

A Tool for Making T&E Itself Net-Centric: *Net-Centric Adapter for Legacy Systems* (NCALS)



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- **Key Concepts:**

- *Information sharing*
- *Geographic dispersion*
- *Effective linking*

- **Benefits:**

- *Shared awareness and knowledge*
- *Collaboration and self-synchronization*
- *Increased tempo and responsiveness*
- *Lower risk and cost*
- *Increased effectiveness*

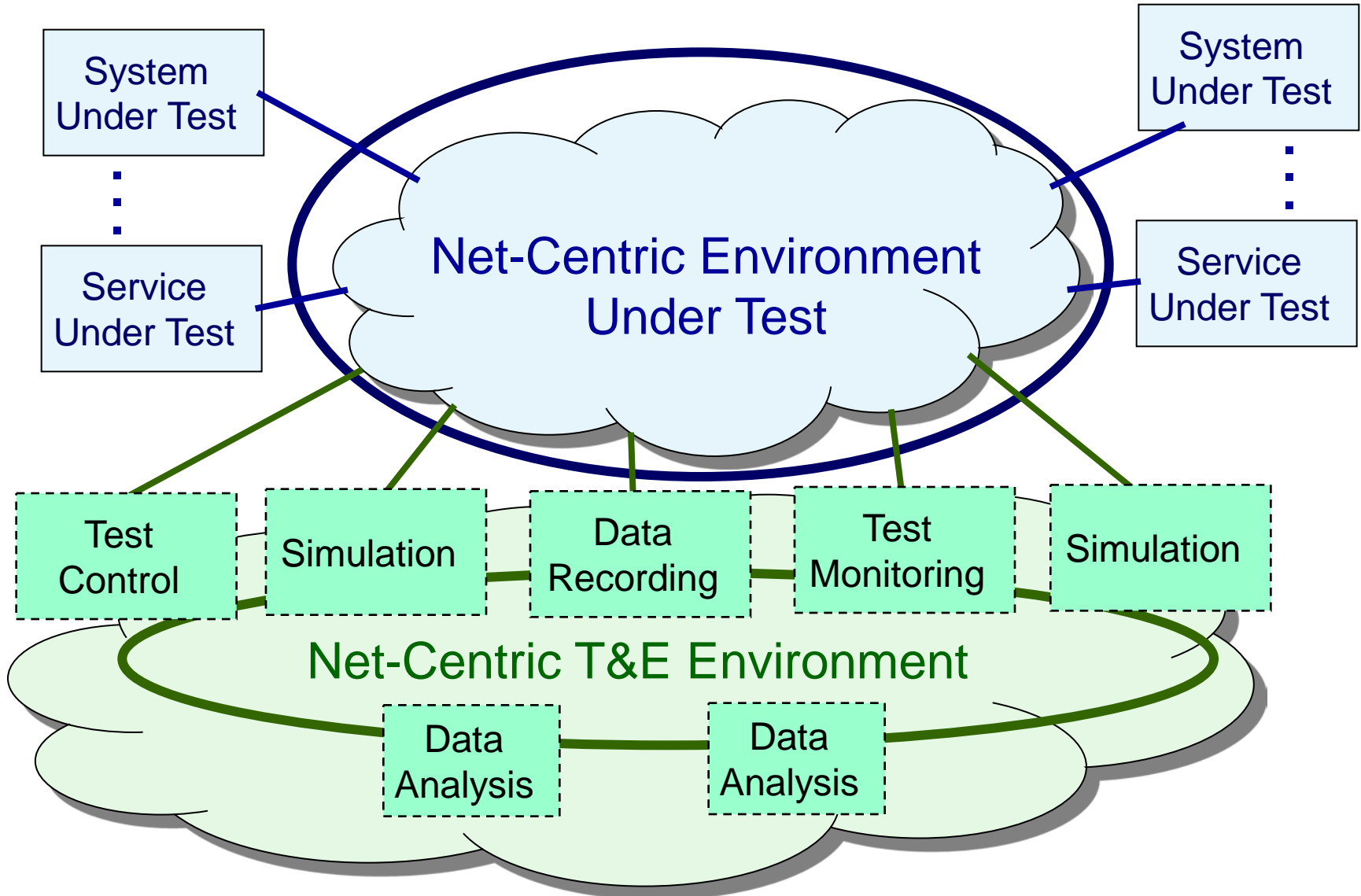
¹ Alberts, Garstka and Stein, Network Centric Warfare, 1999

