

The background is a detailed illustration of a military operation. It shows a large transport aircraft on the left, a helicopter on the right, and several soldiers in camouflage gear in the foreground. The scene is set in a rugged, mountainous terrain with a grid overlay. The text "Addressing the challenge of Air-to-Ground communications" is centered over this illustration in a white, serif font.

Addressing the challenge of Air-to-Ground
communications

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE 30 JAN 2013		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Cursor on Target (CoT) 101 Briefing				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) The CoT Project Office				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Cursor-on-Target, AFLCMC/HNBC Architecture & Standards Division				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 15	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



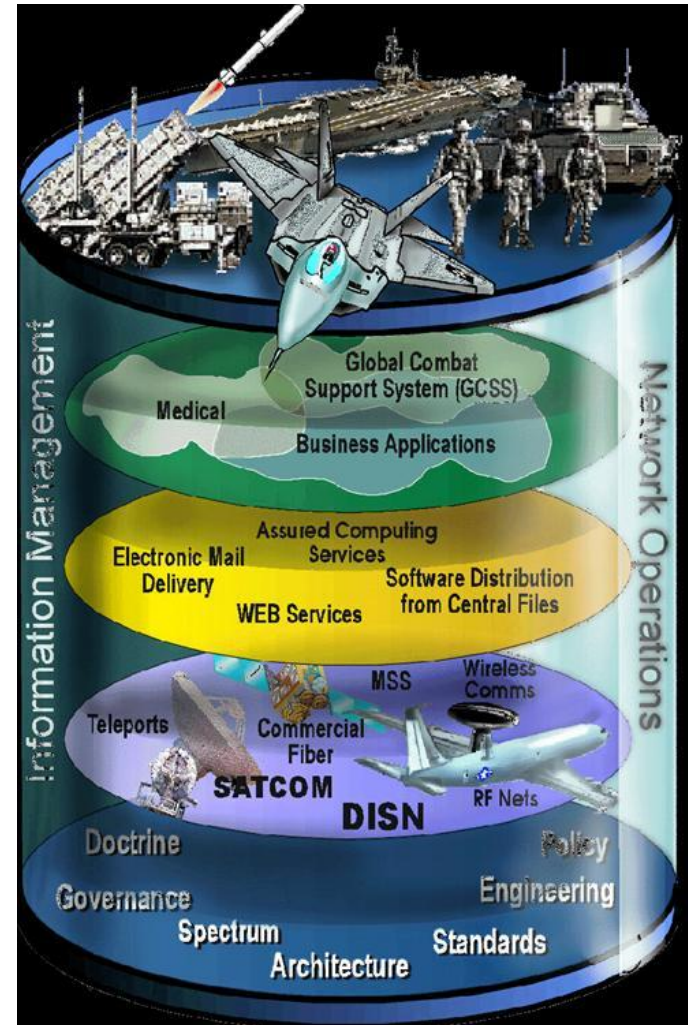
Effective warfare requires...

- **Seamless communications between combat elements**
- **Addressing the challenge of low-bandwidth restrictions at the tactical edge**
- **Timely Situation Awareness**
- **Ability to pass data across disparate systems without significant information loss**



