Reconciling Hierarchical & Edge Organizations

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Overview

- Goal:
  - To show how hierarchical & edge organizational forms may be reconciled using networks of agents
- Overview:
  - Introduction
  - Organizational forms: hierarchy versus edge
  - Reconciliation: layered networks of norm-based agents
  - Illustration: 9-11 revisited
  - Implications & next steps

Introduction: my research

- My research area:
  - Command & Control (C2: military & emergency management)
- My approach:
  - Professional hobby, preferably in collaboration
- My current topics:
  - Information sharing in coalition C2:
    - 2 PhD students (cultural influences; eCommerce to support CMI)
  - Offensive cyber operations:
    - Integrating kinetic & cyber ops
  - Incorporating network science into C2 theory:
    - Editing book (with René Janssen & Herman Monsuur, NLDA)
  - Social media as C2 implementation technology:
    - Analyzing chat from anti-piracy operations (with Oscar Boot, NLDA)

Organizational forms (1)

- Hierarchy versus edge:
  - Recurring theme in C2 literature:
    - Alberts & Hayes (2003) Power to the Edge
    - ELICIT community
  - Findings:
    - Edge generally better for NCO / NEC: more agile
    - Hierarchy and edge seen as “contrasting alternatives”
  - Yet military organizations stubbornly hierarchical!
- Research question: Can 2 forms be reconciled?
  - Answer: Yes, and with synergistic benefits too

Organizational forms (2)

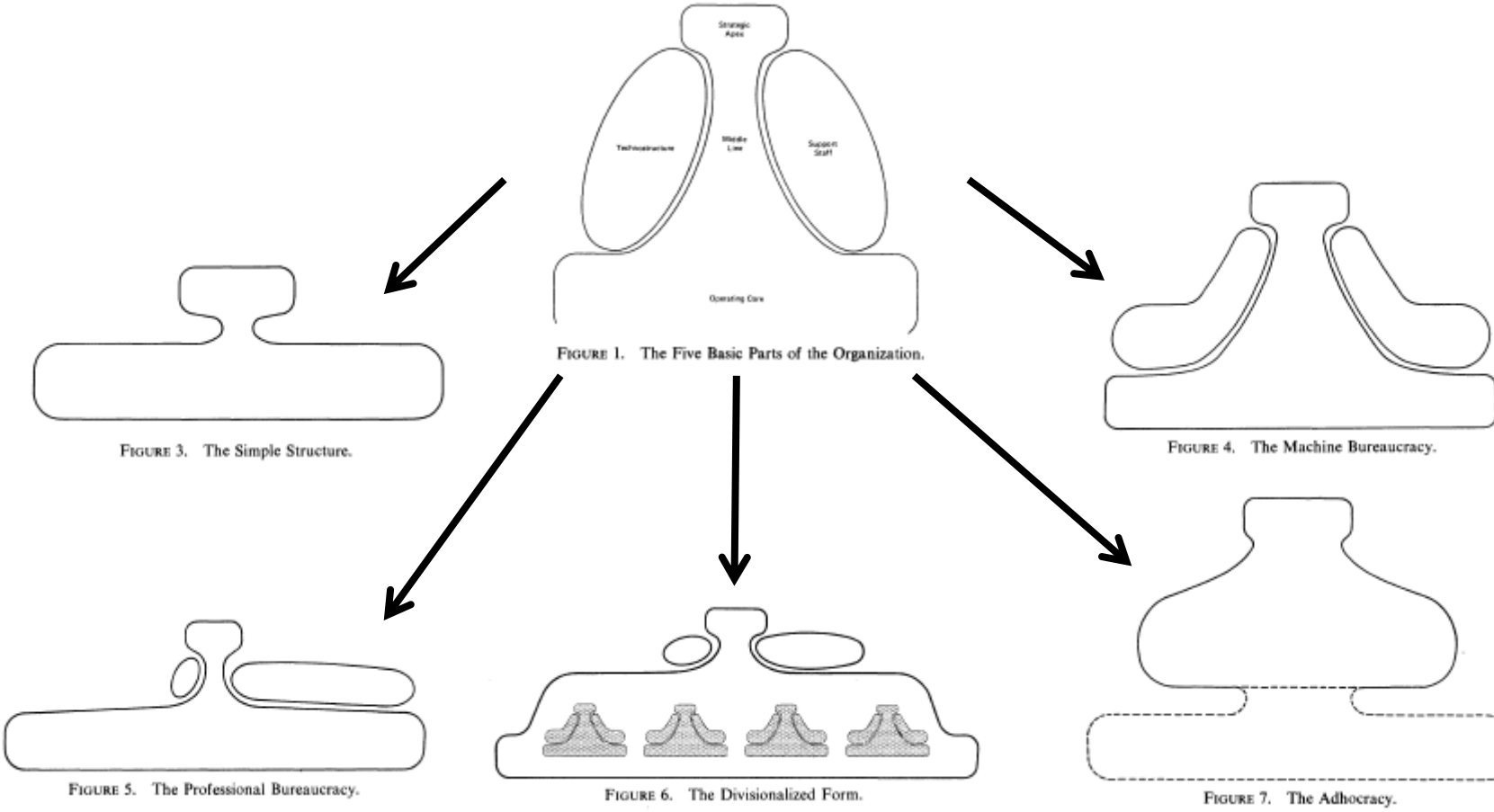

FIGURE 1. The Five Basic Parts of the Organization.

FIGURE 3. The Simple Structure.

FIGURE 4. The Machine Bureaucracy.

FIGURE 5. The Professional Bureaucracy.

FIGURE 6. The Divisionalized Form.

FIGURE 7. The Adhocracy.

