



# **Net Centric Principles**

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# The NCOIC at a Glance

## Members are Global Leaders:

Academic institutions

Air Traffic Management  
providers

Service providers  
Consulting  
Engineering  
Logistics

Defense suppliers  
All military services  
Multinational

Government agencies

Human service agencies

Integrators  
Commercial systems  
Defense systems

IT firms  
Communications  
Data management  
Human-Machine interface  
Information assurance

Standards bodies

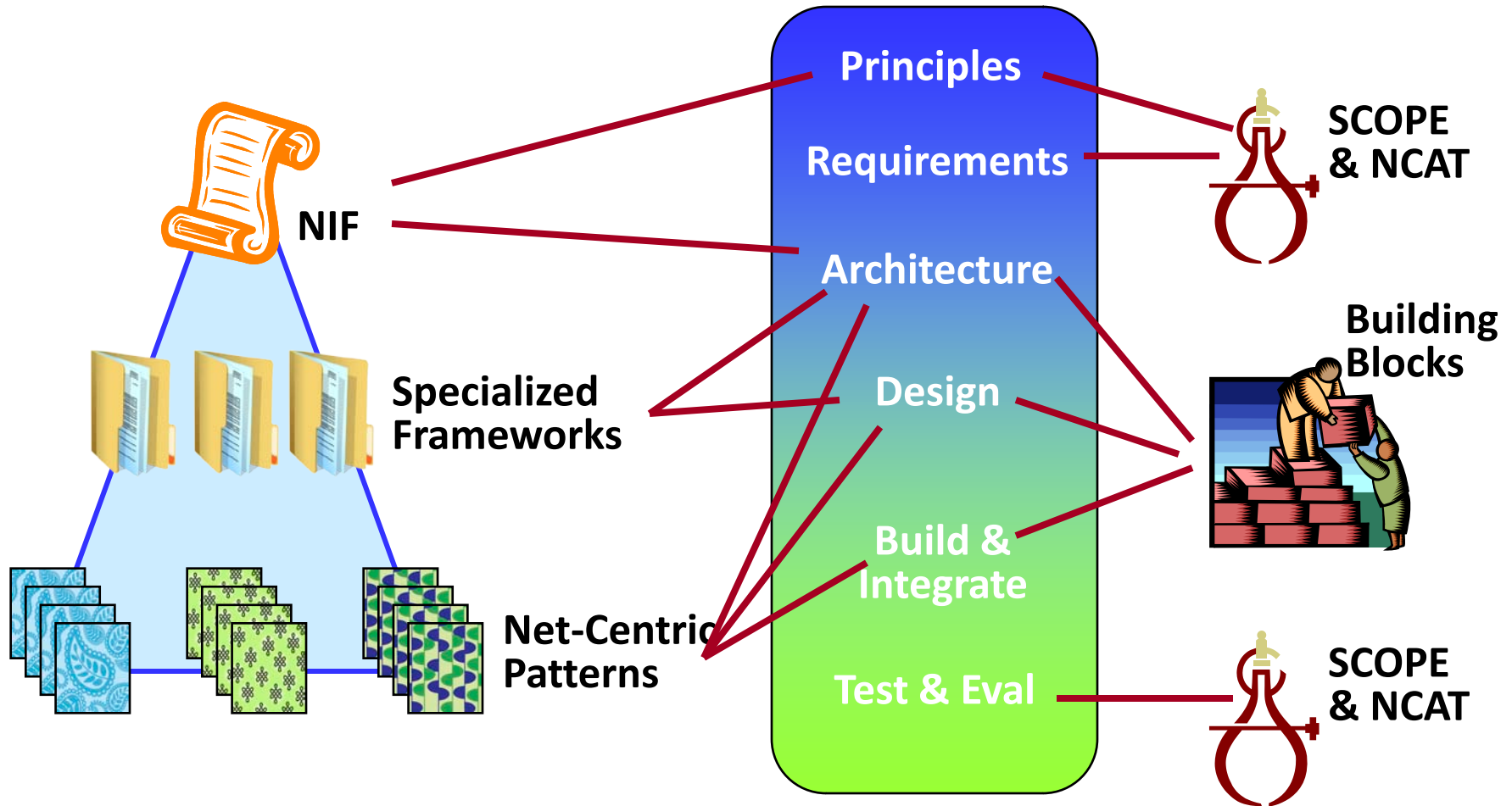
A global organization focused on an industry neutral  
approach to NCO adoption:

- Use of Open Standards in NCO domains
- Net-Centric Architecture Concepts and System Design Best Practices
- Tools for Evaluation and Assessment of Net-Centric Systems
- “Building Blocks” catalog of components compliant with NCOIC recommendations



**Prescriptive  
Guidance On How To  
Build Interoperable,  
Network Centric  
Systems**

# Where Net Centric Principles fit into the NCOIC



# The Essence of Net Centricity



- It's the opposite of system-centricity and enterprise integration
- It's about dynamic crossing of system and organizational boundaries to achieve objectives
  - Greater operational effectiveness through better use of what already exists
    - not just what you “own” or control
- It's not about the network – it's about who and what you can interact with via the network for your purposes when you need to
- It challenges existing business/acquisition and doctrinal paradigms and incentive models – more revolutionary than most realize
- It challenges system-centric system engineering and architecture paradigms
  - It similar to the relationship between ecology/evolution and biology
  - How do you engineer parts that support a variety of architectures?

**Net Centricity – a full contact social sport**

# Key Definitions

## Principles and Attributes



- Principle -- A basic generalization that is accepted as true and that can be used as a basis for reasoning or conduct.
- Attribute, property, dimension -- a construct whereby objects or individuals can be distinguished from each other
  - I.E., They are observable, and, ideally, measurable
- Characteristic, feature -- A prominent aspect of something; a distinguishing quality
- Simply put, 'principles' allow the selection of 'attributes' or 'characteristics' that are deemed useful for certain contexts
- 'Characteristics' or 'Attributes' are used to distinguish or select systems
- Thus, in identifying the core principles of net-centricity the goal is that these 'principles' may be used to select essential and relevant characteristics and attributes of net-centricity.



# NET CENTRIC ATTRIBUTES

# Net Centric Attributes



- Observable characteristics of systems, architectures, capabilities that exhibit net-centric behavior
- DoD develop a short set of high level attributes in the 2002-2004 timeframe
  - Somewhat refined since then
  - Supported by the Net Centric Checklist with more design/implementation-specific attributes
- ASD NII asked NCOIC to provide an industry perspective on the top level attributes last year
- This resulted in an NCOIC critique and recommended changes to the DoD attributes to improve their utility and applicability



# DoD Net Centric Attributes

Attribute	Description
Internet & World Wide Web Like	Adapting Internet & World Wide Web constructs & standards with enhancements for mobility, surety, and military unique features (e.g. precedence, preemption) .
Secure & available information transport	Encryption initially for core transport backbone; goal is edge to edge; hardened against denial of service.
Information/Data Protection & Surety (built-in trust)	Producer/Publisher marks the info/data for classification and handling; and provides provisions for assuring authenticity, integrity, and non-repudiation.
Post in parallel	Producer/Publisher make info/data visible and accessible without delay so that users get info/data when and how needed (e.g. raw, analyzed, archived).
Smart pull (vice smart push)	Users can find and pull directly, subscribe or use value added services (e.g. discovery). User Defined Operational Picture vice Common Operational Picture.
Information/Data centric	Information/Data separate from applications and services. Minimize need for special or proprietary software.
Shared Applications & Services	Users can pull multiple applications to access same data or choose same apps when they need to collaborate. Applications on “desktop” or as a service.
Trusted & Tailored Access	Access to the information transport, info/data, applications & services linked to user’s role, identity & technical capability.
Quality of Transport service	Tailored for information form: voice, still imagery, video/moving imagery, data, and collaboration.



# NCOIC Recommended Attributes

Title	Description
<b><u>Media Independence</u></b>	Information used, produced, published, or disseminated by the services or systems is decoupled from transport mechanisms.
<b><u>Open-Ended Pervasive Accessibility</u></b>	Ability of system(s) or service(s) to find, use, and control information (which requires an ability to identify and distinguish entities and the publication of information with minimal a priori constraints).
<b><u>Open Standards Based</u></b>	To support interoperability programs/projects, systems, and services must maximize the use of openly available and unencumbered technical and process standards that support media independence, pervasive accessibility, and trustworthy control of access to information and services.
<b><u>Protected and Assured Transport Services</u></b>	Program/project, system, or service makes use of existing specified assurance, protected, and defended transport services where feasible/available. Infrastructure systems provide specified assurance, protected, and defended transport services that are accessible and available wherever and whenever needed
<b><u>Producer/Publisher Trust Relationships [with users and services]</u></b>	Program, system, and/or service(s) has mechanisms for establishing and maintaining appropriate trust relationships with users and services on the network. Measures are taken to comply with any security labeling, data protection, and access control requirements entailed by the trust relationships and monitor the environment to ensure that conditions on which the trust relationships were established have not changed

