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Beyond PowerPoint Deep

**A Concept of Operations for Implementing
Net-Centric Warfare**

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#1

Bestselling
Computer
Book Series

By Far one of the Best Network Centric Warfare
References on the Market, next to mine!
- David S. Alberts: Author Network Centric Warfare

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DUMMIES BOOKS
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with NCW-
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Includes GIG/NCES 2.0
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NCW Terms of Reference

“How to win at NCW Bingo”

NCW BINGO				
NCW	COI	SBA/ SOA	XML	Metadata
TPPU	Publish	Subscribe	Portal	EKP
Catalog	B2B	FREE SPACE	Swarming	WSDL
SOAP	Horizontal Fusion	Self Organizing	Collaboration	Monitoring
Shared Awareness	Sense- making	Mangement & Synchronization	IPv6	VPN



NCW Terms of Reference

Network Centric Warfare (NCW):

...an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace...

Source: *Network Centric Warfare*, Alberts, Garstka, and Stein, CCRP



NCW Terms of Reference

- **Community of Interest (COI)**: the collection of people that are concerned with the exchange of information in some subject area
 - COIs can be organized around any group of entities with a common interest, or in the case of the military, common mission
 - COIs are not mutually exclusive; one can be a member of several COIs at the same time
 - COIs provide the groupings by which Service-Oriented Architectures are designed
- **Service-Oriented/Service-Based Architectures**: (informal definition) business-to-business, web-based applications; usually rely on a great degree of trust between service provider and user

Sources:

A Community of Interest Approach to Data Interoperability

Scott A. Renner, Ph.D.

http://www.mitre.org/work/tech_papers/tech_papers_01/renner_community/index.htm

http://www.w3.org/TR/2004/NOTE-ws-arch-20040211/#service_oriented_architecture



NCW Terms of Reference

- **Task, Post, Process, Use (TPPU):**
 - Basic tenet of NCW, based on the concept that consumers of information are smarter than their sources about what is operationally needed “NOW”
 - Term derived from Intel TPED (Task, Process, Exploit, and Disseminate), which was often criticized by operations for providing “cooked” information too late for operational use
 - Implications:
 - Information derived from collections will be posted for community use prior to processing and exploitation via use of “Smart Pull” technologies (i.e., Publish/Subscribe)
 - Enables community users to make use of “raw information” in a more timely fashion for their particular operational application

Source:
TPPU, the New Paradigm (DISA GIG NCES Website)
<http://ges.dod.mil/about/tppu.htm>



NCW Terms of Reference

- **Publish/Subscribe**: a process by which data is distributed inter- and intra-COI
 - “Smart,” filtered push of information is based on filters selected by the user during subscription process
 - “Civilian world” examples include automated stock ticker, news, and weather reporting programs:
 - Pointcast, Infogate (stocks)
 - NBC4 E-Mail News Headlines
 - WeatherBug



NCW Terms of Reference

- Publish/Subscribe (cont.):

- Publish:

- **Advertise:** make information available for consumption. Includes development of all catalog information (White, Yellow, Green, and Brown Pages metadata)
- **Distribute:** to service the subscription list
- **Post:** to make available information on the status of an asset (location, systems/sensors' status, fuel status, etc.), indicates new information is available for:
 - Advertisement
 - Distribution
 - Aggregation/Analysis



NCW Terms of Reference

- **Publish/Subscribe (cont.):**
 - **Subscribe:**
 - **Webster's:**
 - To enter one's name for a publication or service
 - To receive a periodical or service regularly on order
 - **For NCW:** to register to be the recipient of a distribution of information upon its creation and subsequent updates
 - Specification of the type of information one wishes to receive
 - **Subscription Types:**
 - **New Information Available:** provides link to information instead of the actual information - enables "Smart Pull" of information when user is ready to use it
 - **Information Deliver Upon Creation:** delivery of information upon creation by either the creator of the information, or an intermediate distributor



NCW Terms of Reference

- **Portal**: A site featuring a suite of commonly used services, serving as a starting point and frequent gateway to the Web (Web portal) or a niche topic (vertical portal). Civilian web portal services often include a search engine or directory, news, email, stock quotes, maps, forums, chat, shopping, and options for customization.
- **Enterprise Knowledge Portal**: an enhanced Portal that:
 - Is goal-directed toward knowledge production, knowledge integration, and knowledge management
 - Focuses upon, provides, produces and manages information about the validity of the information it supplies
 - Provides information about your business and meta-information about the degree to which you can rely on that information
 - Distinguishes knowledge from mere information
 - Provides a facility for producing knowledge from information
 - Orients one toward producing and integrating knowledge rather than information

Sources:

Marketing Terms.com

<http://www.marketingterms.com/dictionary/portal/>

Implementing Enterprise Knowledge Portals

<http://www.dkms.com/ekocons.htm>



NCW Terms of Reference

- **Catalog**: contains indexed information allowing for referencing all information available in the COI, to include subordinate COIs
 - Catalogs will use XML (described in subsequent slides) to describe the contents of information available to the COI (i.e., metadata)
 - Schema for multi-COI catalog distribution is required for catalog alignment and update

Key point: despite what you've heard about NCW... NCW does not mean "all the data is everywhere, all the time" – it's about a schema for cataloging, accessing, and subscribing to tailored information

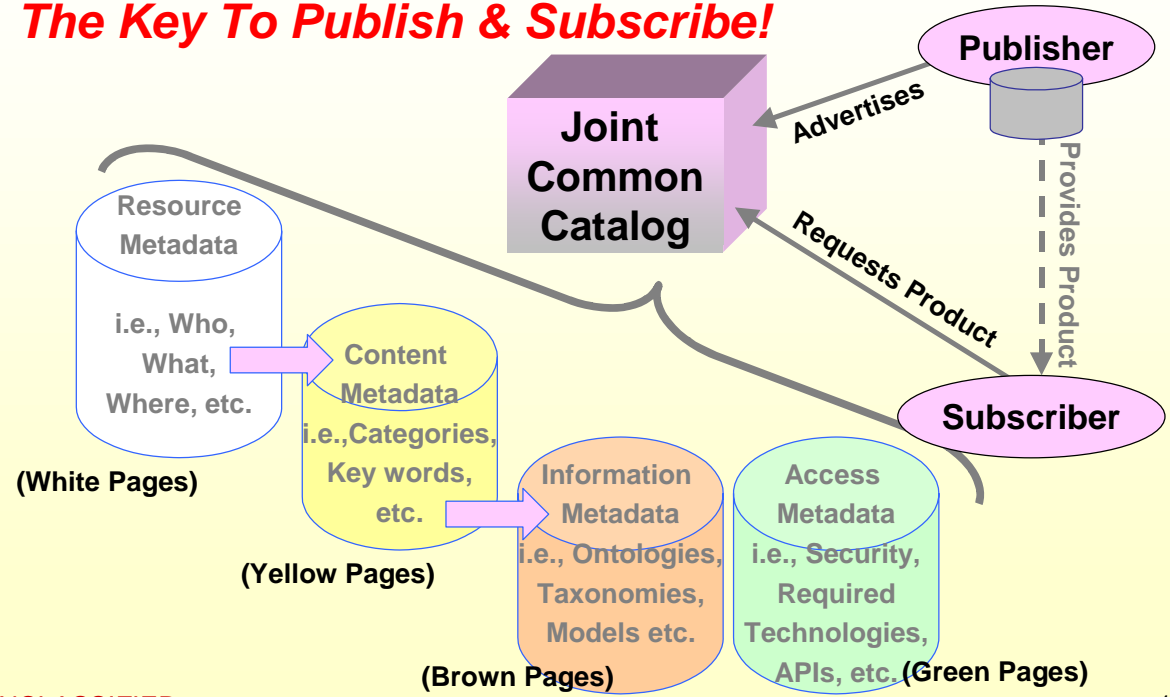


NCW Terms of Reference



Run-Time Electronic Market Joint Common Catalog (JCC)

The Key To Publish & Subscribe!



