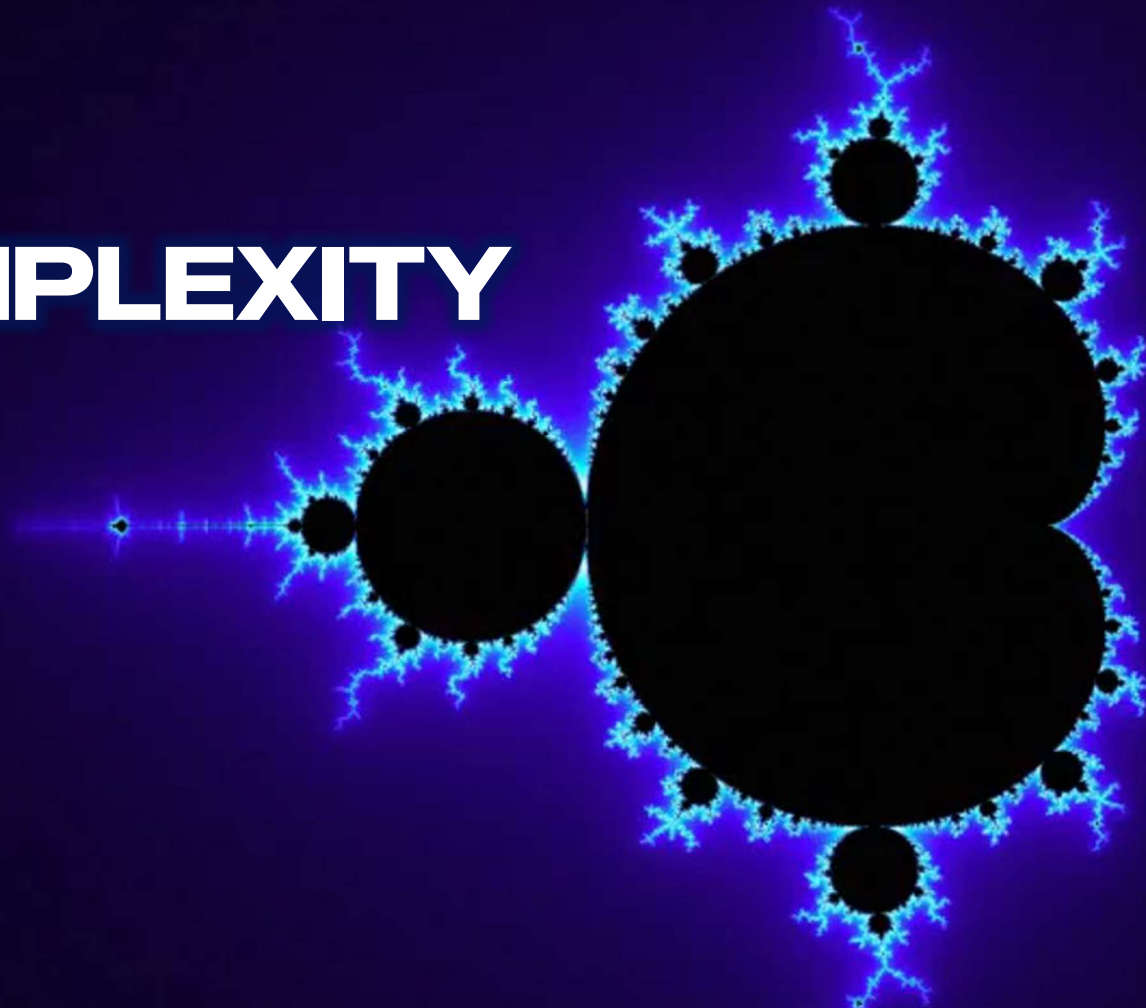




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