Design Patterns: Practice

John Beverley

Assistant Professor, *University at Buffalo*
Co-Director, National Center for Ontological Research
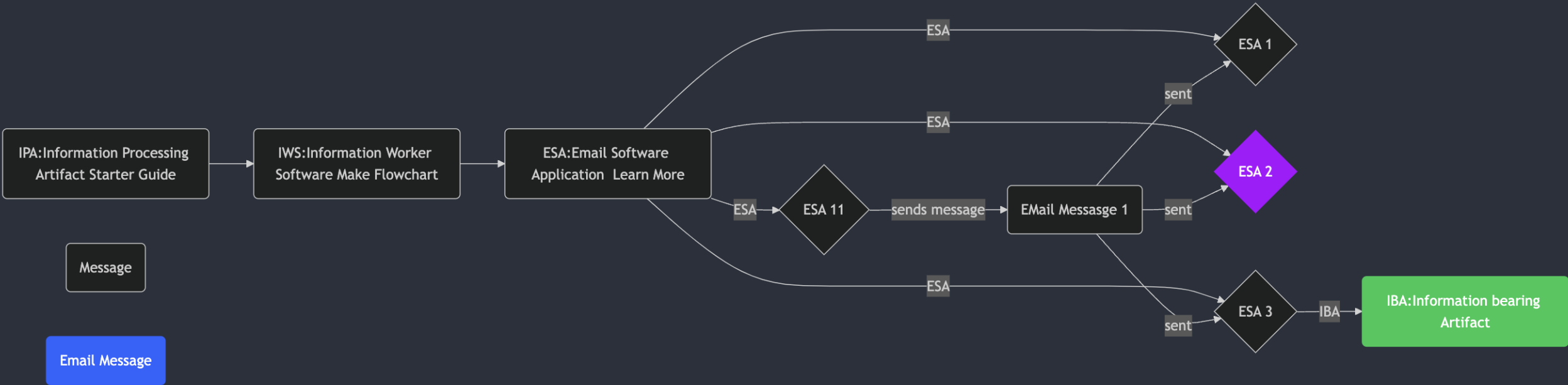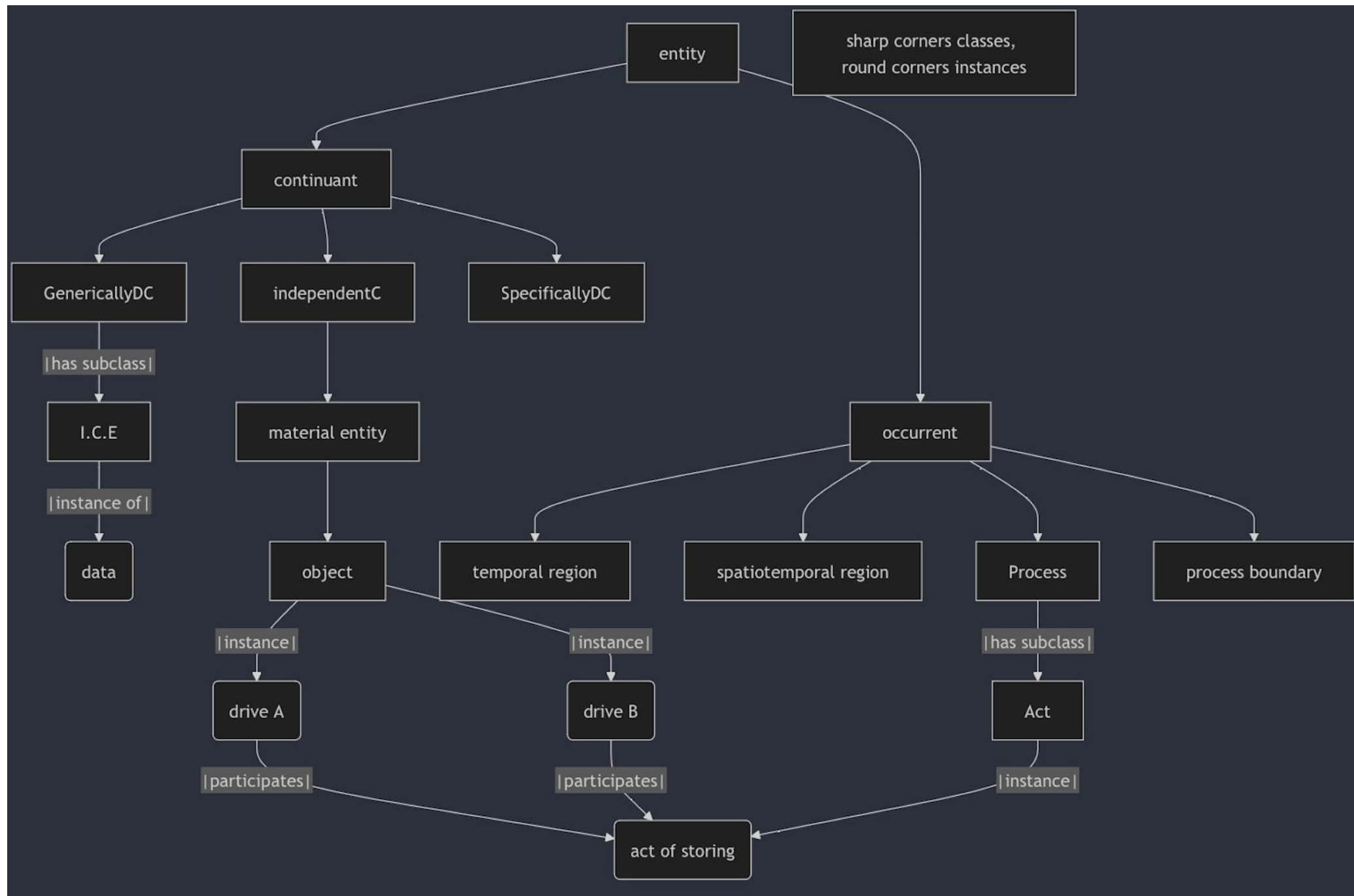Affiliate Faculty, *Institute of Artificial Intelligence and Data Science*
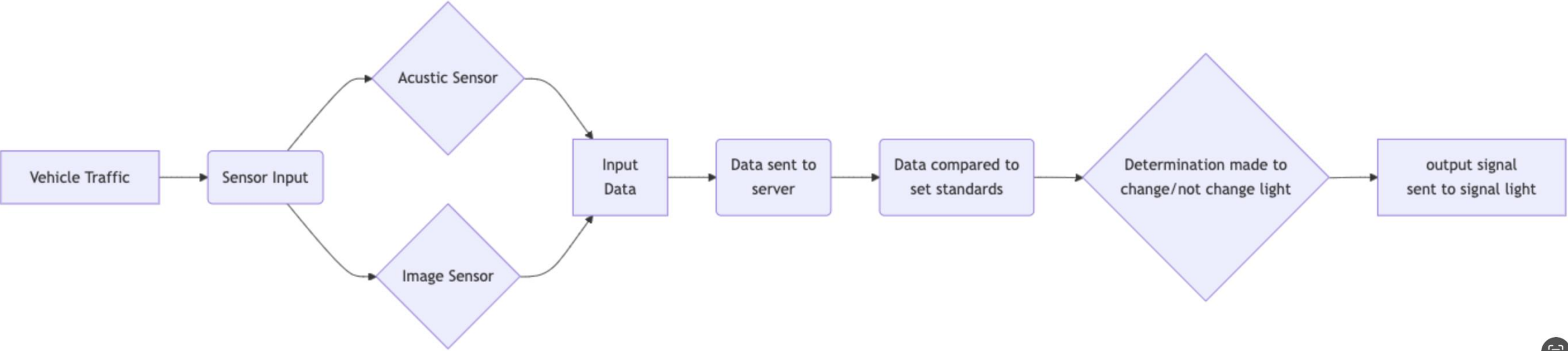
Outline