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Mintzberg, 1980

Organizational forms (3)

- Edge organization:
  - 6th organizational form

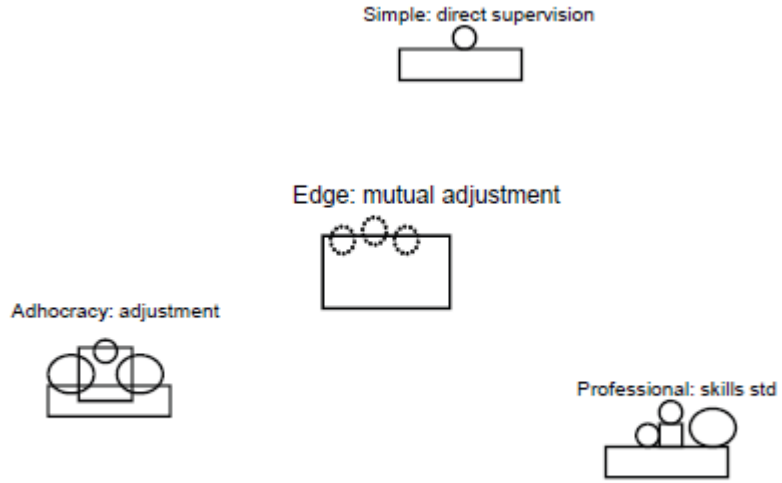
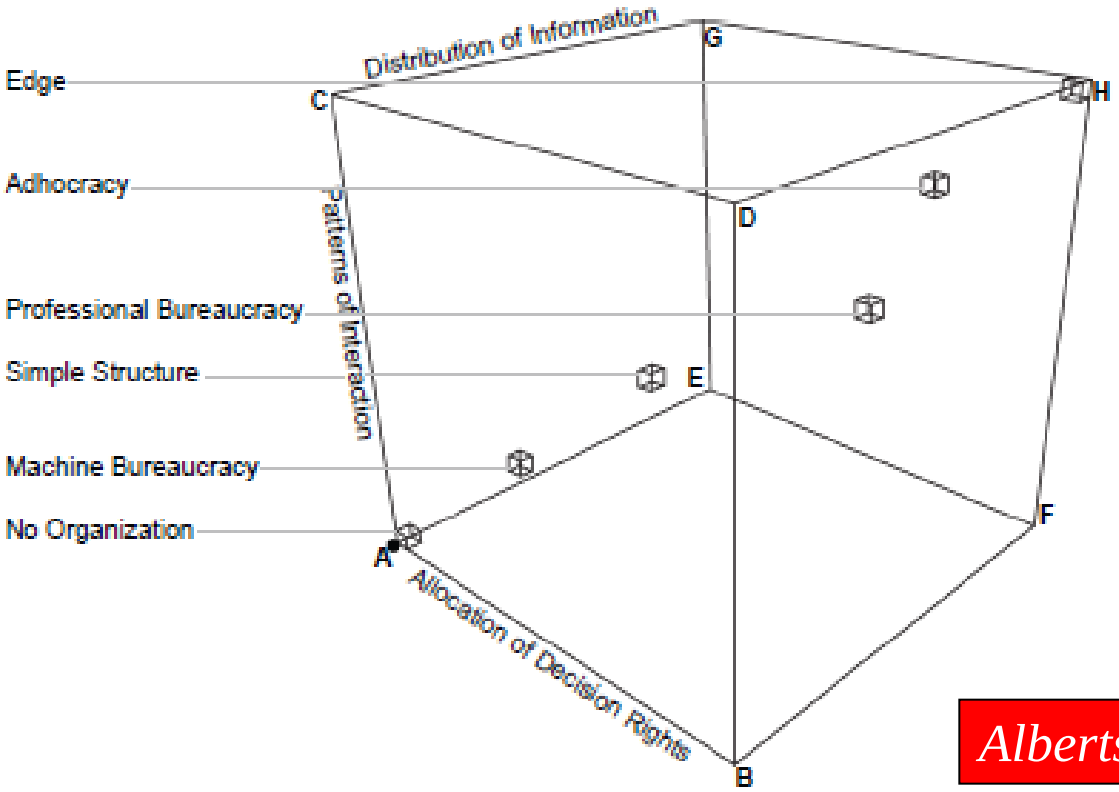


Figure 7. Edge Organization

Alberts & Nissen, 2009

  - Elements of:
    - Simple Structure: low specialization
    - Professional Bureaucracy: prominent operating core
    - Adhocracy: coordination via mutual adjustment

Organizational forms (4)



