Ontology Design Patterns in OceanLink and GeoLink

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OceanLink and GeoLink

OceanLink: NSF 2013-2014, $300k

GeoLink: NSF 2014-2016, $1.9M

        Building Blocks in the NSF EarthCube program

LDEO: Robert Arko, Suzanne Carbotte, Kerstin Lehnert

WHOI: Cynthia Chandler, Peter Wiebe,
        Lisa Raymond, Adam Shepherd

UCSB: Krzysztof Janowicz, Yingjie Hu

NCEAS: Mark Schildhauer, Matt Jones
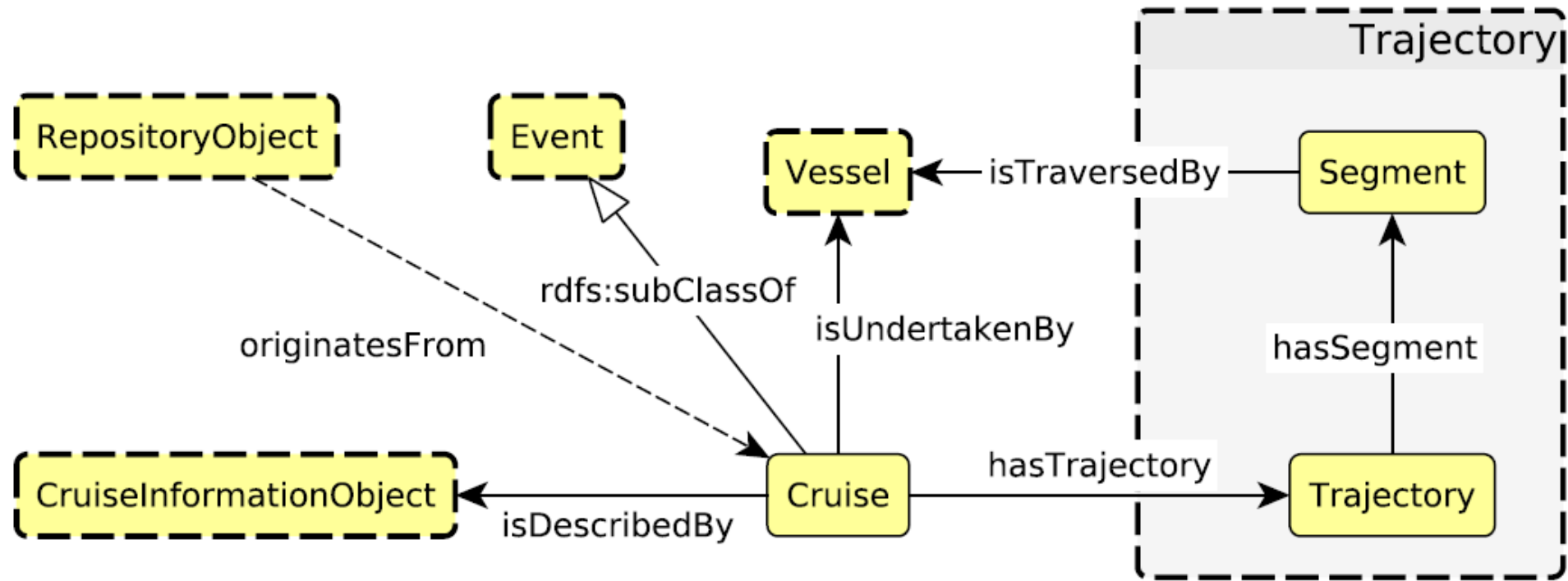
Ocean Leadership: Douglas Fils
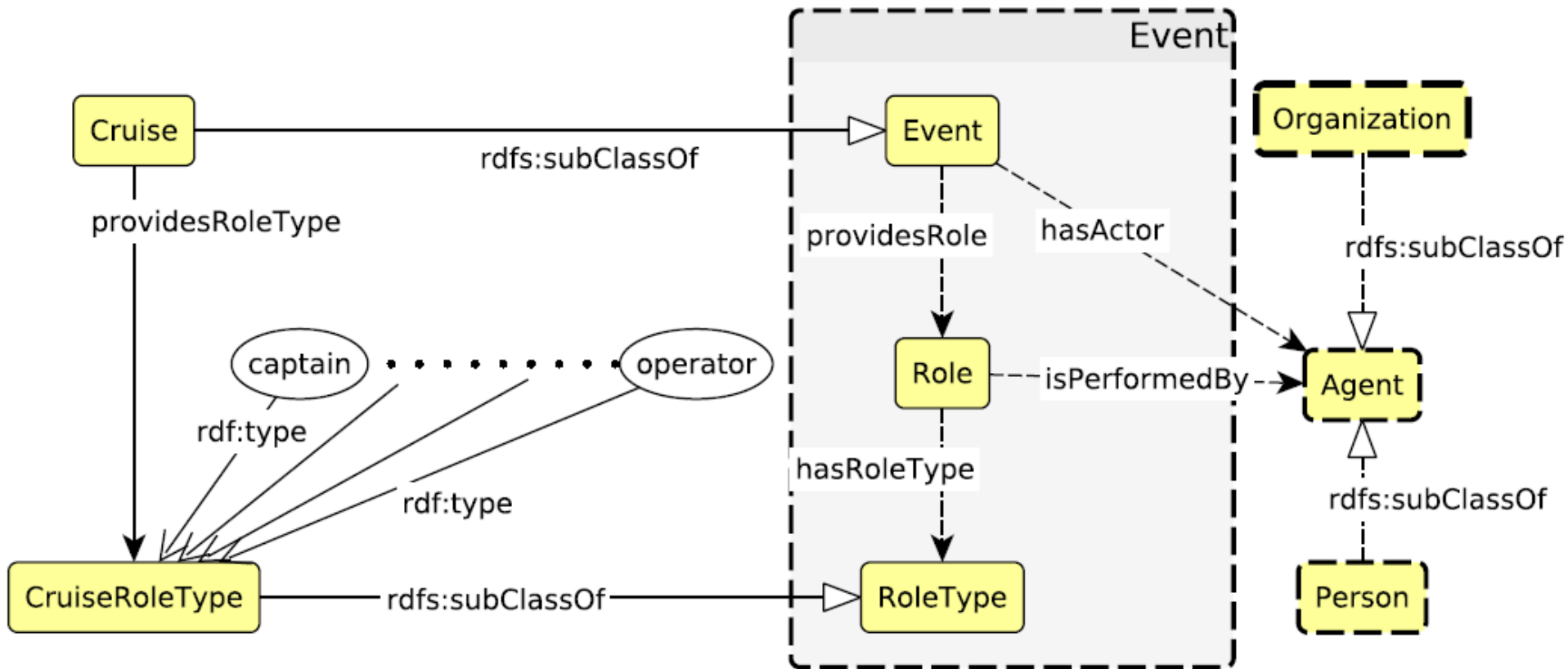
Marymount Univ: Thomas Narock