- Review of Submissions
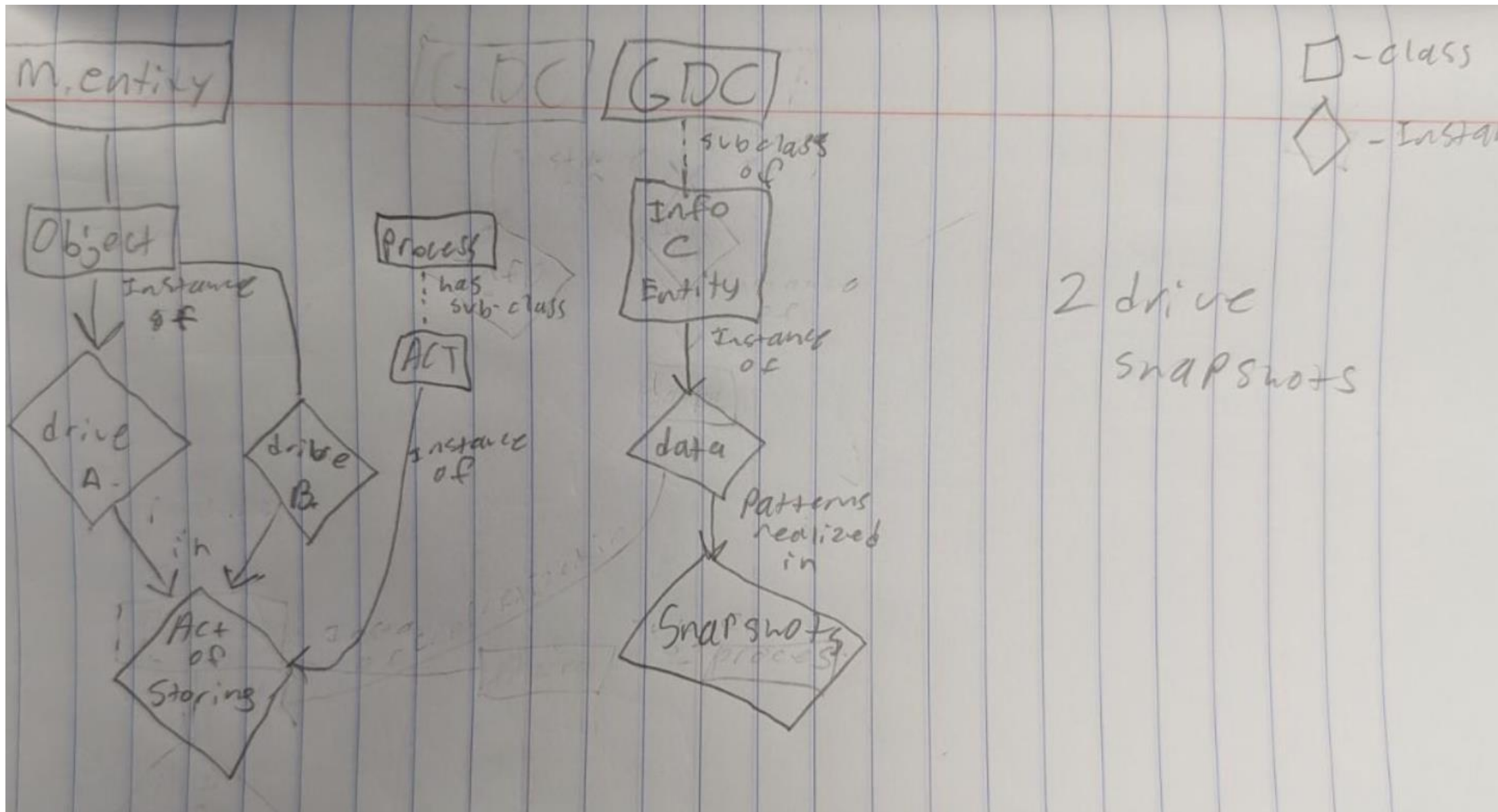
- Refresher on Guidelines

