



# Federated Knowledge Discovery: The Future of Ground System Architectures to Combat IoT and Pandemic Data Growth

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NATIONAL GEOSPATIAL **NGA** INTELLIGENCE AGENCY

# The Information ~~Super, Mega, Giga, Peta, and Zeta~~ Highway

Satellite Network<sup>1</sup>



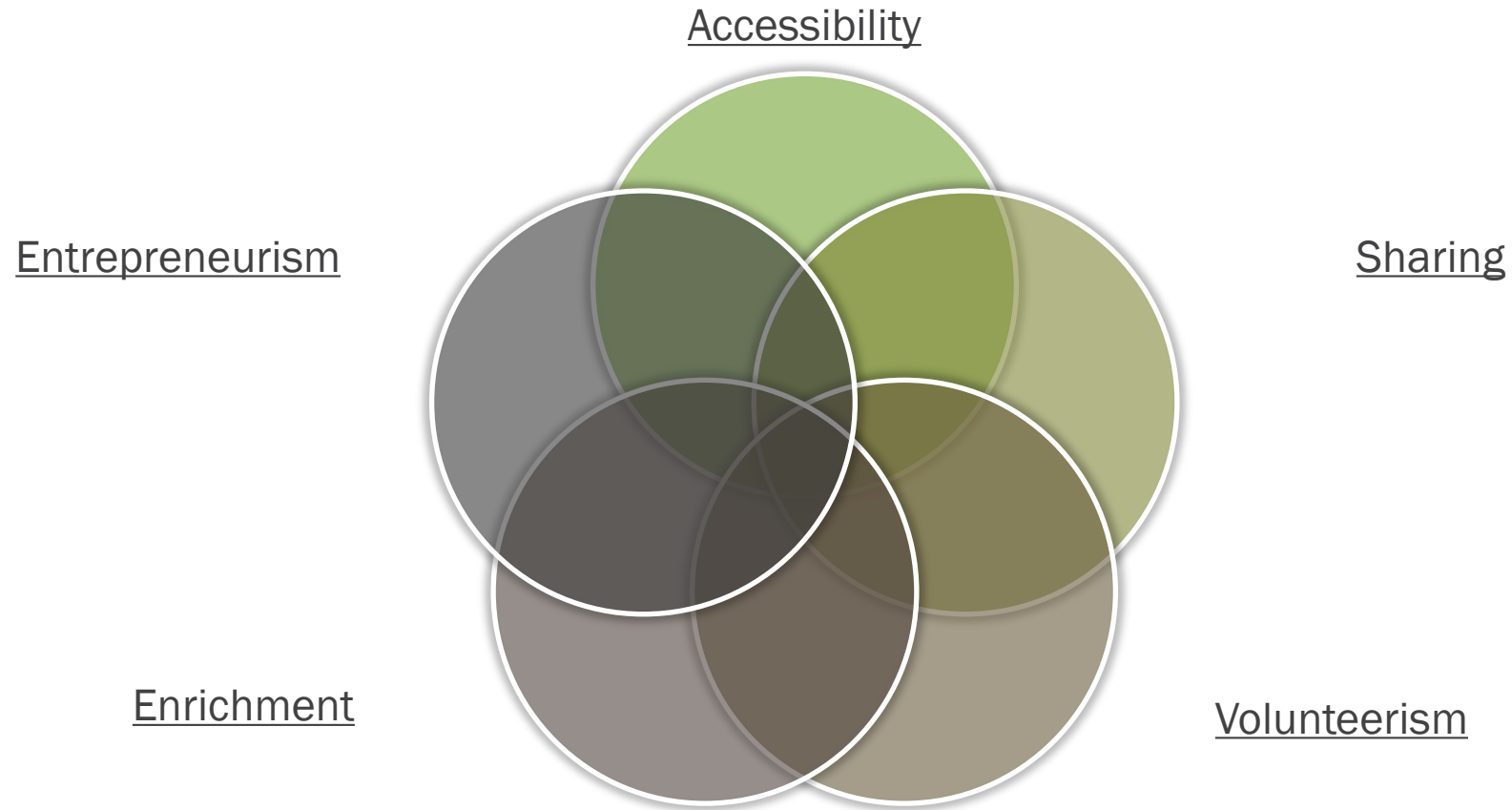
Terrestrial Networks<sup>2</sup>



Two primary means of information dissemination:

