AIST Program
Sensor Web Meeting
Summary of Results

Working Group A

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A: Land Use B: Solid-Earth Hazards C: Weather

Terms and Definitions

- A *Sensor Web* is a coherent set of potentially heterogeneous, loosely-coupled, distributed *Nodes*, interconnected by a communications fabric, that can collectively behave as a single dynamically adaptive and reconfigurable observing system.

- A *Node* is an independent entity that performs one or more of the following functions/services:
  - Sensing
  - Computing
  - Storing
  - Communicating
  - Directing

- A composite node provides two or more of the above functions/services

- A Node can be a member of one or more Sensor Webs.

Terms and Definitions - (characteristics)

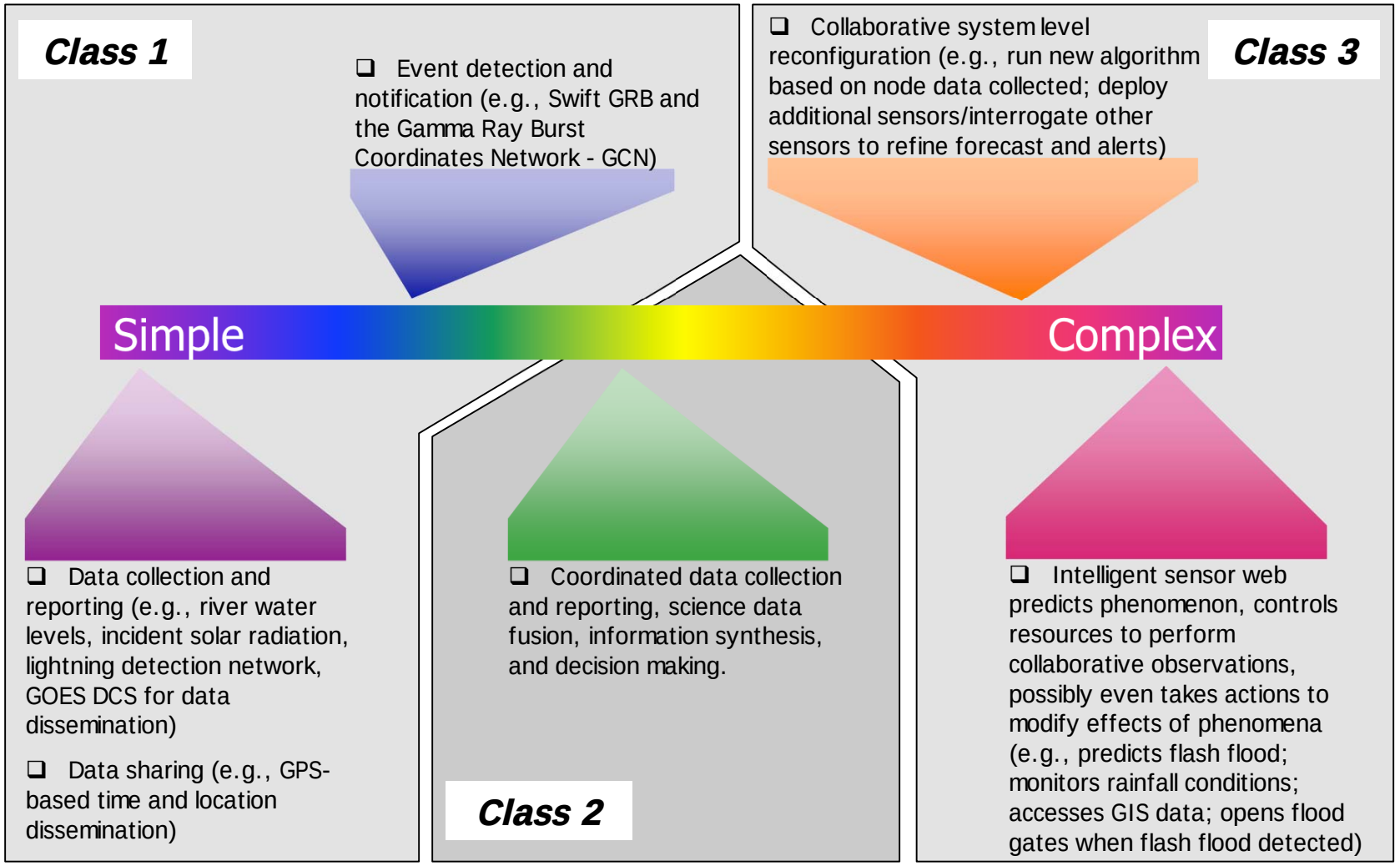
- Sensor Web key characteristics:
  - Nodes interoperate using common standards and services.
  - Two or more sensor webs can be linked, layered, or recursively combined.
  - Can measure physical properties, detect/react to other node states (e.g., node state-of-health), discover node capabilities, notify other parts or outside entities, reconfigure its constituent components, and fuse data/information to maximize useful information (e.g., science) return

