

An Open Source framework for Tracking and State Estimation ('Stone Soup')



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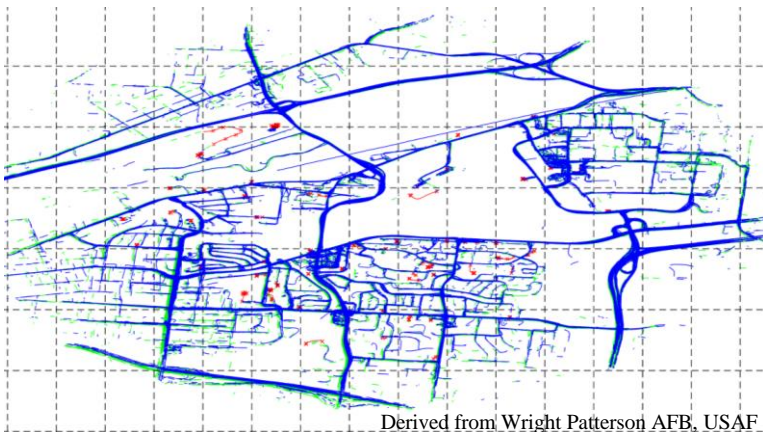
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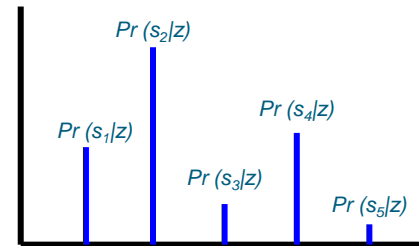
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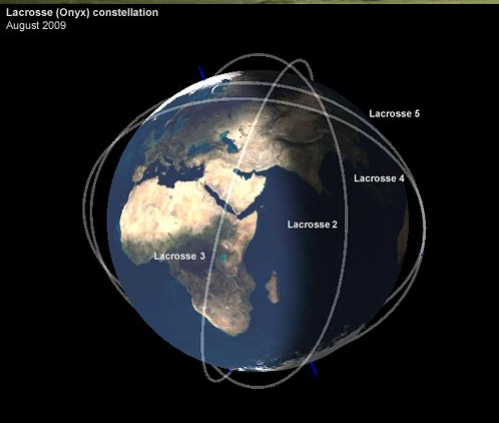
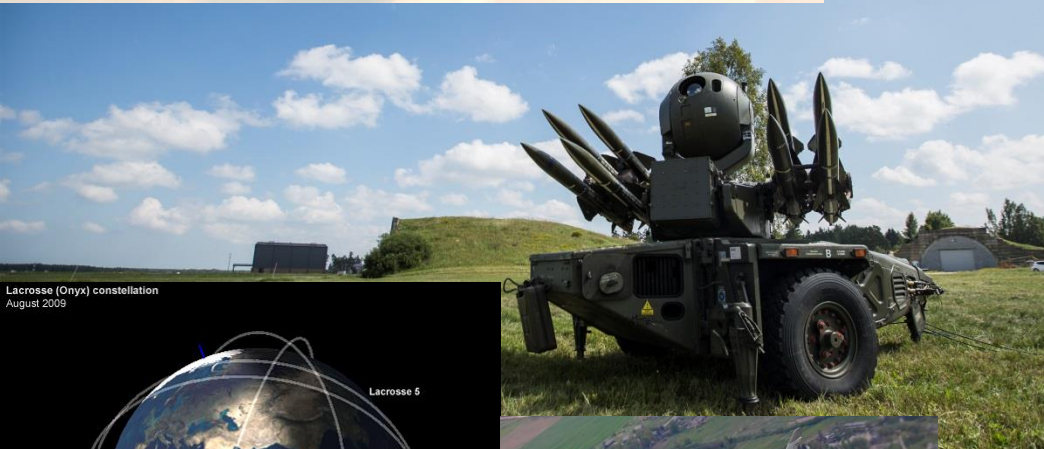
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Tracking and State Estimation