Challenge: Testing and evaluating net-centric services and Systems of Systems

- *Simulation*
- *Data observation and recording*
- *Data analysis*

Opportunity: Enabling T&E to become net-centric

- *Sharing T&E information and assets*
- *Supporting T&E collaboration*
- *Enabling distributed testing, data collection and analysis*
- *Making the T&E process more dynamic, responsive and effective*



- **T&E System Constraints:**
 - *Computationally intensive processing*
 - *Simulations*
 - *Analysis tools*
 - *Real-time simulation processing*
 - *Data recording*
- **Legacy T&E System Architectures**
- **Legacy Data Access**
- **Legacy Data Formats**
- **Legacy Point-to-Point Interfaces**

Net-Centric Adapter for Legacy Systems (NCALS) is . . .



Net-Centric Adapter for Legacy Systems

A *common, highly configurable* software technology that *automatically* . . .

- **Provides** *data and services from a web-enabled network to legacy systems, and*
- **Exposes** *legacy system data and services to such a network*

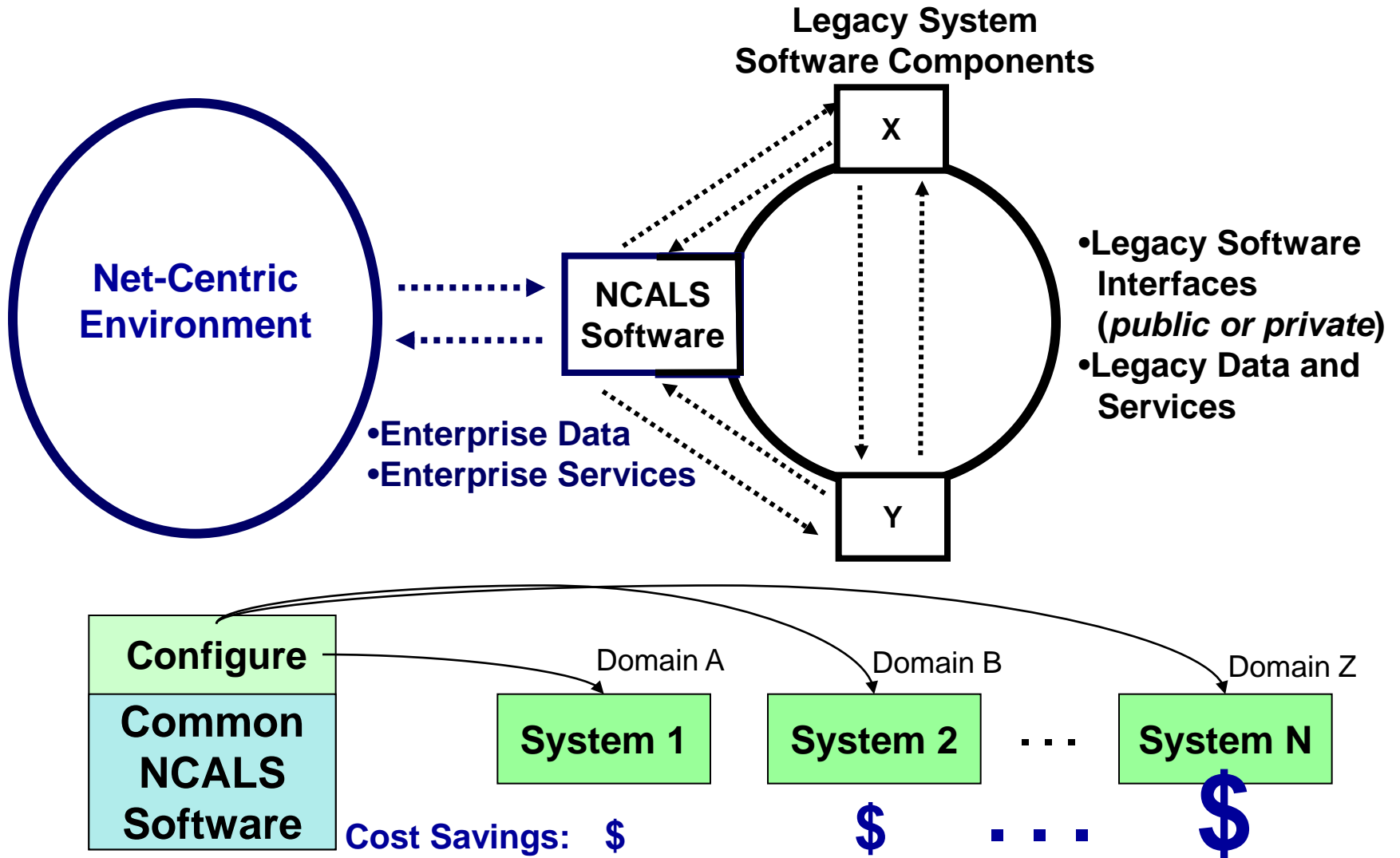
Can be used to enable net-centric T&E

Government-owned, mature prototype

NCALS as a Net-Enabler



Net-Centric Adapter for Legacy Systems

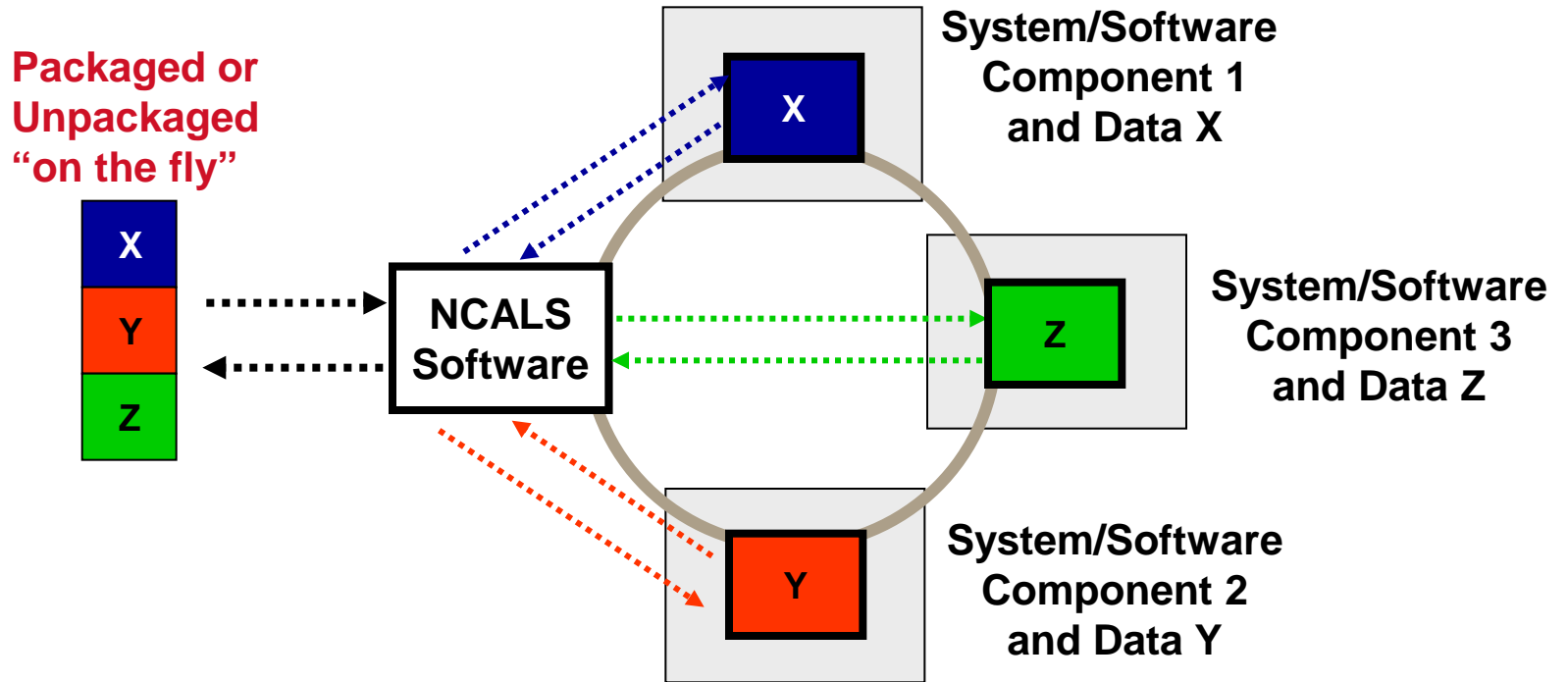


- **Compliant with net-centric standards**
- **Common to reduce cost to enterprises**
- **Lightweight**
 - *Does not require adoption of large S/W infrastructure*
- **Configurable for many different applications**
- **Portable across computing platforms**
- **Extensible to new I/Fs, formats, and connections**
- **Scalable to maximize performance**
- **Transparent to minimize legacy system impacts**
- **Automated to not increase user workload**
- **Supports dynamic data packaging**

