



# Developing the ERS Collaboration Framework

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# ERS Development Challenges

## Resilient System

A system with sufficient **adaptive capacity** to respond to **unanticipated challenges**.

- Finding resilient system designs requires:
  - Large scale **exploration** of cyber-physical design space.
  - Frequent **communication** among stakeholders.
  - Increased **re-use** of design assets.
  - **Automation** of analysis and design tasks.

# ERS Development Challenges

## Resilient System

A system with sufficient **adaptive capacity** to respond to **unanticipated challenges**.

- The current design process...
  - ...is slower than the threat evolution.
  - ...is hindered by communication barriers.
  - ...does not leverage expertise across organizations.
  - ...depends on manual management and tweaking.

# ERS Cloud Computing Architecture (ECCA)

## Impact

- BAE Systems is developing a proof-of-concept platform to facilitate ERS development.

DoD

Large-scale, cross agency trade-space analysis.

Support future asset testing and evaluation.

Industry/Academia

Shape requirements with new, disruptive technologies.

Scalable, reliable computing resources.

Encourage greater **communication** and **collaboration**.

# ERS Cloud Computing Architecture (ECCA)

## Impact

- BAE Systems is developing a proof-of-concept platform to facilitate ERS development.

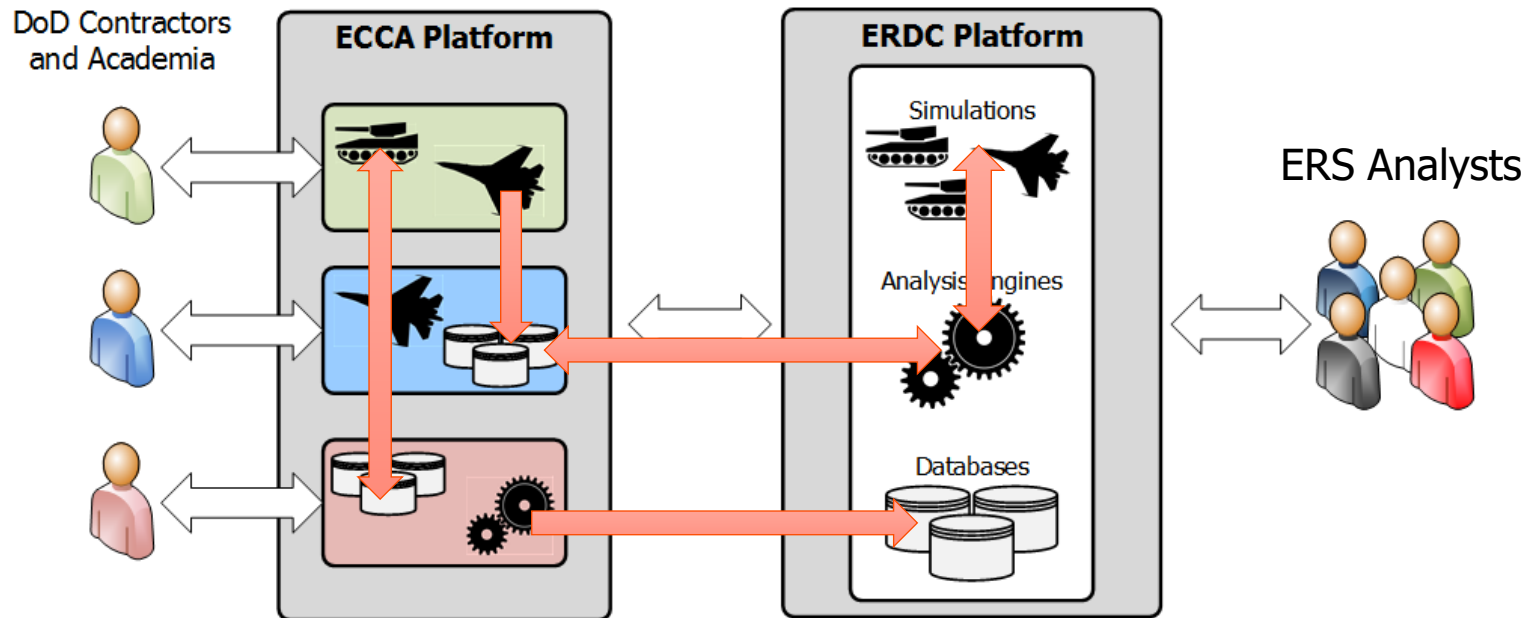
DoD

Industry/Academia

An **agile** design, development, and evaluation process that enables **rapid response** to emerging threats.