Derived from Wright Patterson AFB, USAF



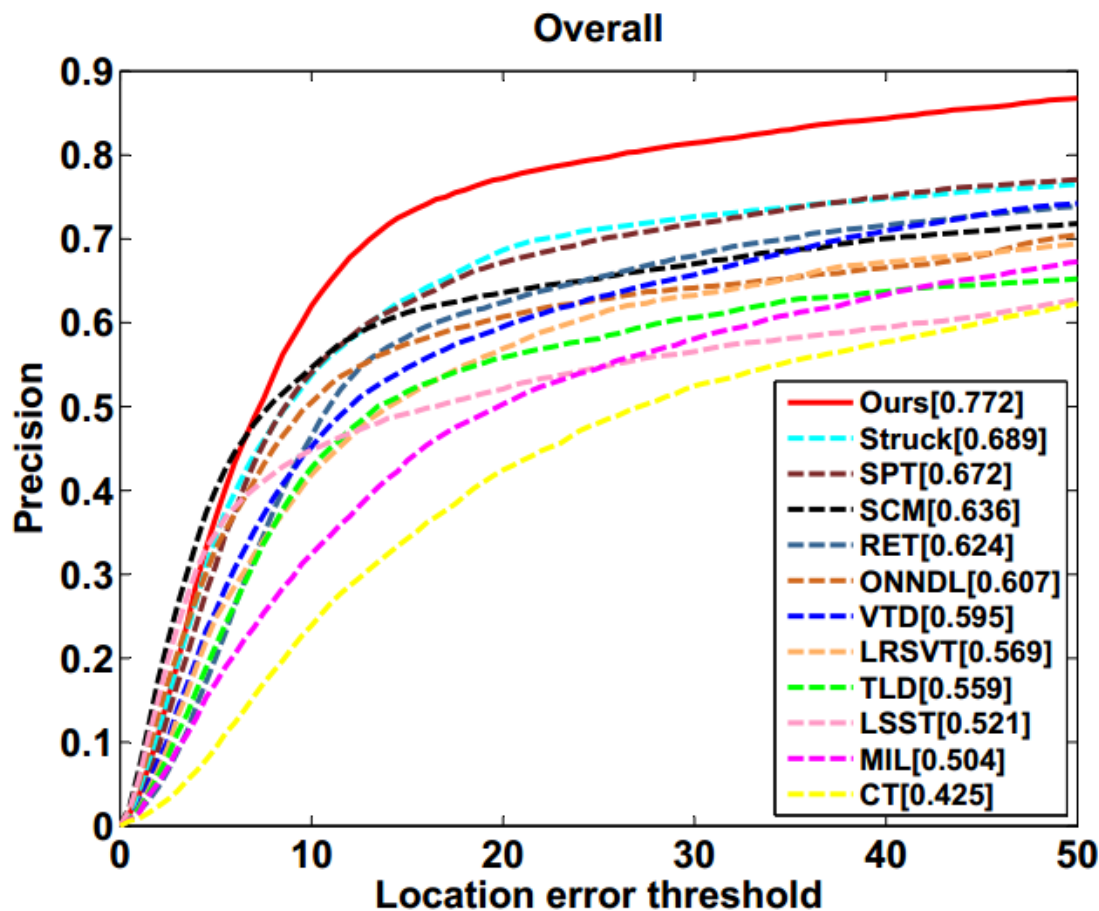


Lacrosse (Onyx) constellation
August 2009



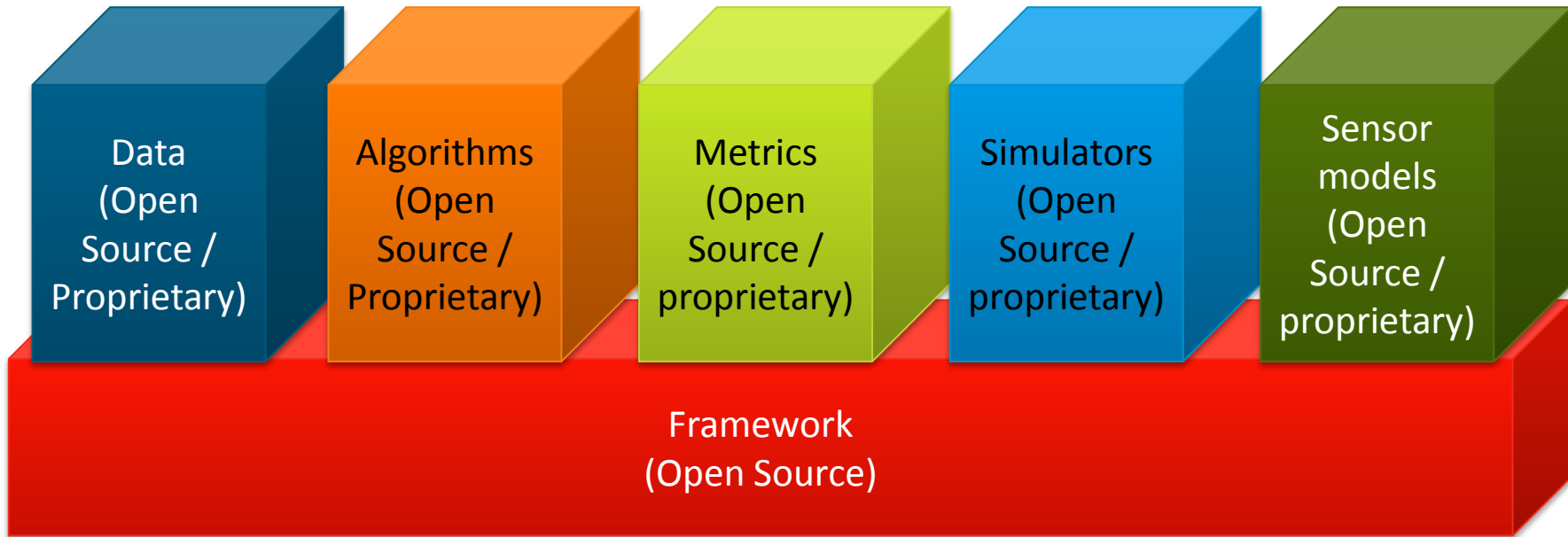
Tracker evaluation / comparison

Time-consuming!



Min Yang, Yuwei Wu, Mingtao Pei, Bo Ma, and Yunde Jia. Online Discriminative Tracking with Active Example Selection. IEEE Transactions on Circuits and Systems for Video Technology (TCSVT), 2015