Dynamic Data Packaging

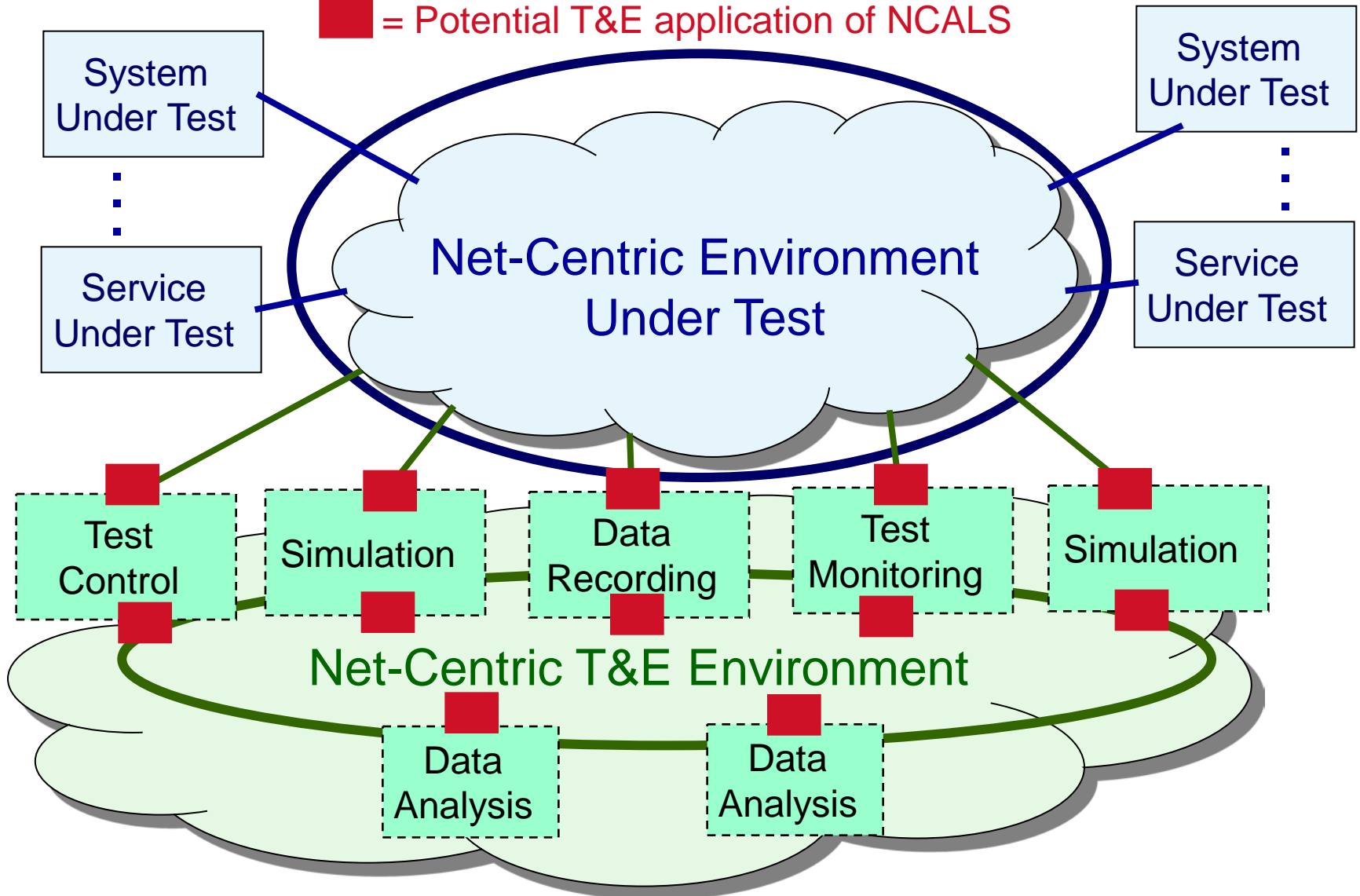


Net-Centric Adapter for Legacy Systems



Dynamically access and repackage data from multiple software interfaces

■ = Potential T&E application of NCALS



- **Implemented in Java (portable)**
- **Supports eXtensible Markup Language (XML)**
- **Supports XML or customized data transforms:**
 - *eXtensible Stylesheet Language Transformations (XSLT)*
 - *Custom transforms (class-based)*
- **Supports variety of software interface types:**
 - *Web Services and SOAP*
 - *Socket-based Application Program Interfaces (APIs)*
 - *Common Object Request Broker Architecture (CORBA)*
 - *Java Messaging Service (JMS)*
 - *Files (triggered on changes)*
 - *Custom interfaces (class-based)*

- **Net-Centric T&E Concepts**

- *Testing and evaluating net-centric systems*

- *Enabling T&E to become net-centric:*

- *Sharing T&E information and assets*

- *Supporting T&E collaboration*

- *Enabling distributed testing, data collection and analysis*

- *Making the T&E process more dynamic, responsive and effective*

- **NCALS**

- *A highly configurable software technology*

- *Can enable T&E systems to work in net-centric environments*

- *Is a mature prototype*

- *Is government-owned*



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Net-Centric Adapter for Legacy Systems

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Abstract—The Net-Centric Adapter for Legacy Systems (NCALS) is a software technology that makes legacy system data and services available in near real-time to the military Global Information Grid (GIG). The intent of NCALS is to lower the cost and risk, and to decrease the time required for legacy systems to comply with U.S. Department of Defense (DoD) net-centric technical standards. Many different systems could use a common, configurable NCALS software component to comply with these standards. The benefit to the warfighter is improved interoperability with joint and coalition forces. NCALS enables legacy systems to move to a Service-Oriented Architecture (SOA) compatible with the GIG without requiring a costly and risky rearchitecture of their legacy software. In addition, NCALS enables mission critical systems such as weapon systems to segregate their real-time, mission critical software