- **Metadata:** “data about data.” Information by which artifacts are cataloged and stored.
- **DISA Vision – 4 catalogs based on “pages:”**
 - **White:** who
 - **Yellow:** what
 - **Brown:** how data stored (format considerations)
 - **Green:** security/ classification requirements (think “behind the green door”)

UNCLASSIFIED

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Source:
 Briefing: “Market-Driven Data Management “
 Dawn Meyerriecks
 Chief Technology Officer
 Defense Information Systems Agency



NCW Terms of Reference

- **XML**: eXtensible Markup Language
 - Tag-based, hierarchical markup language for description of data and its relationships
 - HTML (HyperText Markup Language) is another markup language
 - Specified by typing “http” [HyperText Transfer Protocol] in web addresses)
 - Fixed-meaning tags embedded in document (in your web browser, hit View => Source to see the tags in the document)
 - Differs from HTML in that the user can define the tags which are used to describe data in a page (in HTML, the tags are fixed)



NCW Terms of Reference

- **XML**: eXtensible Markup Language (cont.)
 - Tags “standardized” in communities by definition of Namespaces
 - DoD Namespaces being managed by DISA
 - XML Registry: <http://dides.ncr.disa.mil/xmlreq/user/index.cfm>
 - Namespaces have been “binned” by predefined COIs:
 - Command and Control
 - Intelligence
 - etc.
 - Standard format for XML is unicode, which in most implementations takes 16 bits per character (ASCII takes 7 or 8, depending upon implementation)
 - Possible implications with size of data after “XML-izing”
 - Possibly mitigated with data compression techniques



NCW Terms of Reference

- **Swarming:** “useful self-organization of multiple entities through local interactions”
 - “**Stigmergic**”
 - From the Greek words for sign and action
 - Example: ants and bees use pheromones initiate actions in the group
 - Rules-based:
 - Polyvalent: all members of the potential swarm have the same ruleset and similar skills; swarm uses signals to unify action
 - Specialized:
 - Members come in different configurations
 - Based on signals received from other group members, members adapt community behavior based on rulesets; specific members take on duties matched to their skillset
 - Applications:
 - Animals: Foraging optimization, nest defense
 - Military: “Smart Mobs” employing self-synchronization (Chechnya, Somalia)

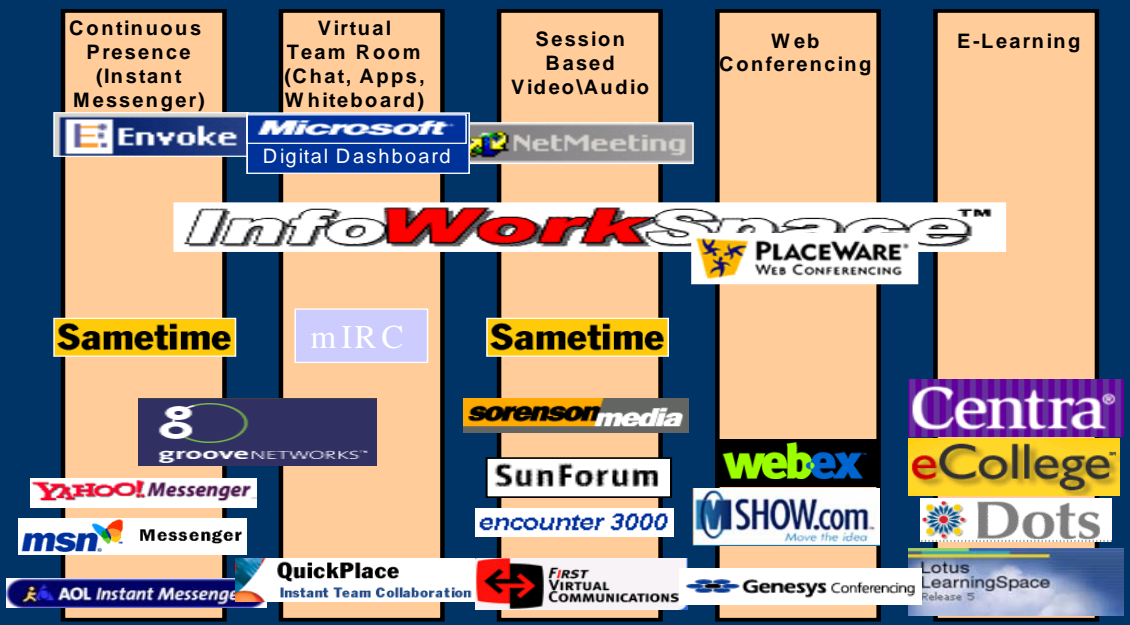
Sources:

“Making Swarming Happen,” Dr. Van Parunak, Altarum
“Military History of Swarming,” Mr. Sean Edwards, NGIC
“Swarming Intelligence,” by Dr. Eric Bonabeau, Icosystem Corporation
White Papers for Swarming Network Enabled C4ISR Conference
13-14 January 2003, McLean, VA



NCW Terms of Reference

- **Collaboration:** use of online tools to involve subject matter experts in the decision-making process that aren't collocated. DCTS (Defense Collaborative Tool Suite) trying to "bridge the gap" between vendor tools



Sources:
<http://www.webex.com>
<http://www.mitre.org/news/digest/archives/1999/cvw.html>
<http://www.ezenia.com/>
<http://www.pixion.com/>
<http://www.microsoft.com/windows/netmeeting/>

Brief: XIII Joint Tactical Communications Summit, Robert M. Shea, LtGen, USMC, Joint Staff J-6, 05Feb04
<http://www.envoke.us/>
<http://www.asolutions.com/movies/CollaborationPres512.wmv>



Assumptions

- **NCW will be enabled by COI-based Enterprise Knowledge Portals (herein referred to as Portals)**
- **In order to provide for “a degree of self-synchronization” as called for by Alberts/Gartska:**
 - Each COI must have some degree of self-determination
 - Thus, each COI has some degree of “self C2”
- **Decision aids enabled by NCW Portal-based paradigm should be driven by the “Command by Negation” premise**
 - No machine can know everything – keeps the “human in the loop”
 - Enables critical, life-threatening decisions to be made automatically



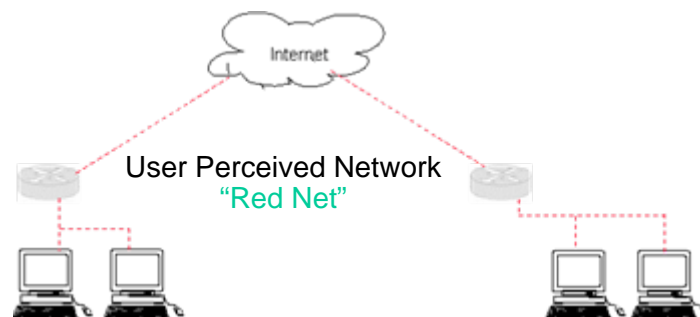
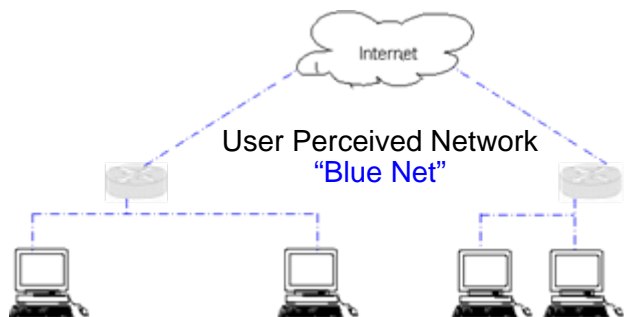
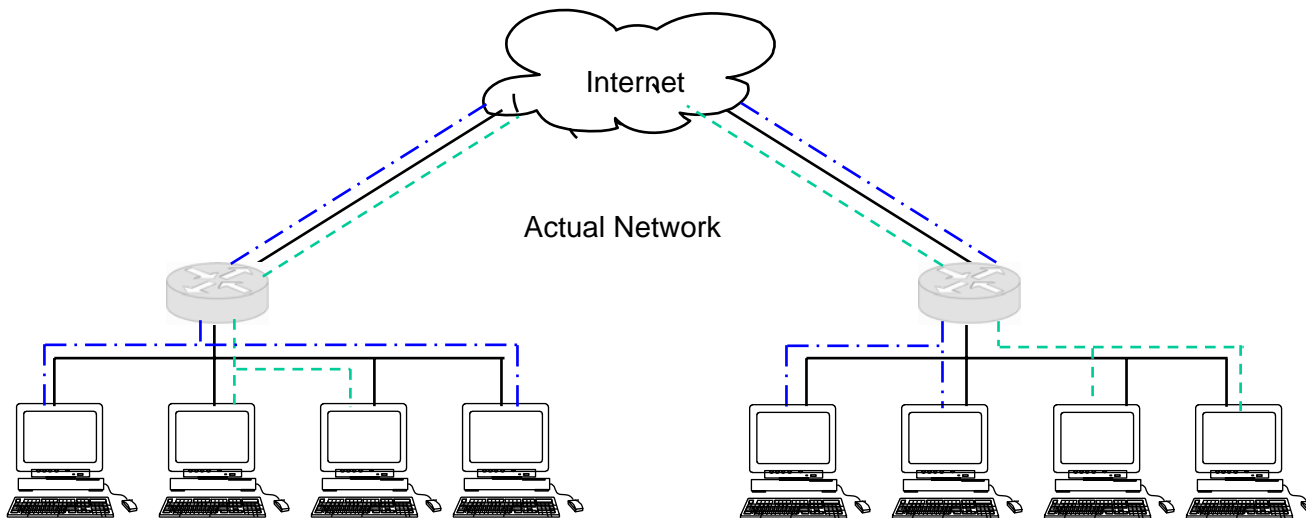
Assumptions

- **IP V6 will be used**
 - Emergent protocol – describes how messages are “packaged” for transmission on networks
 - Each device able to have unique address
 - IP tunneling used to implement broadcast of survival info
 - Improved security via IPSec (authentication + content encryption)
 - Enables prioritization of message traffic
- **COIs implemented via VPN (Virtual Private Networks) or similar services**
 - Enables multiple “virtual” networks to exist over common media
 - Enables distant users to appear on the network as if they were “local users”