WSU: Pascal Hitzler, Michelle Cheatham,
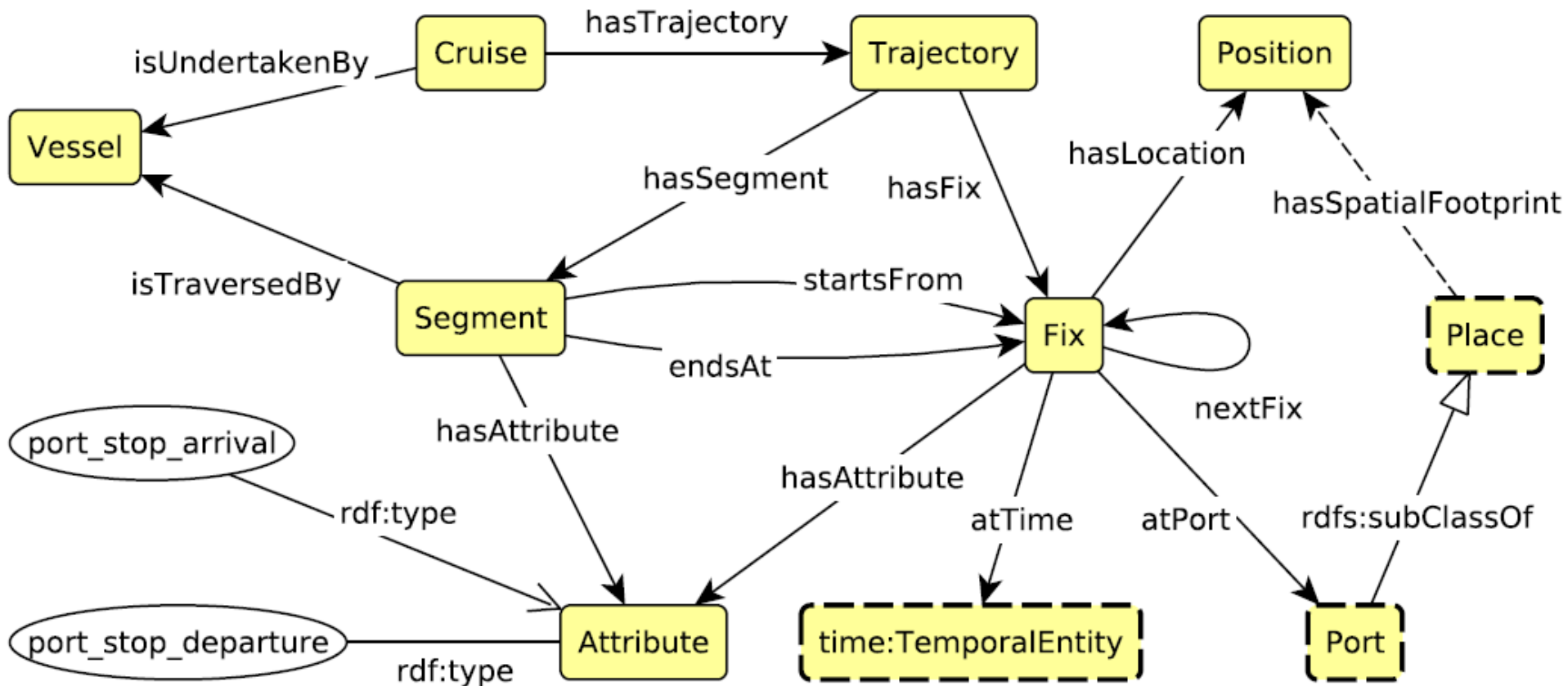   Adila Krisnadhi, Nazifa Karima