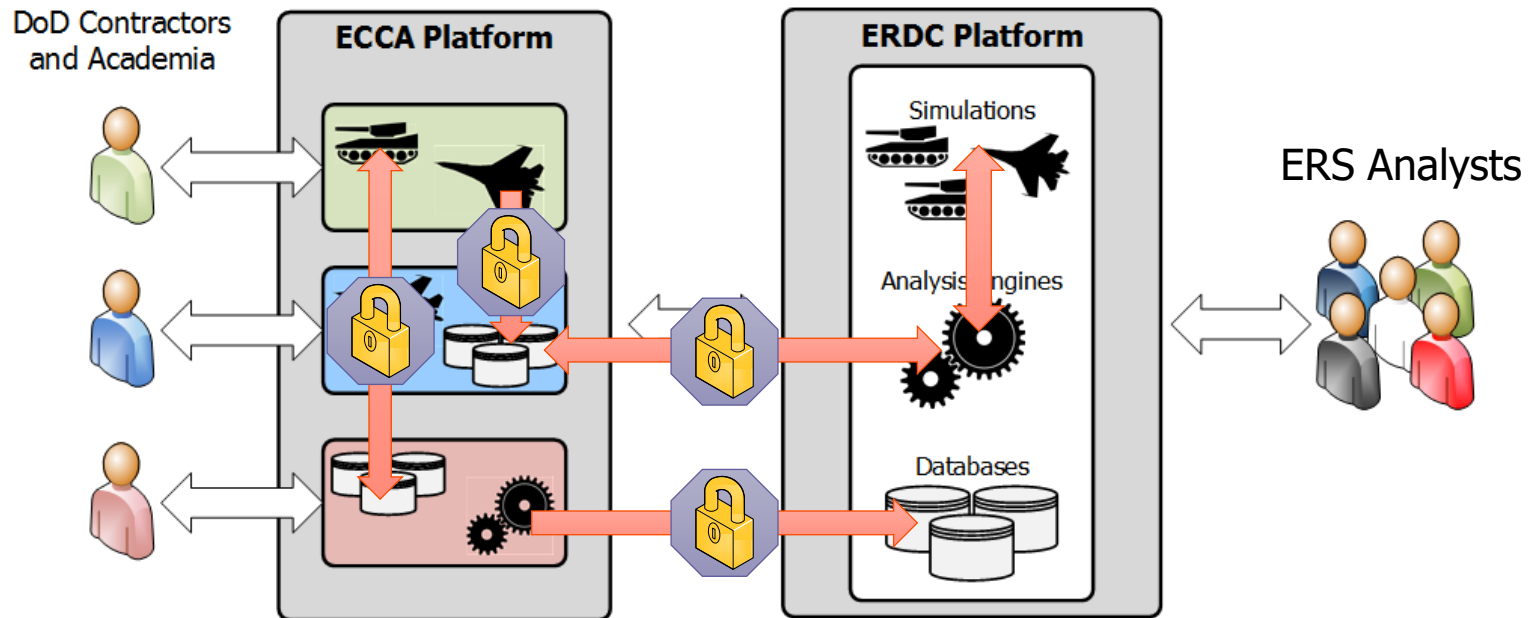
# ECCA Operational Goals

- Tool and data access across the ERS Community.