Alberts & Nissen, 2009

Figure 8. OMT Archetypes in the C2 Approach Space

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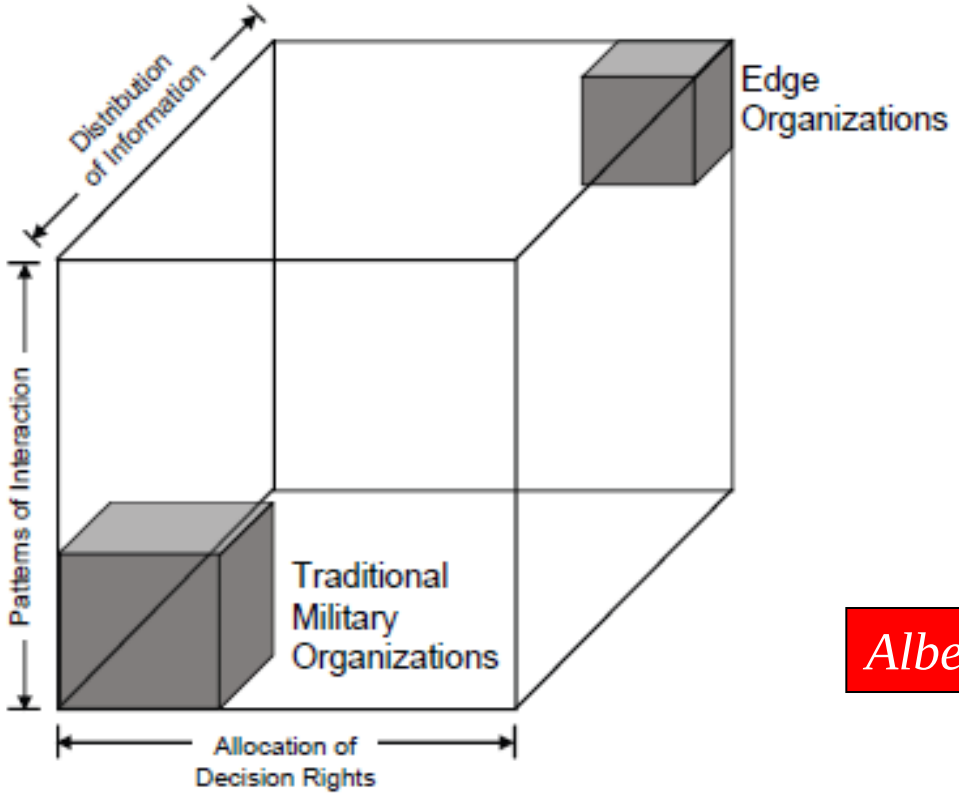
Organizational forms (5)



Alberts & Nissen, 2009

Figure 1. C2 Approach Space (adapted from Alberts and Hayes 2006)

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Organizational forms (6)

Hierarchical and edge organizational forms seen as "contrasting alternatives"

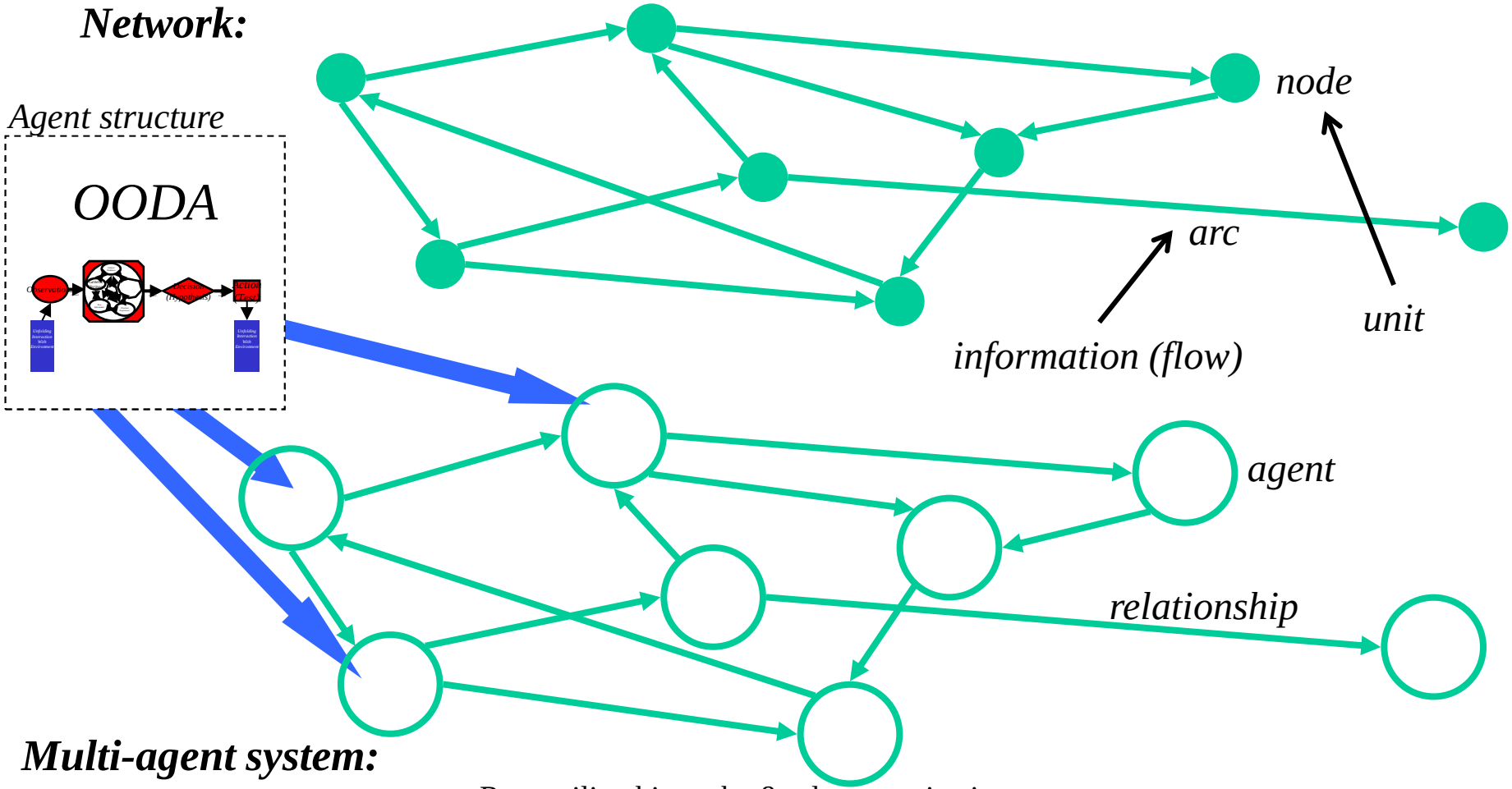
Variable	Meaning	Hierarchy	Edge
Centralization	Breadth of decision rights	High	Low
Vertical specialization	Limitedness of job control	High	Low
Horizontal specialization	Narrowness of job breadth	High	Low
Formalization	Formalization of work processes	High	Low
Liaison devices	Means of horizontal interaction	Few	Many
Planning & control	Management of output	Action planning	Performance control