from enterprise integration software. This maintains the safety and security by such systems, while accommodating rapid changes in Internet-based, enterprise technologies. This paper will discuss the legacy system challenge and describe a technology prototype developed by the Naval Surface Warfare Center (NSWC) Dahlgren to realize the NCALS concept. The prototype works automatically, behind the scenes, to expose legacy data to the GIG and to make GIG data available to legacy systems.

Index Terms—Legacy systems, mission-critical systems, service-oriented architecture, software engineering, systems engineering.

I. INTRODUCTION

THE beginning of the 21st century is an era of surprise and uncertainty, presenting a variety of challenges to the U.S. Department of Defense (DoD). These include: asymmetric operations, non-state enemies, the need to compress mission timelines, and the need to work with a great variety of partners [5]. Meeting these challenges requires great agility. As a result, the DoD Chief Information Officer (CIO) has focused on access to and sharing of information and timely, actionable intelligence among geographically distributed military units, as well as collaborative capabilities [1].

The DoD has developed the concept of Network-Centric (a.k.a. net-centric) Operations (NCO) as a means of meeting these challenges [2]–[6]. The net-centric approach requires the networking of sensors, decision-makers and weapon systems to enable shared awareness, rapid decision-making, higher operational tempo, increased survivability, and self-synchronization [3]. Self-synchronization occurs when forces are able to coordinate their actions in time with one another. Meeting

all these challenges requires timely, complete and accurate information available to all forces.

The premise of net-centric operations is that the “whole of an integrated and networked force is more than the sum of its parts” [2]. This system-of-systems approach demands that we provide warfighters access to timely, relevant and accurate information. Some important attributes required to support NCO are noted in Table 1 [10]. A communications infrastructure, the Global Information Grid (GIG), will network the entire DoD enterprise, serving as a key enabler for net-centric operations [19].