Assumptions

VPN Example





Assumptions

- **OSD directed DISA to enable transformation to NCW**
- **Program of record for this is called Net Centric Enterprise Services (NCES), started FY04**
- **Initial set of common core services identified and are being defined by inter-service, inter-agency teams**
- **Services referred to as NCES Core Enterprise Services**
- **All DoD organizations will use some subset of the NCES Core Enterprise Services during future NCW-enabled conflicts**



Assumptions

- **NCES Core Enterprise Services**
 - **Domain Name Service (DNS)**
 - IP addressing to locate any kind of network resource (people, systems, devices, etc.)
 - **Messaging Services**
 - Ability to exchange information among users or applications on the network (e.g., Email, DMS VMF, USMTF, TADIL, OTH, Message Oriented Middleware, AOL instant messenger, Wireless Services, Alert Services)
 - **Discovery Services**
 - Processes for discovery of information content or services that exploit metadata descriptions of network resources stored in Directories, Registries, and Catalogs
 - **Brokering Services**
 - Federation of services that helps users mediate, fuse and integrate data

Sources:

"Net Centric Enterprise Services – What Problem are we Trying to Solve?" Dawn Meyerriecks
CTO, DISA, Military Information Technology, online edition, Volume 7, Issue 3,
March 2003 <http://ges.dod.mil/articles/netcentric.htm>

Briefing: "NCES Net Centric Enterprise Services," Rob Viemeyer/DISA APC



Assumptions

- **NCES Core Enterprise Services (cont.)**

- **Collaboration Services**

- **Allows users to work together and jointly use selected capabilities on the network (i.e., chat, online meetings, work group software etc.)**

- **Application System Management (ASM) Services**

- **Provides for monitoring and repair of network resources**

- **Security Services**

- **Federation of security capabilities that addresses vulnerabilities in networks, services, capabilities or systems**

- **Storage Services**

- **Physical and virtual places to host data on the network with varying degrees of persistence (e.g., archiving, COOP, content staging)**

Sources:

"Net Centric Enterprise Services – What Problem are we Trying to Solve?" Dawn Meyerriecks
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March 2003 <http://ges.dod.mil/articles/netcentric.htm>

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Assumptions

- **Access to the COI information happens on networks specifically managed by the COI**
 - This does not mean that the COI manages all communications for all members within the COI – only the communications allocated to NCW
 - Separate communications channels will likely be maintained for tactical use, especially for conducting time critical operations where unobstructed access to communications are vital to mission success



Assumptions

- **Achieving economies of scale regarding use of assets across the COI is a goal of C2 associated with COIs**



OK... So How Does NCW Work?



- **Central to all operations is the COI Portal, which performs the following operations:**
 - **Search:** searches COI catalogs based on requests based on “pages” metadata:
 - **Resource Metadata (White Pages):** Who
 - **Content Metadata (Yellow Pages):** What
 - **Information Metadata (Brown Pages):** Format
 - **Access Metadata (Green Pages):** Security
 - **Retrieval:** retrieves info from COI datastore or COI asset datastores
 - **Publish/Subscribe Management:** manages:
 - Subscription profiles
 - Servicing of subscriptions
 - COI Catalog management:
 - Records of advertisements of new data available
 - Synchronize catalogs with higher echelon COIs
 - **Collaboration Management:** provide and manage means for collaboration (bandwidth, etc.)
 - **Common Tools:** provide COI-common tools (NCES Core Enterprise Services “Plus”); may exist in the portal, or external to the portal as services
 - **Bandwidth Management:** manage bandwidth internal to, and at the interface to the COI

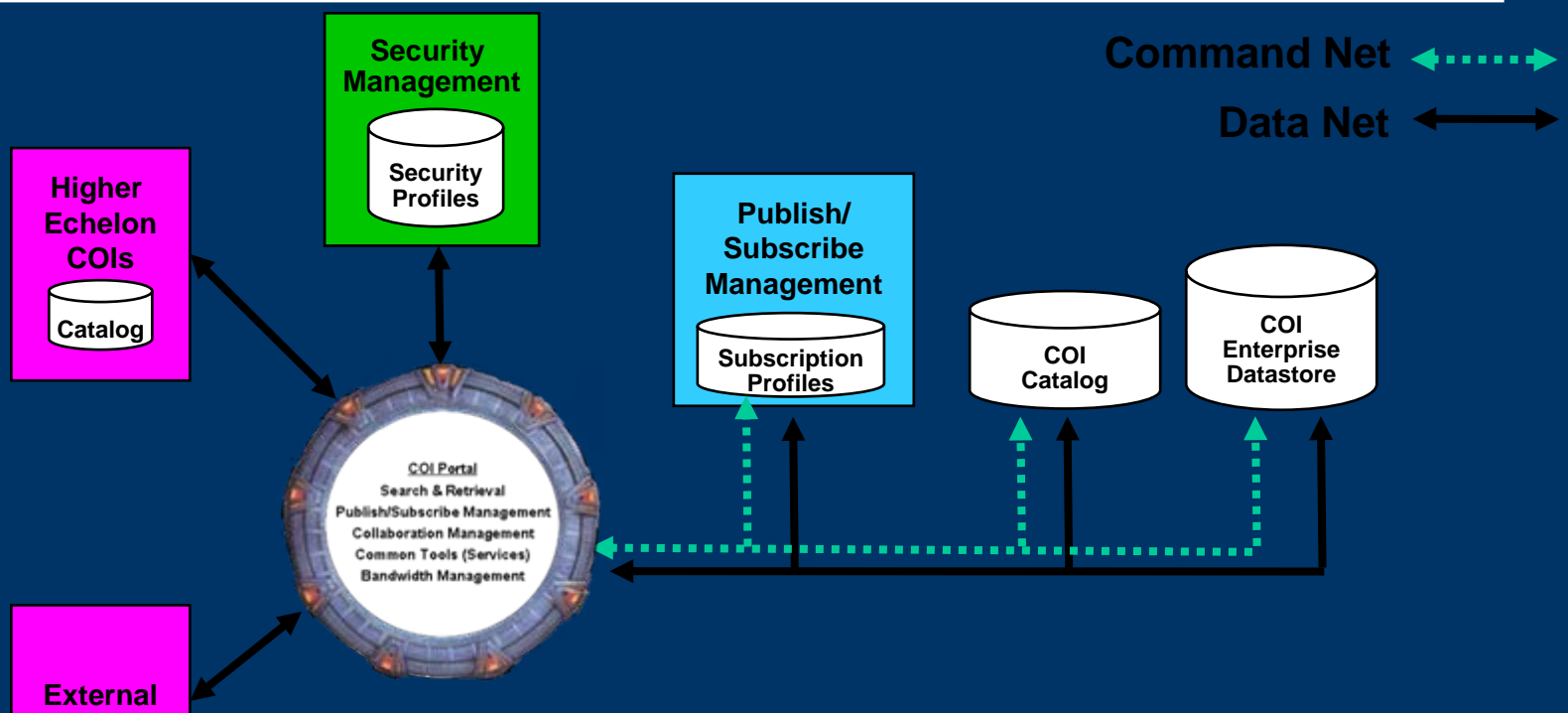
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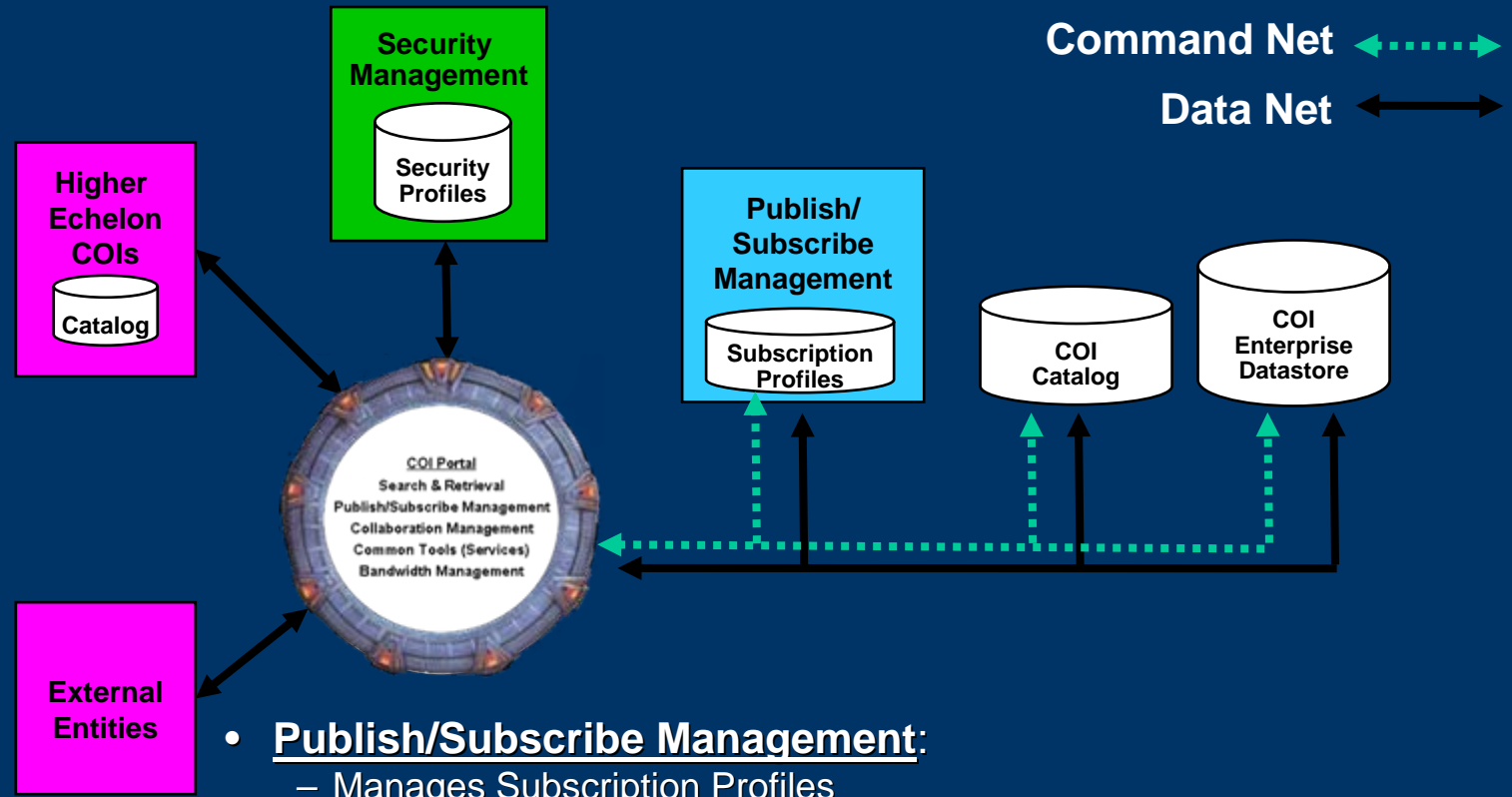
OK... So How Does NCW Work?