Adapted from
Alberts & Nissen (2009), Tables 1 & 2

Reconciliation (1)

- From network science:
  - Layered networks:
    - Physical/technical, information, cognitive, socio-organizational
- From agent-based modelling:
  - Nodes as agents:
    - Not atomic as in network science, but internal structure
    - Sensing, understanding, deciding, acting = OODA
  - Agent behaviour constrained by norms (IF-THEN rules):
    - Structural, functional, deontic, dialogical
- From organization & management theory (OMT):
  - Modular organizations: see paper, section 2

Reconciliation (2)



Reconciliation (3)

Alberts & Nissen, 2009

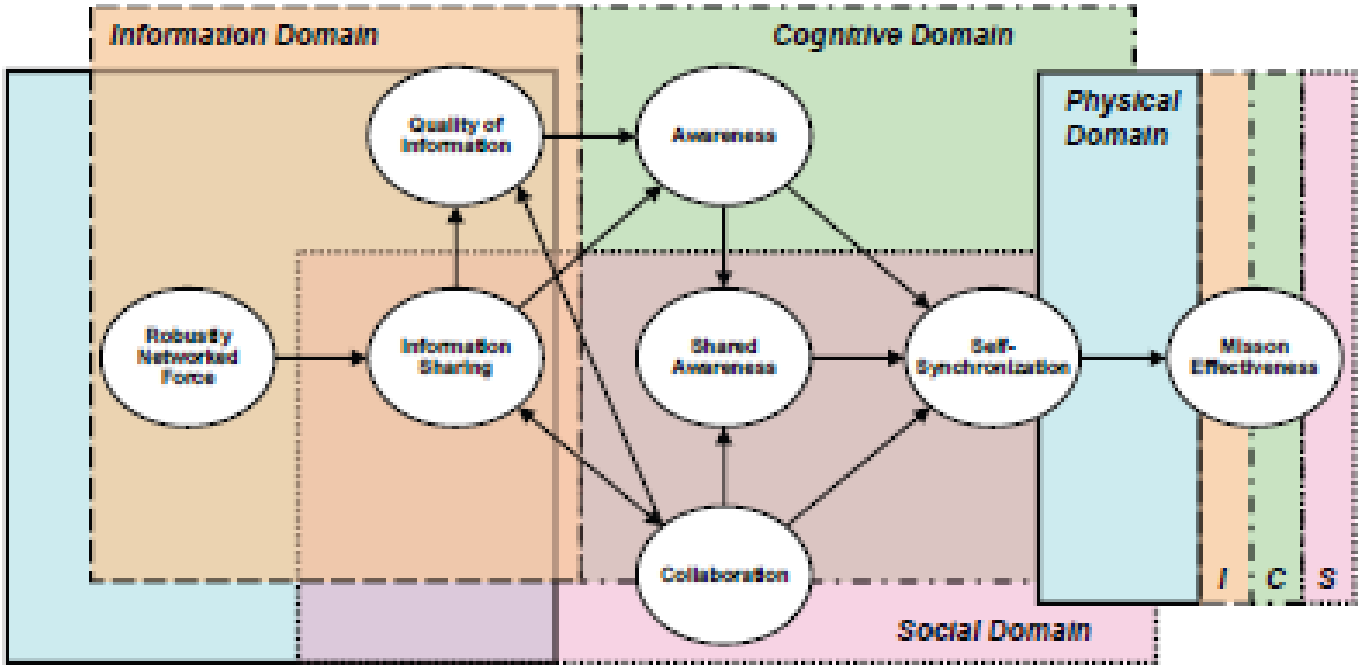


Figure 3. Network Centric Value Chain

*See domains as **layers**, containing **1-to-many** networks*

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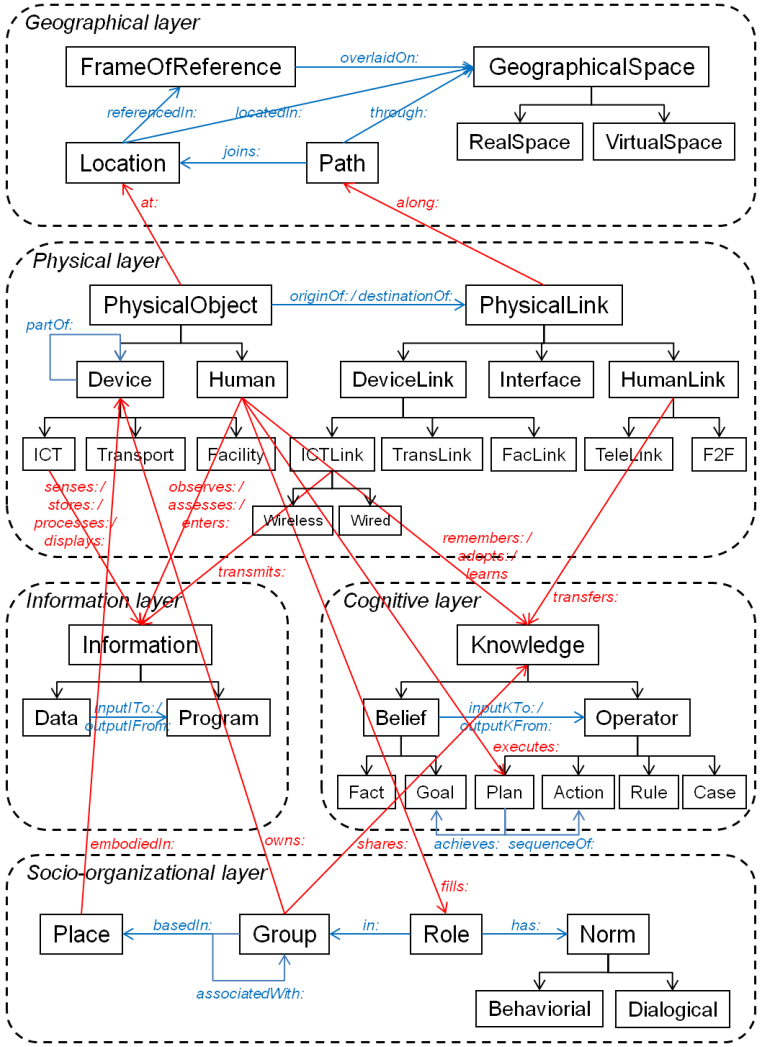
Monsuur, Grant & Janssen, 2011

