19th ICCRTS Track 1: Concepts, Theory & Policy

Essential structures of C2 components and dynamic mechanisms to agility

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1.Introduction

- **Command and Control (C2)**
  - a continual process of evaluating and re-evaluating the situation and environment
  - support decision making as well as decision taking to achieve its objectives in Mil./Emer. Rescue/Traffic Man. Operations
- **Agility**
  - the capability to cope with changes in the situation or environment

1.Introduction

- **Command and Control (C2) in 21st**
  - uncertainty in military mission space
  - the ongoing transformation
  - acquiring, managing, sharing and exploiting information supporting individual and collective decision-making
- **More mature C2 — C2 Agility**
  - includes the ability to recognize situational change, and to adopt the C2 approach required to meet that change—C2 Agility.

1.Introduction

◆ **In view of system engineering, the C2 system comprises two basic subsystems:**

- technical system (TS)
- organizational system (OS)

1.Introduction

- **The TS refers to**
  - the new information systems
    - the Force XXI Battle Command Brigade and Below(FBCB2)
  - the rapid progress of advanced commercial information and communications technologies
    - computing power, information storage, information processing, and connectivity

1.Introduction

- **The OS refers to**
  - the industrial-age hierarchical organizations as well as the information-age decentralized organizations
    - typically the command posts which have commanders and staff in.
    - U.S. Army doctrine establishes that the corps and division generally employ three command posts: TAC CP, Main CP, Rear CP

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2.Essential structures of C2 subsystems

◆ **The C2 system**

- is integrated within the larger military system to support decision making.
- consists of equipment and people (commanders and subordinates) organized in a structure to execute tasks.

◆**The C2 system comprises two basic subsystems**

- technical system (TS) that is constituted of equipments
- organizational system (OS) that is constituted of people

2.Essential structures of C2 subsystems

Communi -cations

technics

apps

facilities

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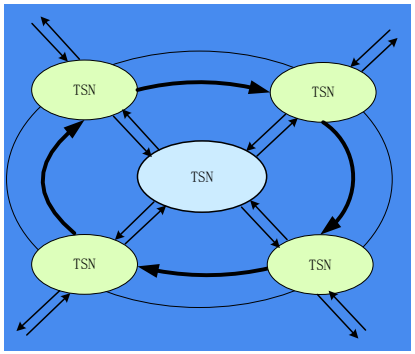
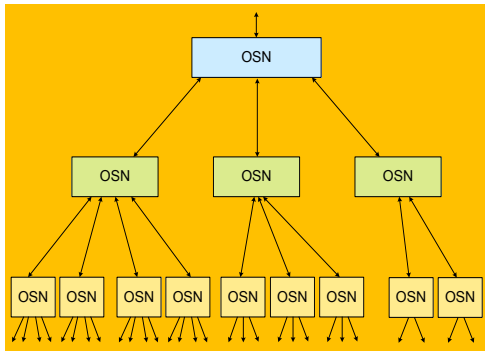
Elements and node structure in TS

Technological System



Net Trait

Organizational System



Echelon Trait

commander

staff

tactics

procedures

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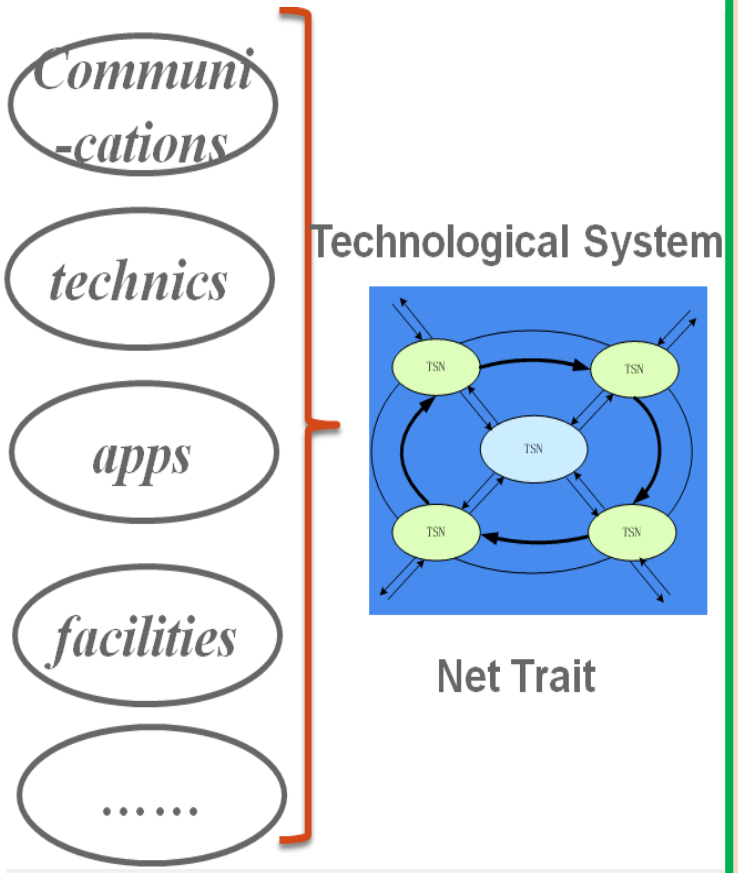
Elements and node srtucture in OS