In 2003 the DoD published its Net-Centric Data Strategy for managing data in a net-centric environment. The key thrusts of the strategy include [7], [9] a) ensuring data are visible and available to the GIG when and where needed for decision-making; b) annotating all data with metadata to enable data discovery; c) publishing of data wherever possible to “shared spaces” on the GIG, ensuring availability to users; and d) moving from unique “point-to-point” interfaces between individual systems to “many-to-many” exchanges on the GIG. DoD systems must expose their data via data access services to support these thrusts.

To realize net-centric operations, the DoD is working to greatly improve communications capabilities through its GIG initiative, to capture warfighter requirements through Communities of Interest, to provide core “enterprise services”, and to identify supporting technical standards through the DoD Information Technical Standards Registry (DISR) [11], [9], [11], [17], [19]. These technical standards are aligned with Internet and commercial engineering standards and will support the implementation of Service-Oriented Architectures. The key net-centric standards are shown in Table II [11].

The authors have observed that one of the most significant obstacles to realization of net-centric operations is the existence of legacy systems within the DoD. Legacy systems are existing DoD systems, which were typically not designed to support net-centric technical standards. For example, the Assistant Secretary of the Navy for Research, Development and Acquisition in 2005 identified 164 legacy systems, 42% of the total number of systems, in the Navy and Marine Corps that will

TABLE I
KEY NET-CENTRIC ATTRIBUTES

Title	Description
Internet Protocol	Network communications
Point in Parallel	Immediate posting of data by Provider
Smart Pull	Data accessible and tagged for discovery
Data Centric	Separate data from applications
Quality of Service	Data timeliness, accuracy, completeness and integrity