Reconciliation (4)



Formalized Layered Ontology for Networked C2 (FLONC)

Grant (forthcoming)

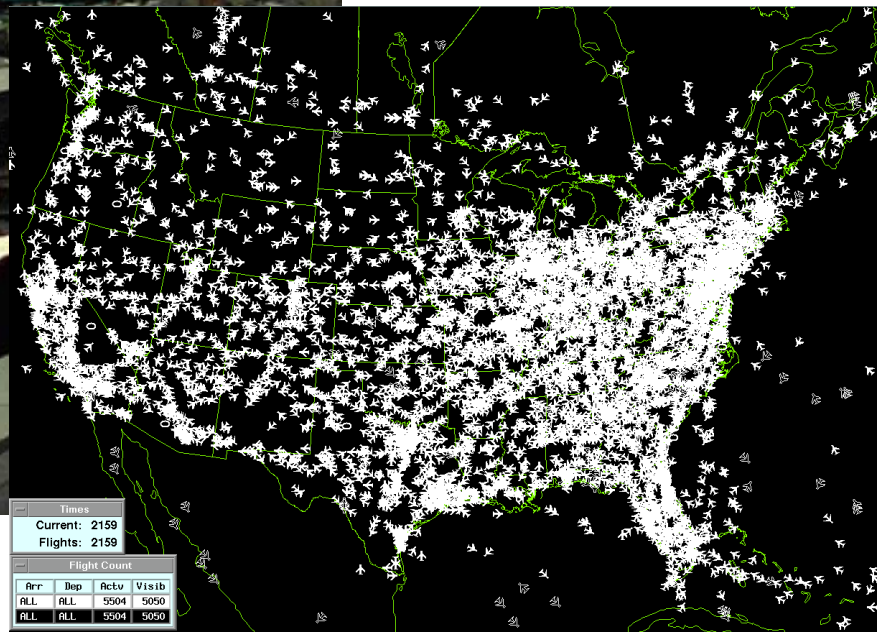
9-11 revisited (1)

9-11 revisited (2)

FAA's System Command Center

Grant, 2006

Their picture



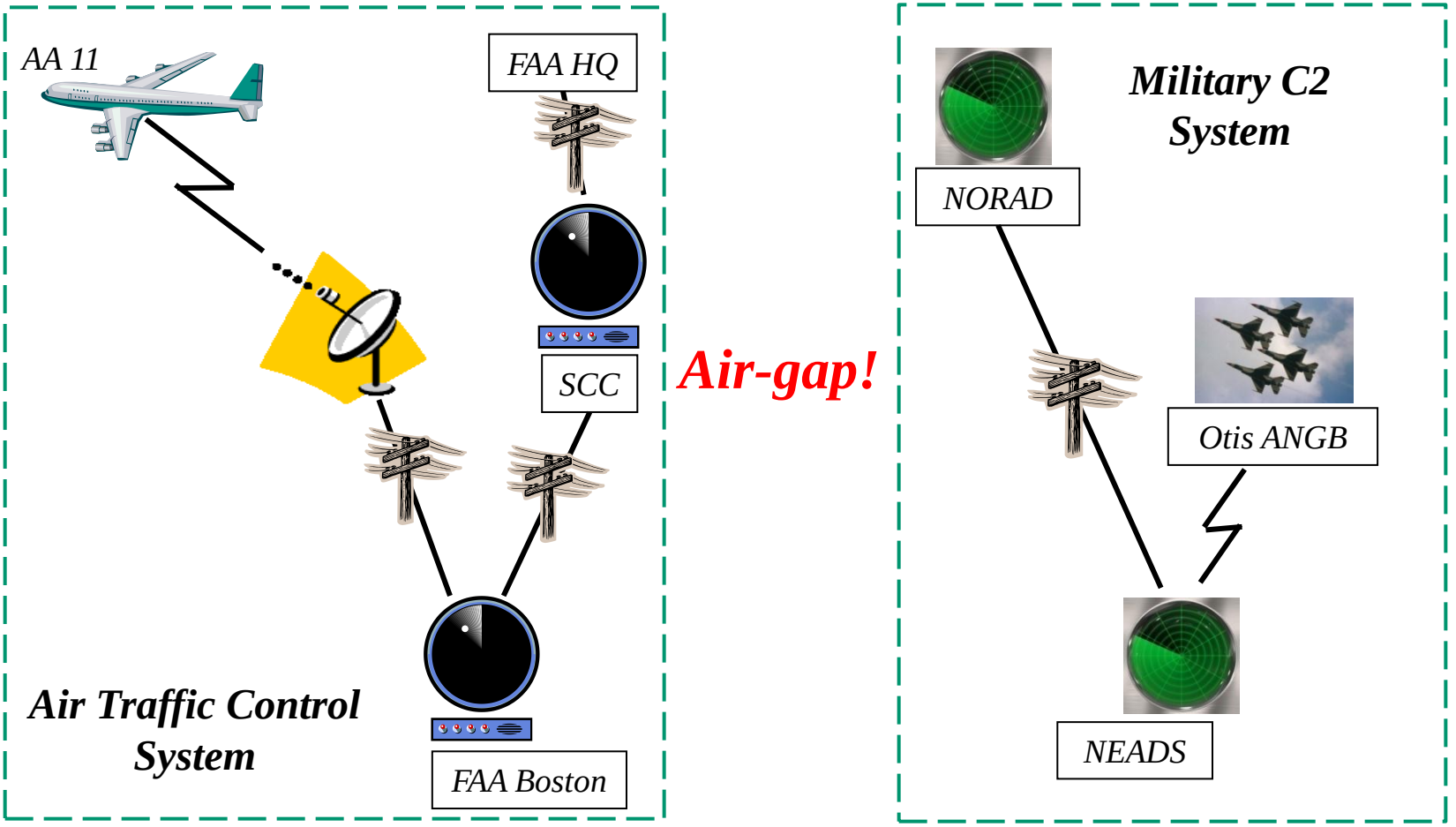
9-11 revisited (3)