DOD's Complex Enterprise Communications

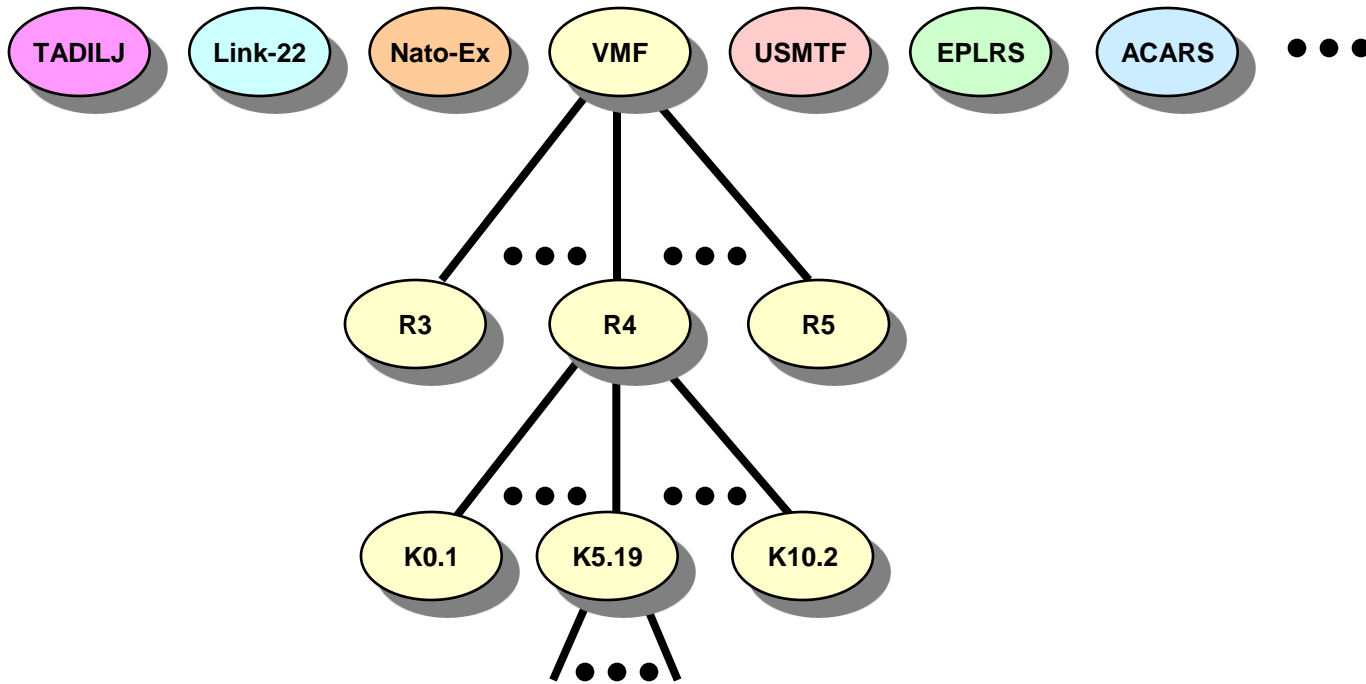
- **Multiple message formats**
 - *Link-16*
 - *VMF*
 - *GCCS*
 - *Etc.*
- **Radio transmissions can be on the order of 2400 bps**
 - *Communications at the tactical edge cannot handle the data being passed on the GIG*
- **Multiple versions of equipment do not communicate with each other**
 - *F-16 Block 50/52 and F-16 Block 60*
 - *VMF support for Digital CAS complicated by multiple versions*



