

# Lecture#3

## Net-Centric Systems

By "net-centric computing" I mean  
connected computing

# Net Centric Systems (NCS)

- What is a “net centric system”?
- Answer: A system where network plays a large role
  - “Network is in the center of the system”
  - “System would not exist without the network”
- In other words: **The focus is on network communications**
- Or, without the network, the system would not exist
- So, we look at systems where:
  - There are several computers
  - The computers are connected by a network
  - Most of the interesting problems stem from the network
- **Note: There are several kinds of such systems**
  - Internet, multimedia streaming, IP telephony, ...

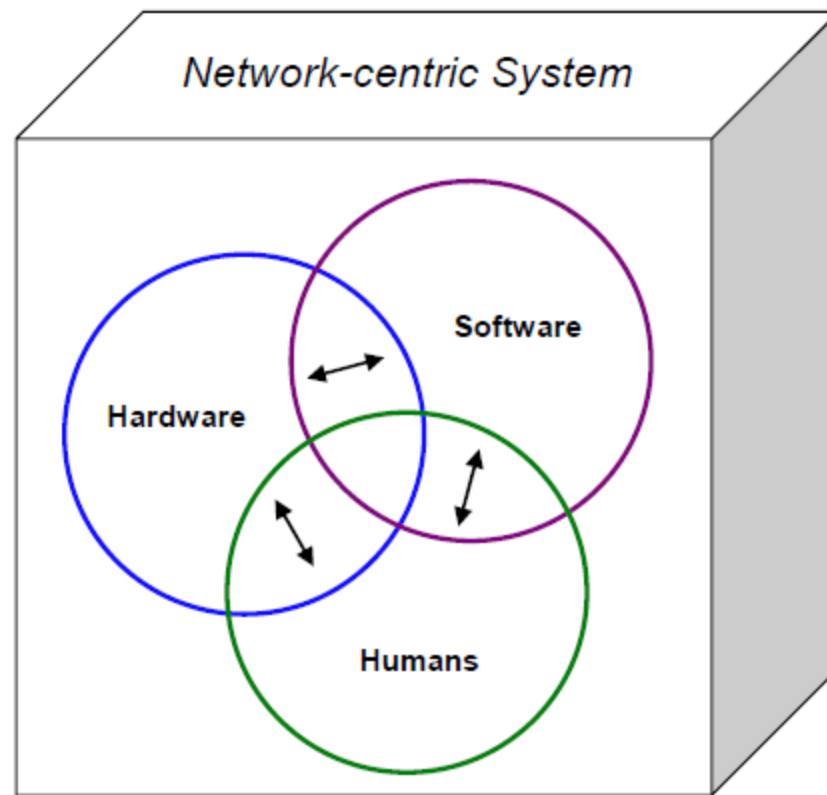
# What is a Network-Centric System?

- A network-centric system is an interconnection of hardware, software, and humans that operate together over a network (e.g., Internet, virtual private network, local area network, intranet) to accomplish a set of goals.
- The major distinguishing characteristic of this class of systems is the fact that the components (or subsystems or modules) of this type of system communicate with each other over a network. For example, the space shuttle or an aircraft is a complex system, but it is not a network-centric system as its components do not communicate over a network. A supply chain system operating over a company's virtual private network with geographically dispersed employees using the system with their PDAs, cell phones, laptops, and PCs is a network-centric system.

# What is a Network-Centric System?

- While Network-centric systems share many characteristics with Distributed systems, they are not another name for distributed systems. The term “distributed systems” typically implies that the system operation is distributed for performance improvement reasons. It also implies that the system is engineered to have distributed components. The terms “distributed processing” and “parallel processing” are used purely for performance improvement. On the other hand, the term “network-centric” implies that the system can be composed by way of reuse of already existing systems or subsystems over a network. The term “Distributed Systems” refers to the old local area or wide area networks. Thus, in the new era of the Internet with which we have witnessed many paradigm changes, the new term is “Network-centric” is more appropriate.

A network-centric system consists of hardware, software, and humans as depicted in Figure 1.



**Figure 1** Major components of a Network-Centric system

The term “Network-centric System” refers to a class of systems. Example systems that belong to this class include the following:

- ***1.1.1 System of Systems***
- ***1.1.2 Family of Systems***
- ***1.1.3 Network-Centric Software***

# ***1.1.1 System of Systems***

- A system of systems (SoS) is an interconnection of interdependent systems through a network to provide a given capability. A SoS may be a single platform or consist of a collection of separate, but interdependent, interconnected platforms performing different functions.
- A military aircraft, for example, is a single platform operating with different systems on board, such as propulsion, weapons, navigation, and communications systems. A ground station dependent on a satellite is an example of interconnected platforms performing different functions.
- A distinguishing factor for a SoS is that it depends on all of its elements working interactively and continuously within a network to accomplish a pre-specified capability. The loss of any SoS element degrades the performance or capabilities of the entire SoS. A SoS provides a capability not possible with any of the individual elements acting alone.

## ***1.1.2 Family of Systems***

- A family of systems (FoS) is a collection of independent (not interdependent) systems that can be interconnected over a network in various ways to provide different capabilities needed depending on a particular situation. Interoperability of the independent systems is a key consideration in the ad hoc deployment of a FoS.
- An enterprise-wide system is a system that covers the entire operation of an enterprise such as the U.S. Navy over a network.



## ***1.1.3 Network-Centric Software***

- From the preceding discussion, we can characterize software components that interact with each other over a network (e.g. Internet, VPN, Local Area Networks, Wireless networks, etc) as network-centric software. This characterization leads us to the following definition of Network-centric software architecture:
- “A Network-centric Software Architecture is software architecture with characteristics and organization that make it suitable for building applications and systems that are deployed over networks. Network-centric Software Architecture Frameworks have mechanisms and tactics that support building Network-centric systems”.