2.1 Net character of Technological System (TS)



◆ **technical support systems**

- assets (effectors), sensors, communications, decision support and situation displays

◆ TS is in net structure with lots of TS nodes (TSNs) widely connected followed with the information revolution.

◆**TS's net**

- large number of TS nodes (TSN)
- edges between the TSNs
- the directions of the edges are double sided

◆**TS is the physical foundation and technical support of C2 system**

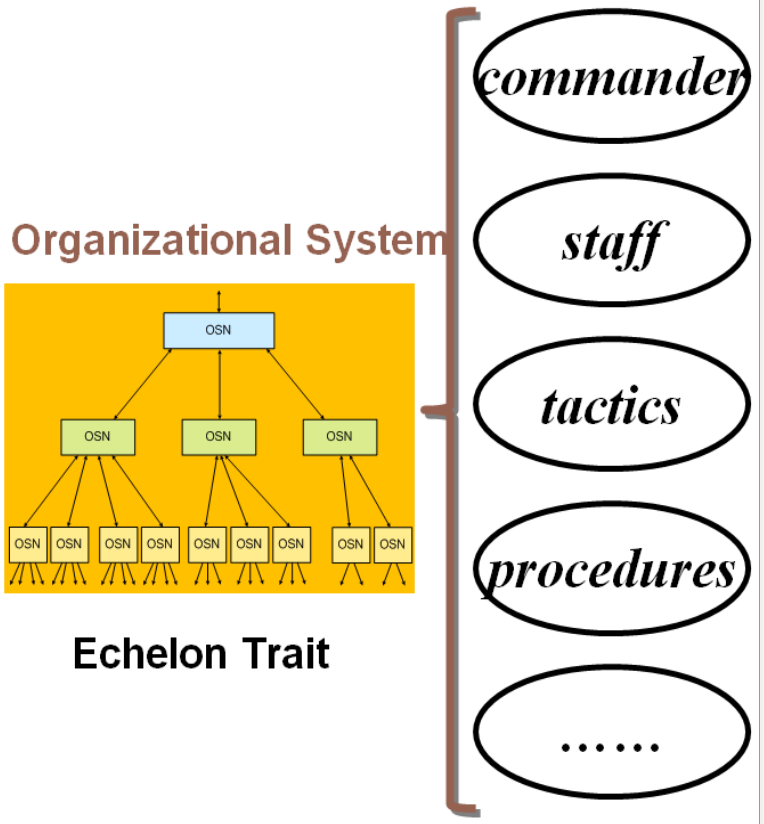
2.2 Tree character of Organizational System (OS)

◆ **Commanders are the key to command and control**

◆**The relationship between higher commanders and subordinates is tree like.**

◆**OS's tree**

- a large number of OS nodes
- edges between the OSNs
- the directions of the edges are single, rigid and limited.
- the command and subordinate relationships are strict.



