



U.S. ARMY  
**RDECOM**

Quality of Information for  
Semantically-Adaptive Networks (QoI)



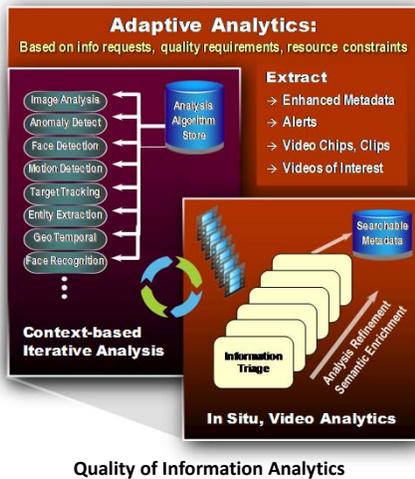
## S&T Campaign: Information Sciences Networks and Communications

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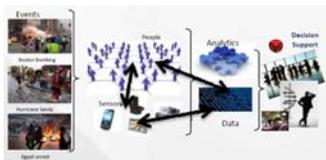
## Research Objective

- Foundational science to model, characterize, and control **information delivered through multi-genre networks** based on the network environment and semantics context of queries
- **Maximize overall information capacity of networks** by taking into account the context in which the requested information is used, and by exploiting the tradeoffs between data representation, the desired information quality, and communication capabilities for tactical networks



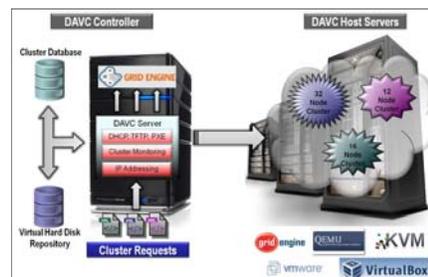
## Challenges

- **Representing semantic analogues of classical information theoretic results:** Foundational science of representing and communicating semantic information. Fundamental limits of representation and communication significantly over classical semantics-agnostic results (source & channel coding)
- **Lack of understanding of relationships within multi-genre networks and their impact on information capacity:** Consider the quality and quantity of information as it propagates through different network structures and types. Model impact of communication modalities on information flow
- **Limited understanding of the tradeoffs between QoI metrics for semantic information delivery:** develop algorithms to improve quality of delivered information while considering network retrieval devices and information base of structured or unstructured items (e.g. video) involved in information queries



## ARL Facilities and Capabilities Available to Support Collaborative Research

- **Research Insights**
  - Use of semantic information in image queries, improves completeness & timeliness over non-semantically-aware schemes
  - Processing on end-devices can drastically impact QoI & required capacity. Tradeoffs are not straightforward
- **Experiment Facilities:** Network Science Research Laboratory (NSRL): state-of-the-art experiment facility with a wide range of capabilities:
  - Integration of various multi-genre network experiment platforms applications (e.g., EMANE, ELICIT, Algolink, Apollo)
  - Concurrent emulation of wireless networks utilizing Dynamically Allocated Virtual Clusters (DAVC)
  - Close collaboration with research partners in the Network Science Collaborative Technology Alliance



Dynamically Allocated Virtual Clusters (DAVC)

## Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- **Integration of other military-relevant networked applications** into NSRL enhances the fidelity of environment and expands the potential for QoI research results
- **New approaches to improve QoI metrics** in various networked scenarios provides perspective into current research direction

## Selected Publications

- J. Edwards, A. Bahjat, Y. Jiang, T. Cook, T.F. La Porta, "Quality of Information-aware Mobile Applications," Pervasive & Mobile Computing, Elsevier, June 2013.
- G. Cirincione, R. Govindan, S. Krishnamurthy, T. F. La Porta, P. Mohapatra, "Impact of Security Properties on the Quality of Information in Tactical Military Networks," IEEE MILCOM 2010.