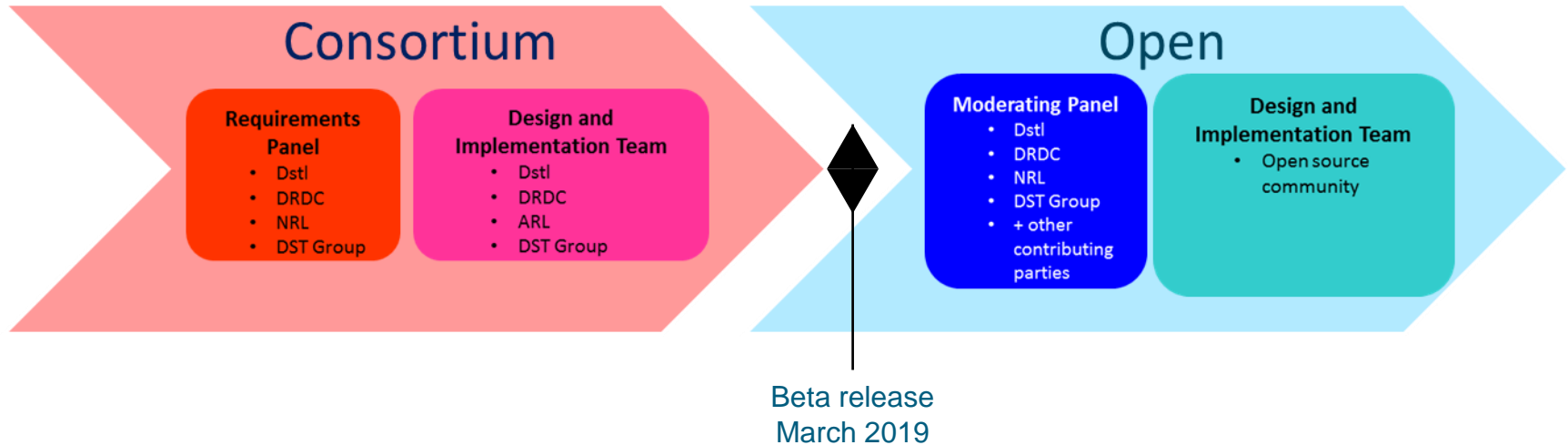
'Stone Soup' project



Aims:

- The software structure necessary to put together any (logical) combination of algorithm or algorithm-component from a repository of algorithms.
- facilitate application of an algorithm to multiple different sets of data,
- contain state of the art metrics for quantification of performance.