- **External Entities:** access all COI information through the Portal
- **Security Management:**
 - Can be either internal or external to the COI
 - Provides information used in building and verifying profiles
 - Subscription
 - Access to COI information (via Search/Retrieval)



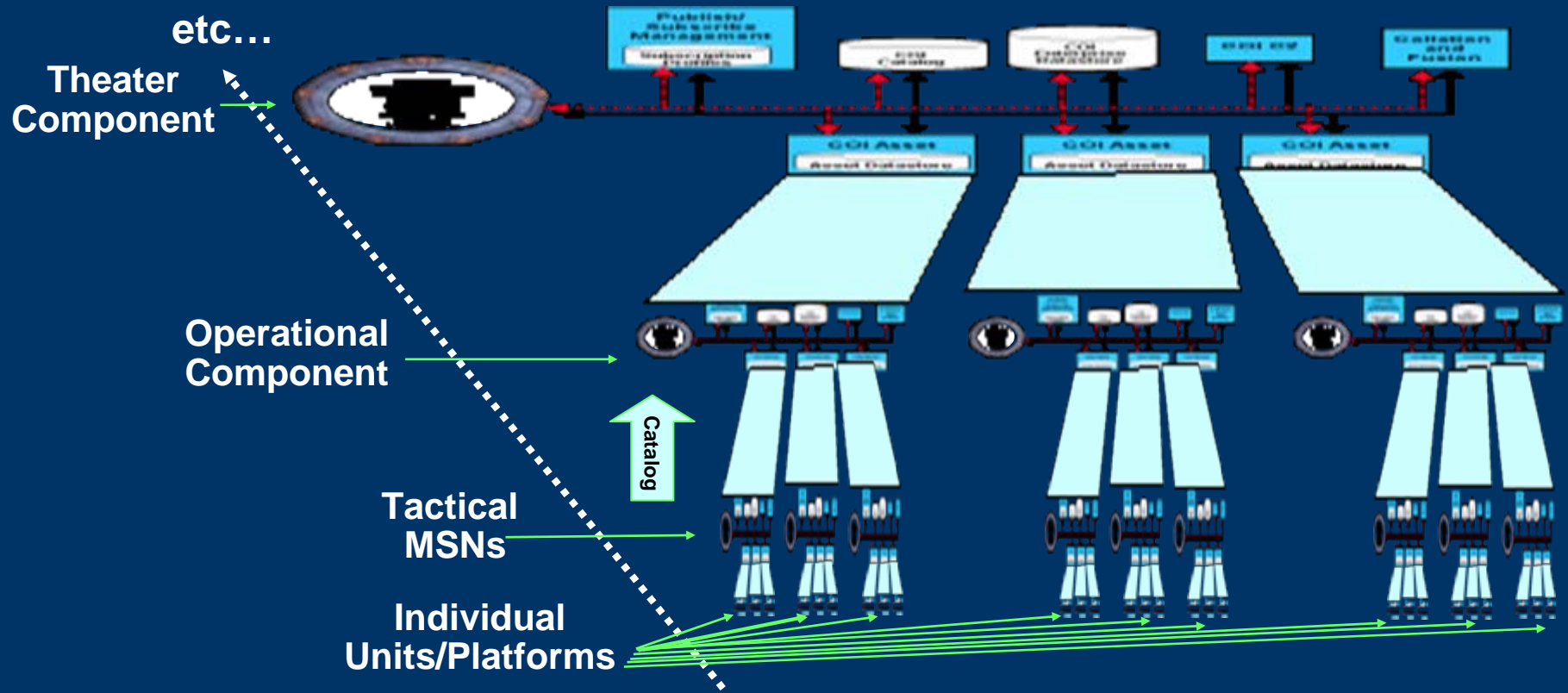
OK... So How Does NCW Work?



- **Publish/Subscribe Management:**
 - Manages Subscription Profiles
 - Servicing of Subscriptions:
 - Matches incoming information to subscription profiles (general information)
 - Mechanism by which alerts are generated (based on profile matches) to appropriate Subscribers
 - Distributions can be the actual information, or merely notification that new info exists
 - Catalog Management (recording of subscriptions, Catalog Propagation)



OK... So How Does NCW Work?



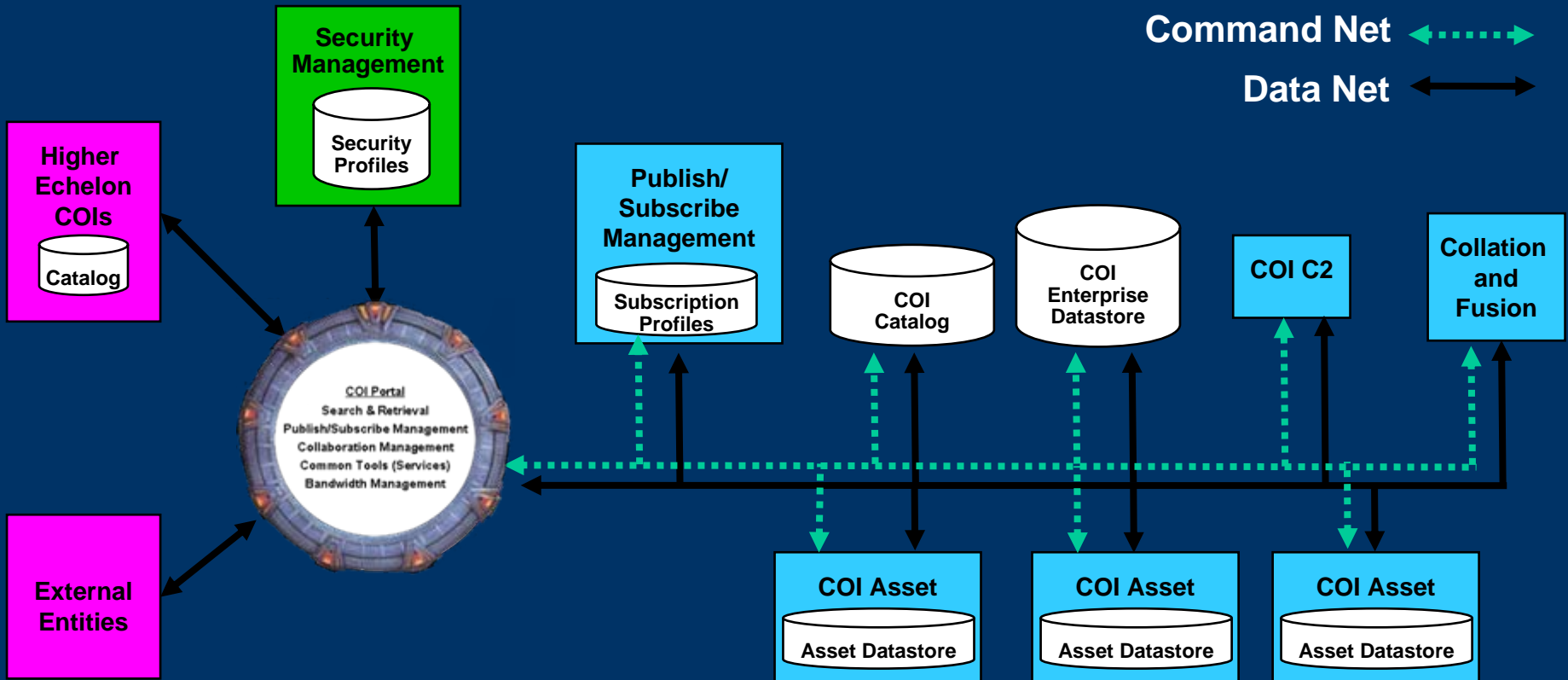
- **COIs Catalogs Propagate Hierarchically:**

- Catalog data is propagated up the chain
- Only catalogs info propagated rather than “all information everywhere” all the time

Key point: there are other schemes for catalog management, but this allows for manageable “catalog by hierarchy,” and horizontal fusion via publish-subscribe mechanism



OK... So How Does NCW Work?