Taking Command and Control Data to the Tactical Edge



Complexity Example: VMF K05.19 in Context

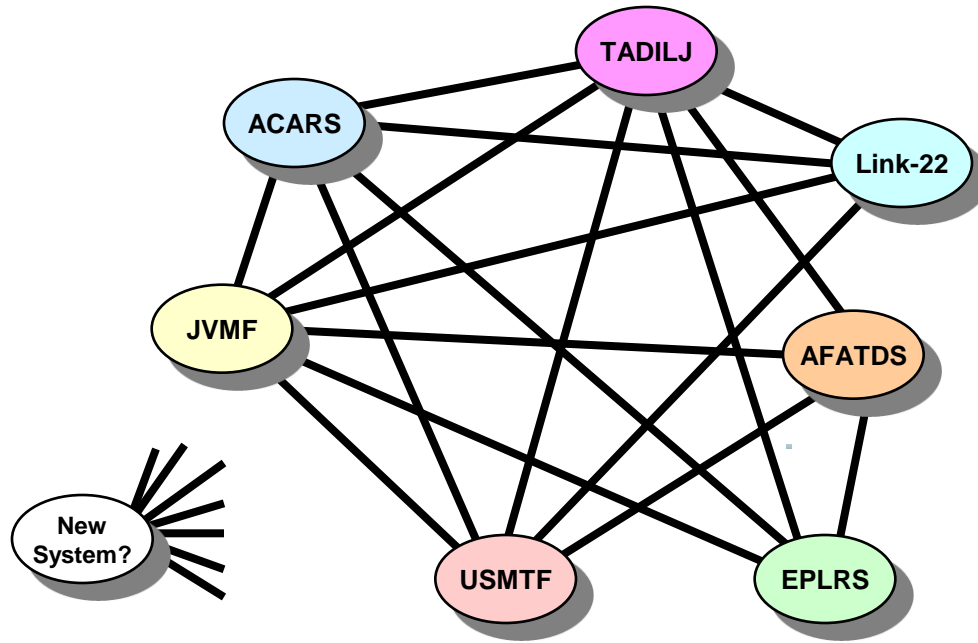


18,014,398,509,482,000 variations

The “total” complexity is simply overwhelming!

Taking Command and Control Data to the Tactical Edge

...Worse Yet, We're Building Numerous Complex Translators



This is a long-term interoperability and maintenance nightmare...

(E.g., How many systems must change to implement MIL-STD-6016D?)

(E.g., How many systems implement “the full” standard?)

(E.g., How do you “synchronize” rollout of standards versions?)

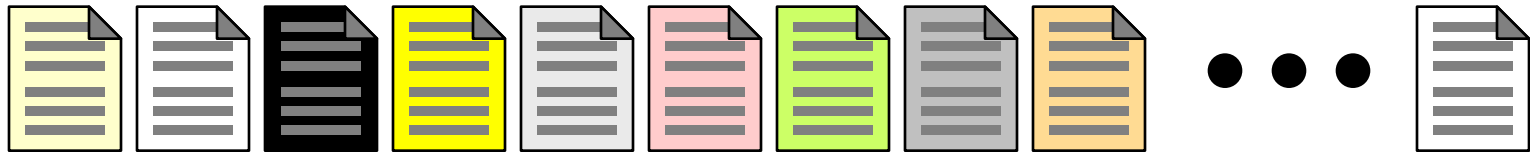
(E.g., Will I need to carry *another* radio to talk to a new link?)



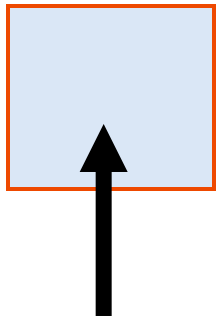
**Cursor on Target resolves
many of these issues...**



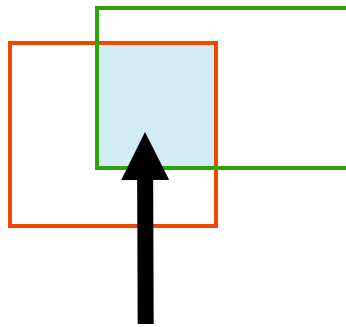
CoT Takes a Different Approach: Start with the most common info



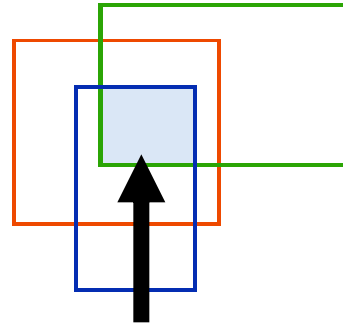
Traditional approach: Add a new message for each new exchange...
and the “catalog” gets large.



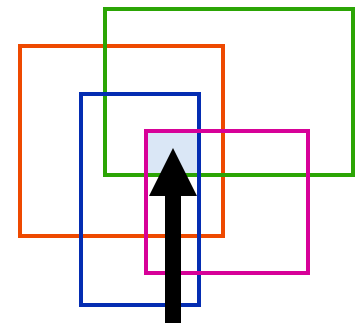
One system,
info intersection
is everything



Two systems,
much info less
is common



Three systems,
Intersection
gets smaller



CoT starts here
with a core set
of common info!