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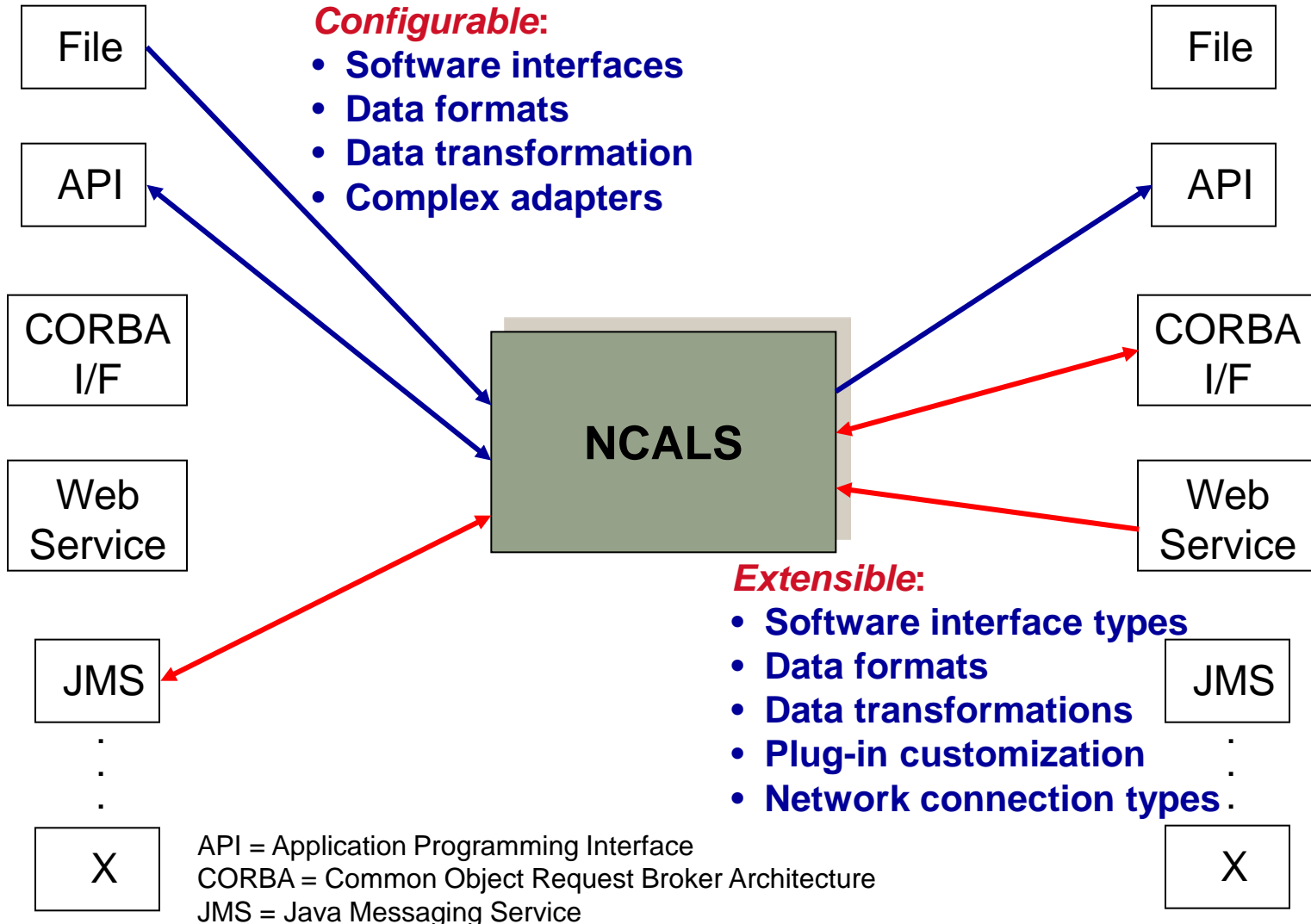
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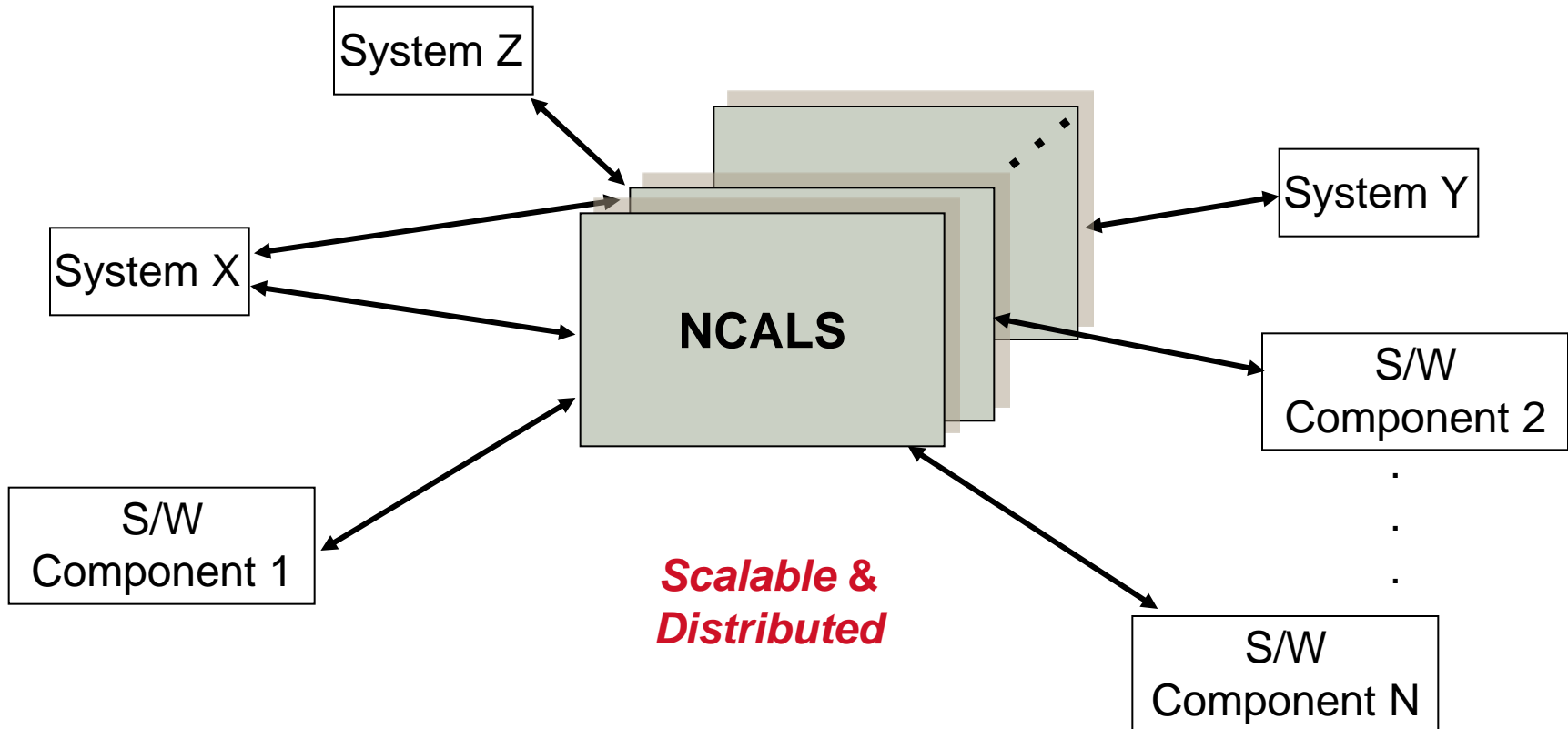
Backup Slides