Collaborative approach



Licence

Consortium

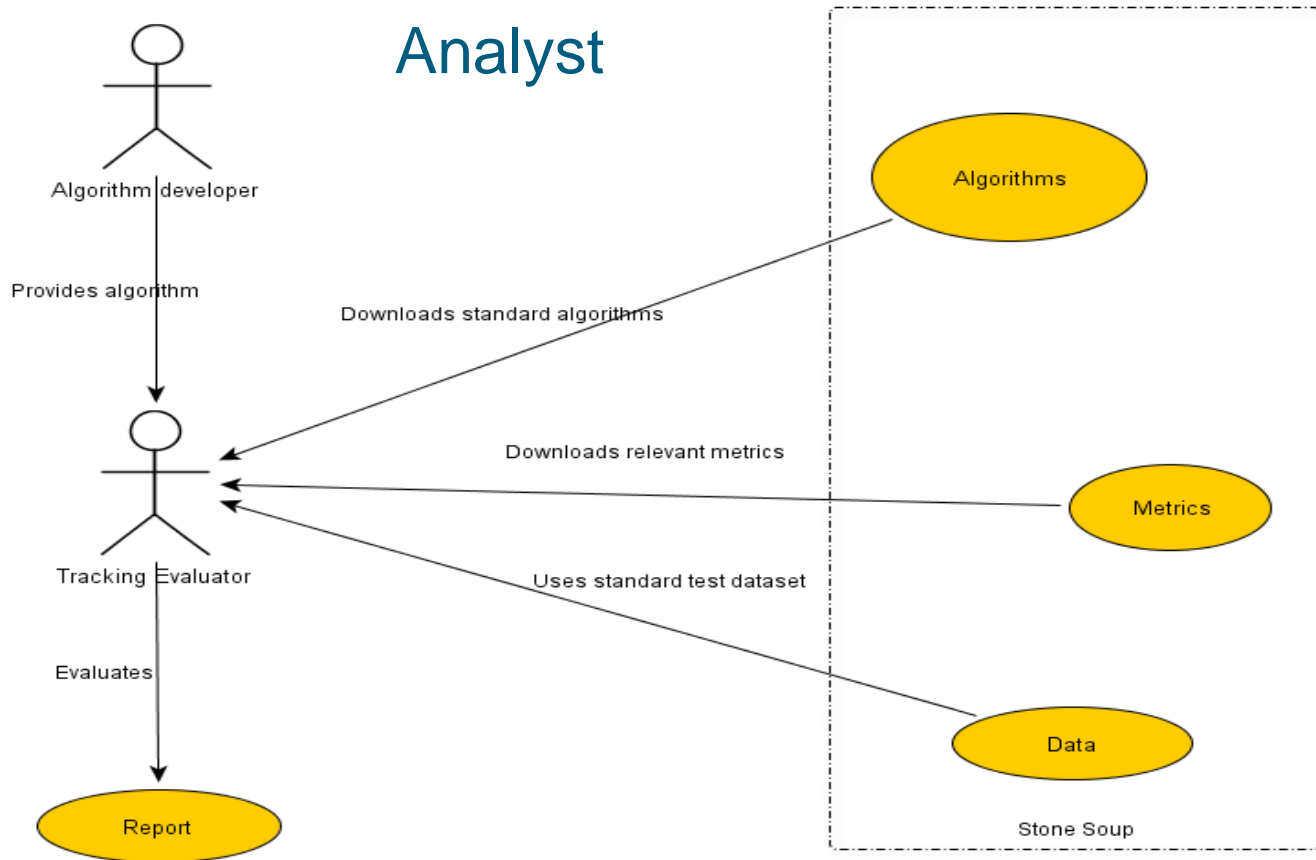
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Open

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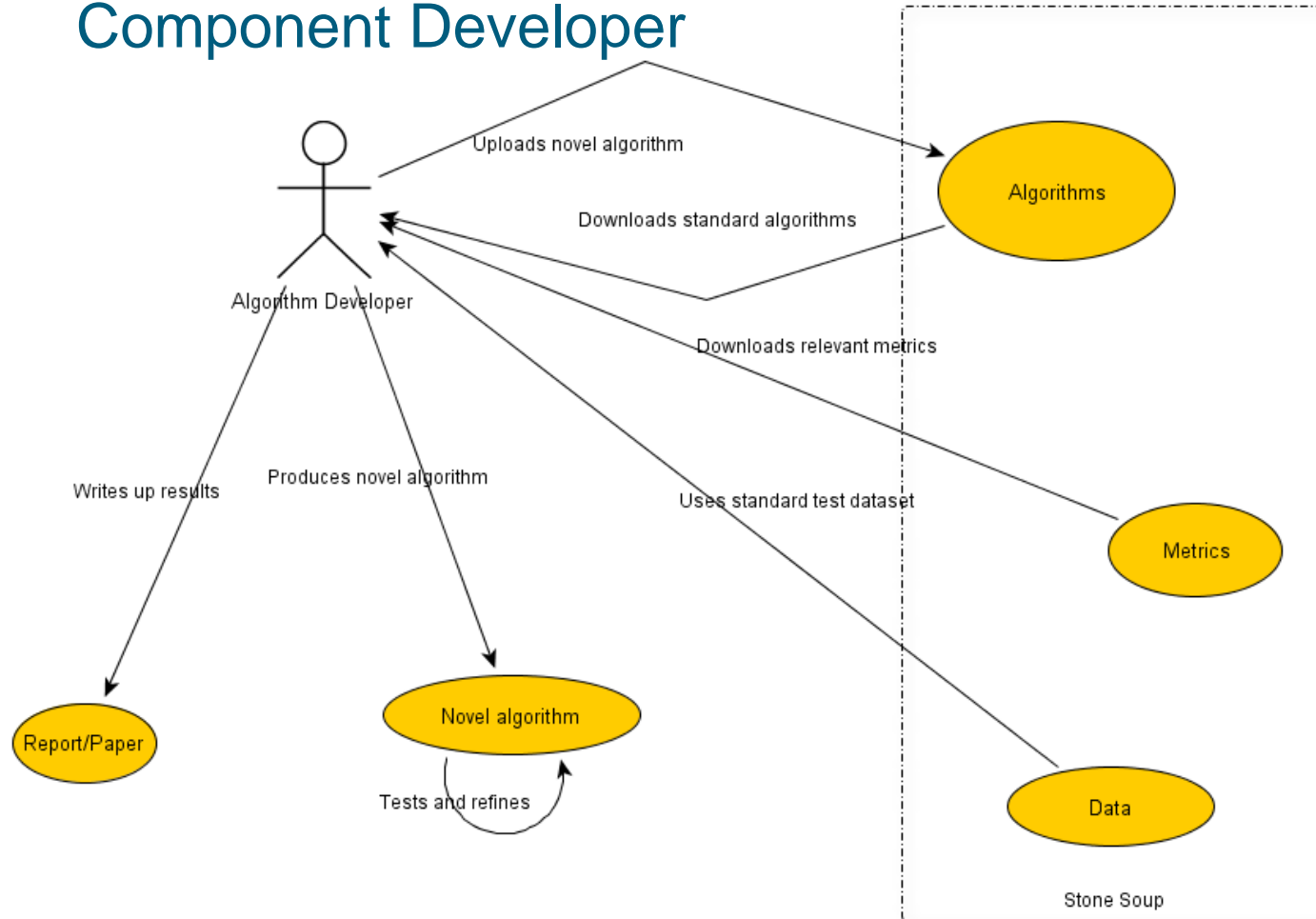
No protective marking (unclassified)