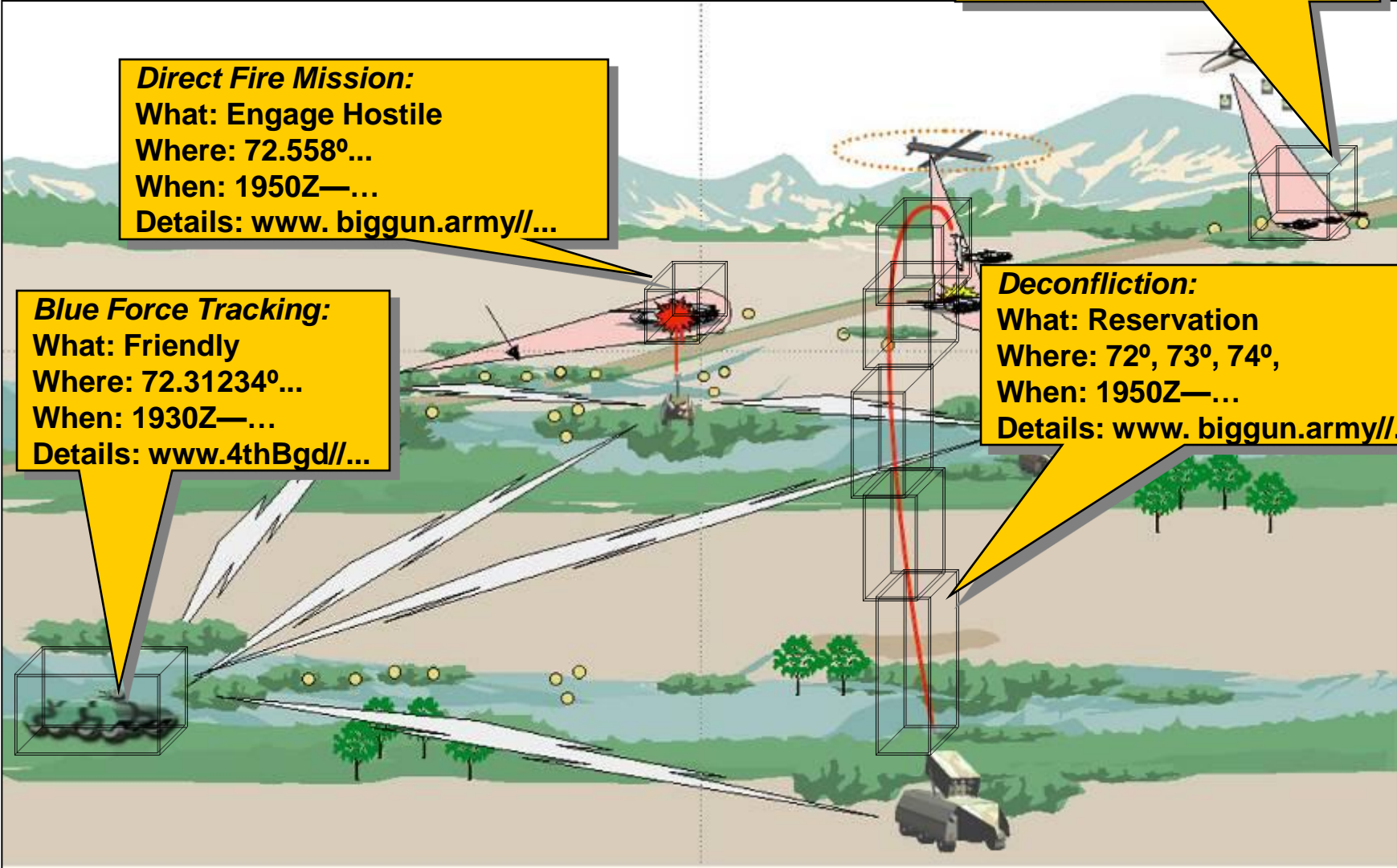
What is the core? “What, Where, Whe

Surveillance results:
What: ISR data
Where: 73°—74°...
When: 1930Z—...
Details: www.intel.af//...

Direct Fire Mission:
What: Engage Hostile
Where: 72.558°...
When: 1950Z—...
Details: www.biggun.army//...

Blue Force Tracking:
What: Friendly
Where: 72.31234°...
When: 1930Z—...
Details: www.4thBgd//...