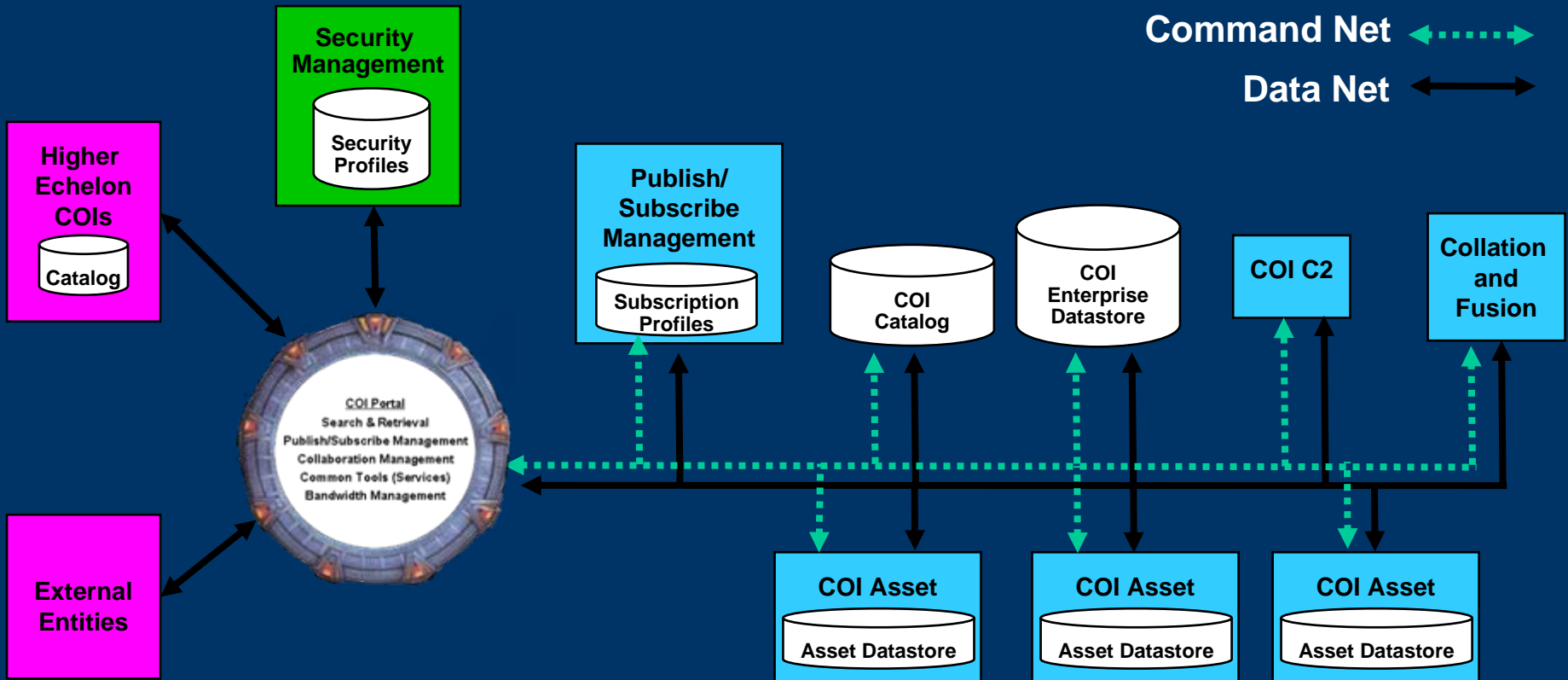
- **COI Assets:**

- Producers of information that changes within the COI:

- “Heartbeat”/Asset Status Information: **fuels, munitions, position, etc.**
- Ad hoc changes: **sensor has captured information, system/subsystem failure, etc.**
- Each Asset has Datastore: **potential for COI-wide use beyond asset (info redundancy, etc.)**



OK... So How Does NCW Work?



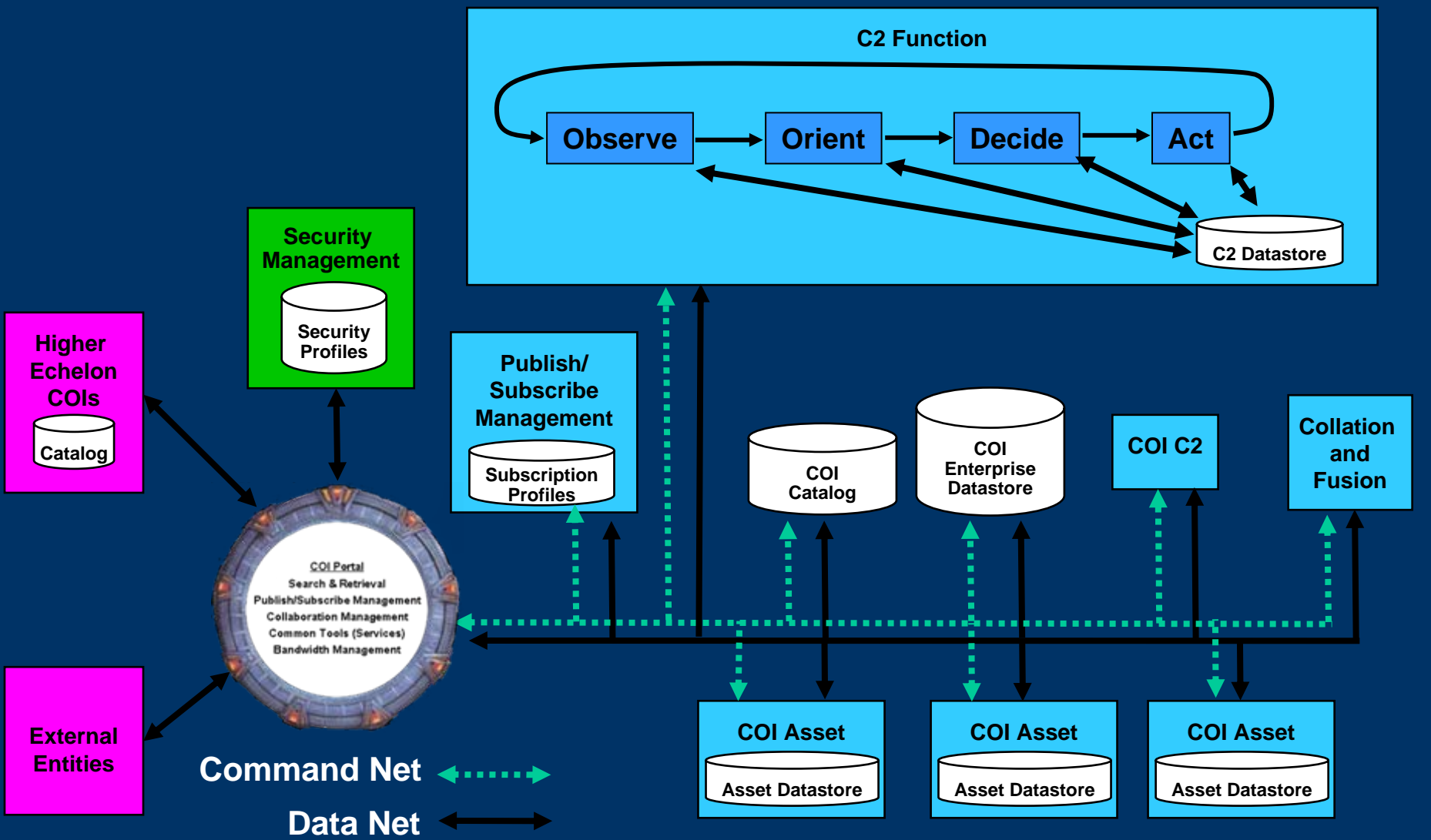
- **Collation and Fusion:**

- Collates/Fuses asset status information – stores info in COI Enterprise Datastore
- Can fuse individual products created by COI Assets into new products