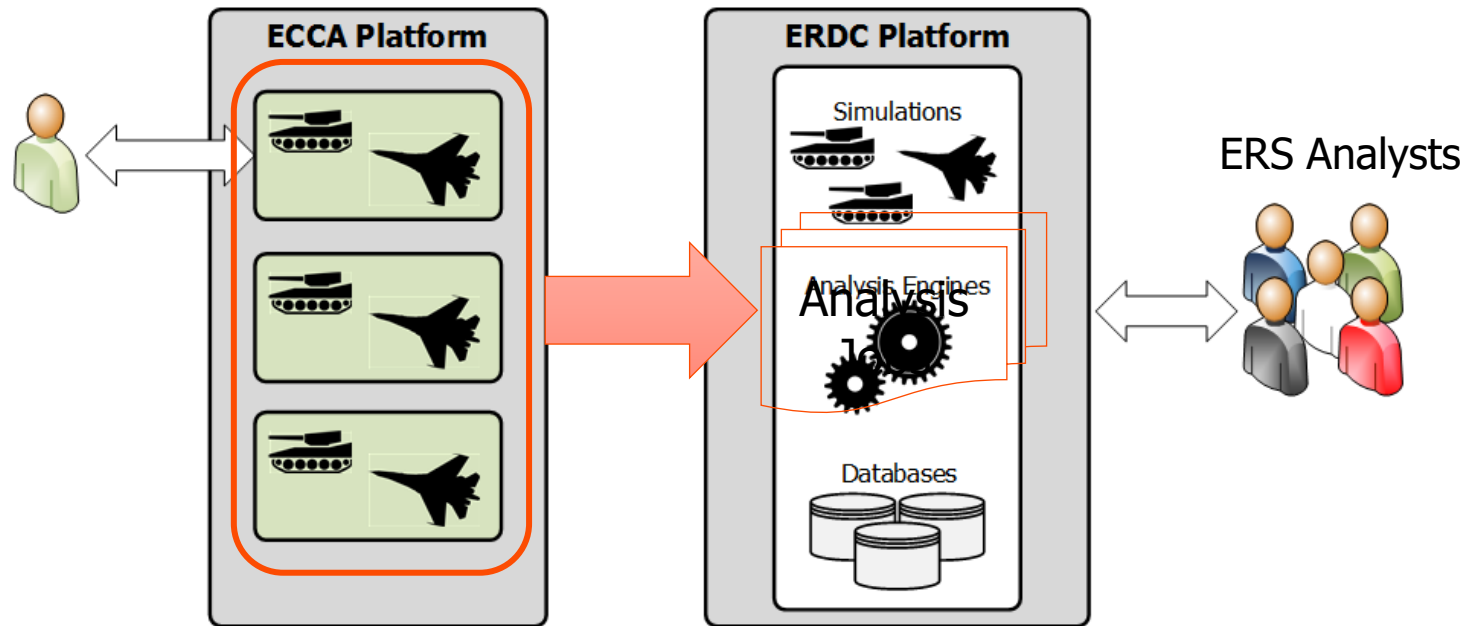
# ECCA Operational Goals

- Dynamically **protect** stakeholder IP.



## ECCA Operational Goals

- Enable **scalable** analysis of alternatives.