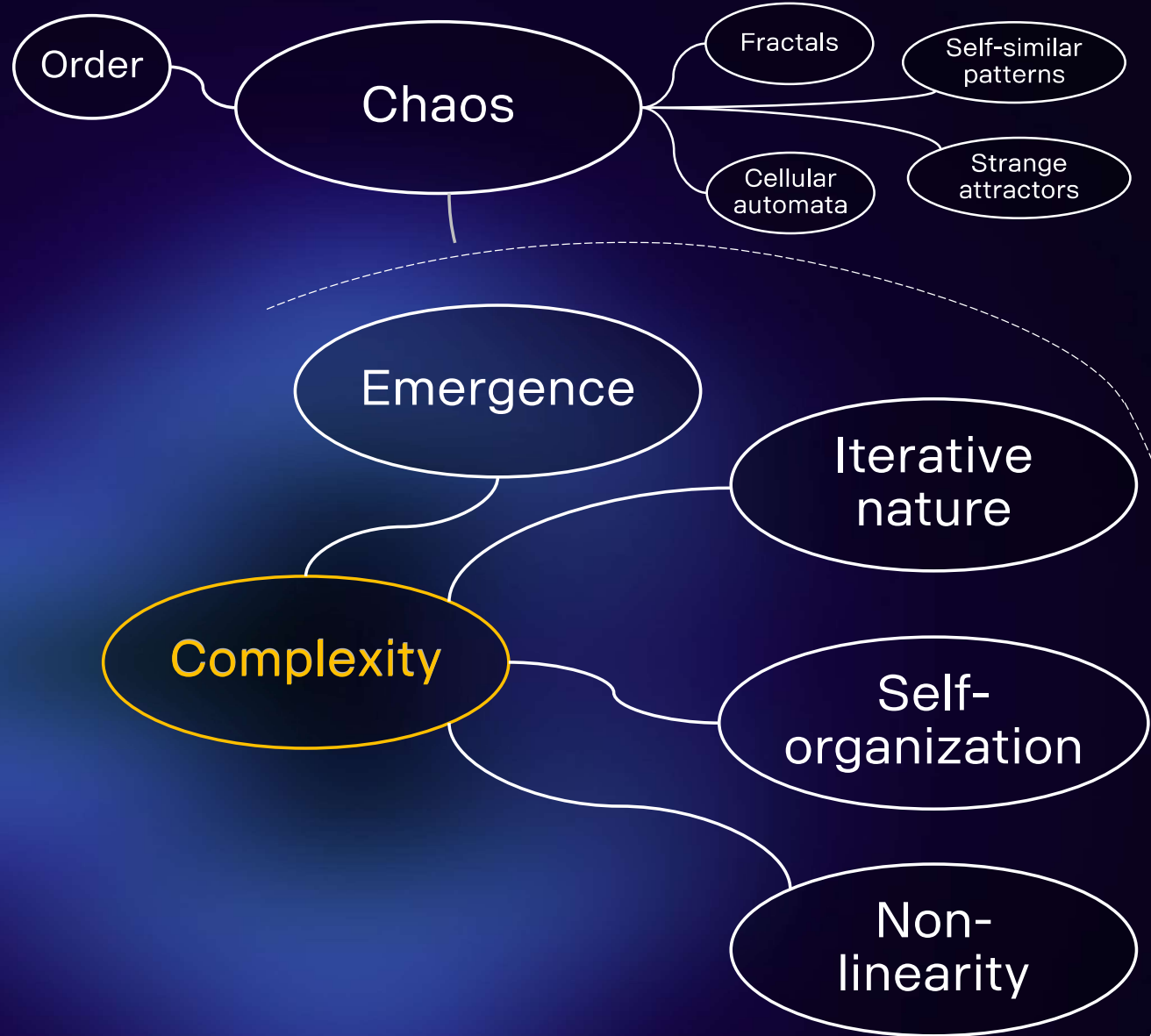
COMPLEXITY