# NCOIC Recommended Attributes

Title	Description
<b><u>Post Data/Information for Network Access</u></b>	Program/project, system, and/or service(s) has made their products discoverable and accessible on the network in a manner and timeframe appropriate to the nature of the information/data.
<b><u>Adaptive Information Access</u></b>	Program/project, system, and/or service(s) has provided users and services access to information and data in ways most appropriate for their context while allowing them to negotiate access arrangements and understand the associated costs.
<b><u>Information and Data Independence</u></b>	Program/project and/or system has separated its information and data from applications and services (dependencies) and is provided with sufficient context (i.e., metadata) to enable users to use the information/data correctly for their purposes.
<b><u>Tailored Resource Access</u></b>	Service levels can be modified, tailored, or negotiated to meet needs as represented by identities, roles, and/or contexts.
<b><u>Social &amp; Cognitive Integration</u></b>	Programs/projects and/or systems include measures of social and cognitive integration that facilitate their effective use.

# Additional Recommendations



- Add non-technical attributes in the following areas:
  - Policy (legal, regulatory, political enablement)
  - Operational Scope (how much functionality is exposed on the net)
  - Organizational (e.g., portfolio management)
  - Cultural (e.g., dependency aversion, empowerment)
  - Business Model/Purpose – what motivates net centric behavior?
- Define an assessment context framework for tailoring and applying attributes to targets appropriately
  - Enterprise, Life Cycle Phase, Capability Type, Application Purpose
  - Follow-up report to be developed



# NET CENTRIC PRINCIPLES

# Net Centric Principles



- Review of DoD Net Centric Attributes raised awareness of implicit context assumptions
  - DoD acquisition planning context
- NATO had a similar but somewhat different set
- NCOIC had developed several sets of principles focused on net-centric architectures, services, patterns, and mobile network contexts
  - Some were statements of intended outcomes
- Needed a set of principles that transcended specific organizational and capability contexts

What makes something more or less net centric?

# Net Centric Principles



<b>Principle Name</b>	<b>Description</b>
<b>Dynamism</b>	<b>Entities should support dynamic behaviors and environments</b>
<b>Globalism</b>	<b>There should be no a priori bounds on the scope of applicability</b>
<b>Explicitness</b>	<b>An entity should make all information about its behavior on the net explicit</b>
<b>Symmetric and Reciprocal Behavior</b>	<b>Relations and entities should exhibit symmetric characteristics and behaviors – no a priori hierarchies</b>
<b>Entity Primacy</b>	<b>Entities have identity distinct from the contexts in which they participate</b>



# Net Centric Principles



<b>Principle Name</b>	<b>Description</b>
<b>Ubiquitous Accessibility</b>	<b>Entities should have omnipresent or ubiquitous access to resources on the net (i.e., each other)</b>
<b>Explicit Relationship Management</b>	<b>Relations among entities should be explicitly represented and provide for negotiation, creation, change, and termination (dynamism)</b>
<b>Open World</b>	<b>Entity/concept representations should be extensible and service capacities scalable</b>
<b>Pragmatism</b>	<b>The ability to improve operational effectiveness is paramount and trumps the other principles</b>

# Examples and Implications



<b>Principle</b>	<b>Examples</b>	<b>Implications</b>
<b>Dynamism</b>	Service discovery and run-time binding; new COP contexts & sources	How to determine relevance and assurance cost of adaptability
<b>Globalism</b>	Security markings, multi-country language, entity, currency, etc. support	OK to have constrained scope but must advertise constraints on the net
<b>Explicitness</b>	Specifying units, frames of reference in service descriptions	More discoverable meta-data on systems/services and discovery logic
<b>Symmetry/ Reciprocity</b>	Peer to peer networking, authentication	Two-way authentication, dynamic hierarchies
<b>Entity Primacy</b>	Multiple vehicle IDs: VINs Lic No, Reg No, Fleet ID	Accommodate mapping IDs to other contexts

# Examples and Implications



<b>Principle</b>	<b>Examples</b>	<b>Implications</b>
<b>Ubiquitous Accessibility</b>	Mobile networks, WiFi, WiMax everywhere	Avoid restriction to site specific or wired network provision mobile access
<b>Explicit Relationship Management</b>	Browser cookies, role assignment in orgs, supply chain members	Manage external systems explicitly and dynamically
<b>Open World</b>	Extensible entity type schemas, multiple service instance designs	Avoid fixed address or attribute value sets, single service designs
<b>Pragmatism</b>	Not using country codes in phone numbers for US-only businesses, Y2K	Pragmatism itself can be dynamic, as seen in the Y2K example