NCALS Configurability & Extensibility



Net-Centric Adapter for Legacy Systems

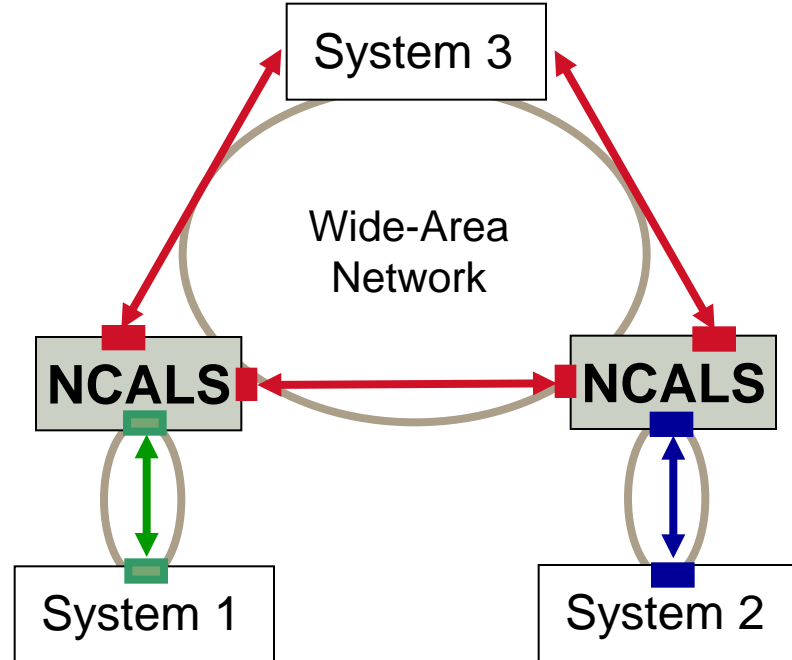
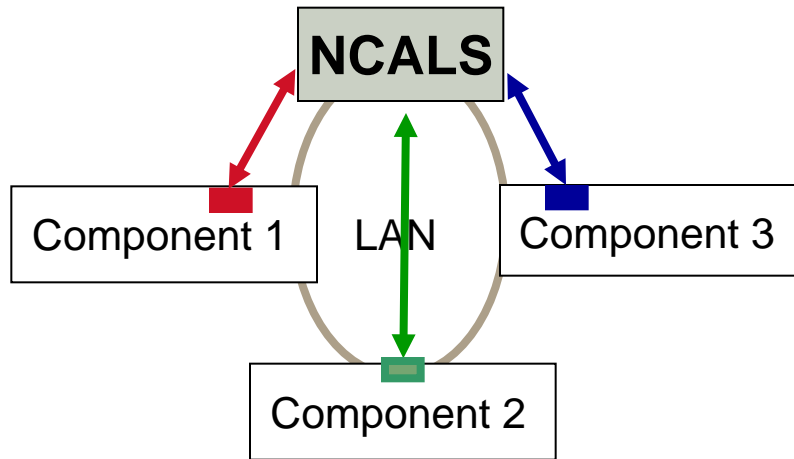




NCALS as a System/SoS Integrator: Examples



Net-Centric Adapter for Legacy Systems



NCALS as a Data Translator: Examples



Net-Centric Adapter for Legacy Systems