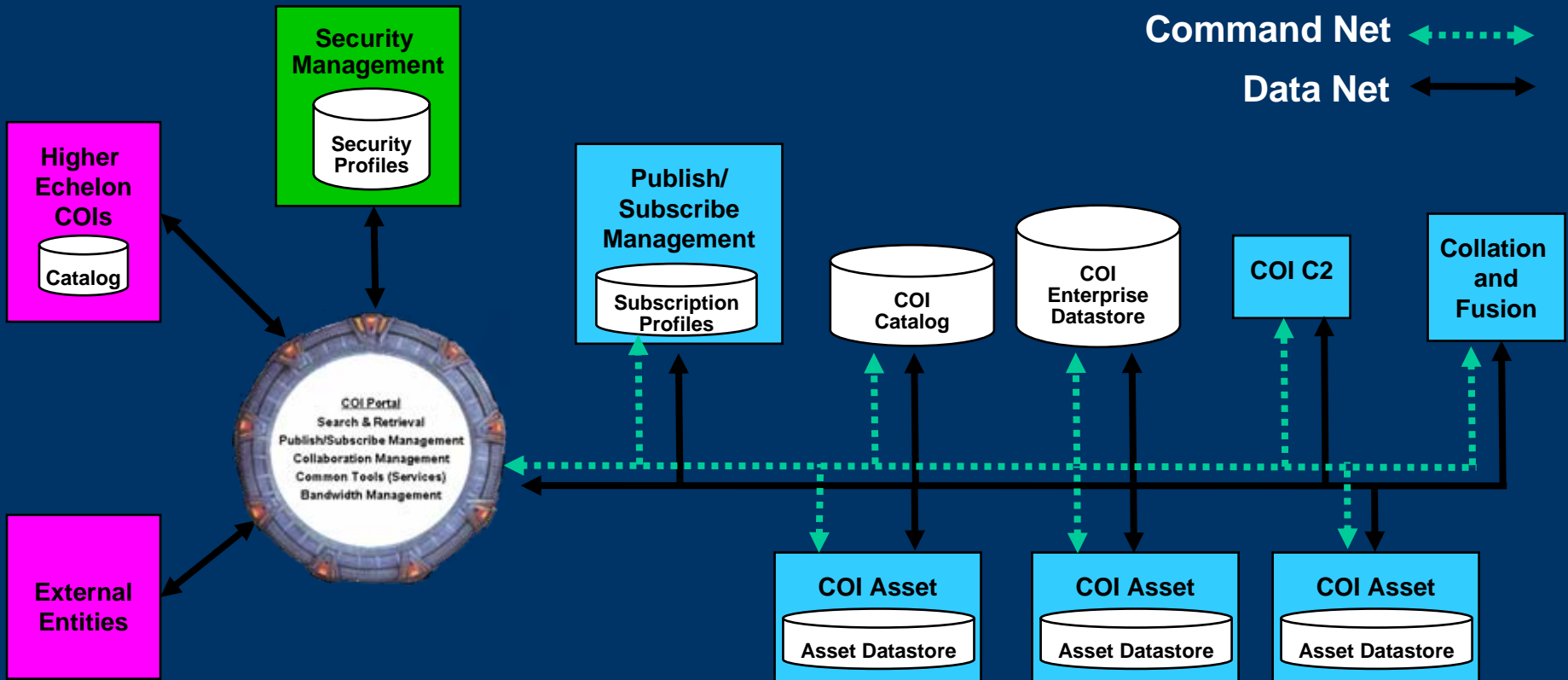
OK... So How Does NCW Work?

Decision Loop





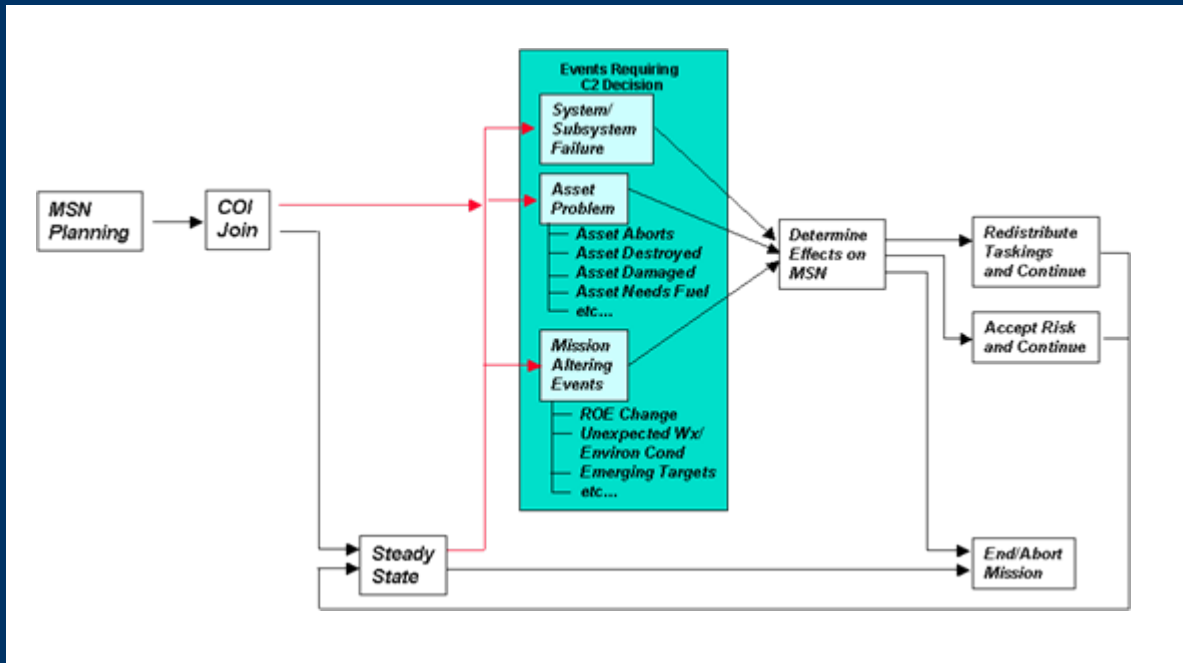
OK... So How Does NCW Work?



- **COI C2**: in order to self-organize to maximize use of assets (economies of scale), COIs have an entity that performs C2
 - Enables C2 decision aids:
 - Assets under full control of COI can be directly tasked; however, in most cases, there needs to be a mechanism by which the asset WILCO's/CANTCO's with tasking
 - Assets shared with other COIs may be requested
 - Command Net notionally separate from Data Net (for purposes of this discussion...)



Self Synchronization of COIs

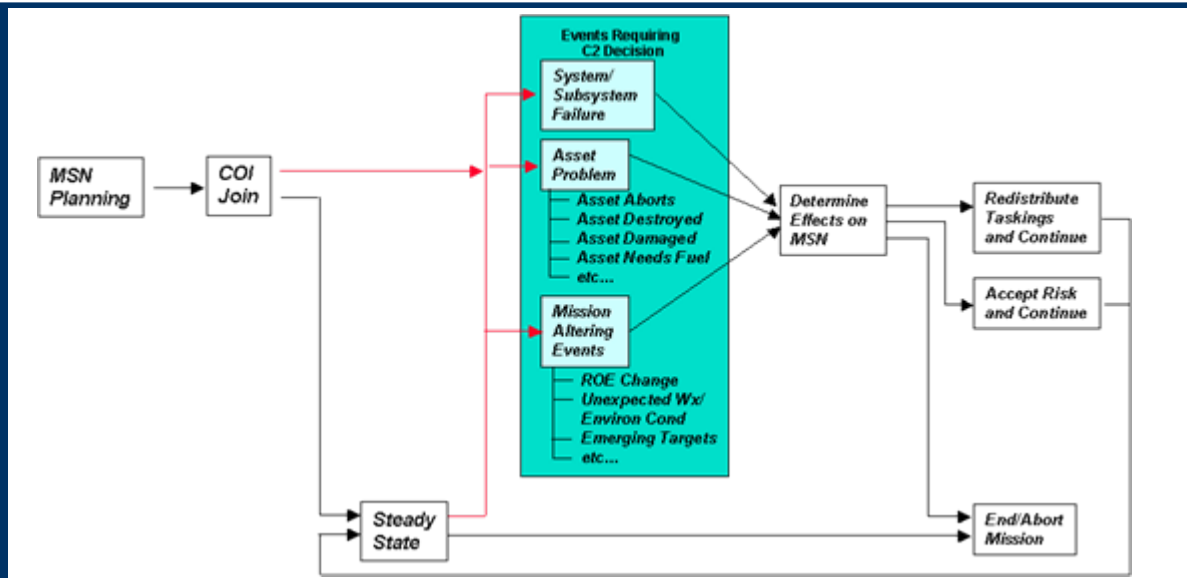


- **Events of Interest:**

- MSN Planning: where COI membership, profiles, frequencies, addresses, etc. are recorded/determined for the mission (the “devil in the details” lives here...)