UMBC: Tim Finin
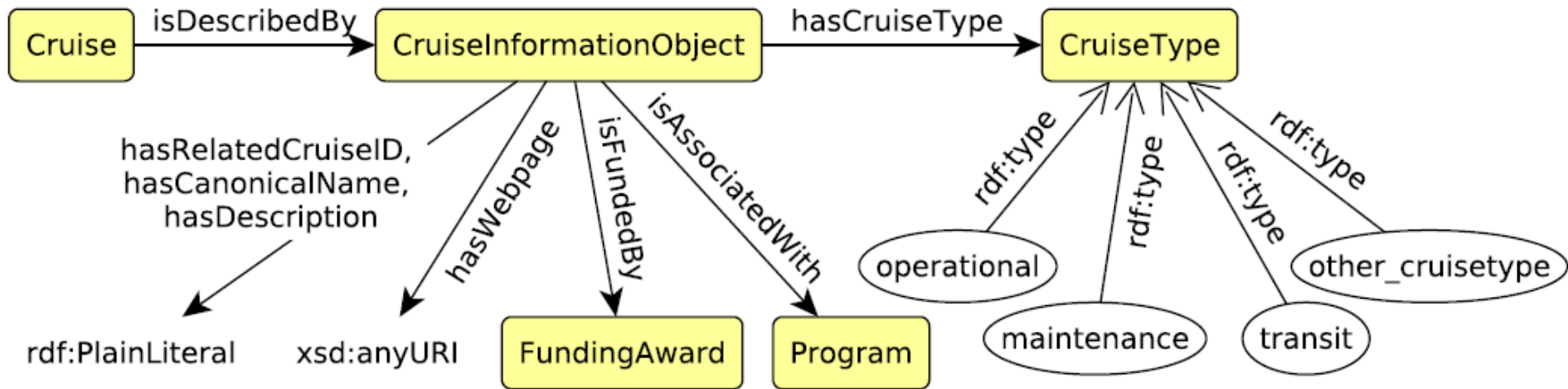
Rationales for using patterns