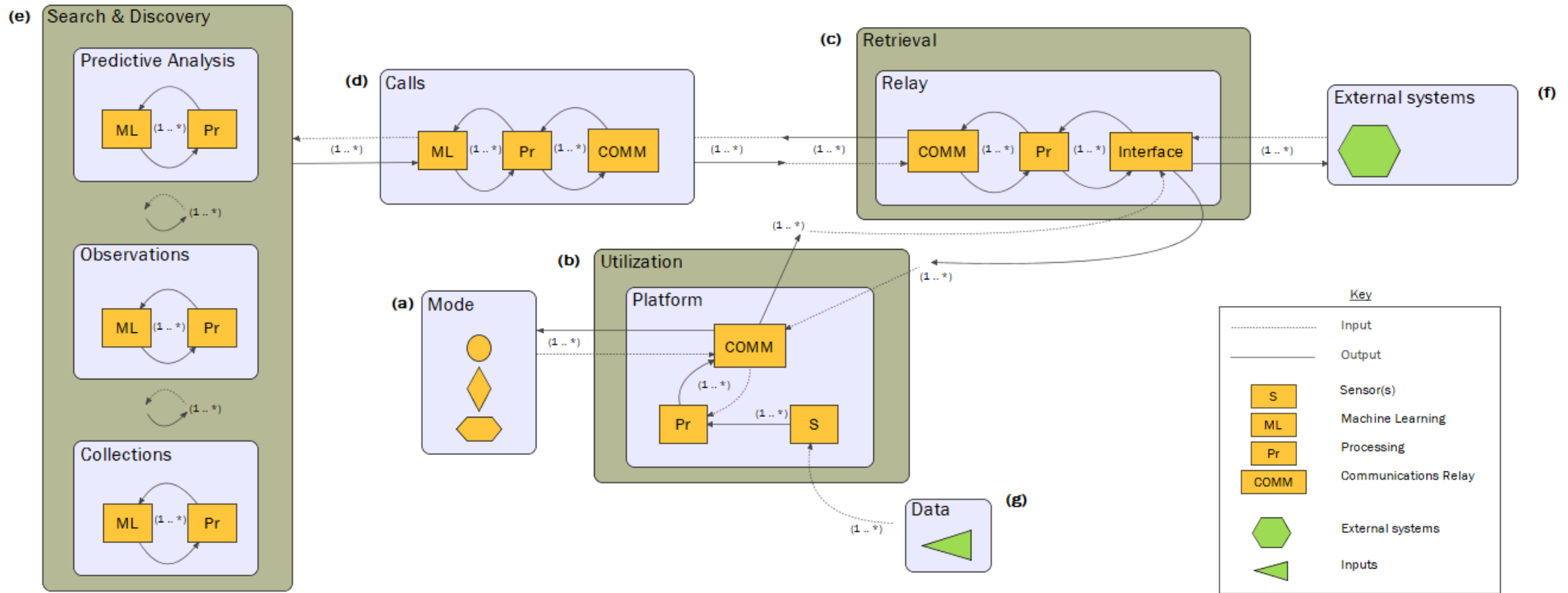
- Wireless (e.g., satellite)
- Terrestrial/Submarine