NORAD

Grant, 2006

Their picture

9-11 revisited (4)



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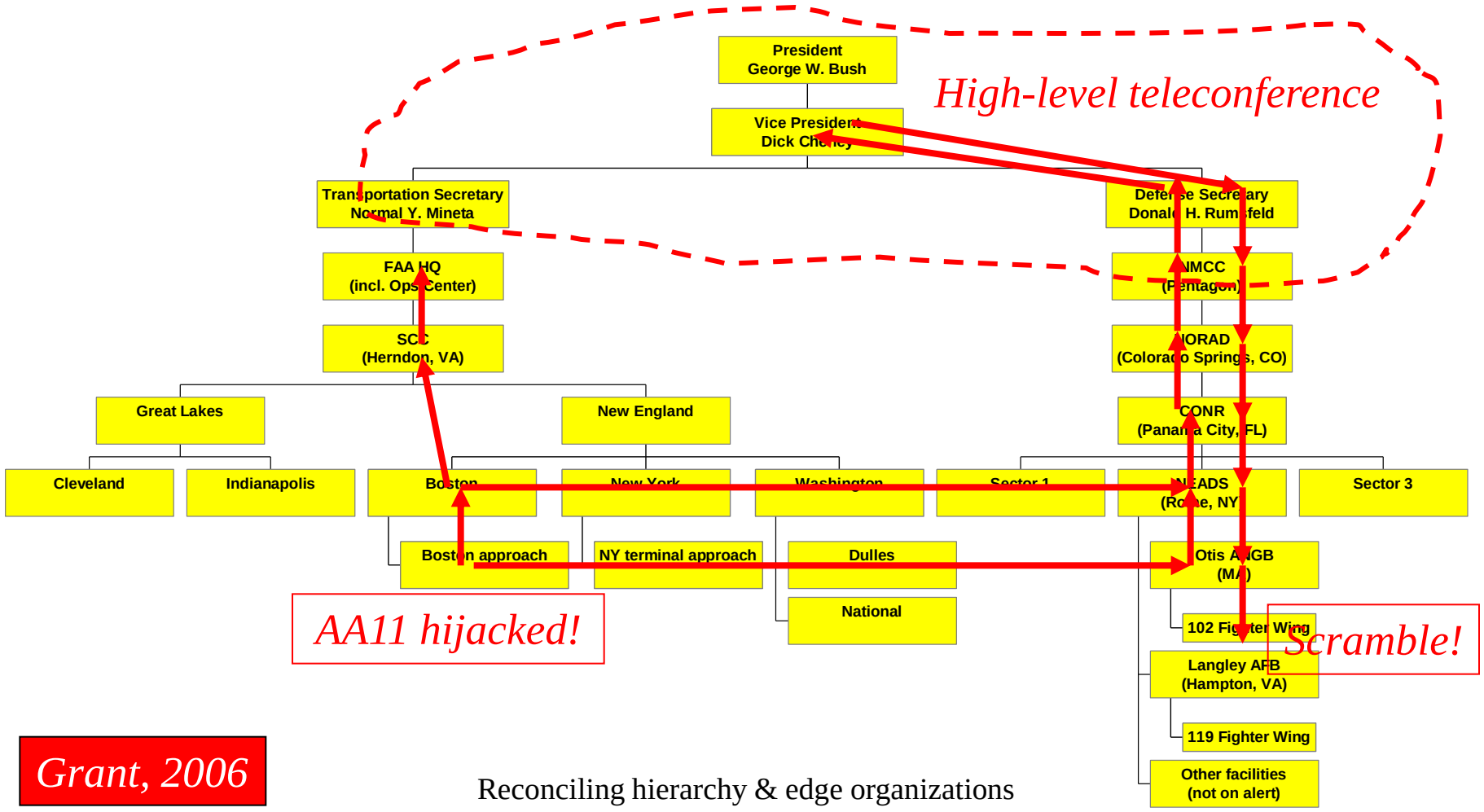
Grant, 2006

9-11 revisited (5)