- Practice, Practice, Practice

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```
entity                    sharp corners classes,
                          round corners instances

            continuant

GenericallyDC    independentC    SpecificallyDC

|has subclass|

    I.C.E        material entity              occurrent

|instance of|

    data         object    temporal region   spatiotemporal region   Process   process boundary

        |instance|        |instance|                          |has subclass|

          drive A           drive B                               Act

       |participates|    |participates|                        |instance|

                        act of storing
```

M. entity

C-DC   GDC

□ —class
◇ — Insta

subclass of

Object

Info C Entity

Process

has sub-class

ACT

Instance of

Instance of

Instance of

drive A

drive B

data

2 drive snapshots

in

Act of Storing

Patterns realized in

Snapshots

Entity

Continuant

Independent Continuant

is_a

Machine

has_property

Dependent continuant

Occurant

process

Information Content entity → Email

Recurring

is reused

Sending

Involves

Sender

Owned by

Machine 1

Participates in

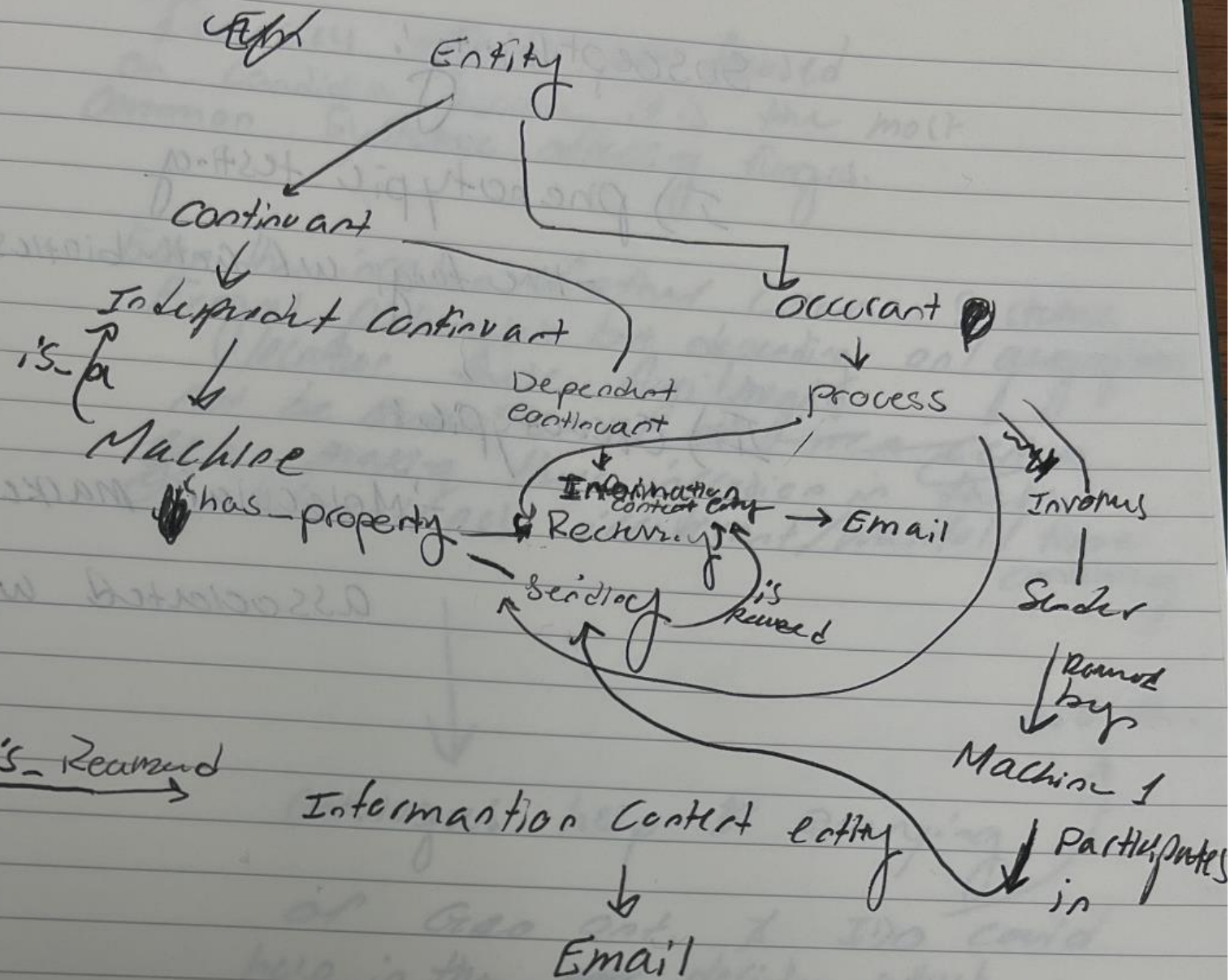decurring is_Reacured

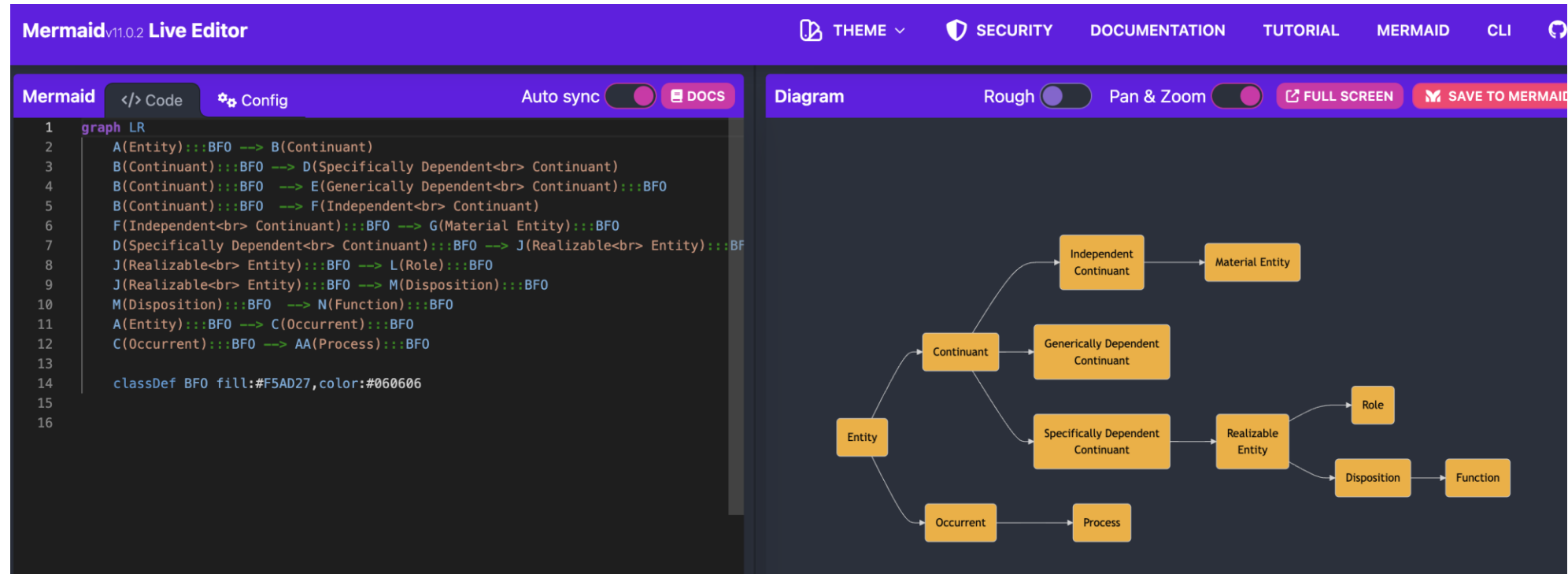Sending

Information Content entity

Email

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Rules of Thumb

- When building a design pattern, describe:

1. Material entities within scope, i.e. **Material Entity**
2. Qualities these material entities have, i.e. **Quality**
3. What these material entities can do, i.e. **Process**
4. What properties underwrite what they can do, i.e. **Realizable Entity**
5. Where these material entities and their boundaries are located, e.g. **Immaterial Entity**
6. When these entities exist, e.g. **Temporal Region**
7. Information we use to talk about 1-6, i.e. **Generically Depedent Continuant**

Mermaid v11.0.2 Live Editor

Mermaid   </> Code   ⚙ Config   Auto sync ⬤   DOCS