# Rebranding Knowledge Management

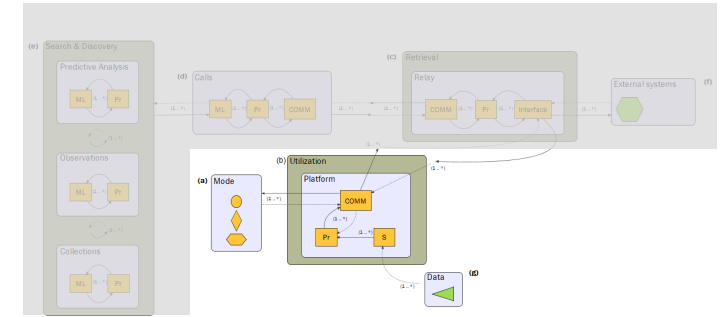
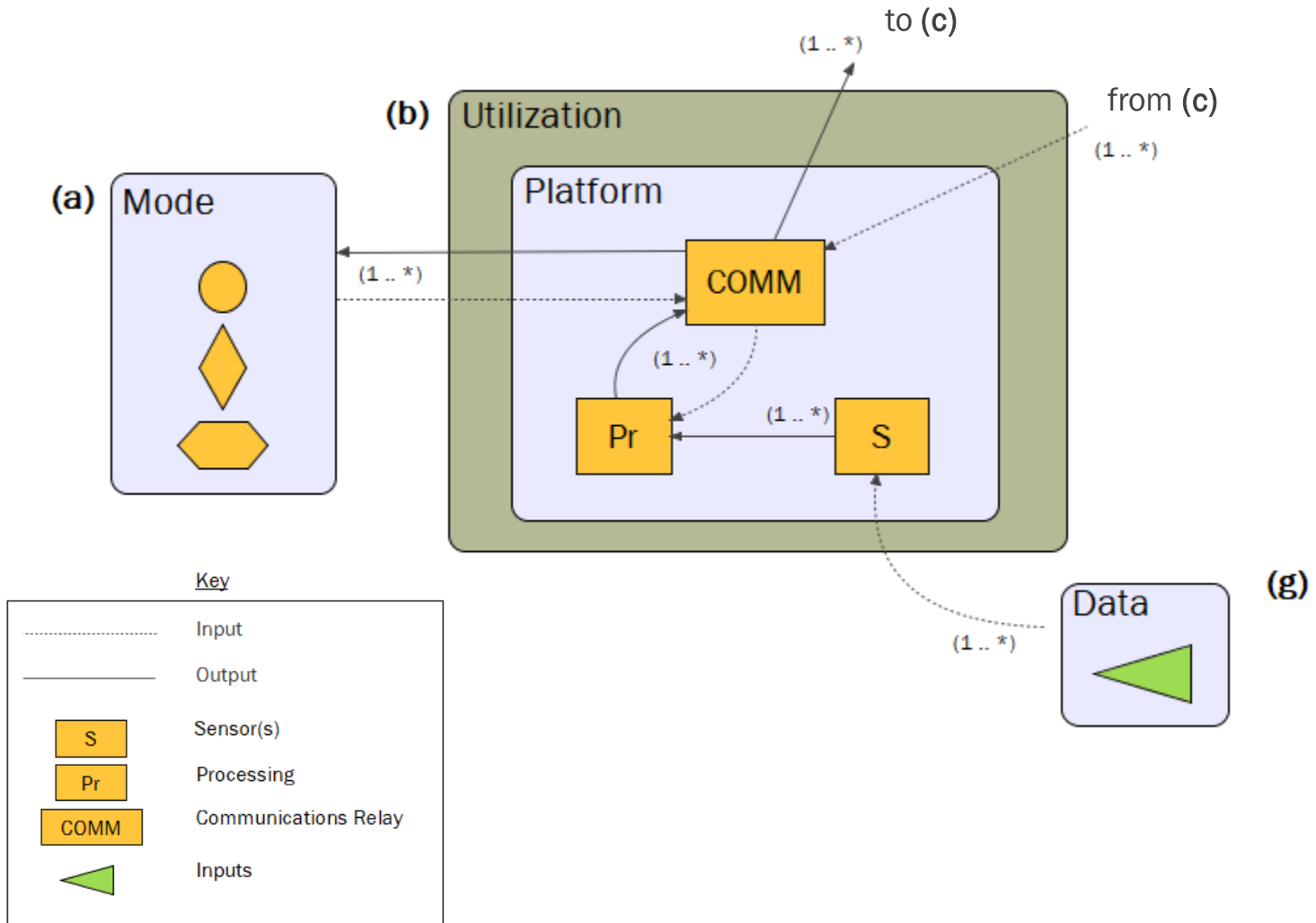