Use cases



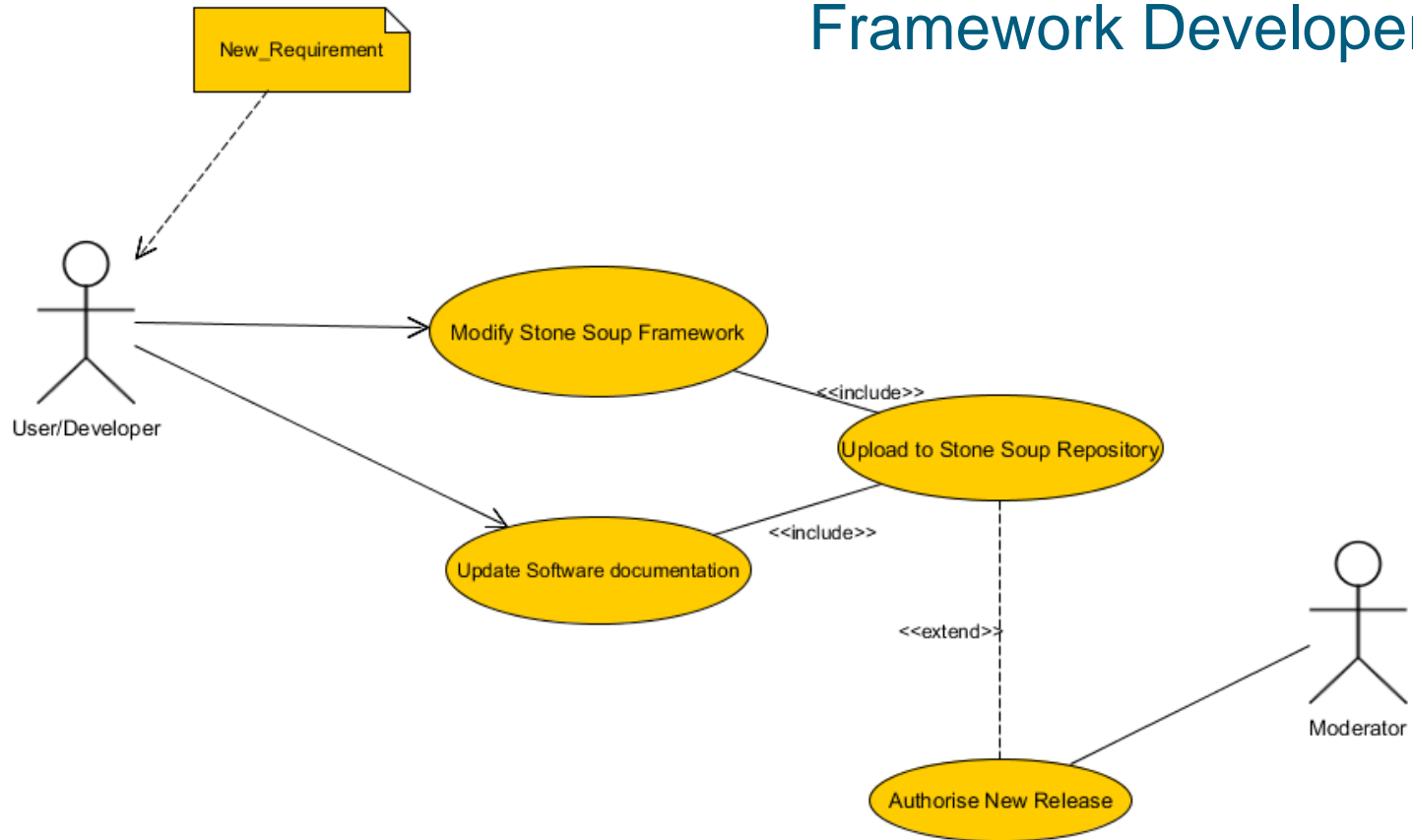
Use cases

Component Developer

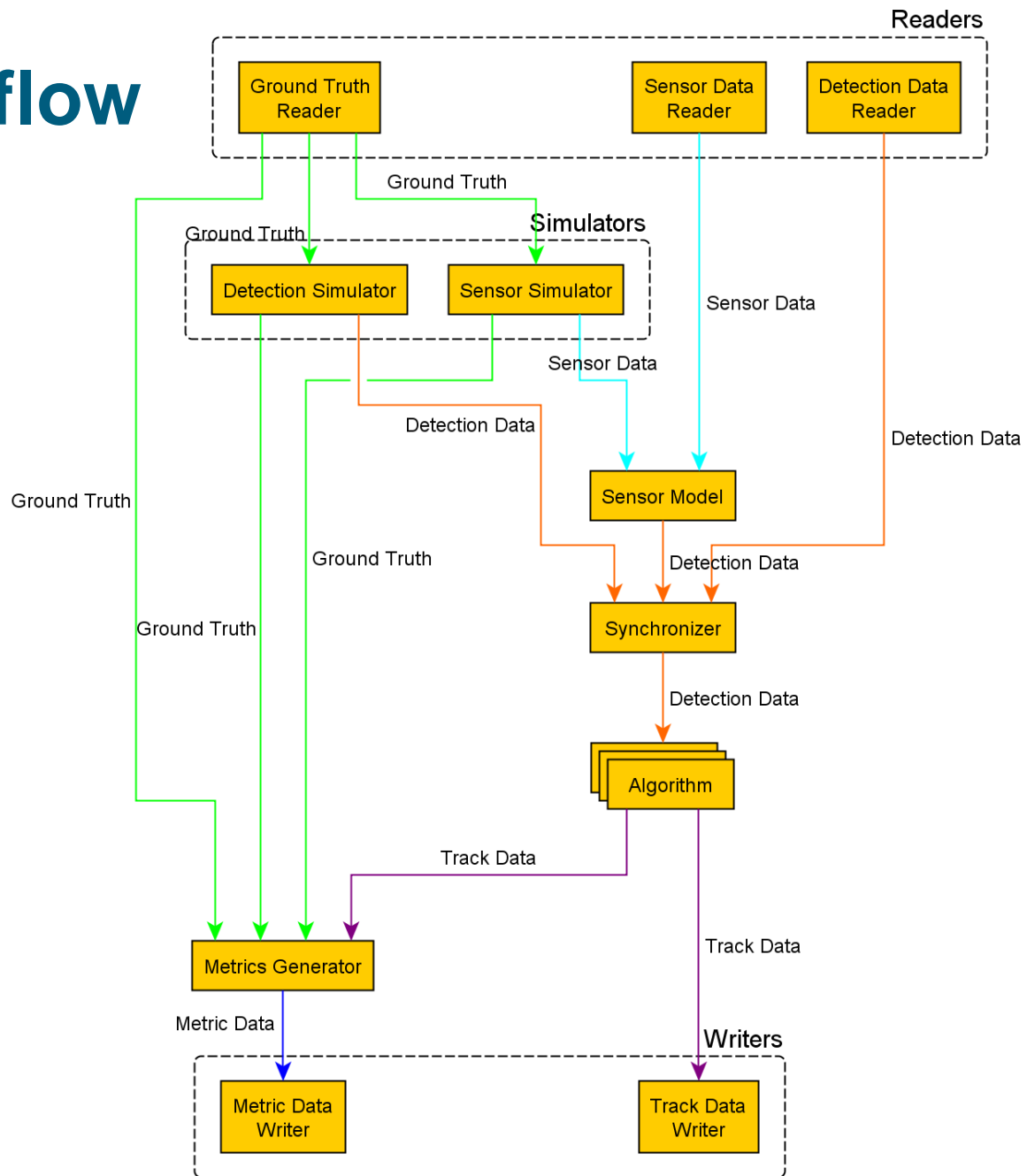


Use cases

Framework Developer



Logical data flow



Algorithms

Filtering algorithms: Discrete-Time State and Measurement Models

- Standard Kalman Filter for the Linear State and Measurement Model
- Extended Kalman Filter
- Derivative-free Kalman Filters

