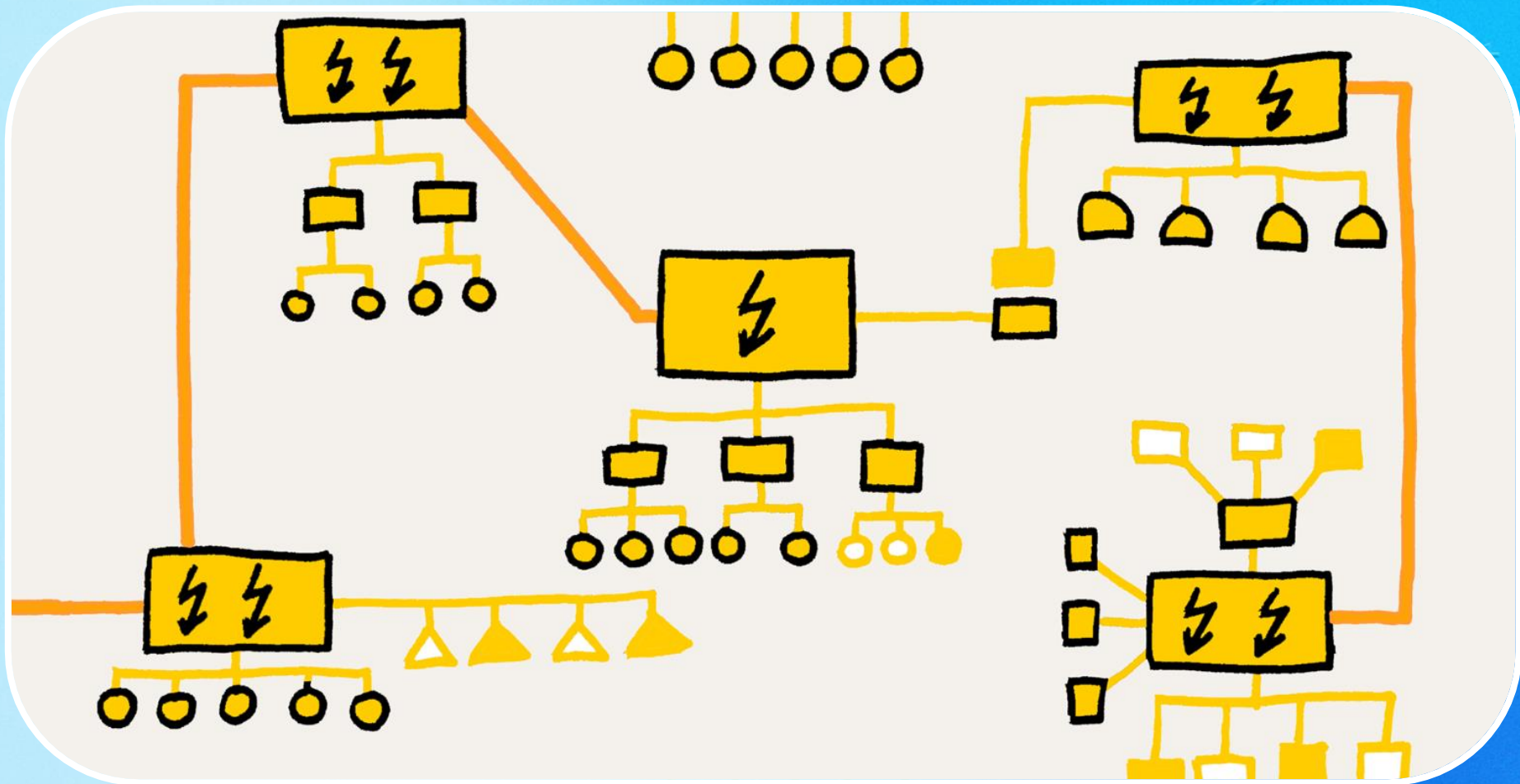


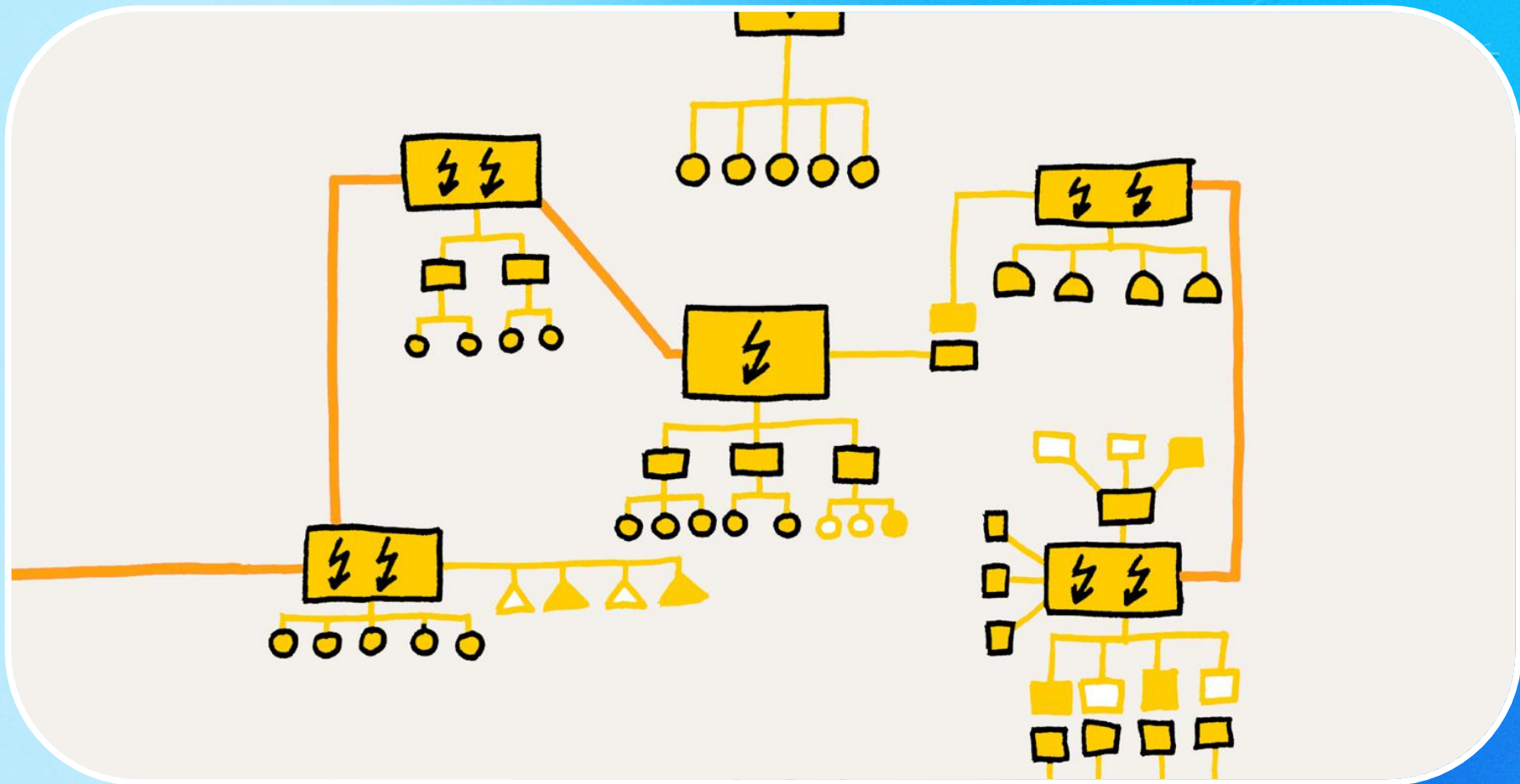


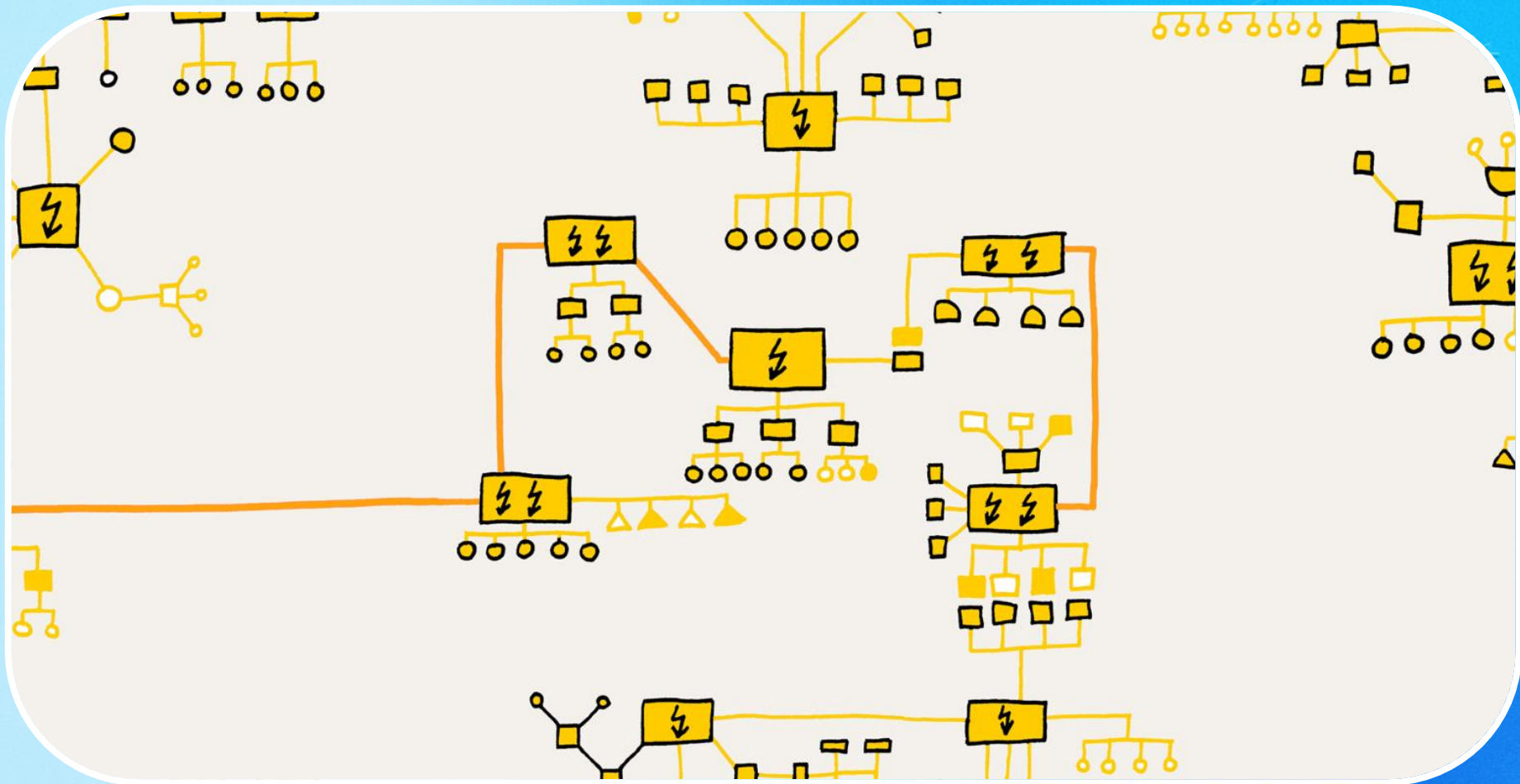


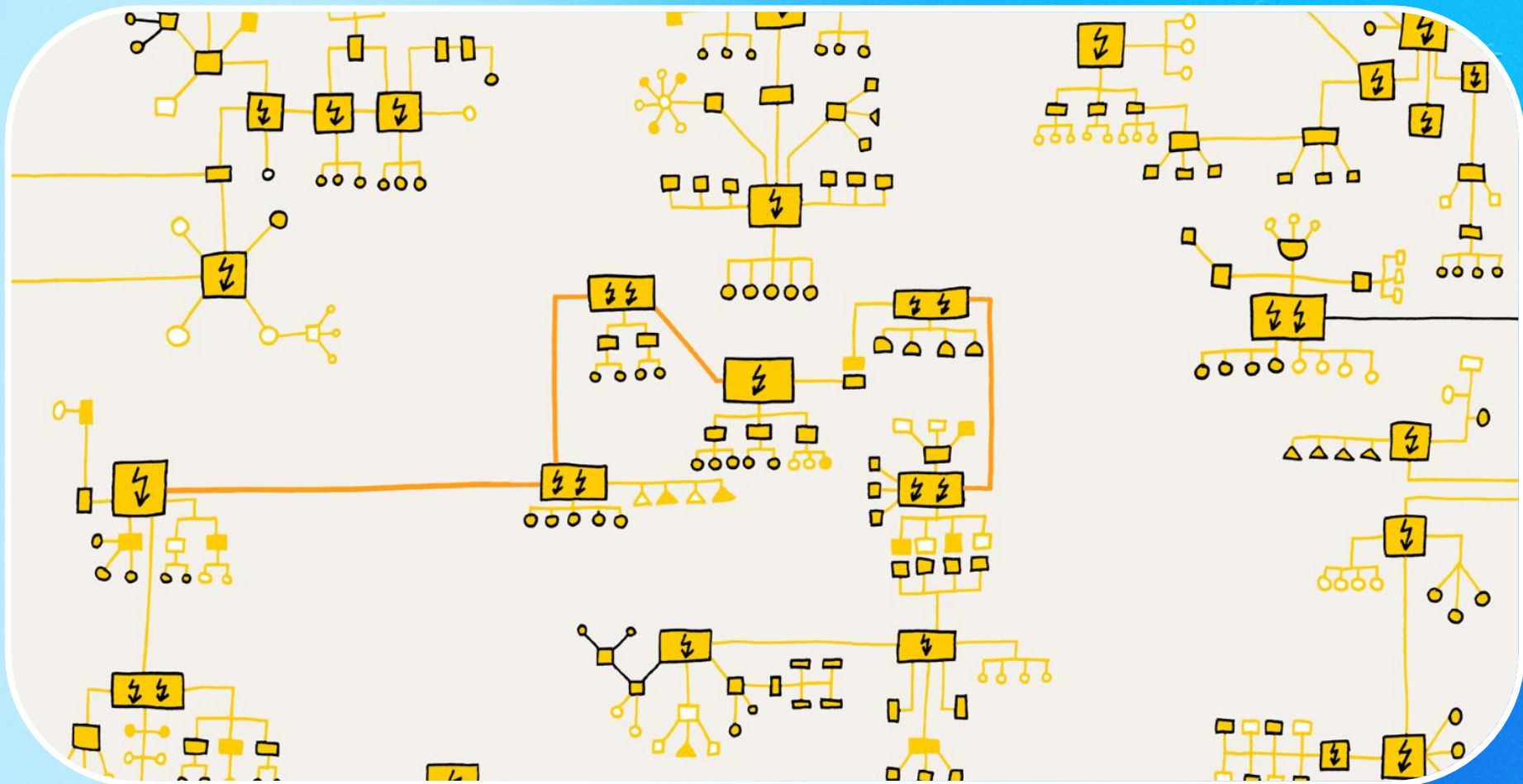


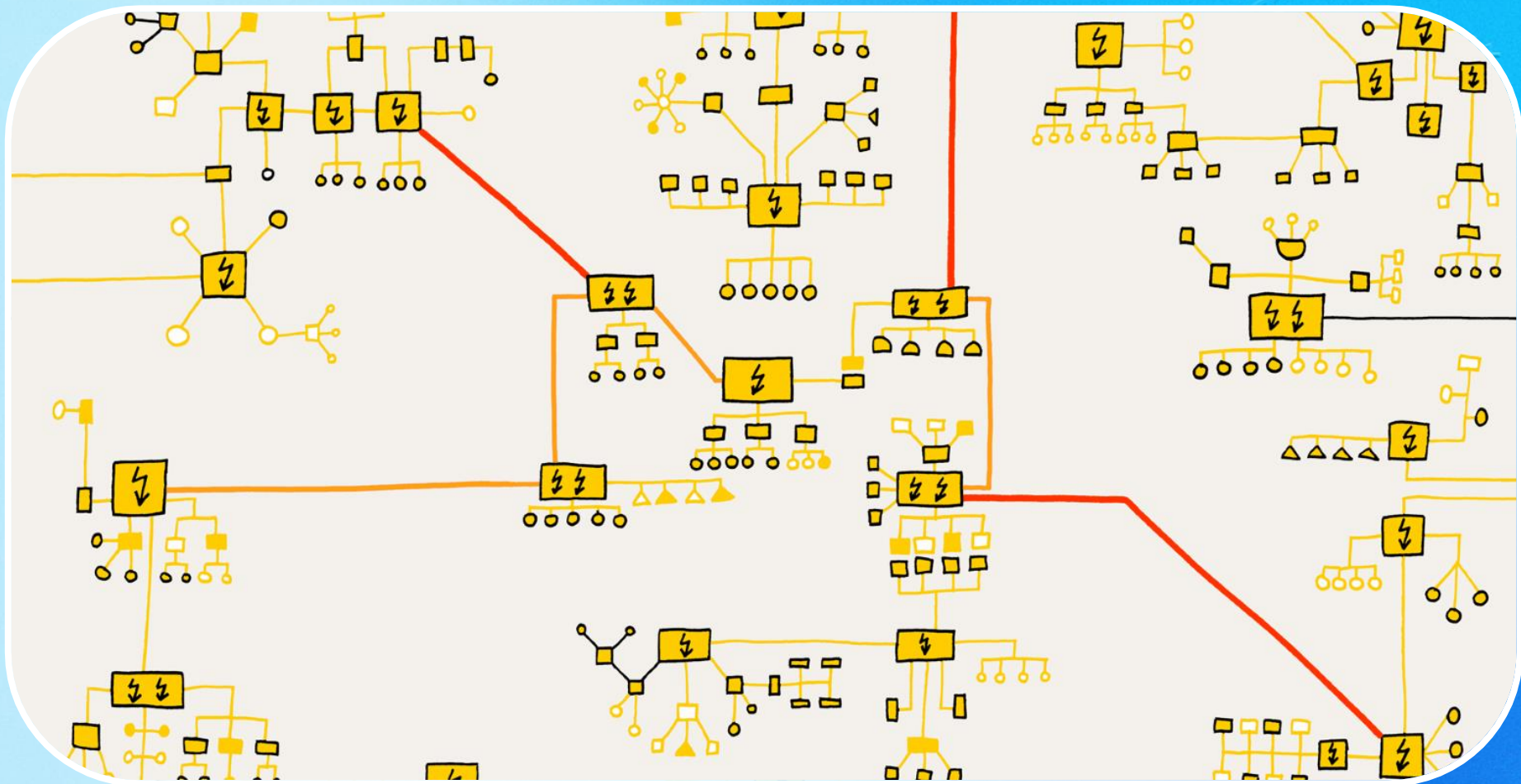




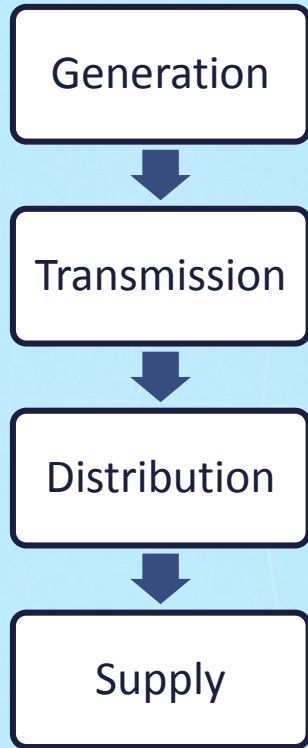








Value chain of electricity sector was:



- **Vertically integrated** companies
- Often public or private **monopolies**
- **Regulation** to safeguard public values

Value chain is changing

Vertical unbundling

- New players enter the scene

Competition in:

- Generation
- Supply

Monopolistic system operators:

- TSO
- DSO

Natural monopoly

Due to **high capital costs** infrastructure networks are often natural monopolies

However, new technologies might change that

→ *E.g. Competing networks in ICT sector*

Technological development

**Drives change in physical
and social reality**

Impact of renewables:

- Scale of power generation



Technological development

Drives change in physical
and social reality

Impact of renewables:

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Technological development

Drives change in physical
and social reality

Impact of renewables:

- Scale of power generation
- Emergence of 'prosumers'



Technological development



New governance structures needed to ensure grid stability

Mismatch

Mismatch between **evolution of infrastructures** and **requirements**

- Recall animation of **evolution** of the electricity infrastructure
- No master plan for integration
- Infrastructures are expected to function as **integrated** systems

The availability of infrastructures
is not a given.