```
1   graph LR
2       A(Entity):::BFO --> B(Continuant)
3       B(Continuant):::BFO --> D(Specifically Dependent<br> Continuant)
4       B(Continuant):::BFO  --> E(Generically Dependent<br> Continuant):::BFO
5       B(Continuant):::BFO  --> F(Independent<br> Continuant)
6       F(Independent<br> Continuant):::BFO --> G(Material Entity):::BFO
7       D(Specifically Dependent<br> Continuant):::BFO --> J(Realizable<br> Entity):::BF
8       J(Realizable<br> Entity):::BFO --> L(Role):::BFO
9       J(Realizable<br> Entity):::BFO --> M(Disposition):::BFO
10      M(Disposition):::BFO  --> N(Function):::BFO
11      A(Entity):::BFO --> C(Occurrent):::BFO
12      C(Occurrent):::BFO --> AA(Process):::BFO
13
14      classDef BFO fill:#F5AD27,color:#060606
15
16
```

Diagram   Rough ⬤   Pan & Zoom ⬤   ⤢ FULL SCREEN   SAVE TO MERMAID

Flowchart

Sequence Diagram

Class Diagram

State Diagram

Entity Relationship Diagram

User Journey

Gantt

Pie Chart

Quadrant Chart

Requirement Diagram

Play around in the live editor:
https://mermaid.live/edit

Navigate to the helpful tutorials:
https://mermaid.js.org/ecosystem/tutorials.html

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- Review of Submissions

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- Practice, Practice, Practice

Competency Question

Towards a Cyber Information Ontology

David LIMBAUGH[a], Mark JENSEN[a,b], and John BEVERLEY[a,c,1]

[a] *National Center for Ontological Research*
[b] *Customs and Border Protection*
[c] *Institute for Artificial Intelligence and Data Science*

Abstract. This paper introduces a set of terms that are intended to act as an interface between cyber ontologies (like a file system ontology or a data fusion ontology) and top- and mid-level ontologies, specifically Basic Formal Ontology and the Common Core Ontologies. These terms center on what makes cyberinformation management unique: numerous acts of copying items of information, the aggregates of copies that result from those acts, and the faithful members of those aggregates that represent all other members.