Grant, 2006

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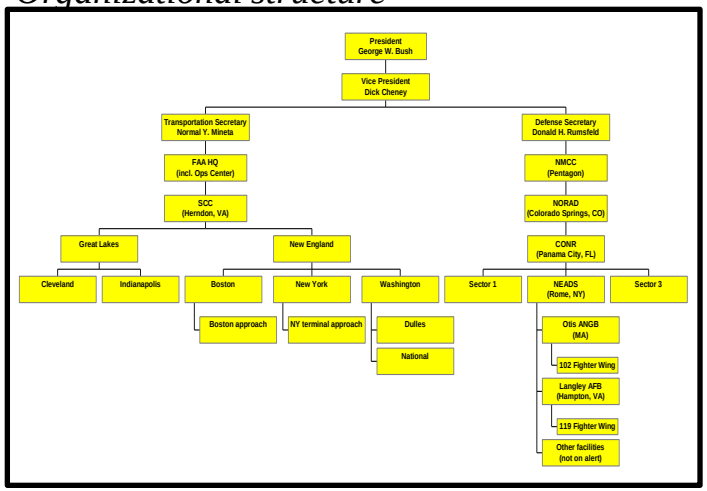
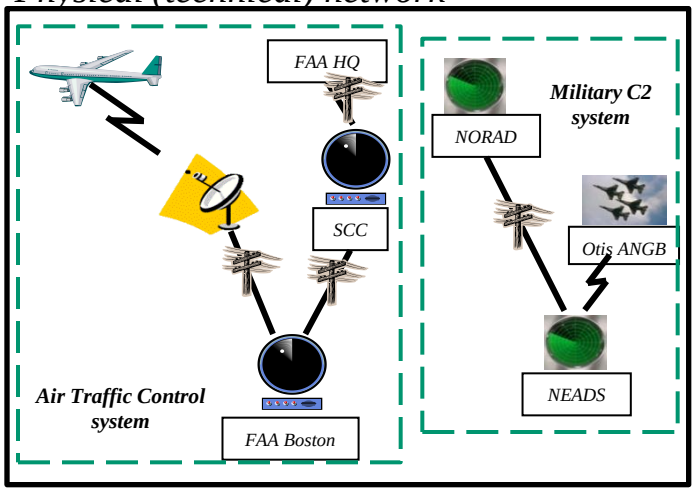
9-11 revisited (6)