Infrastructure needs to be improved



Infrastructure failures

Caused by, for example:

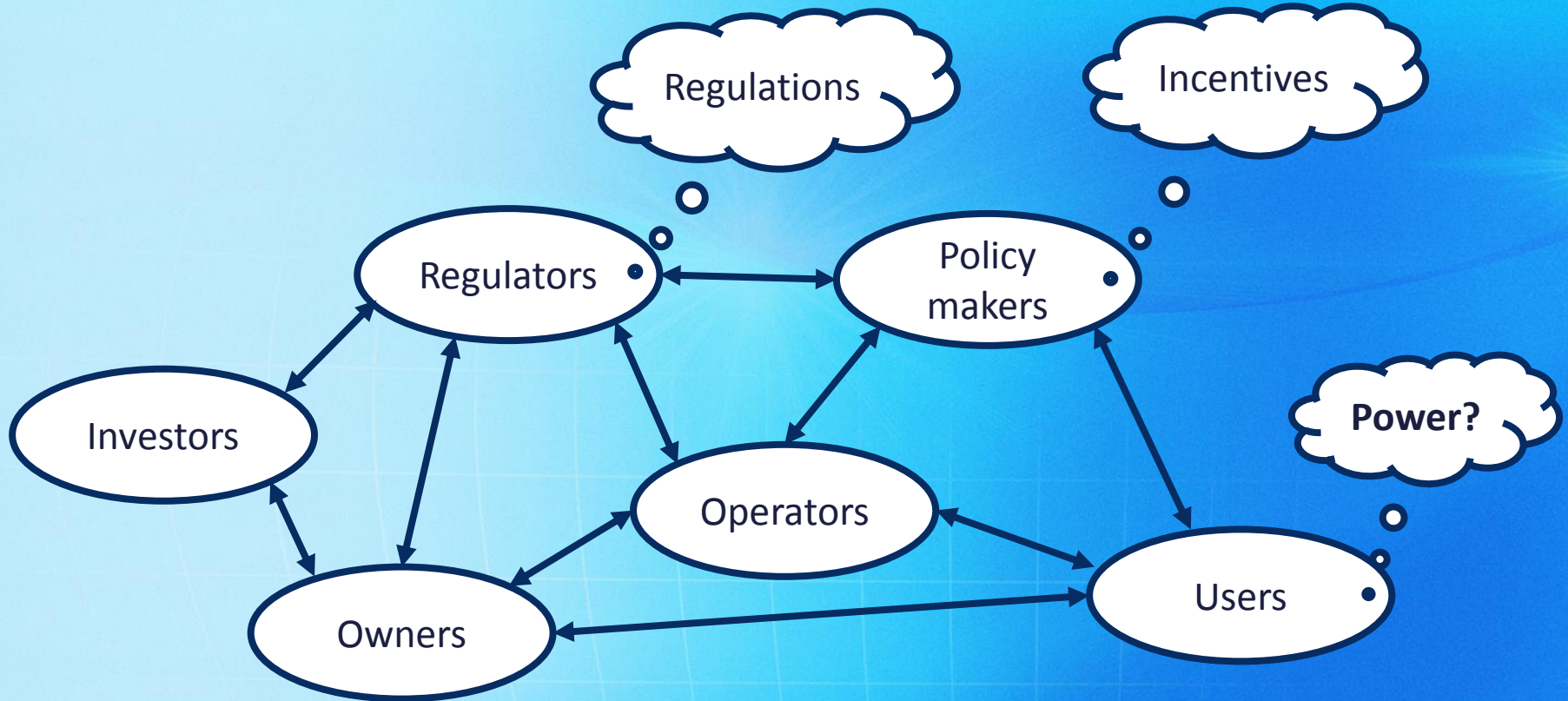
- Mundane causes like **wear and tear**
- A failure **far away** in the integrated infrastructure system
- A failure in another infrastructure on which it depends
 - **Interdependencies**

Next Generation Infrastructures

During the course we will:

“ Capture the socio-technical complexity using Complex Adaptive Systems theory ”

Dynamics in infrastructures



Thank you for your attention!

Please post any questions you may have
on our discussion forum

References

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The European electricity grid map was kindly provided by the **European Network of Transmission System Operators for Electricity** (ENTSO-E): <https://www.entsoe.eu/>

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Artwork on electricity network evolution by **Mark van Huystee**

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