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Enabling Secure Group Communications for UAV Swarms using Distributed Key Management

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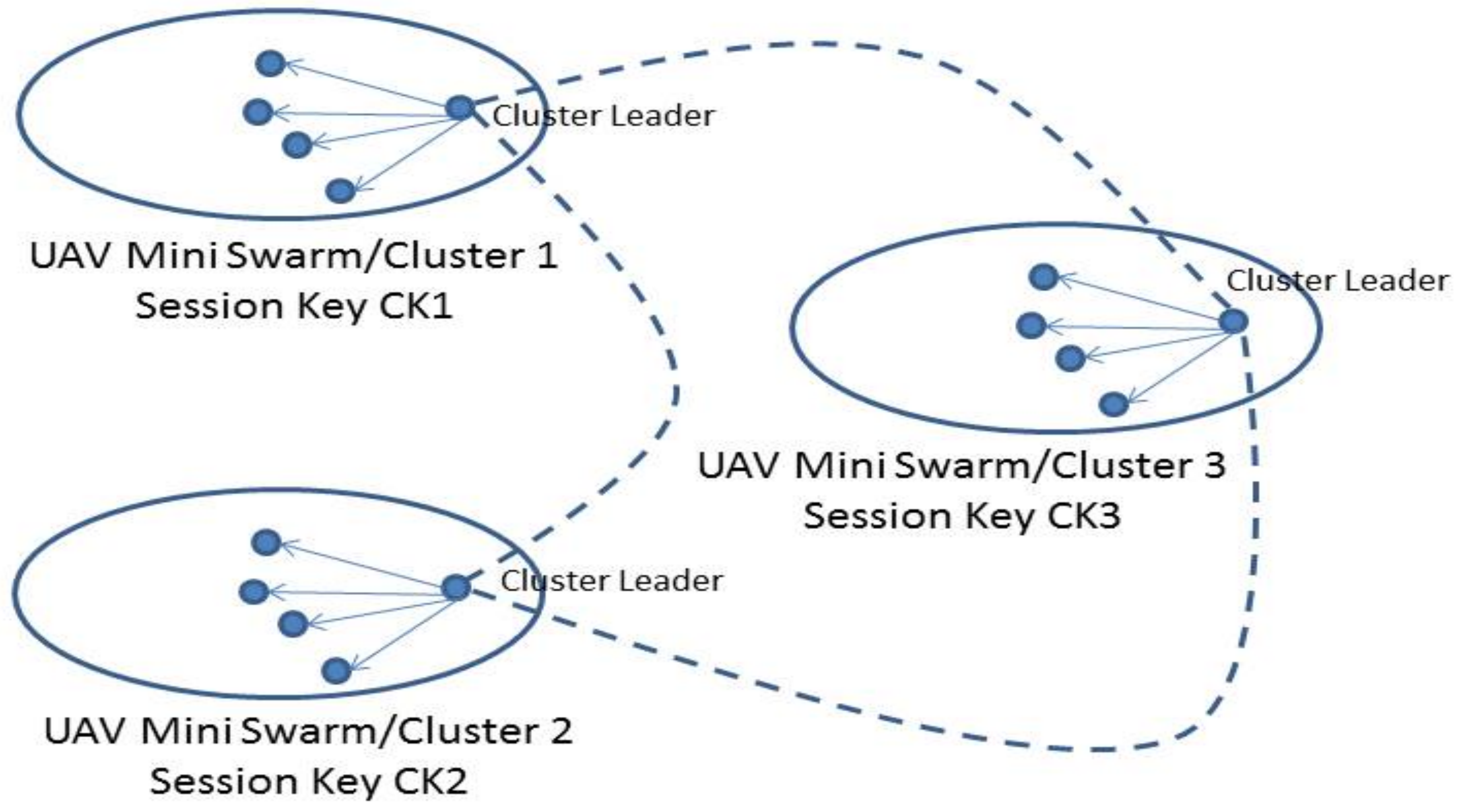

A UAV swarm divided into mini swarms to facilitate security within group communications

- UAV swarm communications need security mechanisms.
- NSA has adopted the Advanced Encryption Standard (AES) as the cryptographic module for S/TS information.
- AES widely implemented because it is fast and has low ram requirements.
- AES needs key management protocol to facilitate key distribution and re-keying.
- UAVs swarms are cooperative and thus can be modeled using group communications protocols.
- Group Key Management (GKM) that is decentralized and can work in tandem with AES is necessary.

- GKM will be developed using dynamic K-means clustering algorithm.
- UAV swarm will be divided into K clusters with each cluster having a dynamically elected cluster leader (CL); all cluster members follow the CL.
- Each cluster leader generates a session key (CK) using the AES Pseudo Random Number Generator (PRNG) for encryption of data within the cluster.
- CL-X communicates to CL-Y as follows: 1) CL-X transmits CK-X to CL-Y; 2) CL-X transmits information to CL-Y which CL-Y decrypts using CK-X; 3) CL-Y encrypts data using CK-Y so that members within cluster X can decrypt information
- Rekeying only required within individual clusters when UAVs arrive or depart; only CK of one cluster is re-keyed as opposed to the whole network.

- Security is important in UAV swarm communications
- To this date very little work has been done on identifying feasible security algorithms for swarms.
- A straightforward encryption algorithm like AES combined with GKM will provide a stepping stone for further security research and collaboration
- This work will make an immediate impact by providing a preliminary solution to the lack of security in UAV deployment.
- This furthers the CRUSER mission
- Cybersecurity is an important research component at NPS and thus furthers the mission of the school, Navy and DoD.

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