Elements and node srtucture in OS

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3. Logics to C2 agility: TS & OS

◆ **Agility is the capability to cope with changes in the situation or environment**

- responsiveness, versatility, flexibility, resilience, innovativeness and adaptability

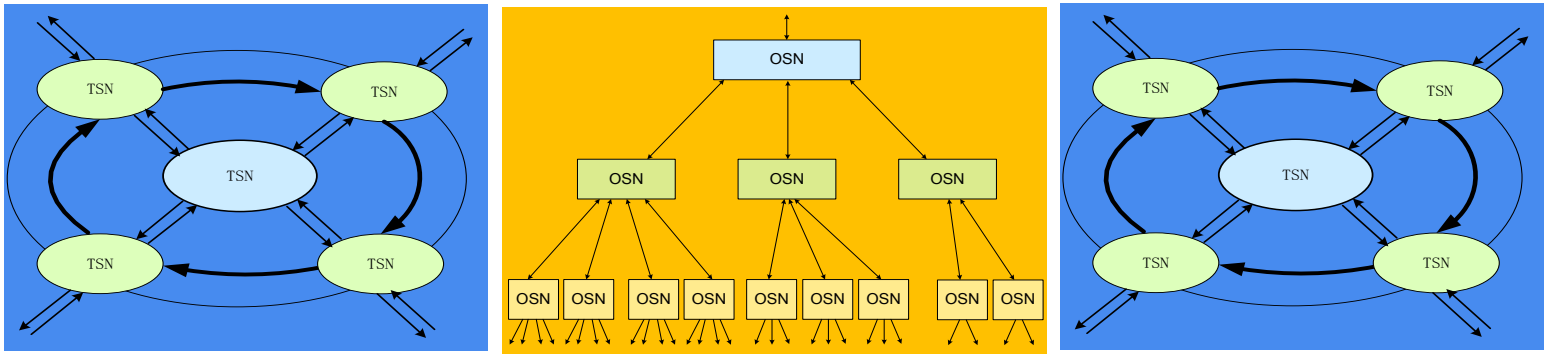
◆**For distributed force (satellites communications systems)**

- break the bonds of line-of-sight tactical communications
- enabling the flow of information
- at all levels of war across a dispersed network of connected TS nodes

◆**two logics for the TS and OS to interact with each other**

- TOT logic
- OTO logic

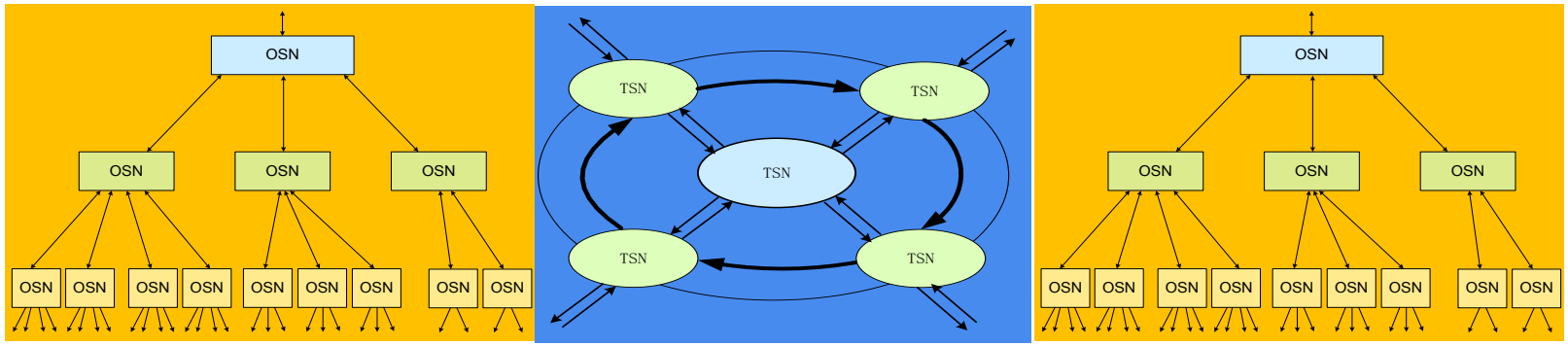
3.1 TOT logic



T-O-T logic with OSN as a bridging role to C2 agility

- **Organizational System Node(OSN) as a bridging role to C2 agility**
- **C2 information flow from TS nodes to OS nodes, and then back to TS nodes.**
- **OS nodes**
  - bridging role which limits the C2 agility.
  - composed of personnel(commander and staffs), organizational structures, work
  - limit the C2 capabilities of responsiveness, versatility, flexibility, resilience, innovativeness and adaptability.