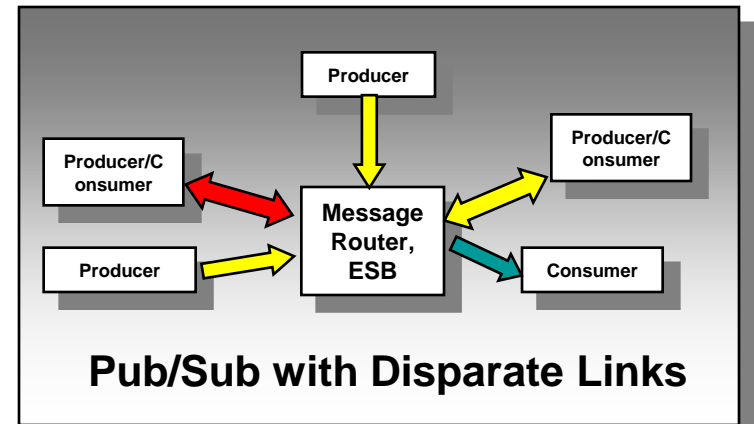
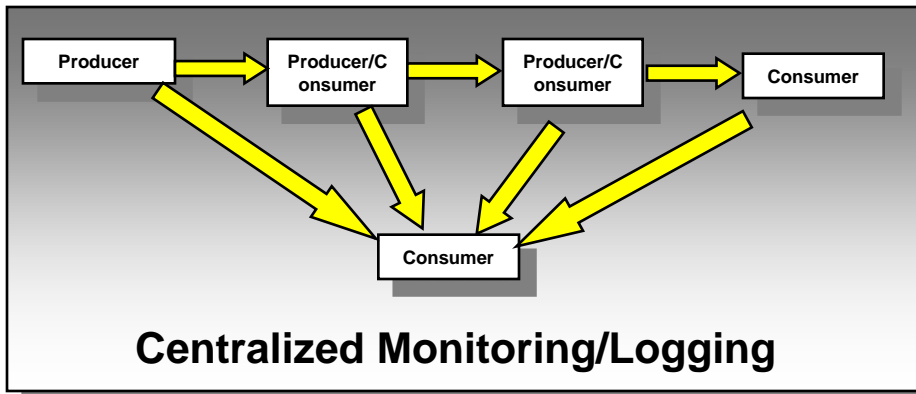
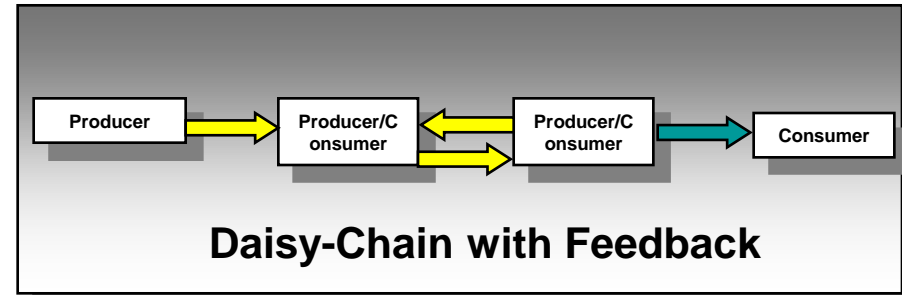
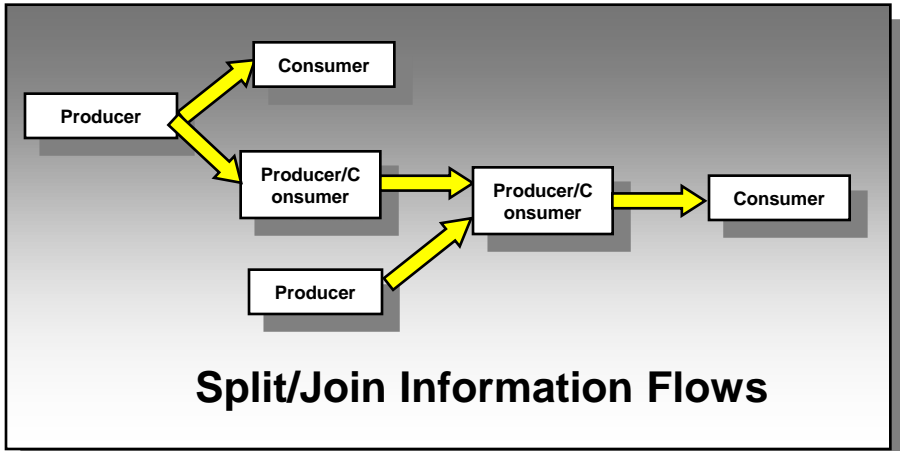
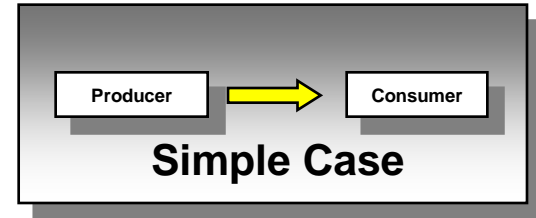
Deconfliction:
What: Reservation
Where: 72°, 73°, 74°...
When: 1950Z—...
Details: www.biggun.army//...