Five evolving areas of knowledge management<sup>5</sup>

# Future Knowledge Management Model



# Utilization



## Mode:

- User or system utilizing another system (platform) to make a data request

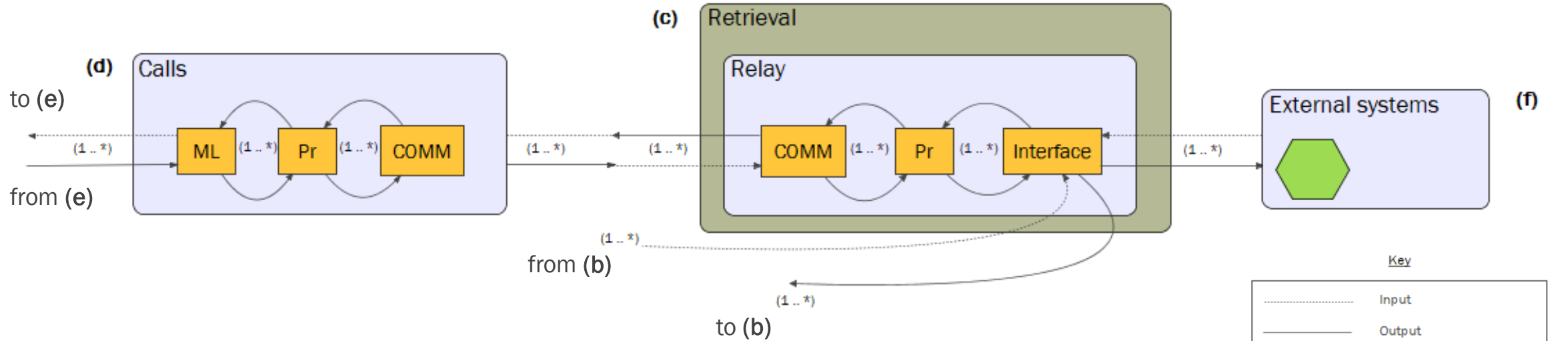
## Data:

- Any data source

## Platform:

- Manned or autonomous system
- Provides, consumes, or relays knowledge

# Retrieval



## Relay:

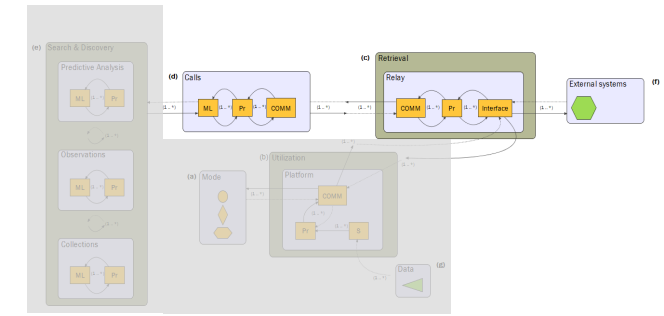
- Interface, processing, and communication relay functionality to transmit inputs (user req.)
- Outputs (data calls)