- **Strongly supportive of collaborative, inter-disciplinary modeling (focus on one central notion at a time)**

- **Keeping overview of a large continuously evolving ontology**

- **Open-ended use case: maximal flexibility of the modular approach for efficient adjustability**

- **Disruptive vision: plug- and playable ontology virtualization**

Roles (Cruise as Event)

Axiomatization (selection)

$$\text{Cruise} \sqsubseteq (=1 \text{ hasTrajectory.Trajectory}) \tag{13.1}$$

$$\text{Cruise} \sqsubseteq (=1 \text{ isUndertakenBy.Vessel}) \tag{13.2}$$

$$\text{Cruise} \sqsubseteq (=1 \text{ isDescribedBy.InformationObject}) \tag{13.3}$$

$$\text{InformationObject} \sqsubseteq (=1 \text{ isDescribedBy}^-.\text{Cruise}) \tag{13.4}$$

$$\text{hasTrajectory}^- \circ \text{isUndertakenBy} \sqsubseteq \text{isTraveledBy} \tag{13.5}$$

$$\exists \text{hasTrajectory.Trajectory} \sqsubseteq \text{Cruise} \tag{13.6}$$

$$\text{Cruise} \sqsubseteq \forall \text{hasTrajectory.Trajectory} \tag{13.7}$$

$$\exists \text{isUndertakenBy.Vessel} \sqsubseteq \text{Cruise} \tag{13.8}$$

$$\text{Cruise} \sqsubseteq \forall \text{isUndertakenBy.Vessel} \tag{13.9}$$

$$\exists \text{isDescribedBy.InformationObject} \sqsubseteq \text{Cruise} \tag{13.10}$$

$$\text{Cruise} \sqsubseteq \forall \text{isDescribedBy.InformationObject} \tag{13.11}$$