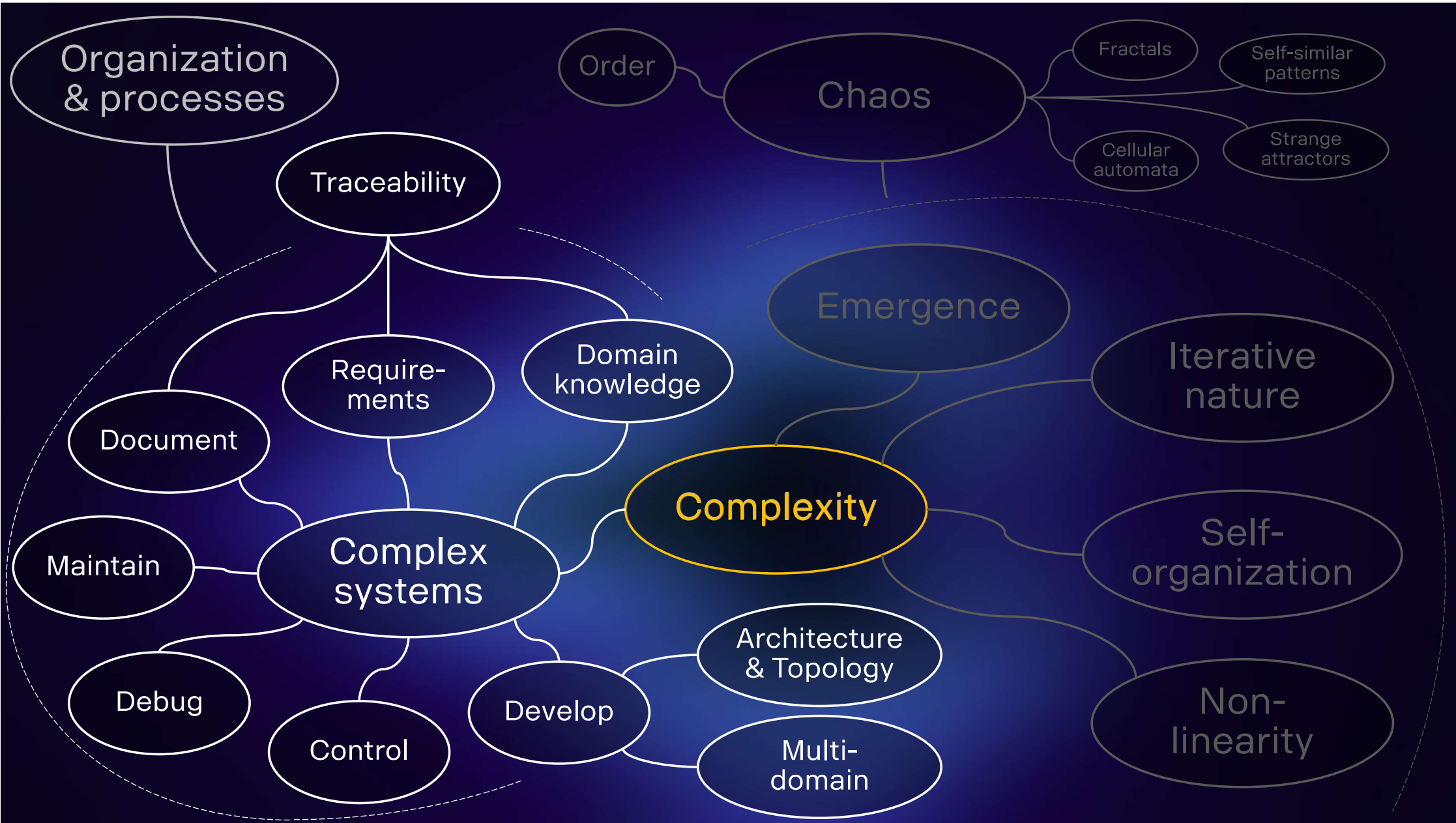
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