- Although these may describe characteristics of a sensor web, a sensor web is *not* any of the following:
  - Just a distributed data collection system (lacks reconfigurability)
    - Note: A distributed data collection system may be an example of a Class 1 Sensor Web (i.e., minimal capabilities suite)
  - Just a portal, or other centralized point of entry to sensors

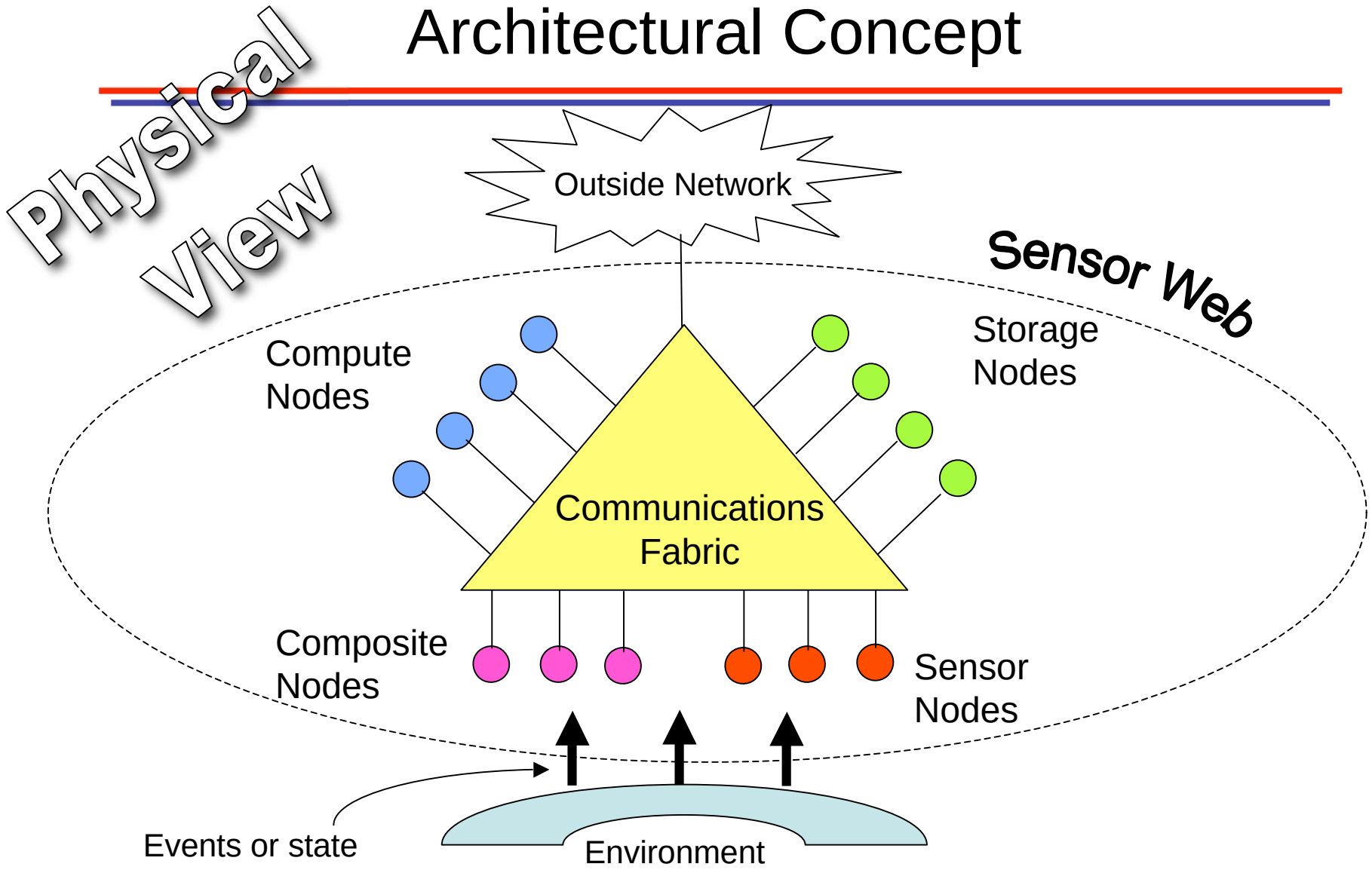
Sensor Web Components

- Control mechanism(s), which enable(s):
  - Reconfiguration
  - Sensor tasking
  - Sensor node resource management
  - …
- Processing capability
- Models (such as)
  - Sensor specific models
  - Environmental system models
  - Others …
- Services, which define how users (people & systems) interact with the sensor web.

Evolutionary Sensor Web Capabilities
(potential to drive NASA road map)



Architectural Concept



Key Features

- Standards Based interaction/interconnection
- Taskable via
  - Dynamic reconfiguration at all levels (e.g., individual nodes, system)
  - Dynamic resource management
  - Dynamic information management
- Context management of the data
- Workflow management
- Accessible via SOA interfaces to allow
  - Discovery of sensor webs and sensor web data
  - Receiving alerts/notifications (e.g. through a properly defined service)
  - Receiving data in a standard encoding and in a standard manner
- Security measures (e.g., encryption, authorization, authentication, etc…) commensurate with specific application/need
- Facilitate cross calibration/validation and data assimilation