$$\exists \text{isTraveledBy.Vessel} \sqsubseteq \text{Trajectory} \tag{13.12}$$

$$\text{Trajectory} \sqsubseteq \forall \text{isTraveledBy.Vessel} \tag{13.13}$$
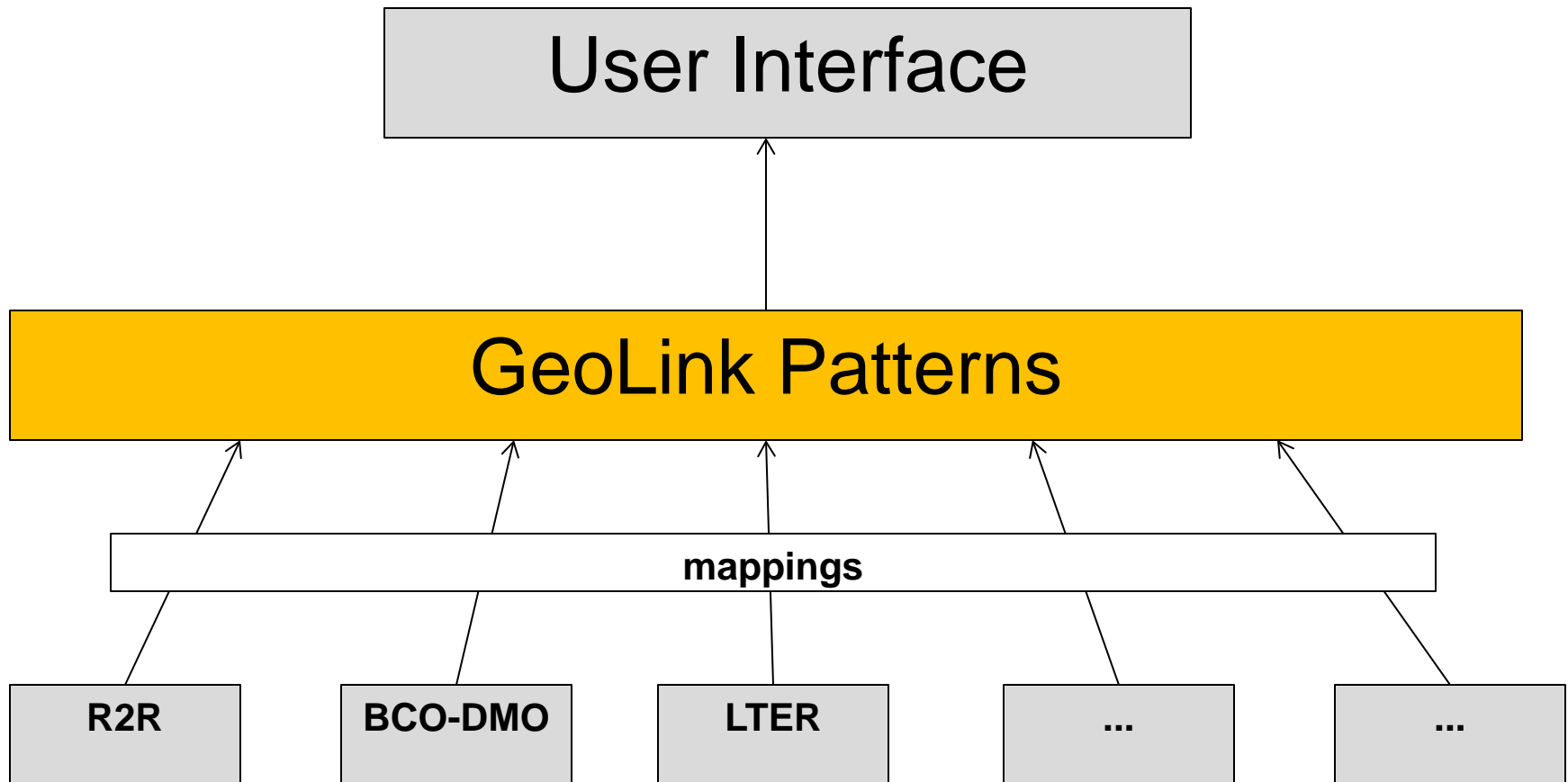
If a trajectory is traveled by a vessel, then every segment is traversed by that vessel.

$$\text{hasSegment}^- \circ \text{isTraveledBy} \sqsubseteq \text{isTraversedBy} \qquad (13.28)$$

Also, a fix cannot be followed by more than one other fix, and cannot follow itself. This gives a linear structure in the ordering of the fixes.

$$\text{Fix} \sqsubseteq \exists\text{hasLocation.Position} \sqcap \exists\text{atTime.TimeEntity} \sqcap (=1\ \text{hasFix}^-.\text{Trajectory}) \qquad (13.14)$$

$$\text{Fix} \sqsubseteq (\leqslant 1\ \text{nextFix.Fix}) \sqcap \neg\exists\text{nextFix.Self} \qquad (13.15)$$

www.geolink.org

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