Self Synchronization of COIs



- COI Join: where one discovers if assets are able to accomplish assigned missions based on their status
 - If No: a C2 Decision/task reapportionment structure is entered (see below)
 - If Yes: enter Steady State
- Steady State: MSN executing according to plan (old or revised)
- Events Requiring C2 Decision: these are events that either add more tasks to the current prioritized list, or remove assets to execute them
 - Effects on mission are determined; one of 3 outcomes
 - Abort/End Mission
 - Taskings Redistributed and return to Steady State
 - Risk is accepted => return to Steady State



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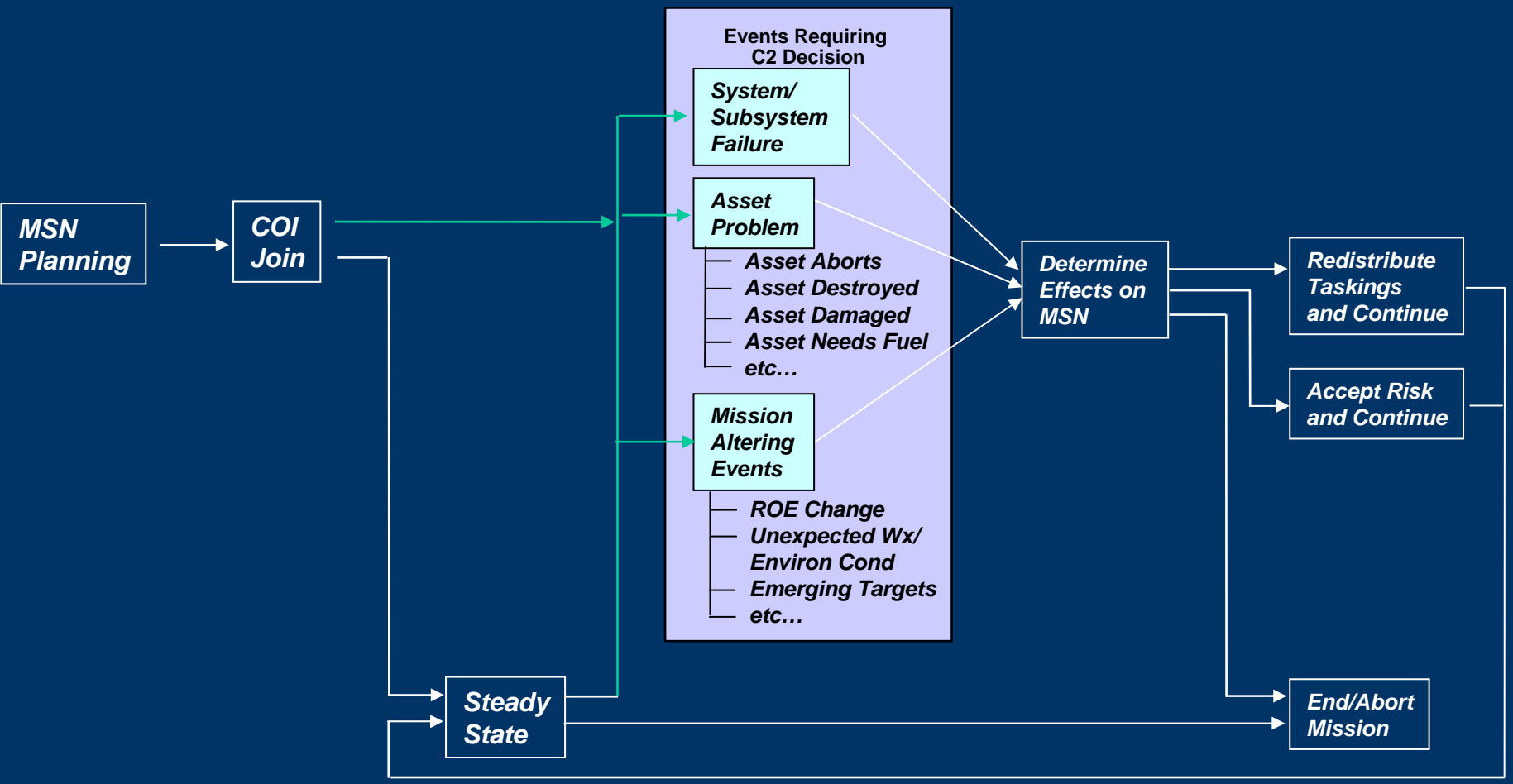
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Backups