Particle Filter Class of algorithms

- Random Particle Filters
- Deterministic Particle Filters

Multiple Model filtering algorithms for Kalman filter class of algorithms

Data Model

The fundamental requirement:

- to enable the comparison of different algorithmic approaches against the same data or simulated scenario
- Therefore, algorithms must be “swappable” at the state and measurement model level

Data

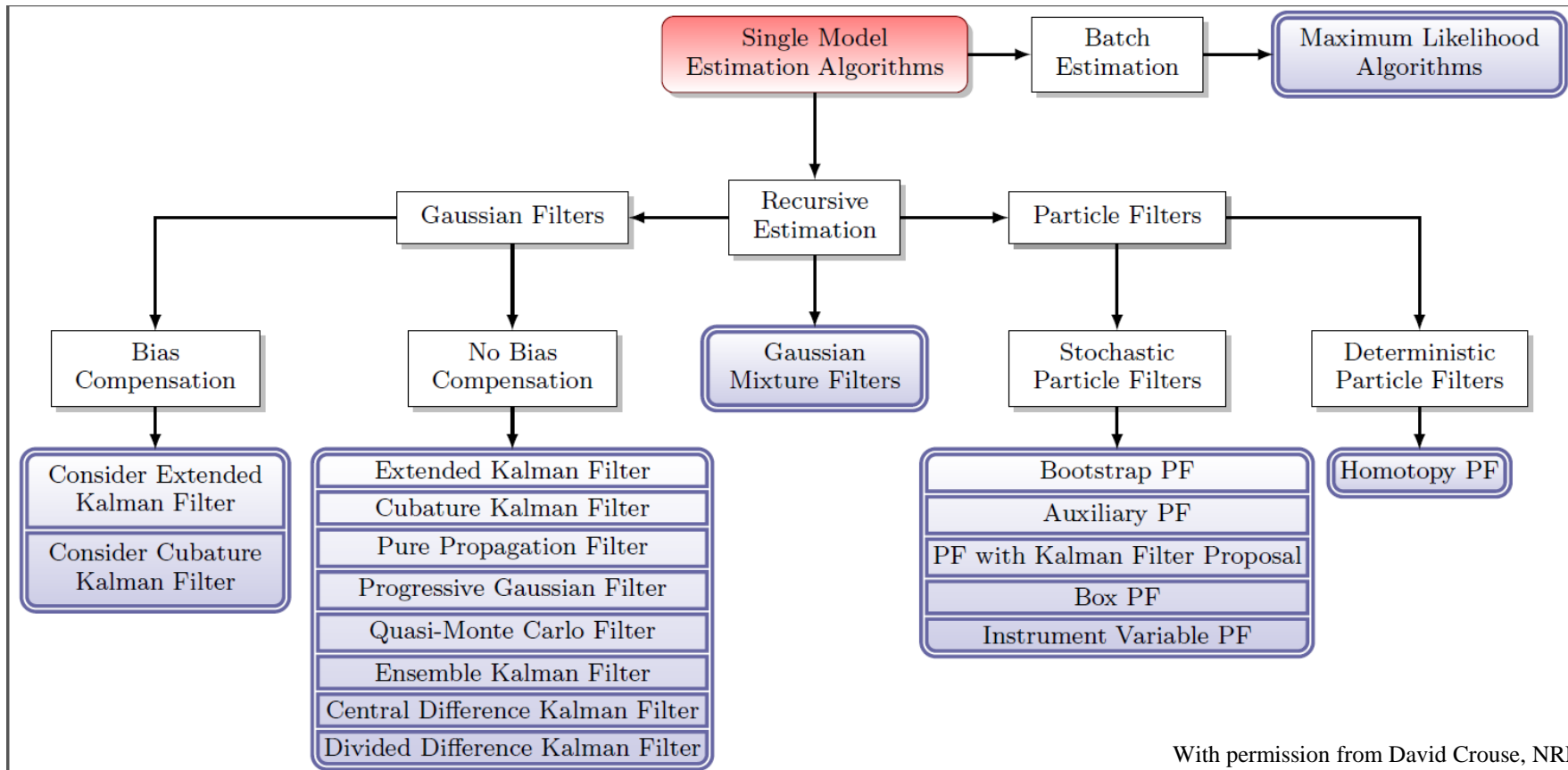
- Airborne radar detection data. This could be in 2D or 3D, from a rotating radar or from a planar array.
- Coincident AIS data
- EO/IR data (which typically is reasonably accurate in bearing but has poor accuracy or no information about range)