## Calls:

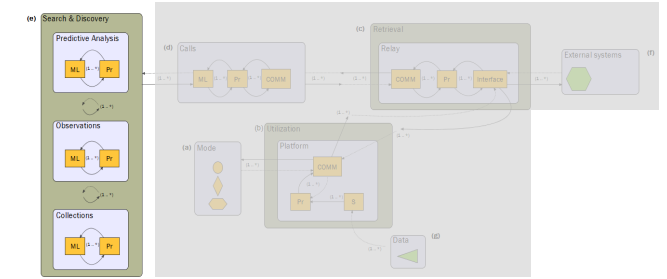
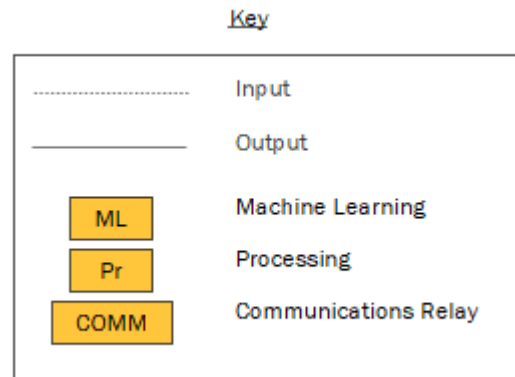
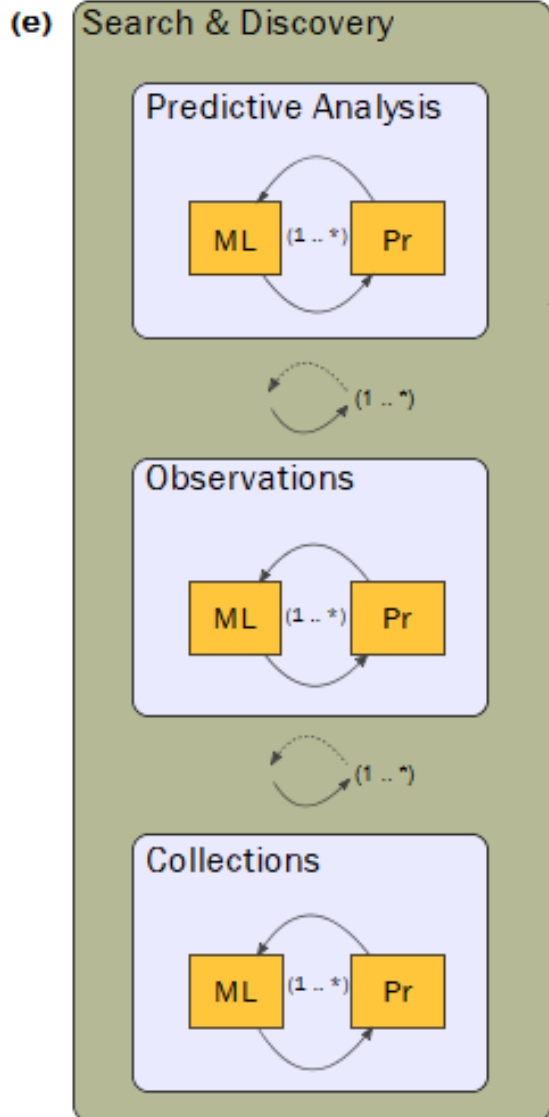
- Data requests to a search & discovery knowledge management repository

## External Systems:

- Complementary/supplementary knowledge management functions



# Search & Discovery



## Predictive Analysis:

- Probabilistic outputs based on user requests (machine derived)

## Observations:

- Trusted data inputs used for AI/ML derived solutions (e.g., crowd sourced)