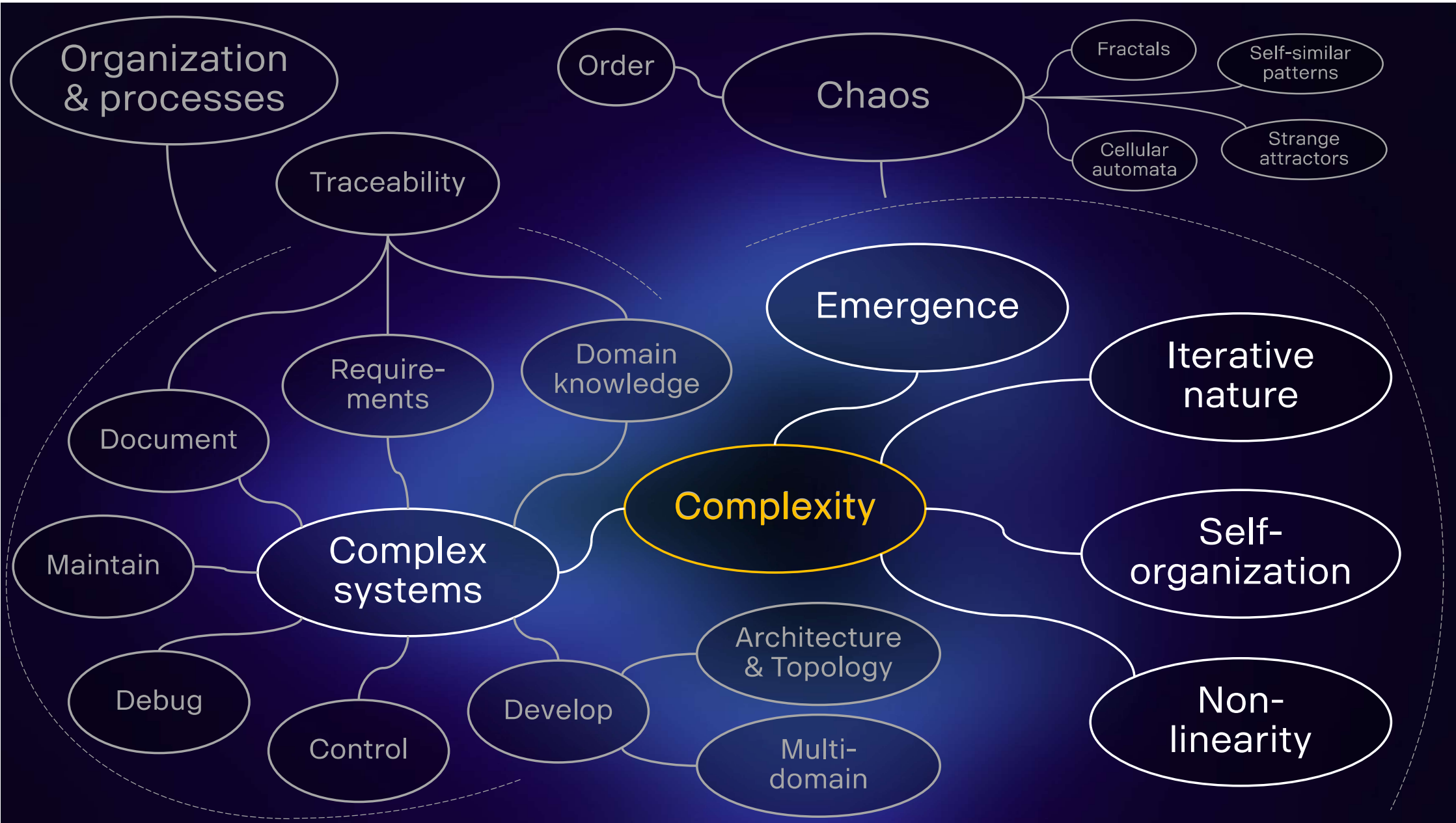