3.2 OTO logic



O-T-O logic with TSN as a bridging role to C2 agility

- **Technological System Node(TSN) as a bridging role to C2 agility**
- **C2 information flow from OS nodes to TS nodes, and then back to OS nodes.**
- **TS nodes**
  - bridging role which limits the six capabilities of C2 agility

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4. Interaction logics of OS and TS to C2 agility

◆ **Synchronize the logics**

- at least one intersection:“a question of instituting signs and signals.”—Sun Tzu

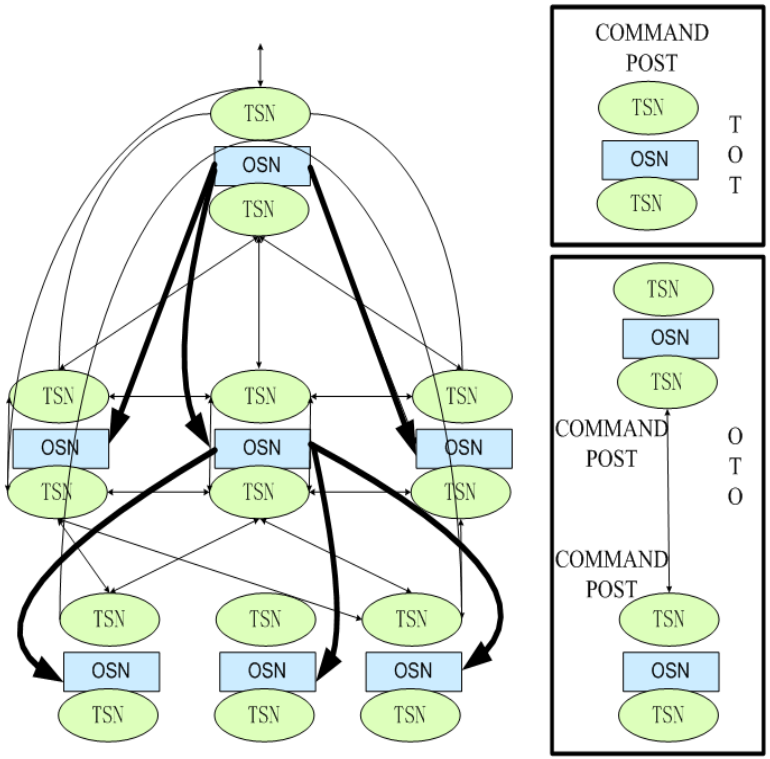
◆**Problem:**

- how to improve information sharing ability, and enable greater interactions and collaboration between all levels of command post (strategic, operational, and tactical), and all those forces (air, land, and marine) easily and effectively

4. Interaction logics of OS and TS to C2 agility

- **a kind of simplified signs and signal**
  - support for all levels of commanders and staffs to easily communicate with each other
  - display military plans and actions multimedia alike
  - common, standard, measureable, minable, visualized, diagrammatic (CSMMVD)

4. Interaction logics of OS and TS to C2 agility



•Figure3 TS and OS interaction logics (TOT and OTO)

◆ CSMMVD

- C:commonly used in the community of commanders and staffs
- S:firmly defined and strictly differentiated with standard rules
- MM :data linked and is measureable and minable
- VD:can be displayed and demonstrated with graphic illustrations and diagrammatic format

◆include common operational picture (COP) and more than COP

◆provide commanders and staffs situational awareness and understanding.

