

**Objective:** Establish an extensible video analytics infrastructure that will support both the PSIAP program and the greater public safety community in an open and extensible manner.

### Planned Case Studies and KPIs

We plan two case studies that will be conducted in partnership with our PSOs and evaluate on impact.

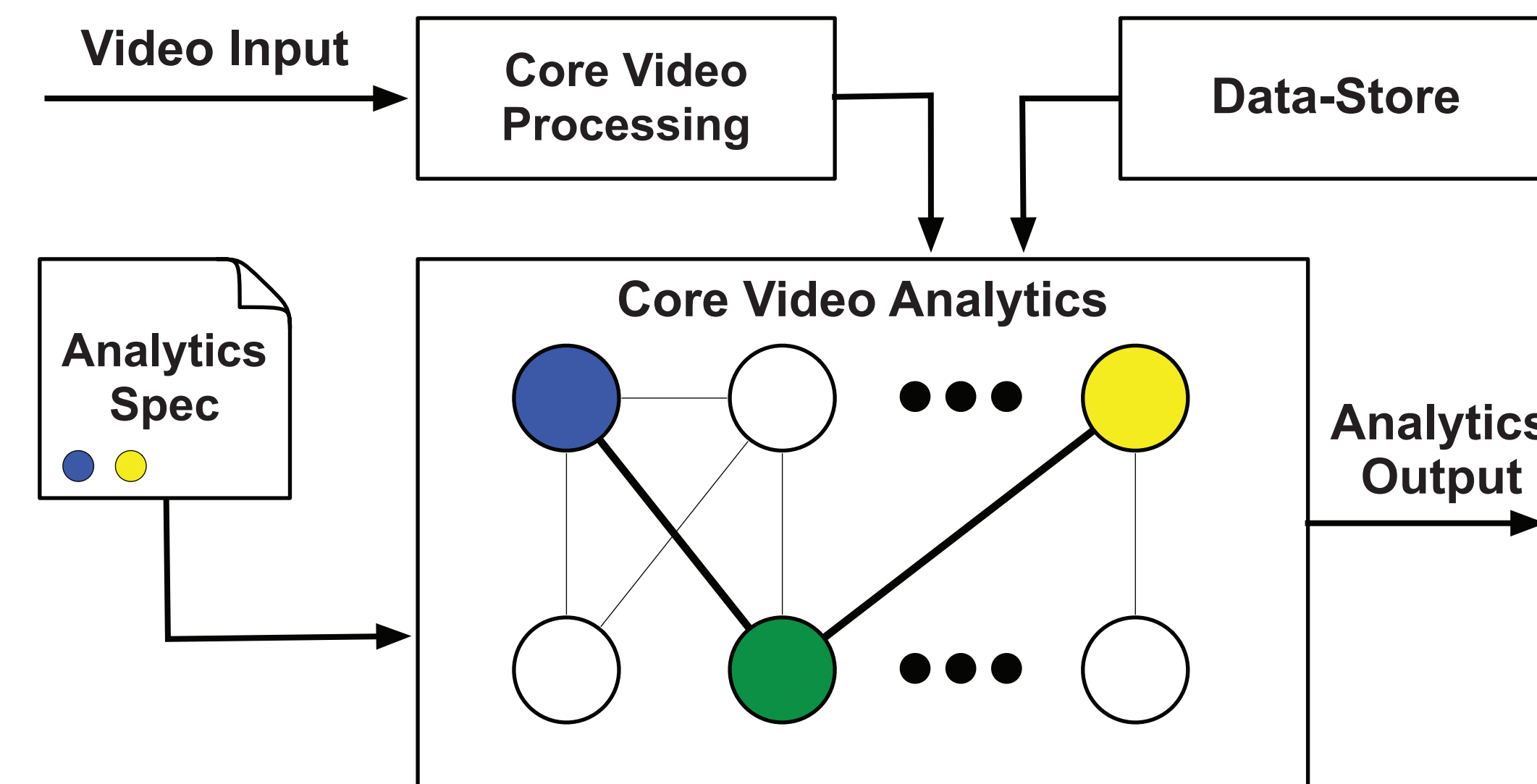
**Target Reacquisition:** this case study will allow for a query-by-example situation where a user provides an example of an entity and the system needs to locate instances that entity across the large camera network.

**Linguistic Description Retrieval:** in the absence of a visual example, this case study will detect the ability to locate entities based on descriptive language.

### Project Milestones and Deliverables

- Milestone 1 (3 months)** – Establish data-space and software infrastructure layout.
  - Milestone 2 (6 months)** – Initial ETA system architecture and prototype released to program.
  - Milestone 3 (9 months)** – Extended ETA analytics integrated into system.
  - Milestone 4 (12 months)** – Target reacquisition case study in enterprise system.
  - Milestone 5 (15 months)** – Streaming & efficient analytics.
  - Milestone 6 (18 months)** – Privacy-preserving analytics.
  - Milestone 7 (21 months)** – Public system release with enterprise delivery.
  - Milestone 8 (24 months)** – Linguistic description retrieval case study in SaaS system
- Deliverables** – Voxel51 will deliver regular whitepapers to track the program progress, software via source code to create an open analytics ecosystem, and results on our PSO-partner case studies.