## Collections:

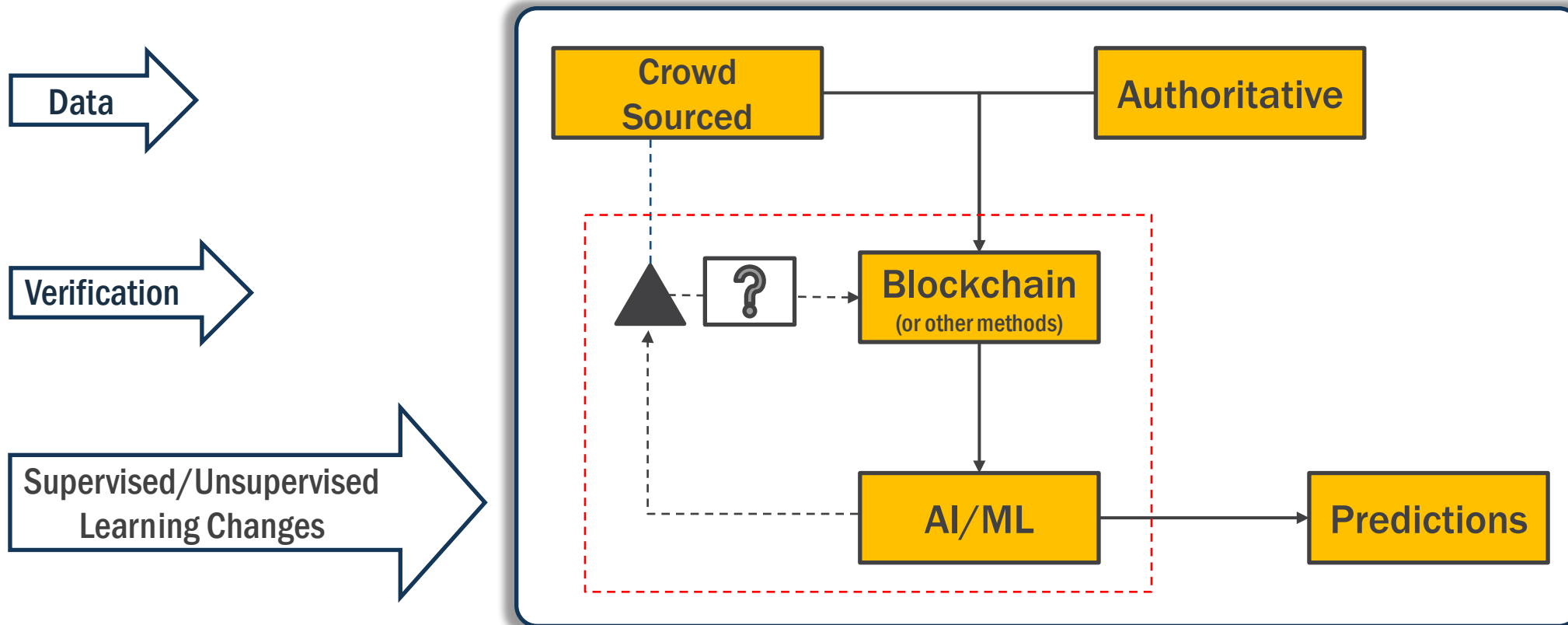
- Authoritative data holdings

# Data Sharing Between Ground Segments

Big Data <sup>6</sup>	Pros	Cons
Volume	New sources of knowledge	Est. doubling every 40 mos. (BBVA)
Velocity	Promotes supervised/unsupervised learning advancements	Real time v. near time; processing power (HPC) needs
Variety	Sense/inference making	Proprietary data concerns; inaccuracies
Veracity	Integration of authoritative & crowd-sourced data	Verification/validation; bias
Value	Community AI/ML	Ontological discrepancies; niche algorithms



# Predictive Analytics and Verification Paradigm



How can learning be optimized w/authoritative and non-authoritative data sources?

# Next Steps

- **Identify Organizations**
  - Interested
  - Performing AI/ML and large scale Knowledge Management Activities
- **Establish Memorandum(s) of...**
  - Agreements and
  - (Data) Use Policies
- **Solidify Common Ontological Frameworks**
- **Baseline Verification Processes (e.g., Blockchain or Other Method)**
  - Standardize across architectures
- **Integrate AI/ML Centers Of Excellence(s)**
  - To create communities of expertise
- **Begin Prototyping Electronic Search, Discovery, and Retrieval Systems**
  - Collection of metrics (TCPED & AI/ML performance)

# Summary

- **Data Measured in:**
  - Bytes (file size) and
  - Bits (transfer rate)
- **Layering Knowledge = Rich Products**
  - For decision making
- **Collecting, Preparing, and Disseminating Data**
  - Cyclical in nature
  - Requires sharing arrangements and partnerships not thought of
- **Value of Knowledge is Subjective and Interpretive**
  - Up to future Ground System Architects
    - ID next steps
- **Community AI/ML (a.k.a. Skynet) is not a bad thing!**



# Presentation Sources

1. Satellite Communications Graphic. <https://www.istockphoto.com/photo/global-telecommunication-network-nodes-connected-around-earth-internet-worldwide-gm859129550-240637833>>.
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5. Cisco Corporation. Consumer 2020. June 2017. Report. <[www.cisco.com/c/dam/en\\_us/solutions/industries/retail/consumer-2020-final.pdf](http://www.cisco.com/c/dam/en_us/solutions/industries/retail/consumer-2020-final.pdf)>.
6. BBVA. “The five V’s of big data.” 26 May 2020. Report. <<https://www.bbva.com/en/five-vs-big-data/>>.