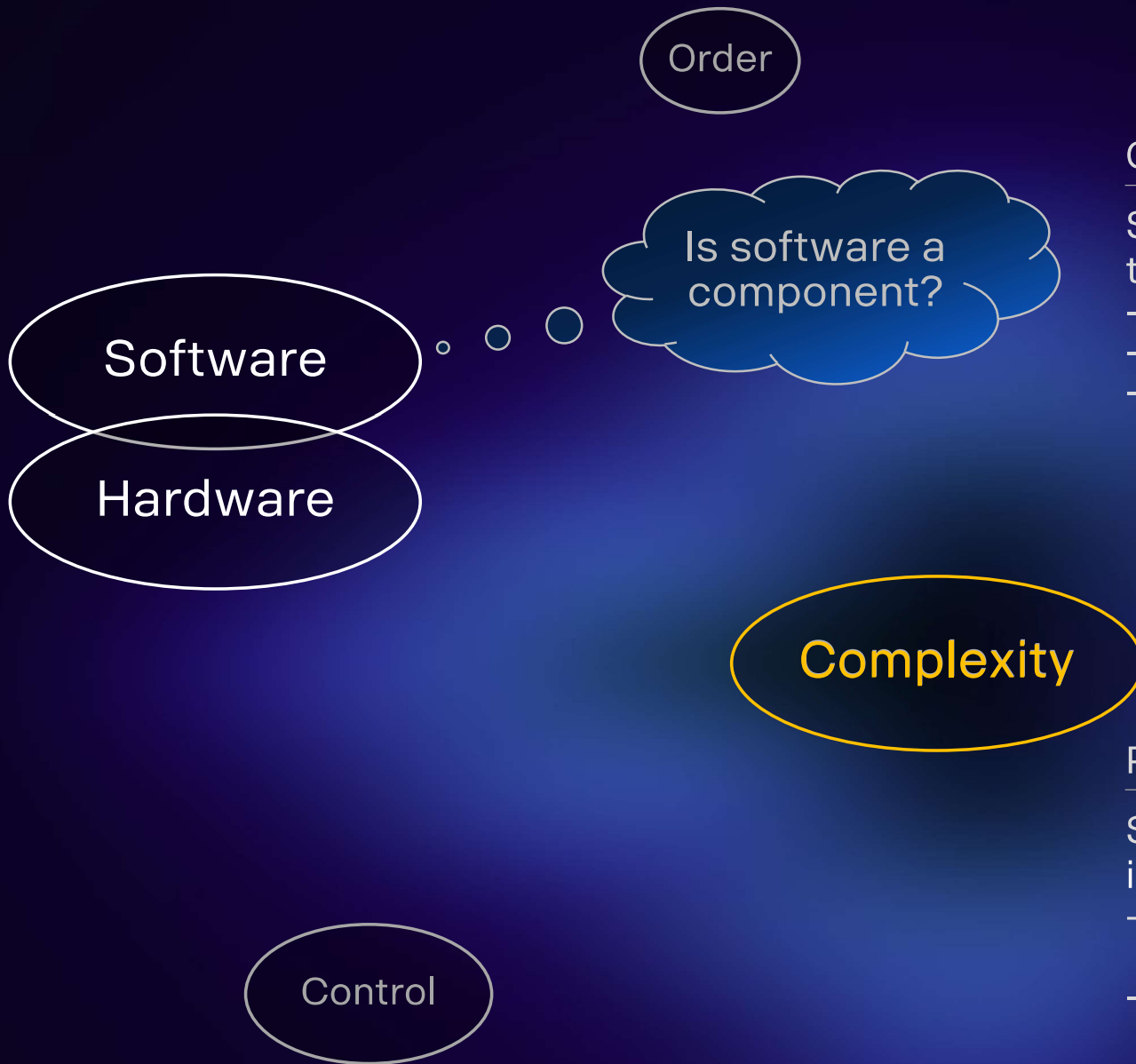
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It's not complex
just because
it's hard to do