### ETA Technical Approach



Analytics are specified via a structure set of requirements (blue and yellow modules in this case). The system derives the pathway through the core analytics modules, including interim modules that are needed to derive full required outputs (denoted by the green module in this case).

### Planned Delivery Mechanisms

**Software-as-a-Service:** we will host ETA on a centrally located and maintained cloud service provider (e.g., Amazon Web Services) and provide an easy-to-use frontend for public safety groups to interface with the ETA backend tools.

**Enterprise:** we will also provide ETA as a standard software package that public safety groups can install on their own hardware, allowing skilled end-users the opportunity to customize the software and address data privacy concerns.

### Public Safety Segment and Partners

Voxel51 is partnered with Baltimore and Oakland Police Departments for the ETA Project. We are working on further PS partners, including Ann Arbor PD, Detroit PD, Michigan State Police and the St. Louis Metro PD.

We plan a generic infrastructure for analytics that will be applicable beyond our initial law enforcement focus.

### Modular Software Infrastructure

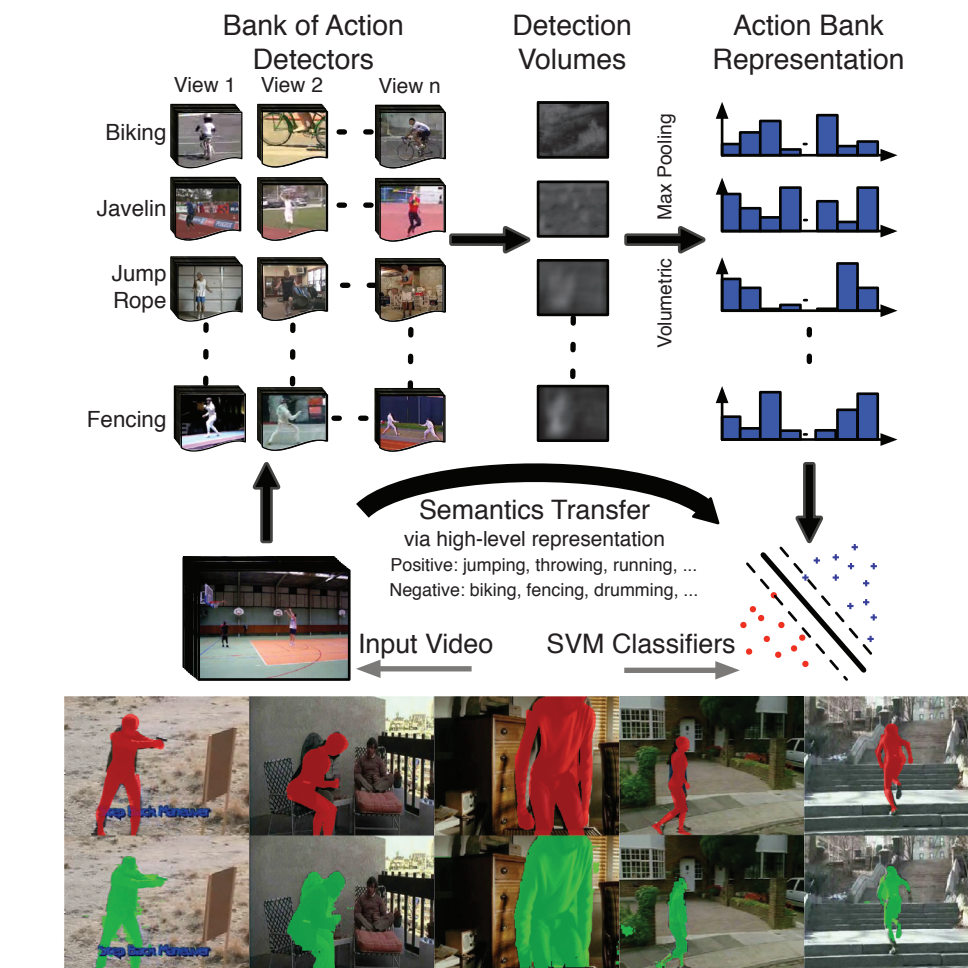
**Core Video Processing:** preprocesses all input video through low- and mid-level pipelines such as optical flow and supervoxel segmentation to generate a representation more amenable to downstream analytics.

**Data-Store:** stores all video data and metadata, model and parameter files, dynamically loadable analytics modules as well as software binaries.

**Core Video Analytics:** implements various information extraction and analytics modules, such as detection, tracking and recognition of specific types of entities and events.

Each module is conceptualized as a node in a large analytics graph composed of Voxel51-provided modules as well as other PSIAP team modules, all loaded dynamically. The pathway through the graph is adaptively constructed based on the analytics available and the requested analytics. The architecture is open and extensible.

### Video Analytics Examples and Plans



**Initial Analytics:** we will integrate existing video analytics from the computer vision literature (examples left).

**Extended Analytics:** we plan to enhance these video analytics to handle streaming data, fast compute at the edge and privacy preservation.

Founded in 2016, Voxel51's mission is to provide robust and customized video understanding capabilities to enable advanced video analytics that enhance societal welfare.

Based in Ann Arbor, MI, Voxel51 has projects in public safety, automotive vision and video annotation.

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