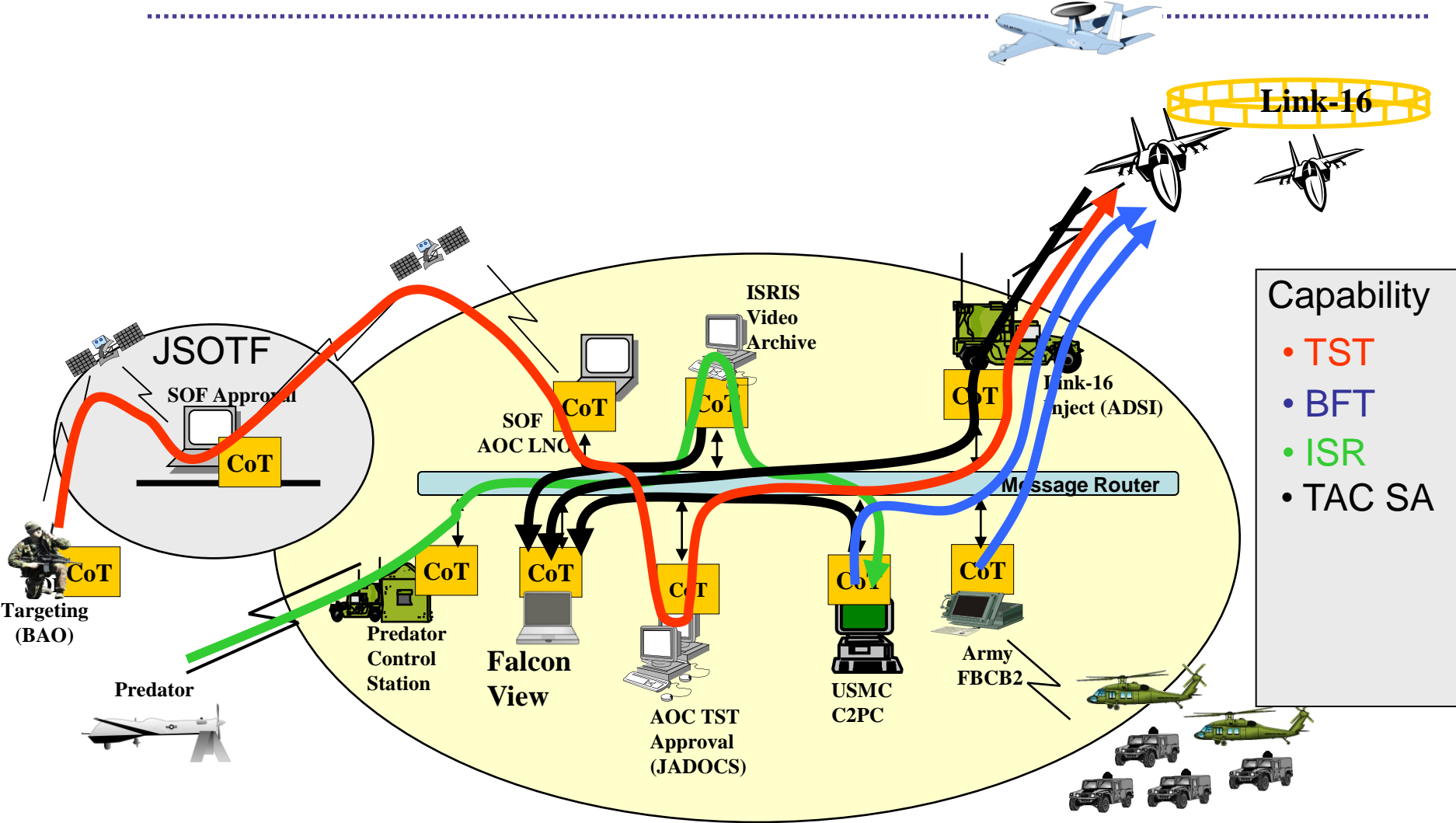
CoT Architectures Vary Widely

- CoT is designed to be *link agnostic*
- Interaction model push or pull (req/resp)
- Used: UDP, TCP, tactical radio, SOAP, etc