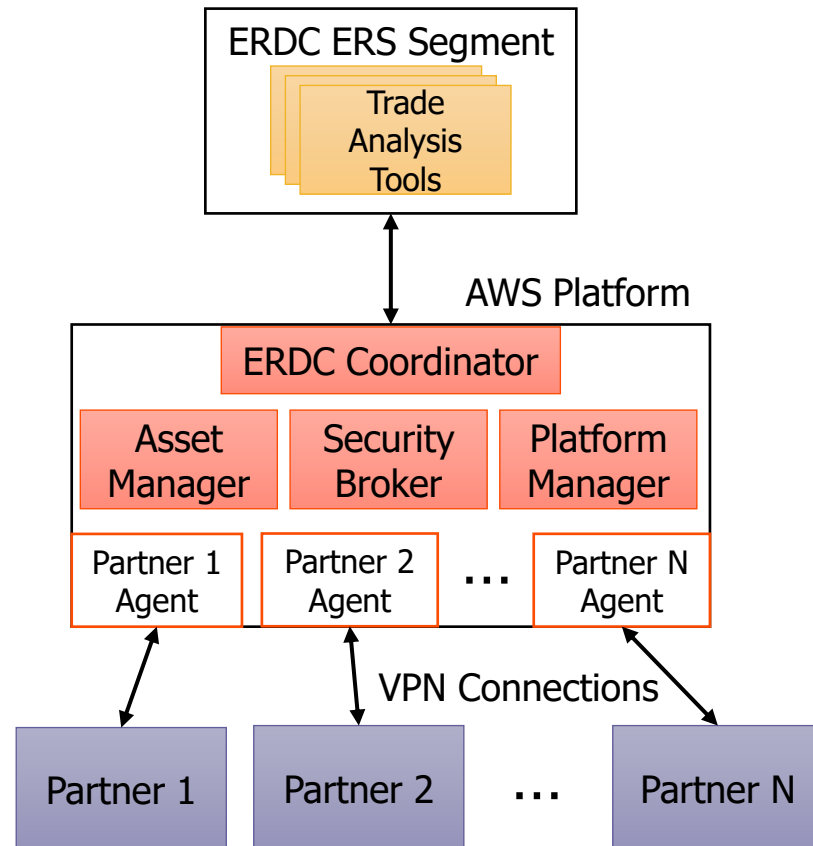




# ECCA Design

## High Level

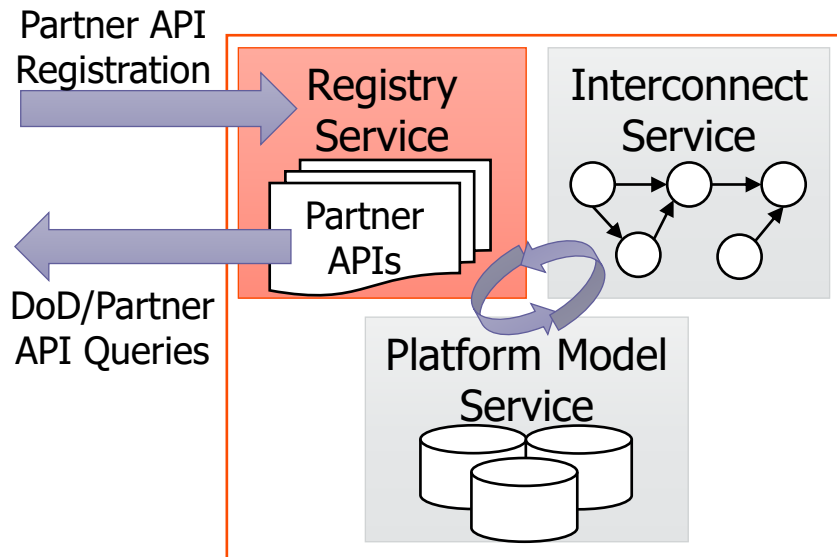
- Facilitate bi-directional access:
  - ERDC  $\leftrightarrow$  ERS partner agents.
  - ERS partners  $\leftrightarrow$  ERDC tools.
  - Use non-proprietary, extensible data formats (e.g. JSON, XML)
- Service oriented architecture:
  - ERDC Coordinator.
  - Asset Manager.
  - Security Broker.
  - Platform Manager.
  - Partner ECCA Agents.



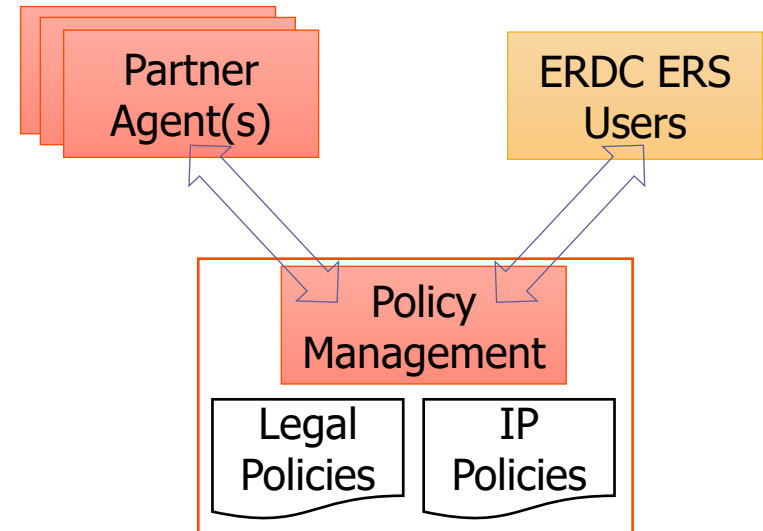
# ECCA Design

## Core Services

- ERDC Coordinator:
  - Handshaking between ERS Segment and the ECCA.
- Asset Manager:



- Platform Manager:
  - IaaS provisioning control.
- Security Broker:



# ECCA Agents

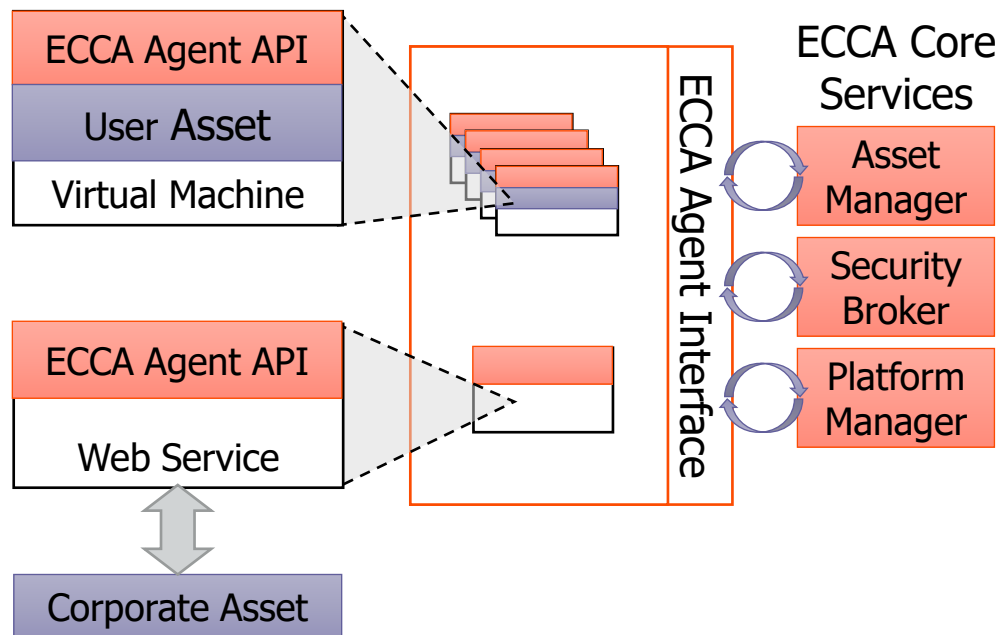
- Manage user assets (e.g. simulations, analytics) deployed in the ECCA or on corporate infrastructure.

## ECCA Deployed Assets

- Loaded into AWS via specialized VM containers.
- Configurable runtime access and scalability rules.

## Corporate Assets

- Communicate via secure web services.
- Configurable runtime access rules.



# Securing Proprietary Assets

- Security Best Practices:

- Data at rest:

Encrypt databases  
and VMs

- Data in motion:

Encrypt  
communication  
channels

- Collaboration:

- Legal.
- Algorithmic:

Call budgets

Differential privacy<sup>1</sup>

Model feature  
control<sup>2,3</sup>

[1] C. Dwork. Differential privacy: A survey of results. In proceedings of the *International Conference on Theory and Applications of Models of Computation*. Springer Berlin Heidelberg, pp. 1-19, 2008.

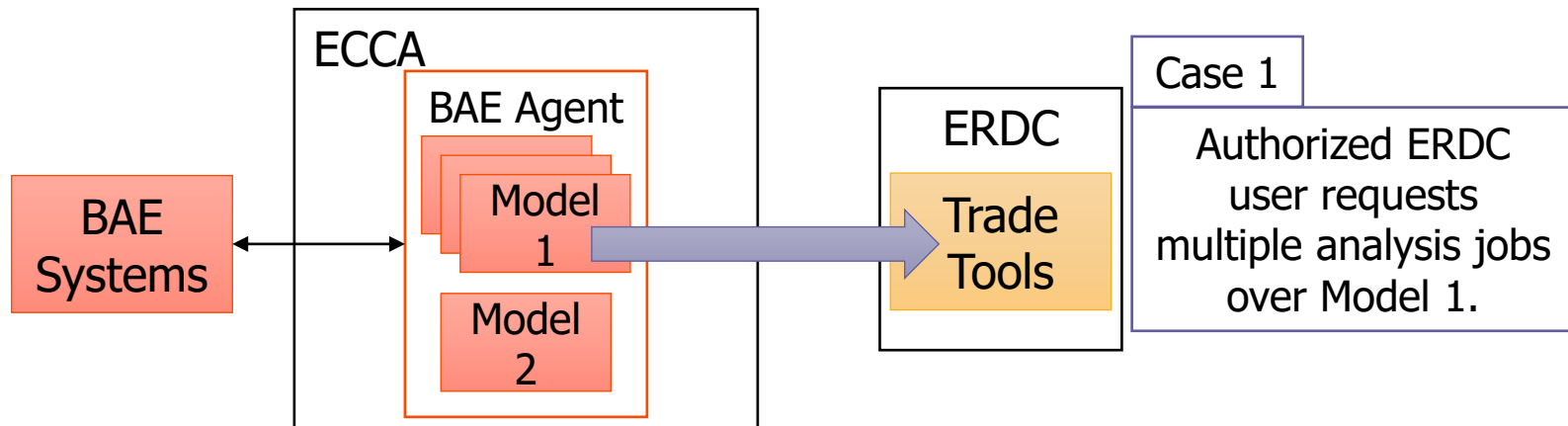
[2] T. Kim, et. al. Multi-Level modeling and access control for data sharing in collaborative design. *Advanced Engineering Informatics*, Vol. 20, No. 1, pp. 47-57, 2006.