Metrics

Initial priority:

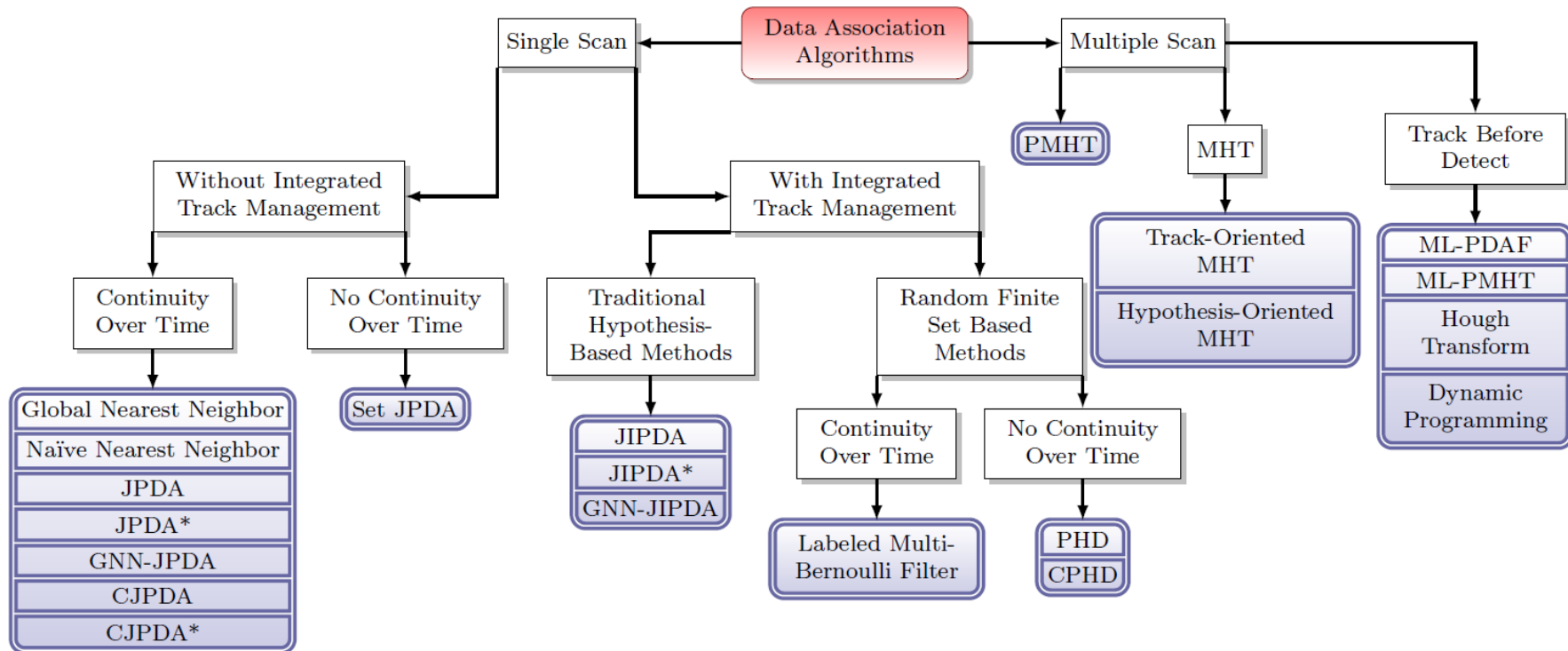
- Assessments in the presence of entity “truth” state information.
 - Initiation of a track following the first appearance of an entity
 - Accuracy of a track estimate compared to the state of an entity
 - Continuity of a track during the time evolution of the state of an entity
 - Existence of false tracks
 - Credibility of a track estimate and its estimation uncertainty

Interface hierarchy: Filters



With permission from David Crouse, NRL

Interface hierarchy: Data Association



With permission from David Crouse, NRL

How can I join in?



Welcome_(By fletcherjcm (May 13) [CC BY-SA 2.0], via Wikimedia Commons)

- We welcome additional commitments of developer resources during the Consortium Phase.
- Open to all types of contributing agency; e.g. Government, Industry or Academia
- The minimum meaningful commitment is 0.5 x developer-year per year.

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Stone Soup - Summary

- Collaborative initiative to create an open source framework for comparison of tracking and state estimation algorithms, data, metrics, simulators and sensor models
- Facilitates easy comparison of algorithm performance
- Allows algorithms to be developed with real data and benchmarked against “standard” data sets
- Enables characterisation of performance against different types of tracking problem
- Standardisation across research community
- “accelerated development” programme for personnel in industry