# APPLICATION CONTEXTS

# Application Context



- The conditions under which principles and attributes are applied
  - Who, which institutions, in what environment
  - Enterprise context dimension
- The purpose of applying them
  - Requirements elicitation/exploration, affordability, operational effectiveness, compliance assessment
- The scope and type of what they are being applied to
  - System, domain/product line, vehicle, radio, capability, enterprise
- Where in the lifecycle are they being applied?
  - Concept development, system design, verification, post deployment evolution

**Best Practices Assume a Specific Range of Application Contexts**

# Context Impact on Attributes

Context Dimension	Impact on Attributes
<b>Enterprise/ Environment</b>	The frames of reference used to represent entities and concepts including level of granularity and scope range (determines compliance attributes and values used)
<b>Purpose</b>	The importance of and possible scoring of specific attributes and attribute values
<b>Operational Scope</b>	The number and variety of domain-specific attributes and the complexity of scoring them and relating them to net-centric effects
<b>Life Cycle Phase</b>	The level of specificity and binding of attribute values to specific architecture and environmental elements
<b>Others?</b>	Open World principle suggests extensibility



# Summary



- Past definitions of Net Centricity and Net Centric Attributes have been context-specific
- Difficult or inappropriate to apply in different contexts
- NCOIC has revised the DoD Net Centric Attributes to be generally applicable
- NCOIC has also developed a more basic set of Net Centric Principles
  - Context independence allows broad application
  - Help identify net centric architecture/pattern or design shortcomings
- Context dimensions provide guidance on how to apply principles and attributes



# QUESTIONS?

# For Additional Information

[www.ncoic.org](http://www.ncoic.org)

Or Contact:

[ncat-content@lists.ncoic.org](mailto:ncat-content@lists.ncoic.org)

Net Centric Attributes  
Content WG email

Content WG Chair: Todd  
Schneider,

[todd.schneider@raytheon.com](mailto:todd.schneider@raytheon.com)

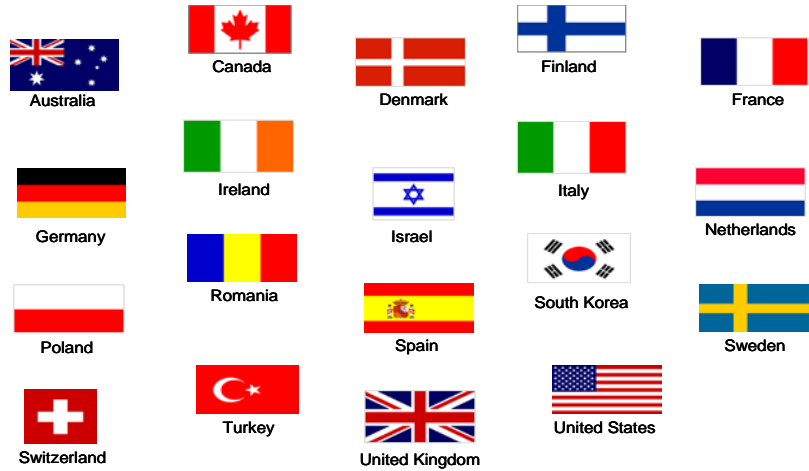
Net Centric Principles Draft  
available on request from  
Content Working Group



The screenshot shows the NCOIC website homepage. At the top, there is a navigation menu with links for Home, About NCOIC, NCOIC Role in Technology, Calendar & Events, Press Room, Join NCOIC, Sign-In, and Contact Us. The main banner features the text "13TH ANNUAL Systems Engineering Conference" with details: Hyatt Regency Mission Bay, San Diego, CA, Event #1870, October 25-28, 2010. Below the banner, there is a link to "See more member stories, news coverage and highlights of NCOIC™ work." The page is divided into several columns:

- Technical Deliverables:**
  - Interoperability Frameworks and Guidance**
    - NCOIC Interoperability Framework (NIF™)
    - Net Centric Services Framework (NCSF)
    - Mobile Networking (MNO and MNE)
    - Baseline Approach for a Standards Management Framework
  - Netcentric Attributes, Measurement and Tools**
    - NetCentric Assessment Tool (NCAT™)
    - Systems, Capabilities, Operations, Programs and Enterprises Model (SCOPE™)
  - Netcentric Patterns**
    - Operational
    - Capability
    - Technical
- NCOIC in the News:**
  - NCOIC Elects Boeing, Lockheed Reps to Lead Technical Council** (07 Jun 2010)
  - NCO Consortium Selects New Leaders** (26 Oct 2009)
  - NCOIC To Unveil Improved Data Exchange Standards** (28 Jun 2010)
  - Net-Centric Pattern for Legacy Systems** (01 Apr 2010)
- Quicklinks:**
  - Technical Brochure
  - General Presentation
  - eLearning
  - Collaborative Networking
  - Featured Videos
  - WebEx
  - Contact Us
- Calendar & Events:**
  - Plenary Meeting Schedule

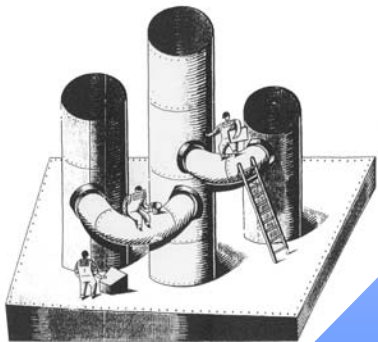
At the bottom right, there is a "BAE SYSTEMS" logo and a link to "See all NCOIC Member Organizations". A "Join NCOIC" button is also visible.