Keywords. ontology, information, cyber information, Basic Formal Ontology, Common Core Ontologies

What entities are involved in the spread of information from one information bearer to another?

Competency Question

Towards a Cyber Information Ontology

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SELECT AND MODEL ONE OF THE FOLLOWING

An email is sent from a laptop to a personal computer.

Information stored on a solid-state drive is displayed on a monitor.

A file system snapshot is stored on a backup drive.

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What entities are involved in the spread of information from multi-modal information bearers to a target?

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SELECT AND MODEL ONE OF THE FOLLOWING

Acoustic and image traffic data are sent from field sensors to a controller which adjusts the timing of traffic light changes.

Bathymetric, meteorological, and temperature data are sent to a dataset for tracking marine life.

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What relationship exists among information bearers participating in the spread of information from a source?

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SELECT AND MODEL ONE OF THE FOLLOWING

Relationships among 10 machines that receive an email from a single machine.

Relationships among distinct drives storing identical snapshots of a system.

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What entities are involved in spreading information according to standard transmission protocols?

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A password is submitted over an encrypted Secure Socket Layer connection.

A password is submitted over an unencrypted HTTP connection.

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What relationships exist among information entities under version control which correspond to a single, current, version?

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What relationships exist among information entities under version control which correspond to a single, current, version?

SELECT AND MODEL ONE OF THE FOLLOWING

Two authors collaborating on a paper using Google Docs.

A developer accessing code on a GitHub repository, from distinct machines.

BFO: Basic Formal Ontology

J. Neil Otte[1], John Beverley[2], and Alan Ruttenberg[3]

[1]Johns Hopkins University Applied Physics Laboratory
[2]Northwestern University
[3]University at Buffalo

CASE 6: *A marriage is a contract that is regulated by civil and social constraints. These constraints can change but the meaning of marriage continues over time.*
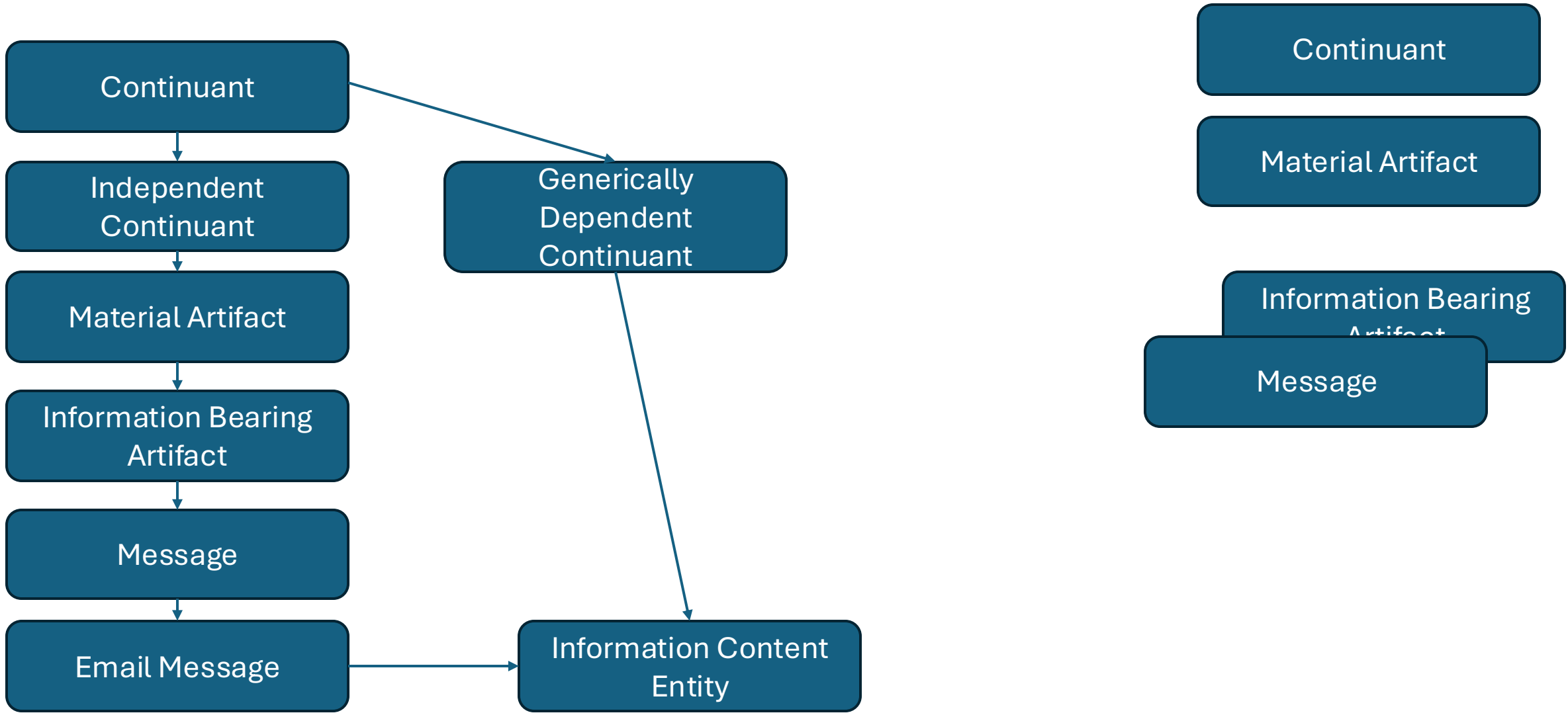
Marriage License

- In the U.S., states impose *eligibility requirements on individuals*, e.g. individuals entering marriage must be able to consent and above a certain age.

- States also impose *eligibility requirements on the couple*, e.g. one member of the union must be a U.S. citizen

Marriage License

- Before 1967, several states prohibited interracial marriage; until 2015 several prohibited same-sex marriage.

- Governments grant *obligations to spouses* - married partners bear financial responsibilities to one another - and *privileges* - married partners are not required to testify against one another in court.

CASE 6: *A marriage is a contract that is regulated by civil and social constraints. These constraints can change but the meaning of marriage continues over time.*
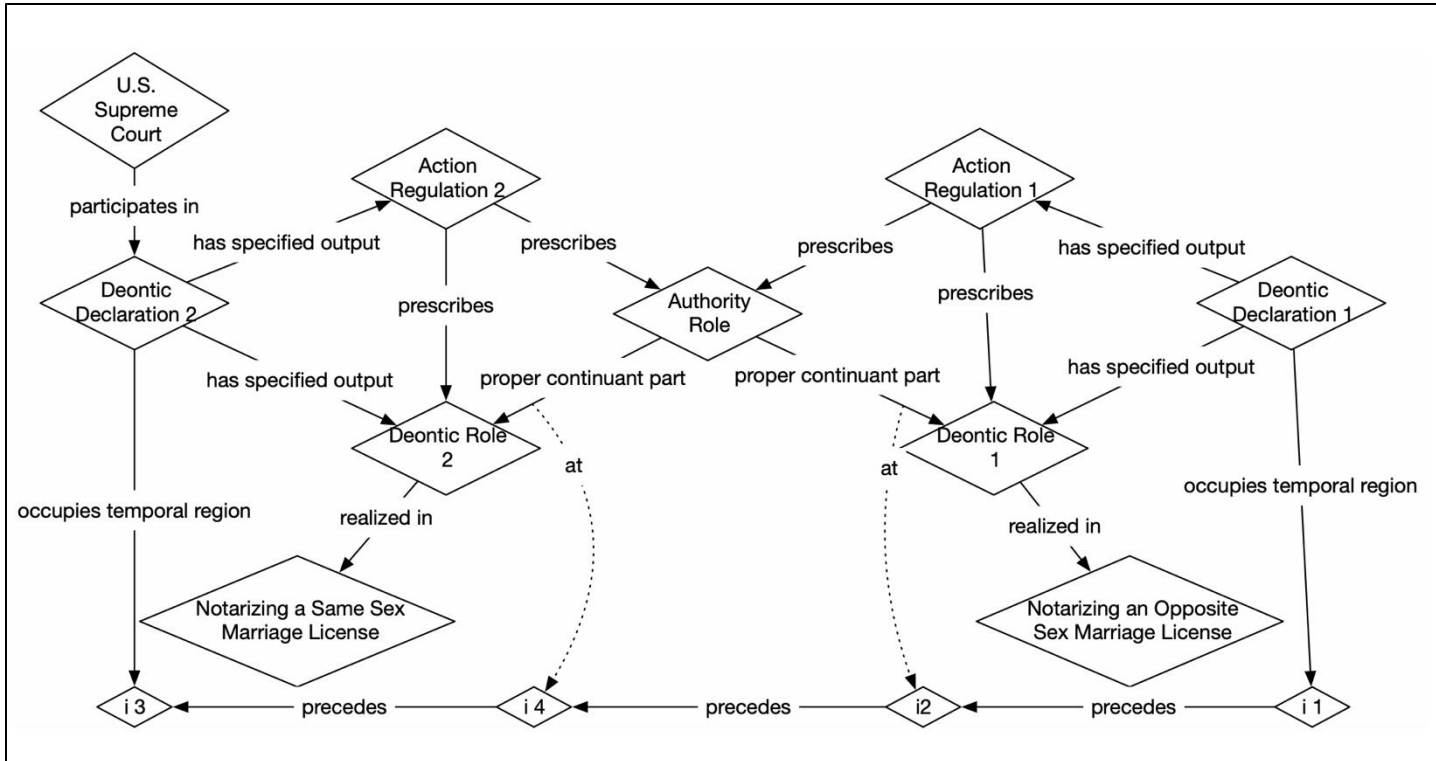
Class	Definition or Elucidation
document	a collection of information content entities intended to be understood together as a whole
government	an organization that exercises executive, legislative, or judicial authority over a region
marriage license	a document issued by a government, which legally binds agents as spouses, and invests them with associated **instances of** deontic role
deontic declaration	a social act that creates or **revokes** a deontic role
