



SCIMMA: Scalable Cyberinfrastructure to support Multi-Messenger Astrophysics



SCIMMA

Multi-Messenger Astrophysics (MMA) brings together communities working in astrophysics, gravitational wave science and particle physics. Progress in real-time MMA requires reliable, performant and scalable cyberinfrastructure that

1. connects experiments and researchers at low latency to remove communications barriers
2. enables immediate data analysis as information is received, and
3. provides tools to coordinate observational follow-up and data sharing that takes ownership, embargo periods, and intellectual/project credit into account.

The SCIMMA collaboration is working with the MMA community to prototype the cyberinfrastructure tools it needs and to conceptualize the organization necessary to ensure sustainability. We will discuss two key cyberinfrastructure products we have prototyped: a next-generated publish-subscribe system, SCIMMA Hopskotch, and an integration of Identity and Access Management systems into MMA cyberinfrastructure.



Federated Identity and Access Management

MMA data is often proprietary or bound by usage agreements, necessitating access controls. Meanwhile, users already have institutional logins and do not want to create/manage more. Federated Identity and Access Management (IAM) allows:

1. user logins with users' own institutional accounts
2. creation of application credentials
3. access management by creation of roles and groups, allowing ad hoc collaborations to be spun up and down
4. delegated on- and off-boarding

SCIMMA IAM system uses Cilogon to manage access to SCIMMA resources (such as AWS account and hopskotch) by users listed in Comanage.



Building an open Institute

SCIMMA conceptualization of an MMA Cyberinfrastructure Institute:

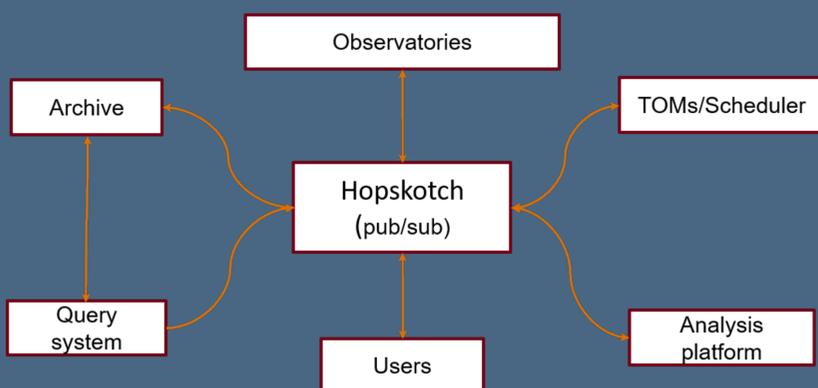
- includes astronomers, physicists, computer scientists, data scientists and cyberinfrastructure experts
- partners with scientific collaborations; welcomes community contributions
- provides services, software, data-handling infrastructure and platforms for MMA



Hopskotch at the heart of an ecosystem

Exchange of data is at heart of MMA, often with low latency. Hopskotch [1] is the SCIMMA Kafka-based pub-sub system

1. Consumes, GCNs [2], ATEL [3], TNS [4], etc
2. hop-client library abstracts access to Hopskotch
3. High reliability, low latency, excellent scaling behaviour

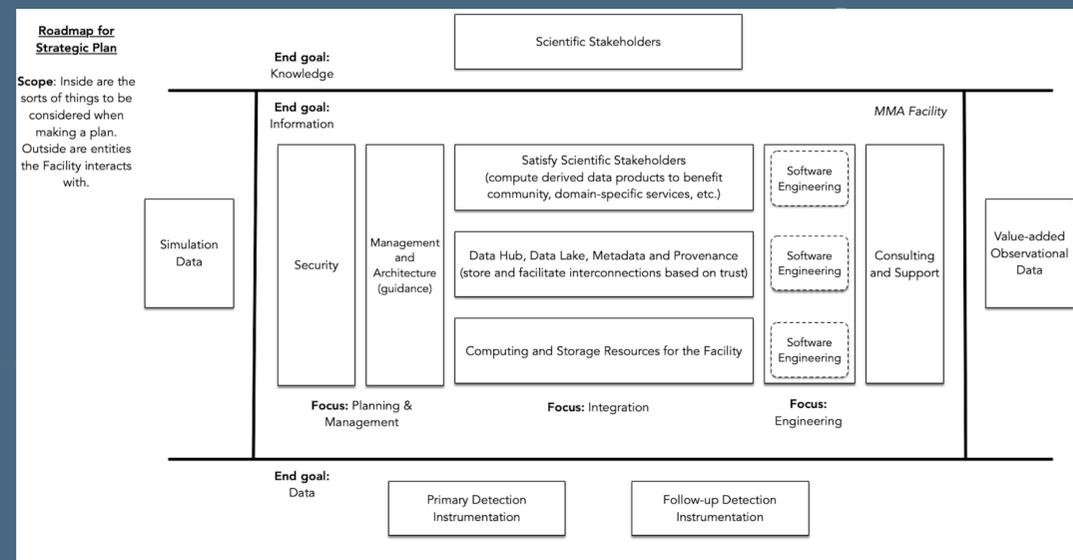


Institute Conceptualization

MMA cyberinfrastructure and services must be built in response to community need and maintained for community benefit. This implies an Institutional approach:

1. Identifying and prioritizing community needs
2. Building cyberinfrastructure with stable funding and employment prospects
3. Long-term commitments to reliability and availability

SCIMMA has conceptualized the form of an MMA Institute [7] to achieve these goals:



Get involved!

All are welcome!

Join at our website <https://scimma.org>



References

1. <https://scimma.org/projects.html>
2. <https://gcn.gsfc.nasa.gov/>
3. <http://www.astronomerstelegam.org/>
4. <https://wis-tns.weizmann.ac.il/>
5. <https://snews.bnl.gov/>
6. <https://www.youtube.com/watch?v=ZZO4ClqUTcY>
7. [Cyberinfrastructure Requirements to Enhance Multi-messenger Astrophysics](https://arxiv.org/abs/1903.04590)
<https://arxiv.org/abs/1903.04590>



Engagements Case Study: SNEWS

SCIMMA worked with SNEWS [5] to implement new internal messaging system ("SNEWS 2.0") for their detector network, based on Hopskotch:

1. Integrated SNEWS and SCIMMA software engineers into a min-Scrum for 2 months
2. Produced working SNEWS 2.0 prototype with Hopskotch, demo available [6]
3. Runs with entirely distributed components (via remote installations and cloud servers)



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