*Net-Enabled  
Future*

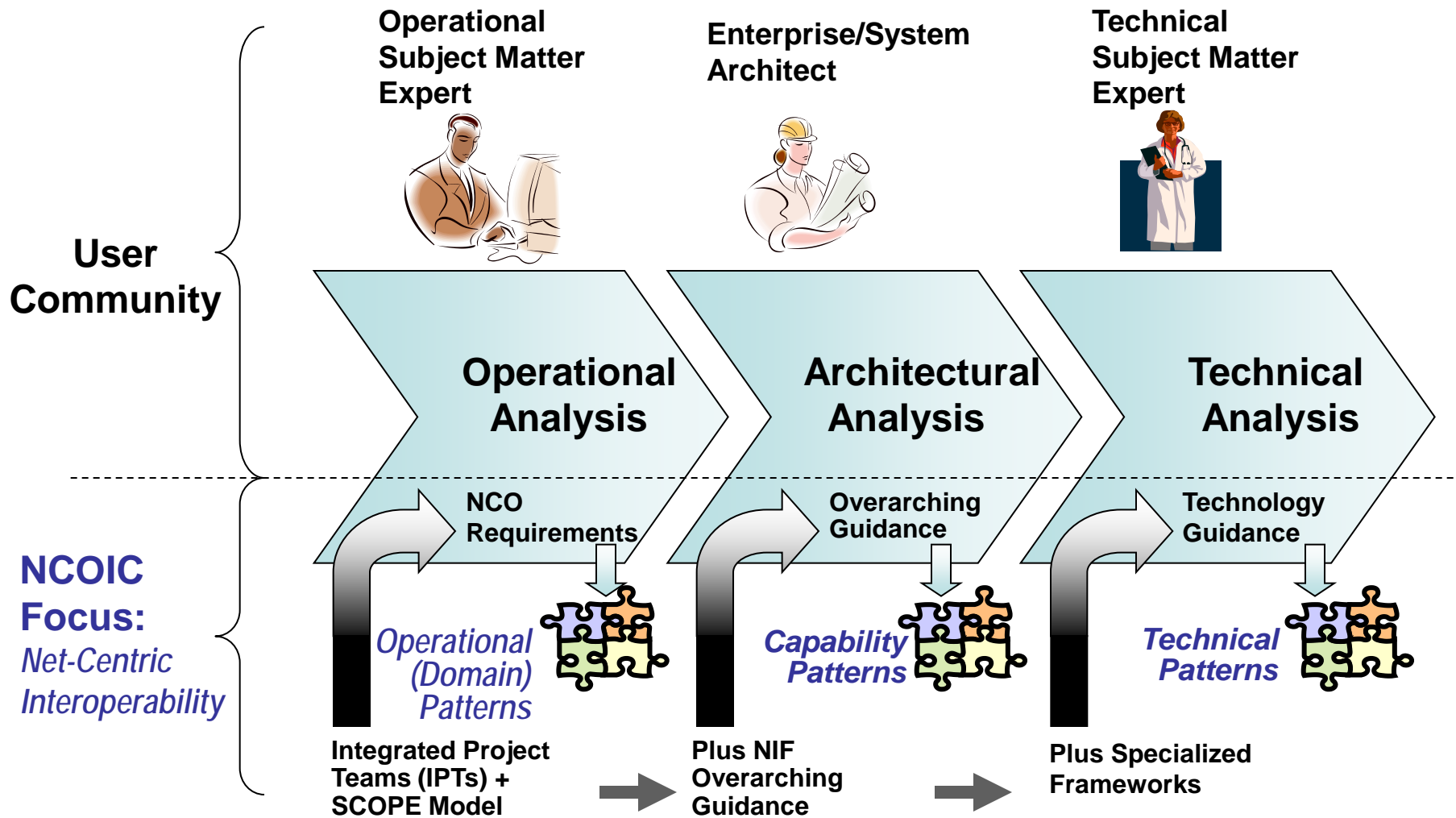


**NET-ENABLING**

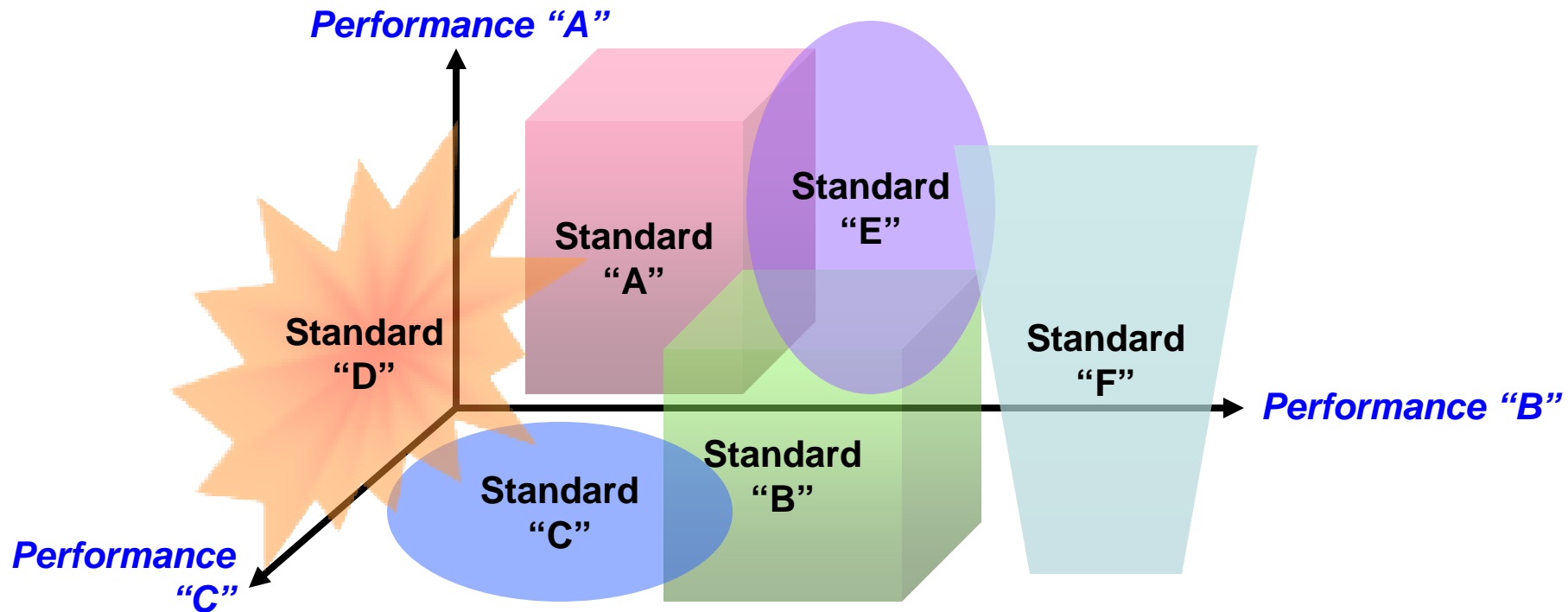


**TODAY:  
Stovepiped  
Systems,  
Point-to-Point  
Networks**

# NCOIC Assists Customers in obtaining interoperable solutions: *NIF Guides Development of Net-Centric Systems*



# The Problem with Interoperability Standards

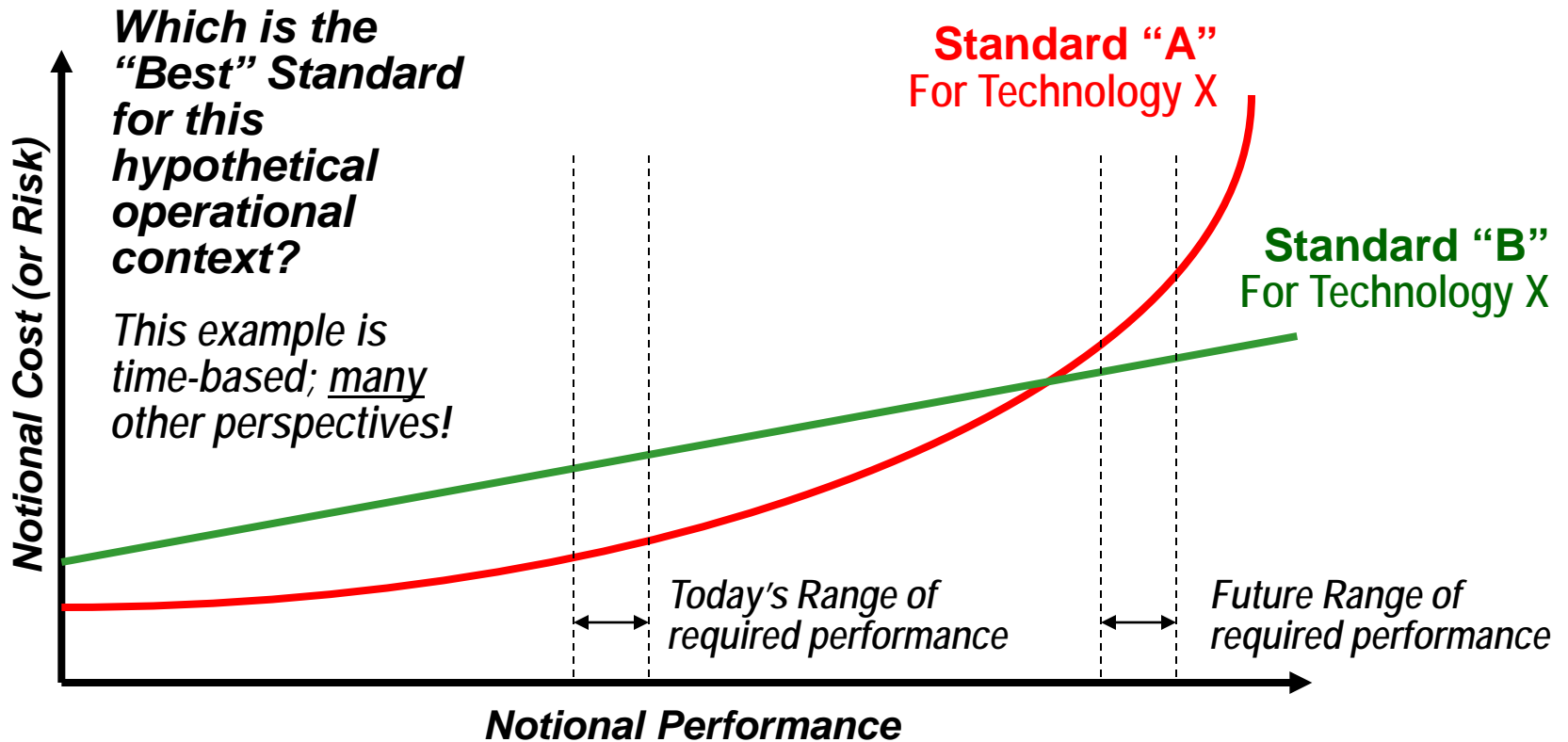


- Often the "BEST" Standard depends on the Mission
  - Real-World Condition! Often no *"One Size Fits All"*