Classic design theory by Pahl/Beitz:

Systems are composed of components that exchange

- matter
- energy
- information

Perhaps:

Software is a means to handle flow of information in order to control

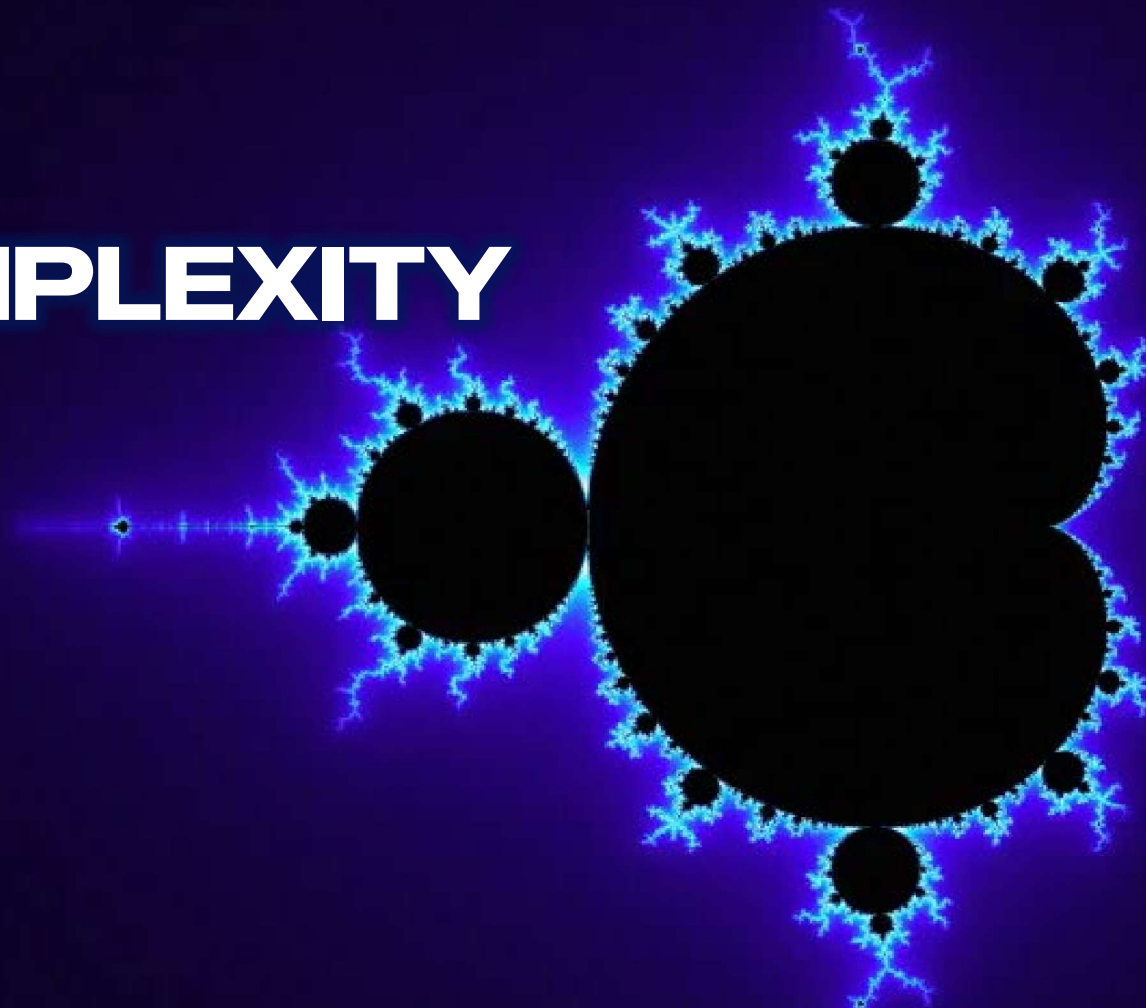
- the exchange of matter, energy and information
- and the behavior of components, subsystems and systems



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COMPLEXITY

2024-11-19



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COMPLEXITY



- **Everything depends on one's focus**
 - Everything is a system (at the right “zoom level”)
 - Practical to lump into components (“zoomed out”)
 - Details out of focus become boundary conditions

ZOOM IN **ZOOM OUT** REPEAT





ZOOM IN ZOOM OUT REPEAT

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https://media.scania.com/fotoweb/archives/5016/images/Mediaprovide_A/2017/17/1711/171101-416.tifr.info



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https://media.scania.com/fotoweb/archives/5016-Images/Mediaprovider_A/2017/171171710117101-222.tif/info



<https://www.yellowheadaggregates.ca/wp-content/uploads/2018/01/Yellowhead-Aggregates-Sand-Gravel.jpg>

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ZOOM IN **ZOOM OUT** REPEAT

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TRANSPORT SYSTEM & ENERGY SYSTEM

- Convergence
- Federation of networks (rather than monolithic)
- Contextual control needed

- Sensors!
- Actuators as sensors
- Models as sensors ("virtual sensors")

- ...at all zoom levels
- ...all the way up to the vehicle as a sensor in the transport & energy system
- Connected, collaborative



SAAB





<https://www.iotworldtoday.com/transportation-logistics/how-smart-infrastructure-industry-collaboration-is-driving-the-future-of-connected-vehicle-technology>

CONTEXTUAL CONTROL

WHY DOES **CONTEXT** MATTER?

WHAT IS **INFORMATION**?