social act	a planned process that is carried out by a person or an organization, and is self-generated, directed towards another person or an aggregate of persons, an organization or an aggregate of organizations, and that needs to be perceived
deontic role	a role that **inheres in** a person and that is externally grounded in the normative expectations that other persons within a social context have concerning how that person should behave
action regulation	an information content entity that **prescribes** an act as required, prohibited, or permitted, and is the **output of** an act that **realizes** some authority role
authority role	a role that is **realized** by actions that create, modify, transfer, or eliminate action regulations or other authority roles, and **inheres in** an agent in virtue of collective acceptance of that agent's ability to issue binding directives

Appendix

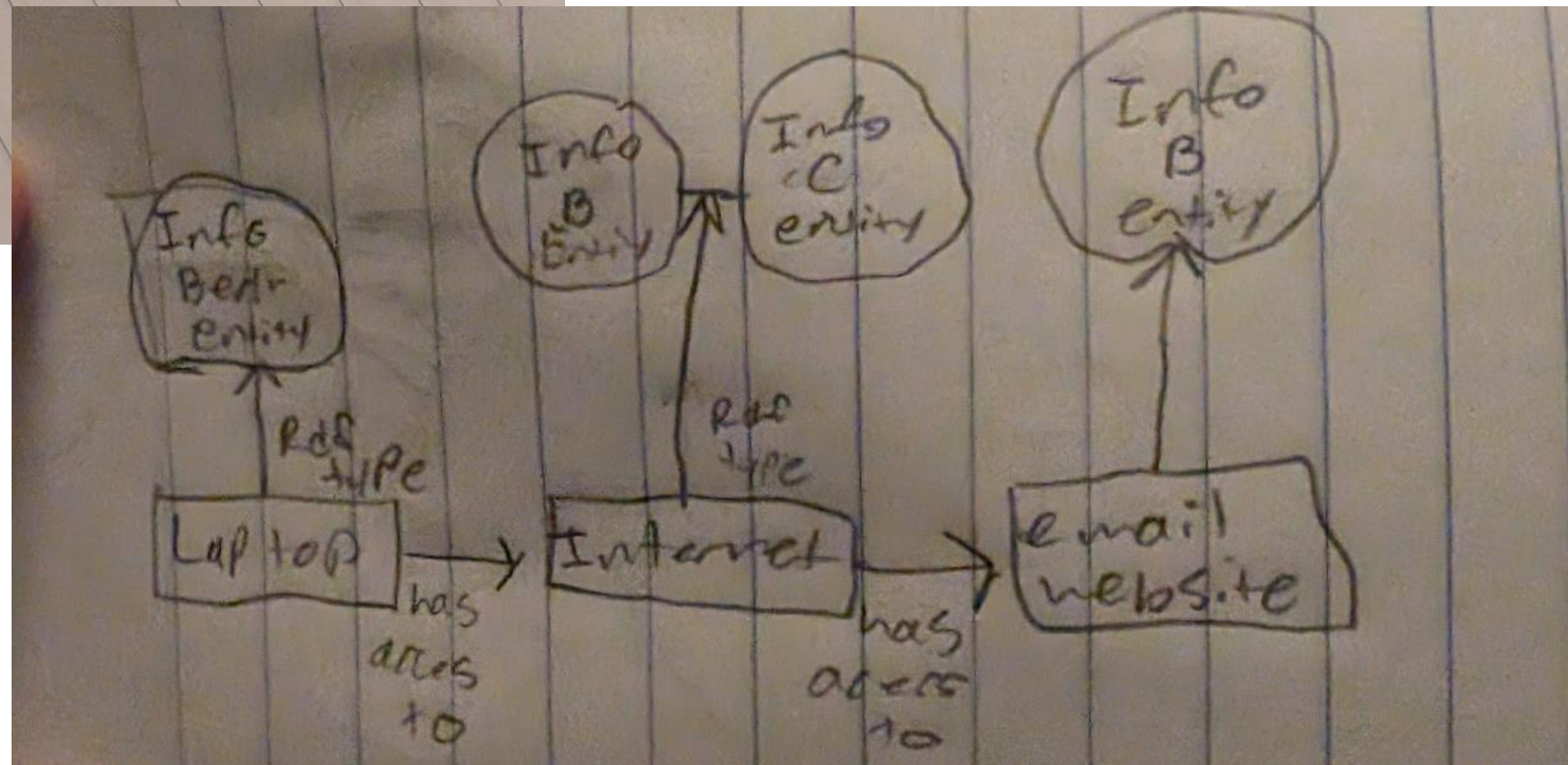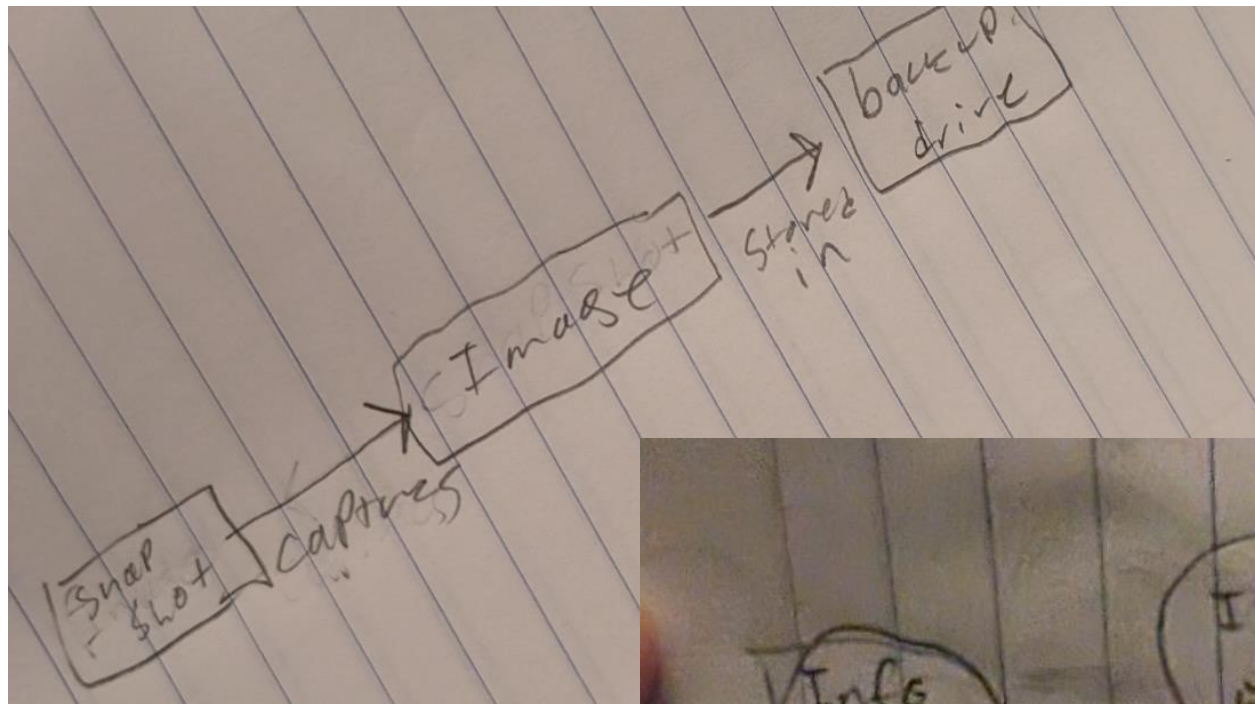- Previous design patterns from in-class exercises to follow
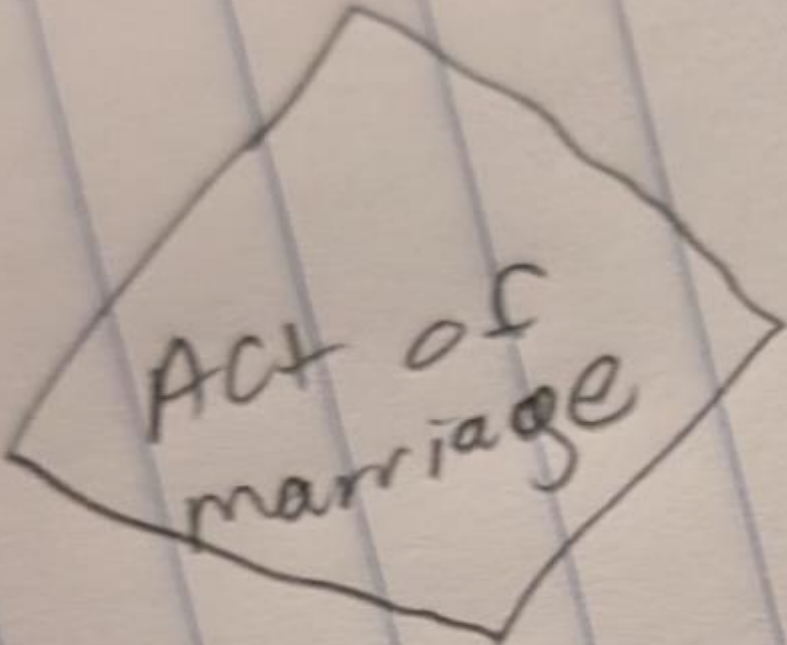
Occurrent
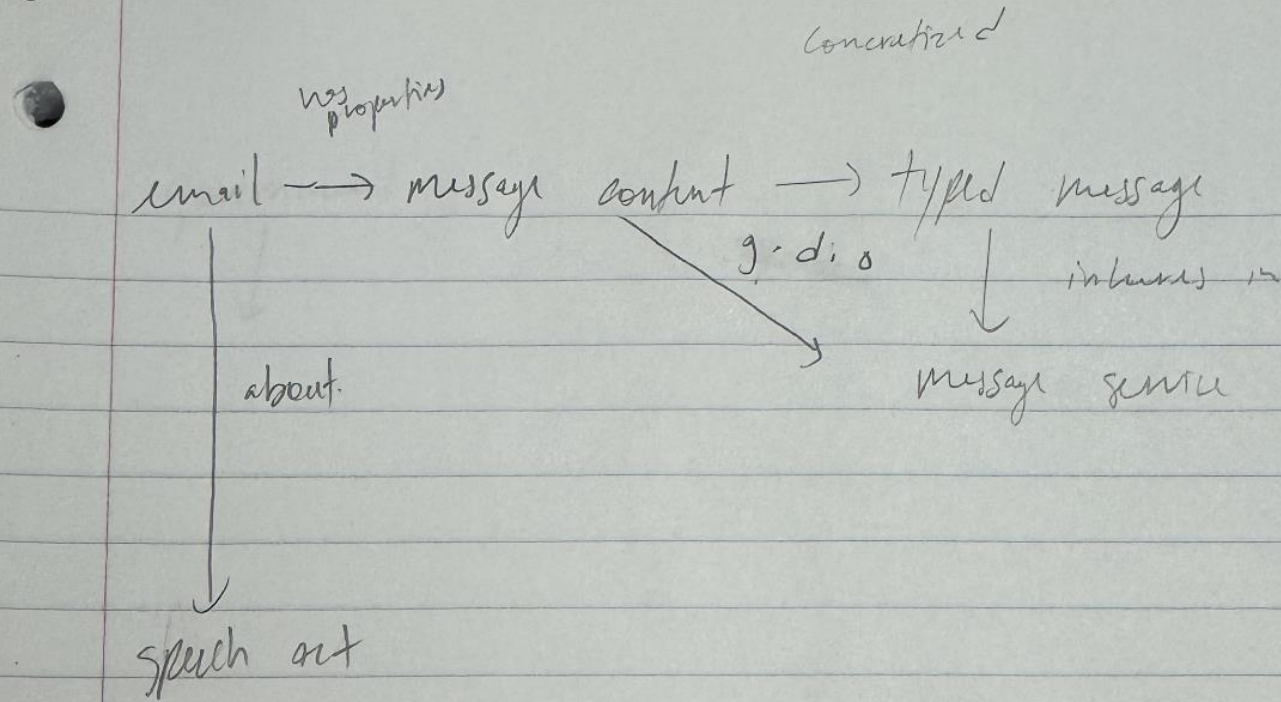
Process

Planned Act

Social Act

Act of Ceremony

Email Message
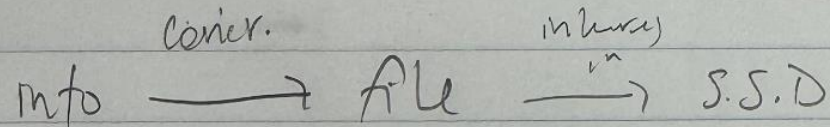
Snap shot → captures → Image → stored in → back up drive

Info Betr entity ← Rdf type — Laptop → has acces to → Internet

Info B Entity

Info C entity ← Rdf type — Internet → has acces to → email website → Info B entity

email model:

Concretized

has properties

email ──→ message content ──→ typed message

                             g. d. o   inheres in

about   message source

speech act

info
model   concr.   inheres

info ──→ file ──→ S.S.D

marriage

government

↓

Our group felt we needed a visual representation in order to create a knowledge graph and instead spent our time gathering resources. So, we do not have a knowledge graph to represent any of our thoughts.

We did not know where to start and perhaps were thinking too broadly and jumping to the too specific, too quickly.