Three networks

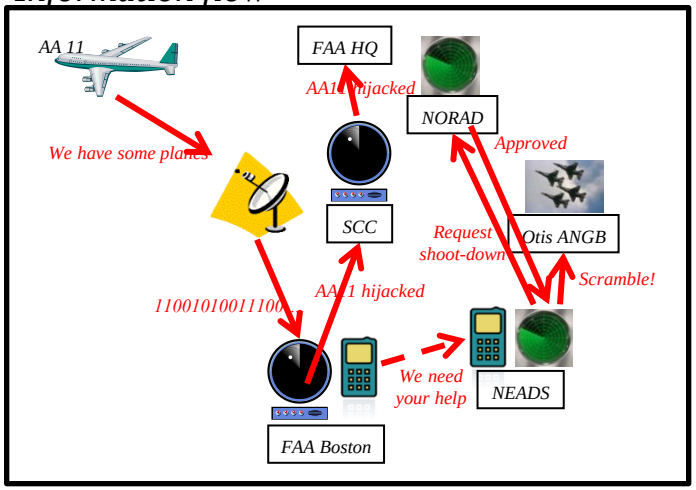
Organizational structure



Physical (technical) network



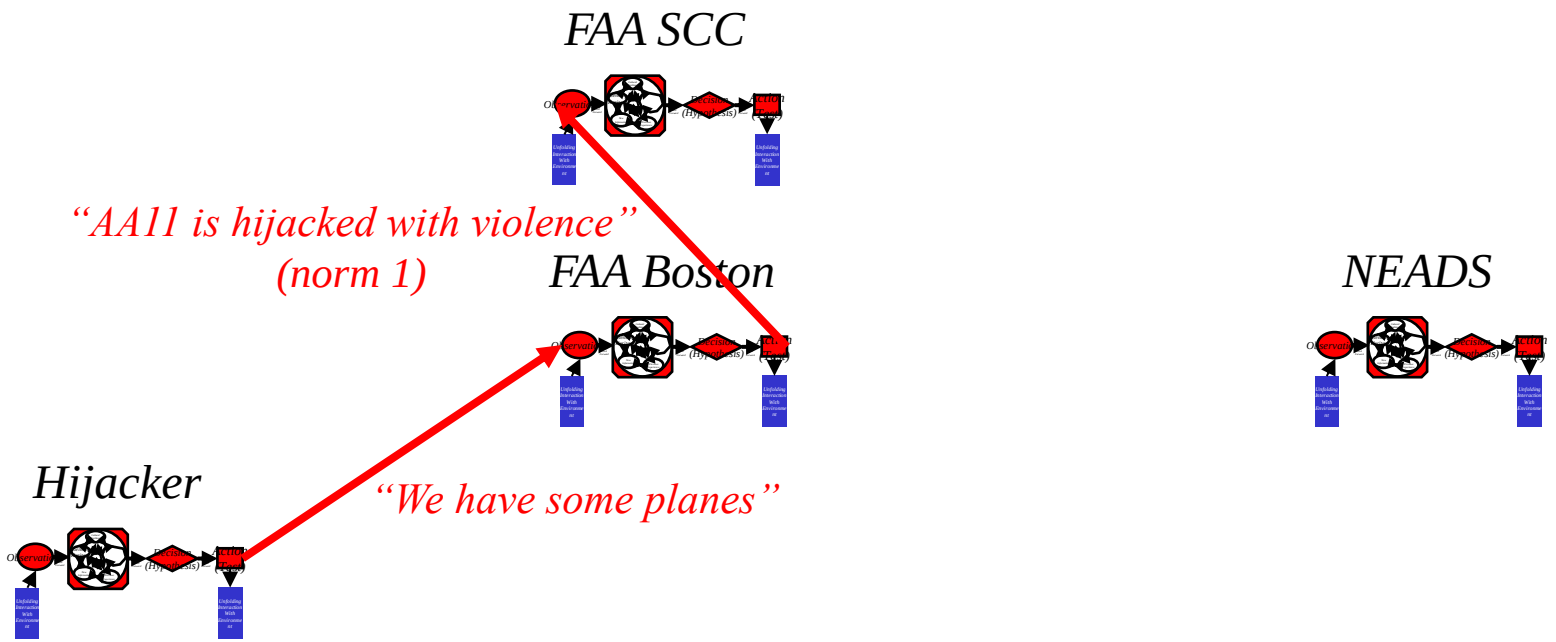
Information flow



Grant, 2006

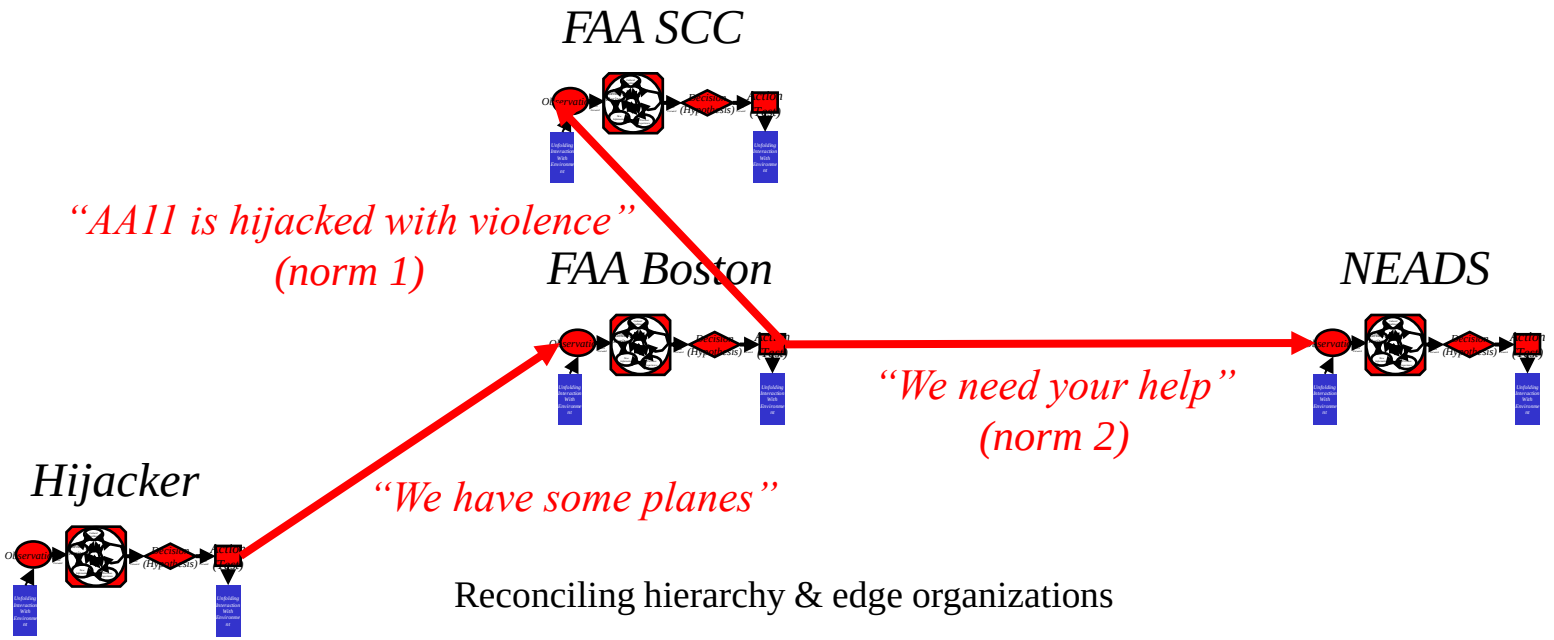
9-11 revisited (7)

- Case (1): what *should have* happened:
  - **IF** you receive information that aircraft is hijacked **THEN** pass information to superior



9-11 revisited (8)

- Case (2): what *actually* happened:
  - **IF** you receive information that aircraft is hijacked **THEN** pass information to superior
  - **IF** you receive information that aircraft is hijacked **AND** violence has been used **AND** you have friend in military **THEN** pass information to your friend



Implications

- Military can keep their beloved hierarchies!
  - Network defined by superior-subordinate relationship
- Information flow plays over organizational network:
  - Flow pattern (network) can vary according to situation:
    - More or less centralization
    - Need for agility (see 9-11 case study)
    - NCO / NEC maturity of coalition partner(s)
  - Defined in terms of dialogical norms:
    - Norms relate to doctrine / RoE -> brings doctrine into C2 systems
    - Easy to change for agility (although units must be trained to do so)
    - Even possible to have different norms in different parts of organization
- Technical network is enabler

Next steps

- Implement agent-based simulation:
  - Several researchers already working on norm-based agents
  - Based on OODA-RR & FLONC (Grant, 2005; 2011; 2014)
- Testing:
  - Cyber: hacker (attacker) versus sys admin (defender):
    - Model for “it takes a network to fight a network” (3+ agents)
    - HackSim (Grant et al, 2007), version 2.0
  - Reproduce 9-11 behaviour:
    - All 3 cases from Grant (2006) thought experiment (18 agents)
  - MECA scenario (Van Diggelen et al, 2009):
    - Multi-cultural (eg civil-military) organization (15+ agents)

Any questions?

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