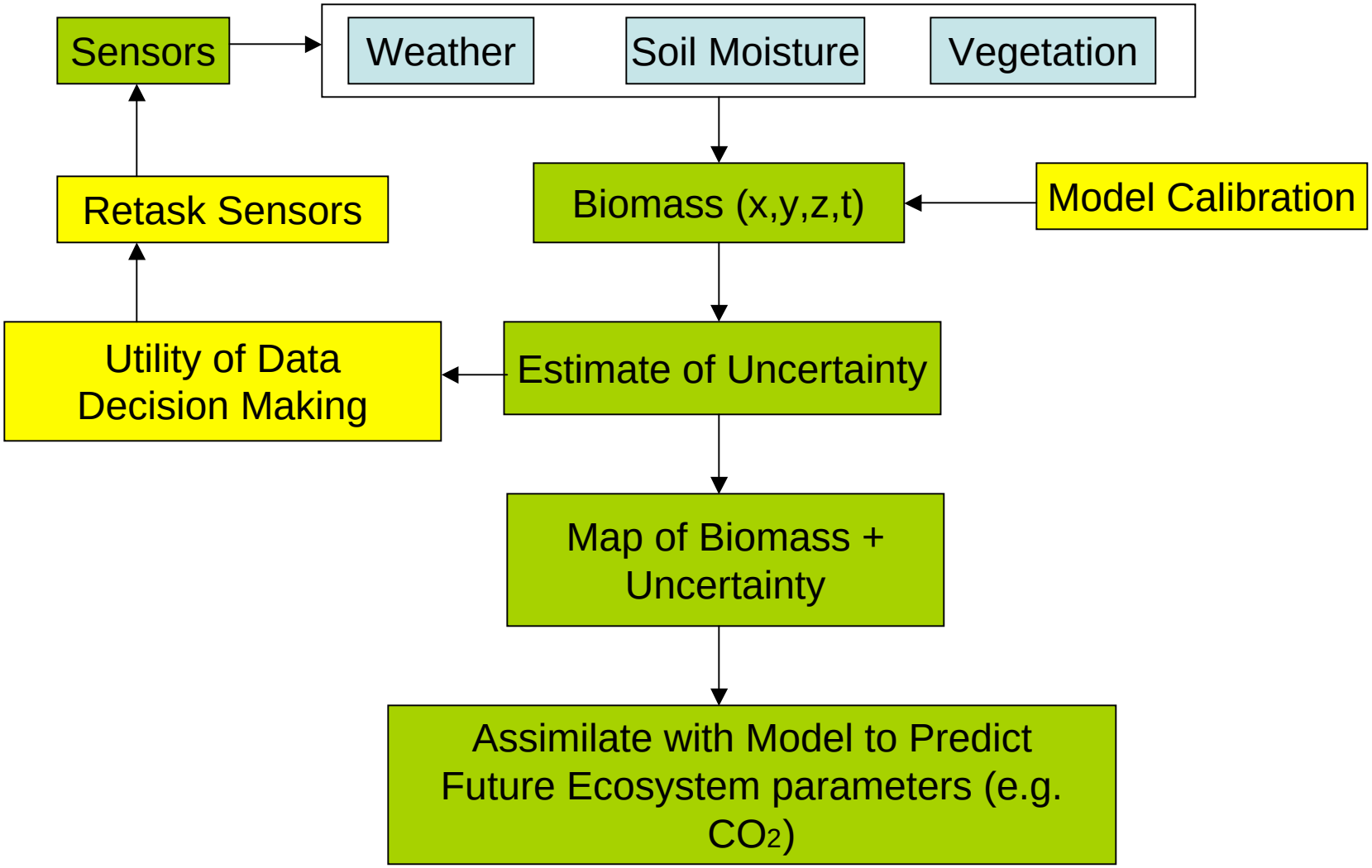
Key Benefits

- Maximize useful science return
- Increase societal benefits
- Potential to improve return on investment
- Increase robustness
- Improve resource utilization
- Minimize redundancy
- Evolvable and scalable
- Sharing information and resources
- Improve response to rapidly evolving, transient phenomena
- Human and machine accessible
- Standards and service based means no need for a priori knowledge of all nodes
- More accurately track dynamic behavior

Critical External Systems

- List and describe key systems external to the sensor web but critical to the concept
  - Communications Fabric
  - Discovery/Registry System
  - Relevant ontologies and standards
  - Other data portals
  - Decision Support System (could be in or out)
  - Scientific/Societal Need/Requirement Driver

Biomass Measurement Scenario



GROUP A: Flip charts
Mapping of Challenge problem to Sensor Web components

1: Sensors:
- observations
  - s/c
  - airborne
  - in-situ
- spatial resolution
- physical parameters
  - weather
  - soil moisture
  - vegetation
    - structure
    - type