CONTEXTUAL CONTROL

SIGNALS

NATURAL PHENOMENA



SIGNALS

CONTEXTUAL CONTROL

DATA

SIGNALS **IN** CONTEXT



CONTEXTUAL CONTROL INFORMATION

SIGNALS



DATA



DATA **IN** CONTEXT



SIGNALS



DATA



INFORMATION

CONTEXTUAL CONTROL KNOWLEDGE

INFORMATION **IN** CONTEXT



CONTEXTUAL CONTROL WISDOM

SIGNALS



DATA



INFORMATION



KNOWLEDGE



KNOWLEDGE **IN CONTEXT**



CONTEXTUAL CONTROL



SIGNALS



DATA



INFORMATION



KNOWLEDGE



WISDOM

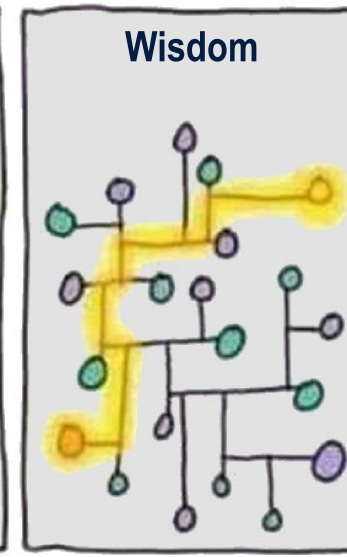
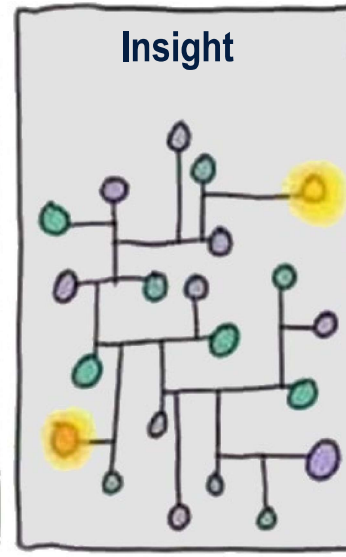
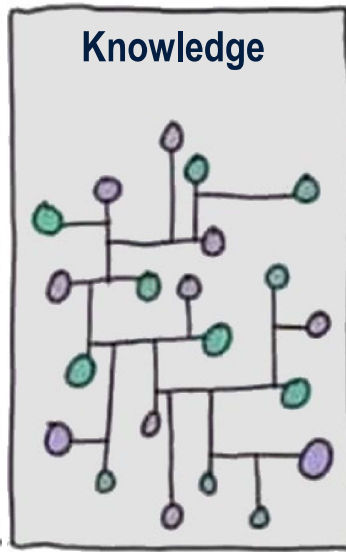
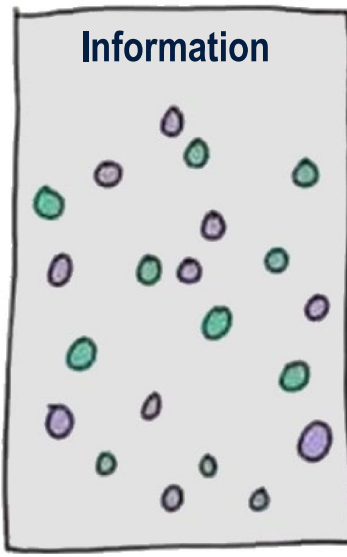
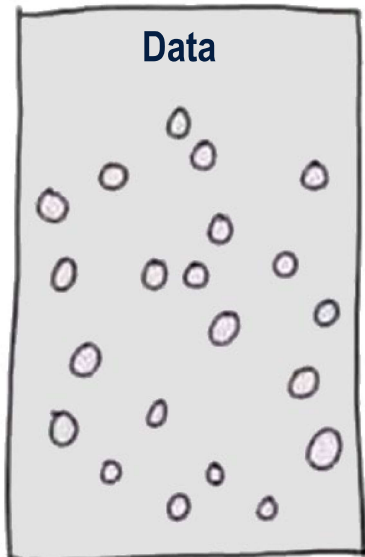


LEVEL OF
CONTEXT

CONTEXT



INNOVATION



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TRANSPORT SYSTEM & ENERGY SYSTEM

- Convergence
- Federation of networks (rather than monolithic)
- Contextual control needed
- Sensors!
- Actuators as sensors
- Models as sensors ("virtual sensors")
- ...at all zoom levels
- ...all the way up to the vehicle as a sensor in the transport & energy system
- Connected, collaborative

73



THANK YOU!

https://www.iotworldtoday.com/transportation-logistics/how-smart-infrastructure-industry-collaboration-is-driving-the-future-of-connected-vehicle-technology



RENO.FILLA@SCANIA.COM

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