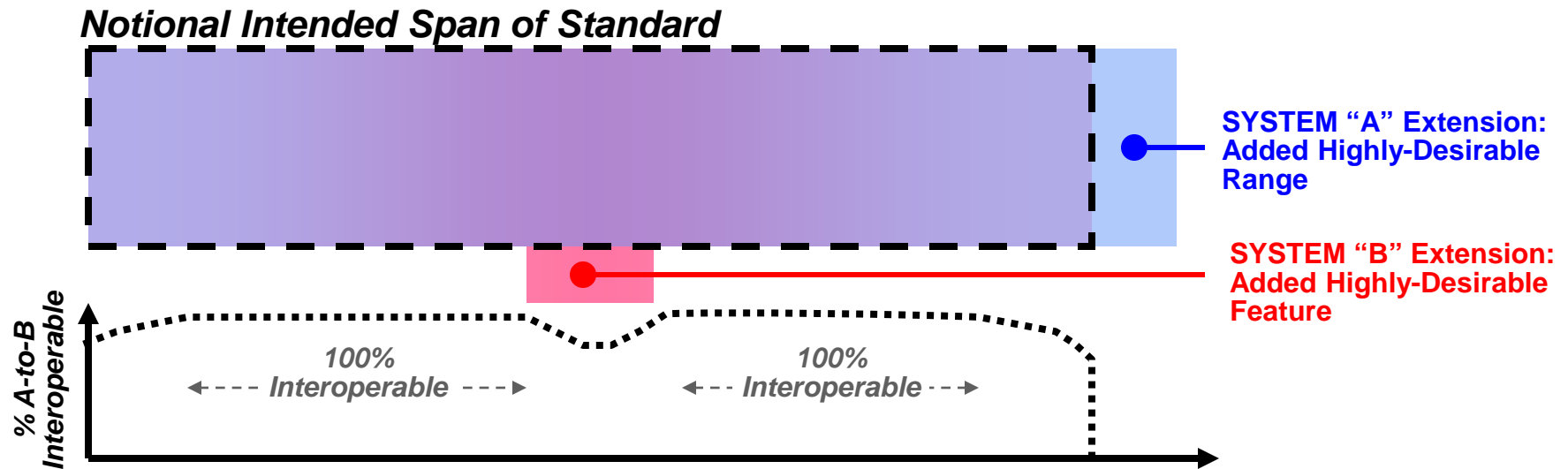


# The Problem with Interoperability Standards

- What is the appropriate level of NetCentricity for a given operational context? May impact selection of Standards!



# The Problem with Interoperability Standards



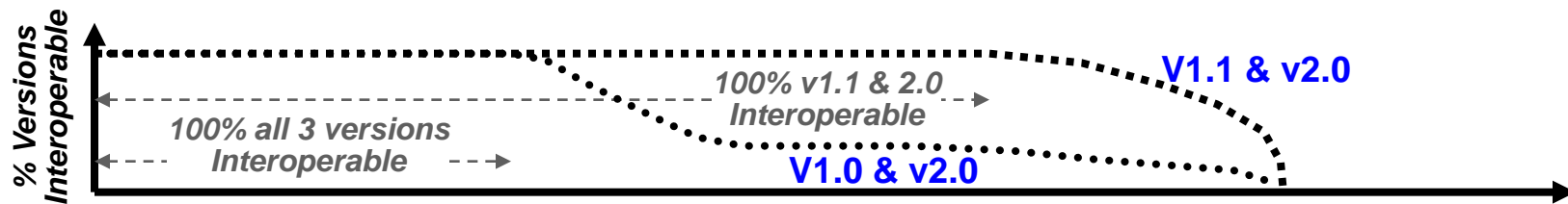
- "Bad" Standard, or "Bad" System Designs?
  - Real-World Condition!
  - In a System-of-Systems, cannot force systems to not use highly-desirable features when operating independently

# The Problem with Interoperability Standards

ORIGINAL Standard v1.0

UPDATED Standard v1.1

NEW Standard v2.0: “Backward Compatible”



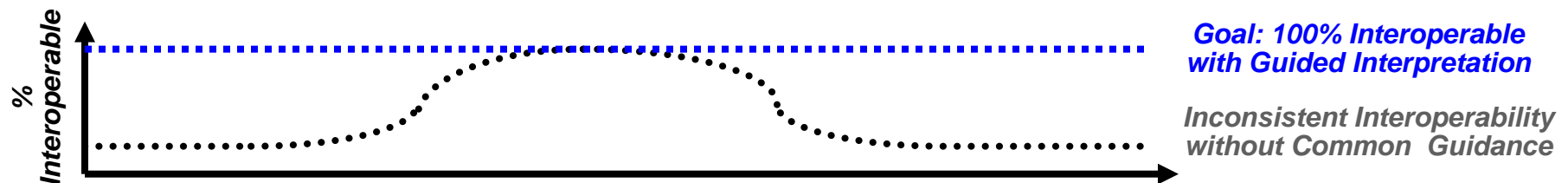
- Is Everyone Running the Same Version?
  - Real-World Condition!
  - In a System-of-Systems, cannot force Legacy systems to update to newest standard

# The Problem with Interoperability Standards

Interpretation “A” of Standard

Interpretation “B” of Standard

GUIDED Interpretation of Standard



- Does Everyone Understand the Standard the Same Way?
  - Real-World Condition! (Not necessarily a bad Standard)
  - Different Languages; different Cultural backgrounds
  - Same Standard applied in different Operational Domains, implemented by designers with different levels of experience, different technical disciplines, different company rules