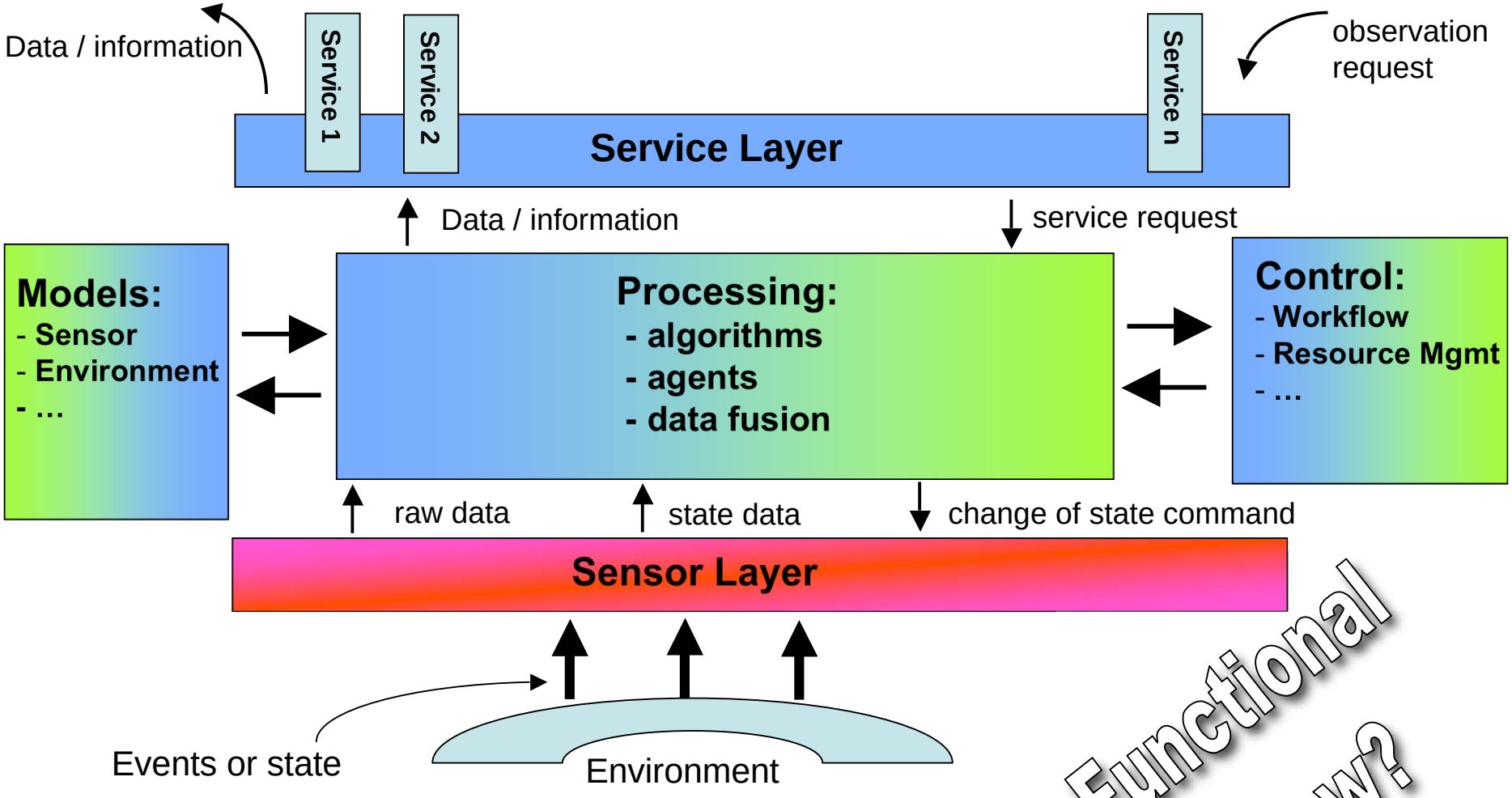
2: Storage

3: data Assimilation
- a model to fuse data
- cal / val

4: Control node
- optimize data collection

Backup

Architectural Concept (cont.)



Architecture Concept / Use Case Challenge

- Using the architecture concept, describe your earth science use case. Highlight which components are needed and what specific benefits to end users are envisioned.

Architecture Concept / Project Mapping

- Using the architecture concept pictured on slide 2, show where each of the projects (or their products) map into the concept

Sensor Web Components

- Physical components:
  - Nodes, which come in various flavors:
    - Compute nodes
    - Sensor nodes
      - These can either have sensors directly measuring the environment, or simply be a model of a sensor(s) providing this data
    - Composite nodes
      - These could be combinations of the other nodes, or a complete sensor web itself
    - Storage nodes
  - Communications Fabric (intentionally left vague)
  - Outside Network Interface (e.g. to the Internet)