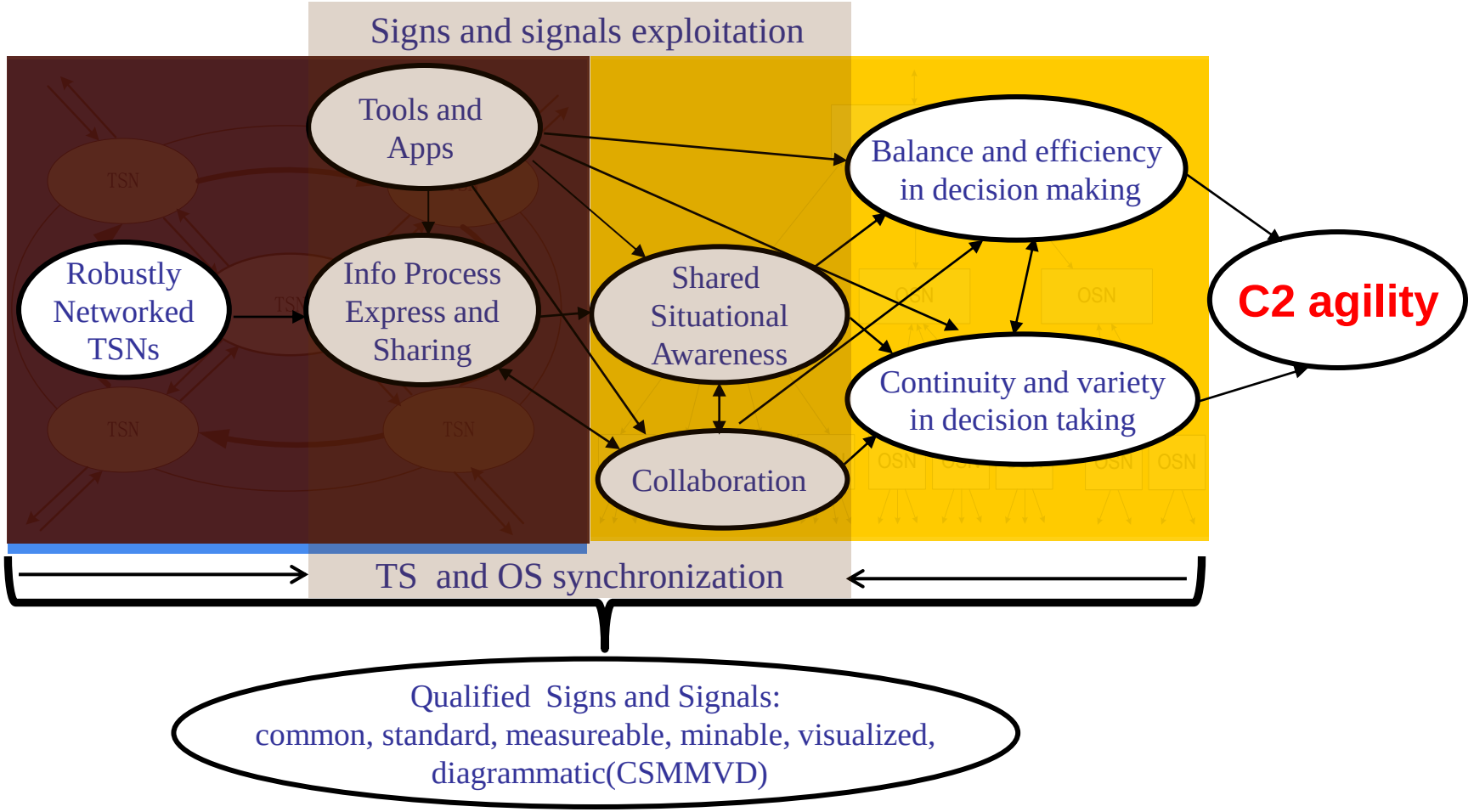
4. Interaction logics of OS and TS to C2 agility

- **The aim of CSMMVD :**
  - improve the efficiency of sense making of the circumstance in the battle space,
  - reduce the influence of individual experience and expertise.
  - help all leaders to provide near real-time information with objective conditions
- COP and CSMMVD signs and signals provide a common basis for interaction and collaboration among commanders, between commanders and staffs.

4. Interaction logics of OS and TS to C2 agility

- This results in shortened decision cycles, greater unity of effort, more C2 responsiveness, versatility, flexibility, resilience, innovativeness and adaptability.
- To synchronize the logics, find the intersection of two: common, standard, measureable, minable, visualized, diagrammatic (CSMMVD) information both for computers and people. Then balance and efficiency, continuity and variety on the way to C2 agility.

4. Interaction logics of OS and TS to C2 agility



•Figure4 Interaction of the TS and OS to C2 agility

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5. Conclusion

Signs and signals are to be exploited for C2 agility in future.

“凡治众如治寡，分数是也；斗众如斗寡，形名是也；”

《孙子兵法》

“The control of a large force is the same principle as the control of a few men: it is merely a question of dividing up their numbers. Fighting with a large army under your command is nowise different from fighting with a small one: it is merely a question of instituting signs and signals.”

Sun Tzu

The Art of War

Developing Road Map of C2?