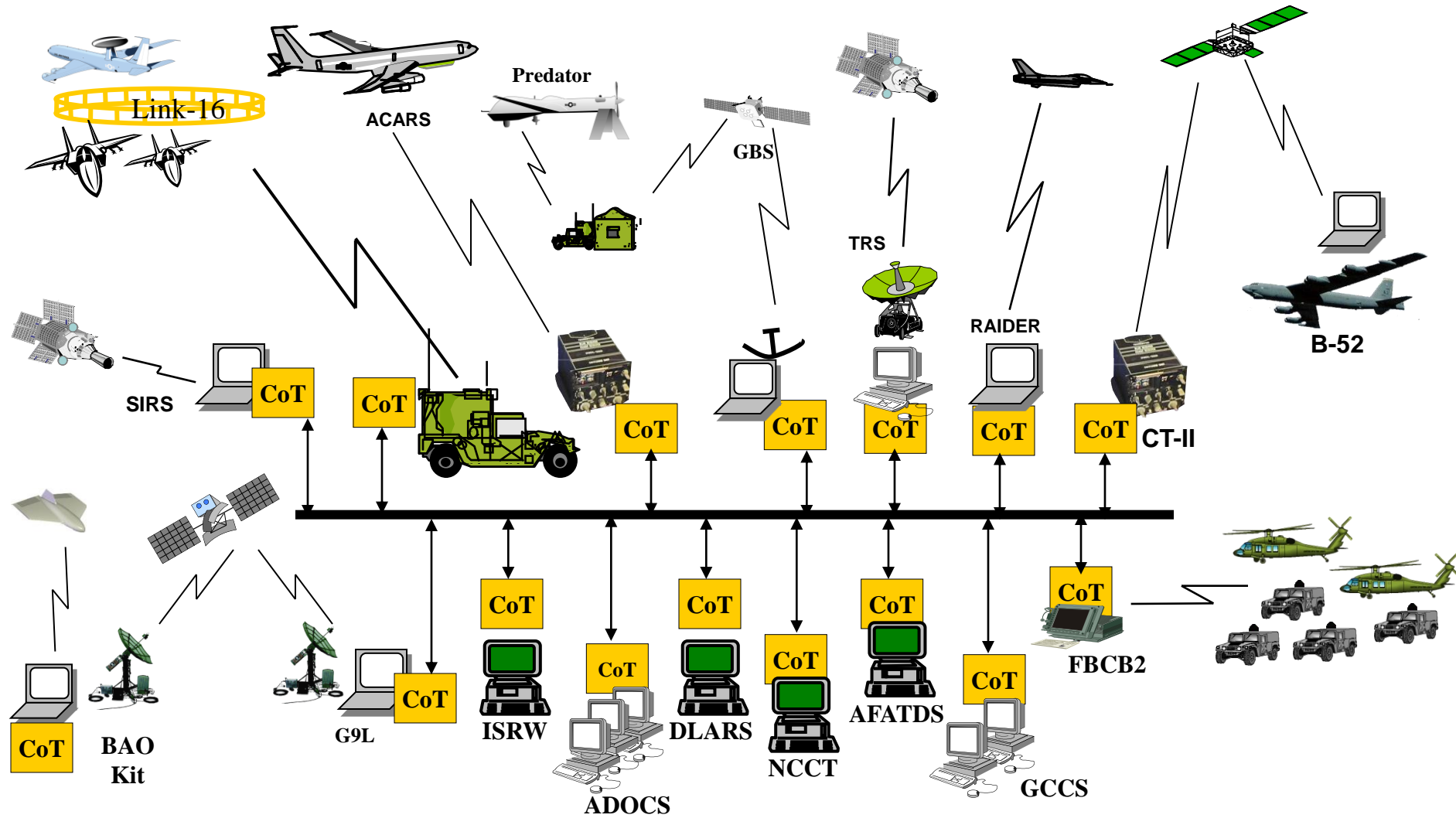
CoT Reduces Communication Complexity



Connects disparate systems to enable mission capability



130+ DoD Systems "speak" CoT...





CoT Components

- **An XML message schema**
 - *Basic (mandatory): “what, when, where”*
 - *Extensible (optional): add subschema to add details*
- **A standard**
 - *Established as USAF standard by SECAF memo April 2007*
 - *Incorporated in USAF (SAF/XC) Enterprise Architecture*
 - *Registered by SAF/XC in DISROnline as a USAF Organizationally Unique Standard (OUS)*
 - *Foundation for UCore data model*
- **A set of software plug-ins to enable systems to input and output CoT messages**
- **A set of software translators to exchange messages with VMF and Link-16 networks**
- **A CoT message router (software + computer) to facilitate publish/subscribe message routing**
- **A simple developer’s tool kit**



CoT Usage

- Employed heavily in AFSOC systems and UAS communities; used operationally 24x7 in Iraq and Afghanistan
- All Services, not just USAF
- Widely used in experimentation/demonstration venues
 - *JEFX, CWID, Empire Challenge, Bold Quest*
 - *Many others*

Examples

<u>ISR</u>	<u>UAV</u>	<u>Manpack</u>	<u>C2</u>
High Mobility FLIR	Video Scout	BAO Kit	AFATDS
Litening Pod	Raven and Wasp	Soldier-worn	Combat Track II
RAVE video exploitation	Air RECCE Low, MARSS	gunfire detection	FCS Test Bed
Constant Hawk		THLDS	JADSI



CoT User Group Organizations

402 XMSG (AFMC)
642 AESS (AFMC)