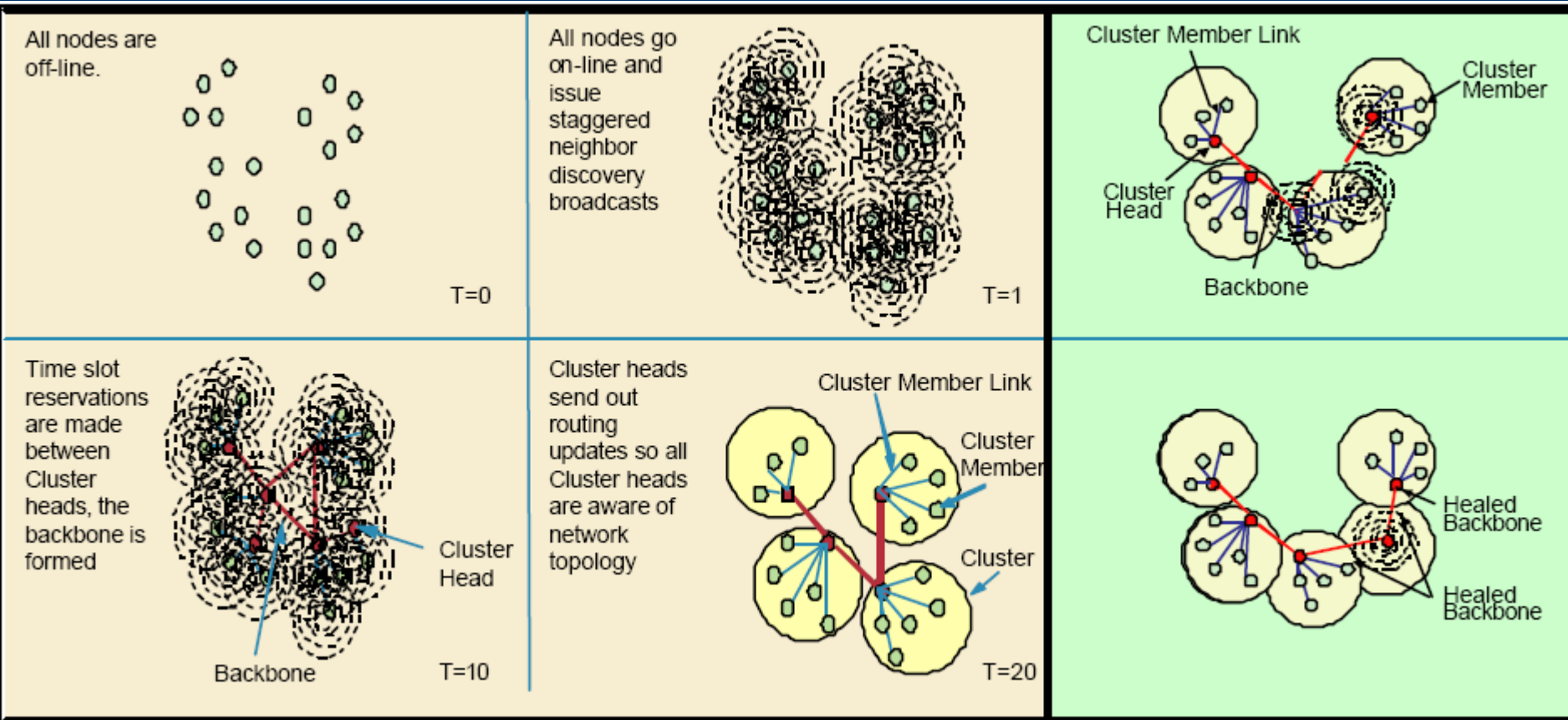


Self Synchronization of COIs





JTRS Notional Rules-Based Routing

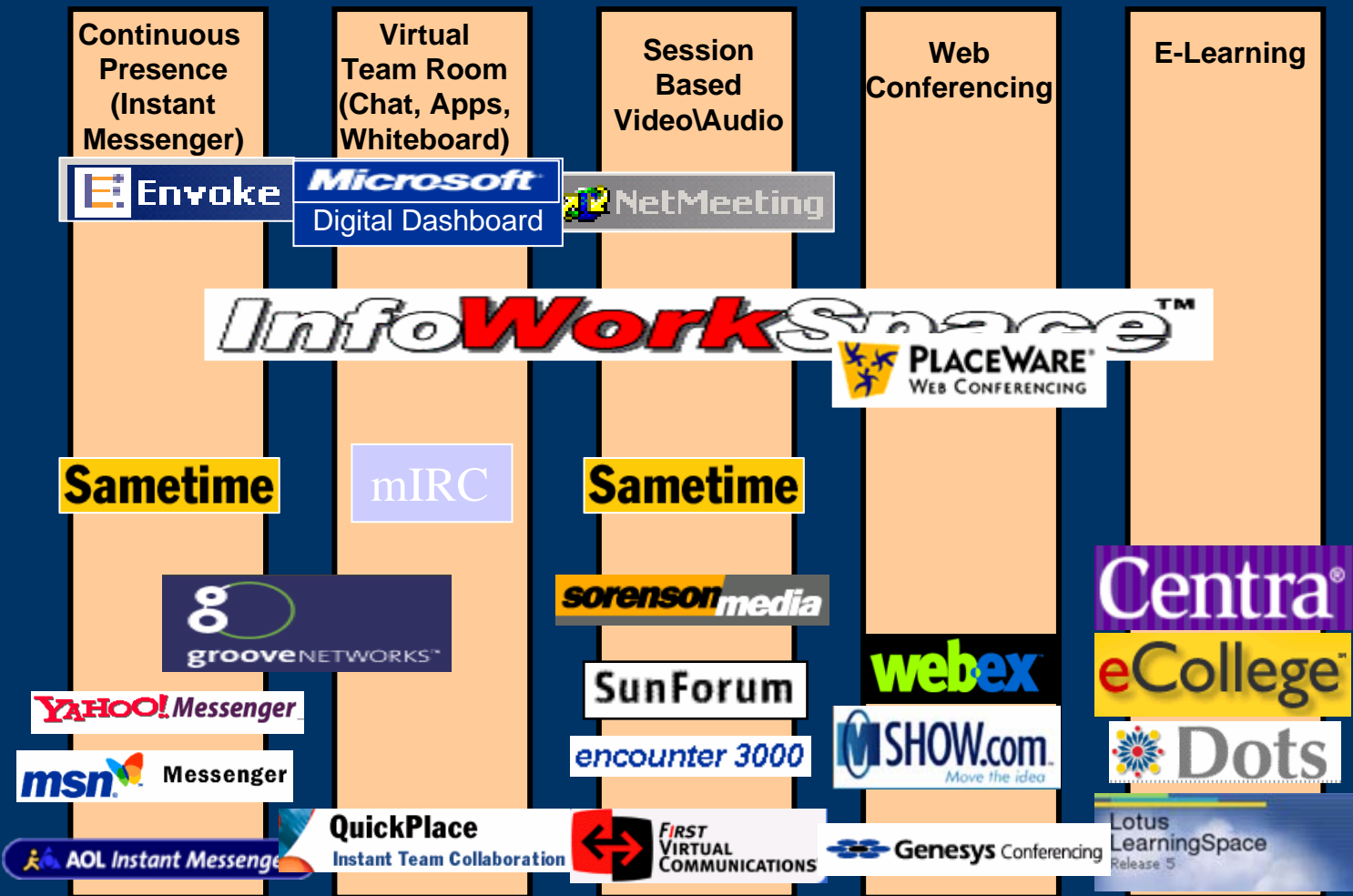


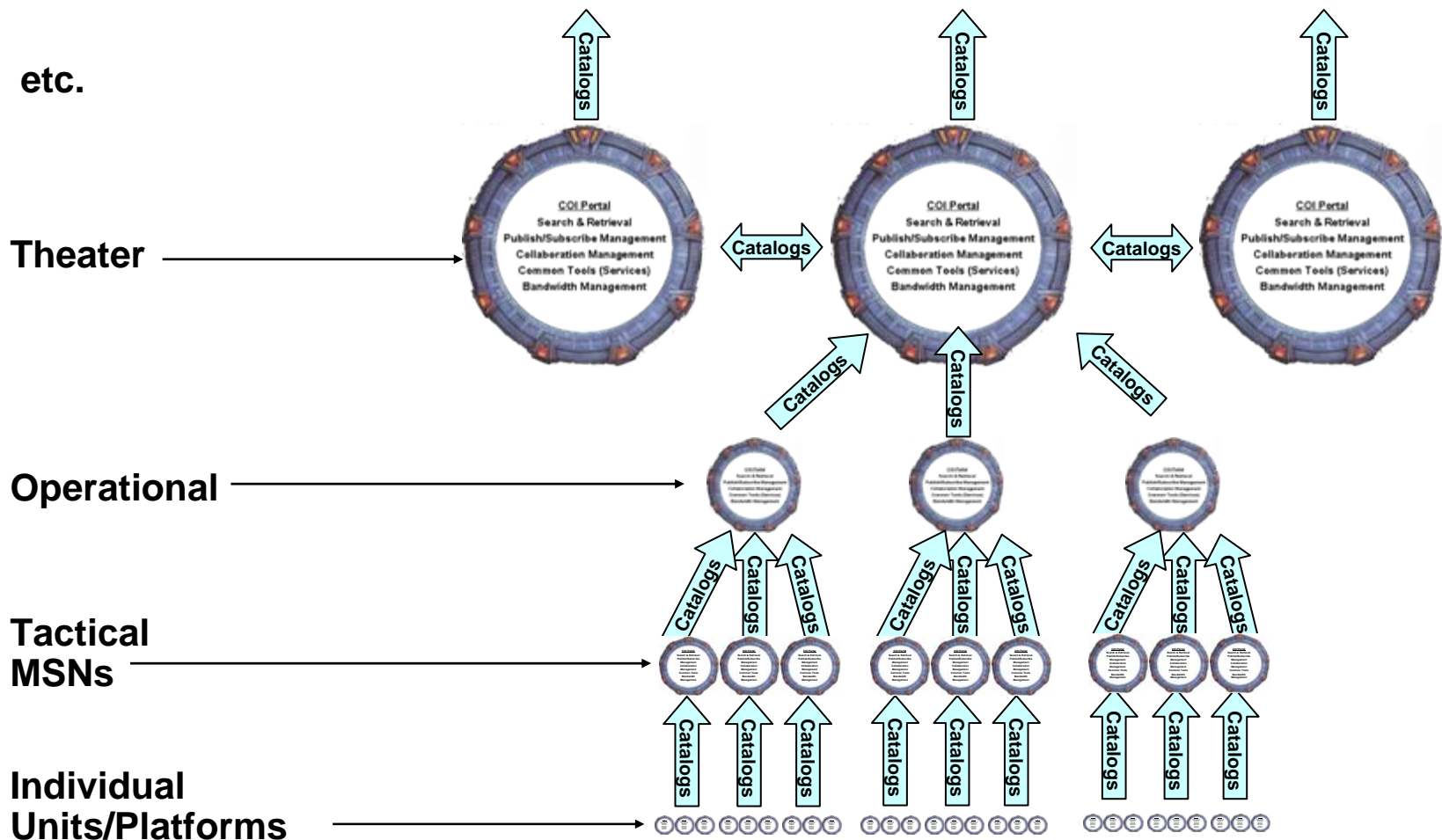
Rules-based engines determine routing rules for JTRS

- Most capable become routers
- Self-healing in case of loss-of-node



The Collaboration Playing Field





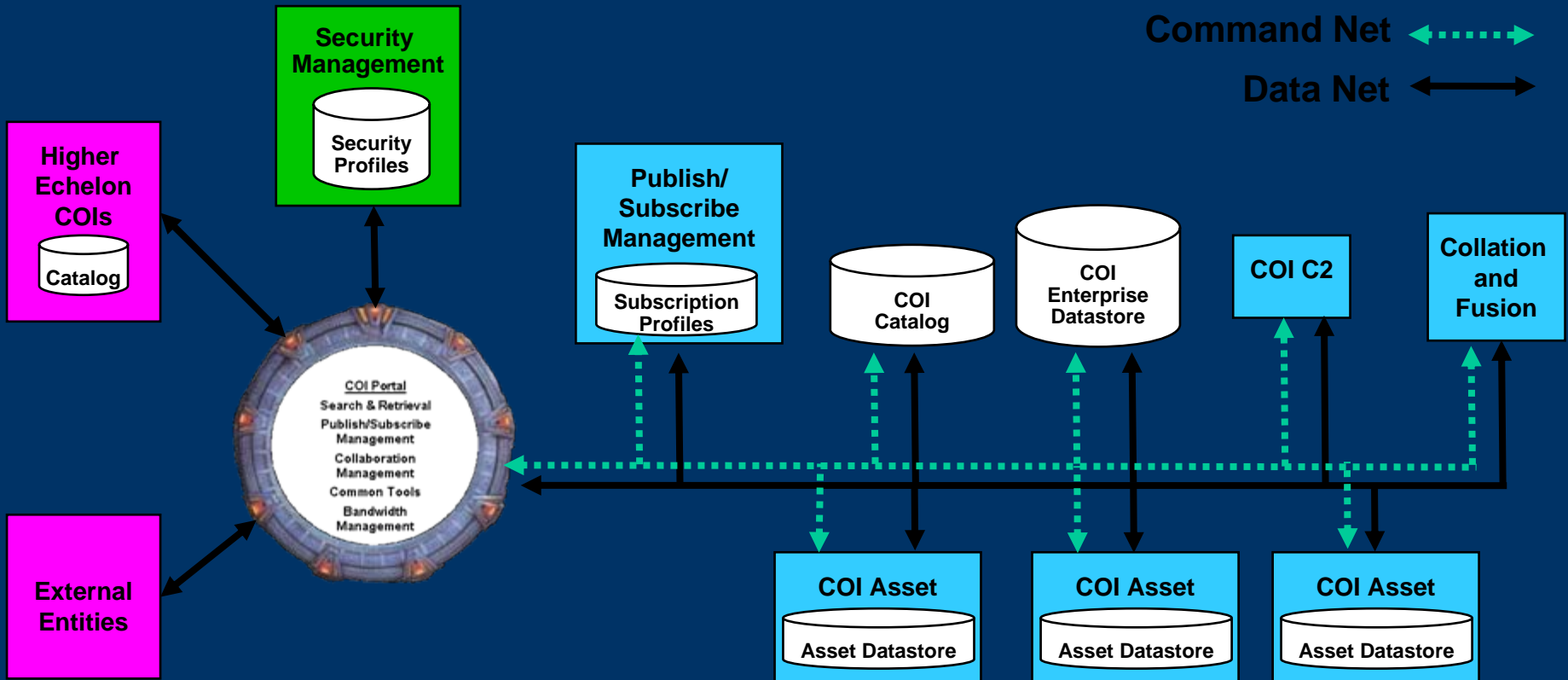
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