[3] Y. Wang, et. Al. Intellectual property protection in collaborative design through lean information modeling and sharing. *Journal of computing and information science in engineering*, Vol. 6, No. 2, pp. 149-159, 2006.

## ECCA Phase 1 Effort

10/2016 – 07/2017

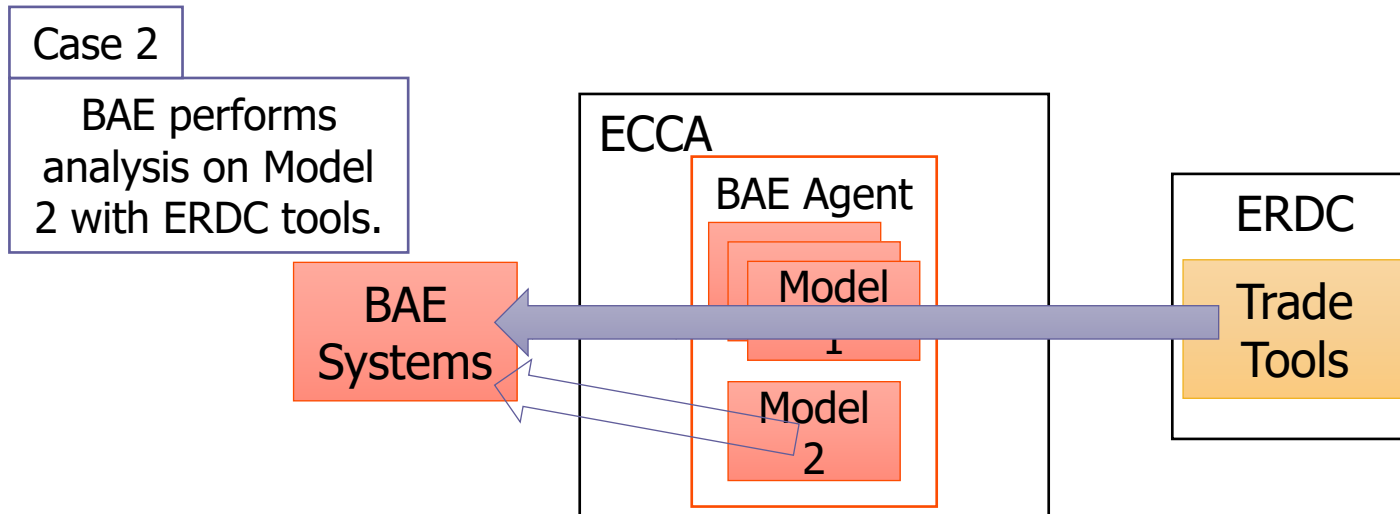
- Develop ECCA components that support ERDC ↔ BAE Systems collaboration.
- Develop and deploy surrogate models as “guinea pigs.”



## ECCA Phase 1 Effort

10/2016 – 07/2017

- Develop ECCA components that support ERDC ↔ BAE Systems collaboration.
- Develop and deploy surrogate models as “guinea pigs.”



# ECCA Infrastructure Exploration

## AWS GovCloud

- GovCloud region dedicated to State and Federal Entities.

- Managed by US citizens, on US soil.
- ITAR, FedRAMP compliant.
- Core AWS services available, e.g. EC2, S3.



- Initial ECCA Mapping to AWS.

- Partners connect to AWS via Virtual Private Clouds (VPC).
- ECCA Agent services front segments of VPCs.
- Partner communication via VPC peering.
- Security broker clears/rejects communication based on policies.

## Future Challenges

- Trust.
  - Reliability, model accuracy, security, usability.
- Automatic workflow provisioning and interconnect.
  - Granularity and composition of simulation components.
- Maintaining analysis and design workflows.
  - Evolvable interconnect among tools, simulations, and components.
- Component and Design management.
  - Design repositories.





# Thank you!

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