645 AESS (AFMC)
653 ELSG (ESC)
653 ELSW/EID (ESC)
670th AESS (ASC)
720 STG/OSS
8 AF
812 AESG/SYCA (ITC)
HAF/A2U
HAF/A2UI
AAI Corporation
AFRL
AFSOC
AGIS, Inc.
Applied Research
ARINC
AVWatch
BBN
Boeing
BOSH Global Services
Critical Response
Deloitte
DHS
DRS-IAS
DSCI
ForceX

Foster-Miller
General Dynamics
Georgia Tech Electronic Systems
Laboratory
Harris
Insight Technology
Insitu
ITT Advanced Engineering and Sciences
Jackpine Technologies
JFCOM
Lockheed Martin
Johns Hopkins Advanced Physics Lab
Joint Interoperability Test Center
JFIIT
Kihomac
KC Regional Terrorism Early Warning
Group
L-3 Com
Lakota Technical Solutions
Missouri Civil Air Patrol
MIT Lincoln Labs
MITRE
Naval Postgraduate School
Naval Surface Warfare Center
NGA
Northrop Grumman
Oregon National Guard

Orion Networks
Proxy Aviation Systems
RAIDER TPG (US Navy)
Raytheon
Rockwell Collins
SET Corporation
Sierra Nevada Corporation
Smartronix
Symetrics
System Dynamics Int.
TAIS
Thales
Ticom Geomatics
Traverse Technologies
US Army
US Navy
USASOC-SOAR
USSOCOM
VIPMobile
Wintec Aeromaker, Inc.
WVHTC Foundation

Taking Command and Control Data to the Tactical Edge



Summary

- **Simple light weight core – Starts with most common data elements**
- **Sub-schema extension “Future-Proofs” standard**
- **Network-centric – Value grows as N^2 , not cost**
- **Readily Reconfigurable - Approach handles unforeseen needs**
- **Government developed, all material openly available to all with US DoD sponsorship**