



# NETWORK CENTRIC OPERATION: Its Essence and Applications

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# Contents of Today's Topic



- I. Introduction to Network Centric Operation
- II. Examples and Application
- III. Conclusions

# I Introduction to Network Centric Operation

The background of the slide is a light yellow-green color. It features several decorative elements: three thick, curved green lines that sweep across the frame from the bottom left towards the top right, and two smaller, dark green starburst shapes. One starburst is located in the lower-left quadrant, and the other is in the upper-right quadrant, near the end of the longest curved line.

# Introductory Remarks

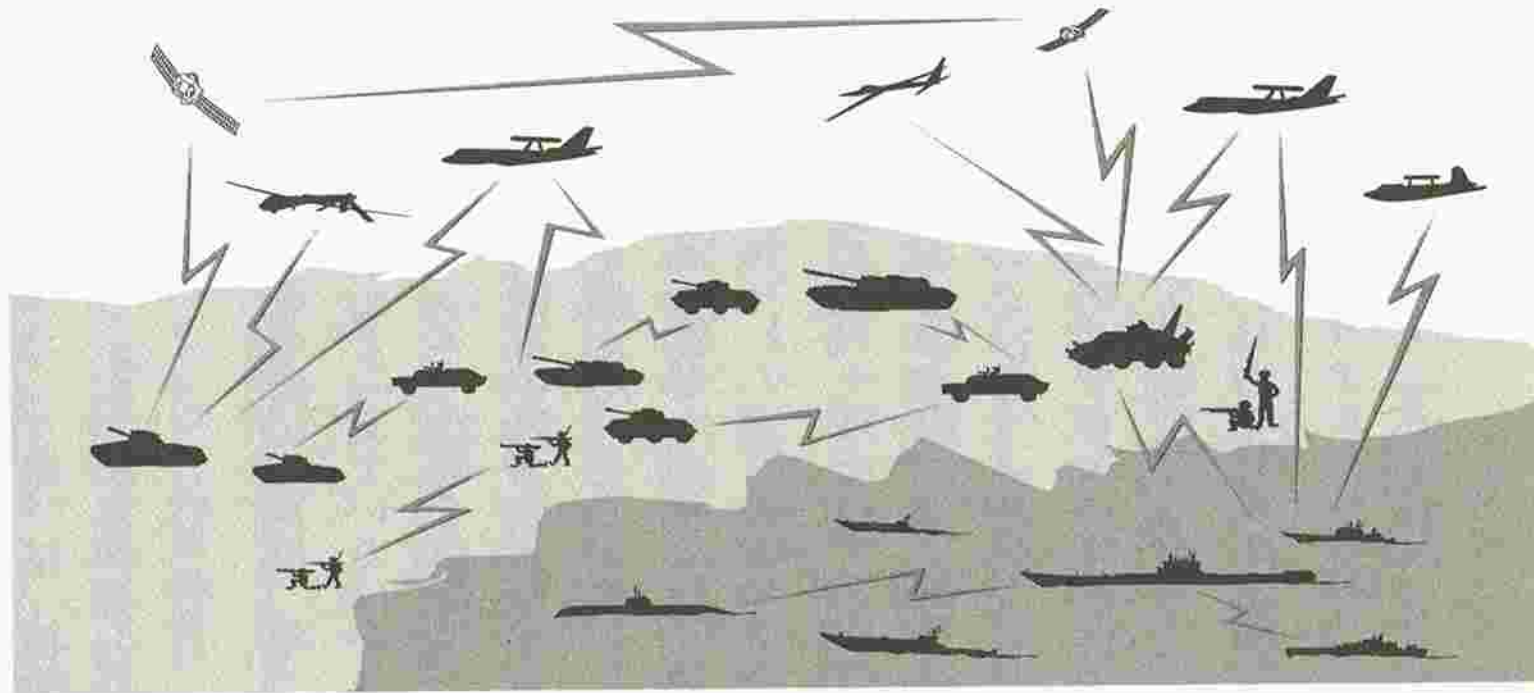
- Semantics of Network Centric Operation, (Geocentric, Heliocentric)
- Philosophy, Concept, Guide Line, Methodology should be worked out by the person who has the problem to solve.
- Strategy ? Tactics ? Technique

# Brief Summary of Battle Space Management

- War fighters' tradition is as old as human history, and battle field management has not been changed for the past thousand years.
- Entering the modern age, new inventories are added in weapons systems such as guns, battle ships, fighter/bomber airplanes, armed vehicles, missiles/artificial satellites later on.
- Also added are new communication devices, radar systems, and processing computers, but not much change in battle field management down to 1980s. This classical practice is called **Platform Centric Operation**.
- **Network Centric Operation** is a brand new concept to revolutionize the battle space management practice.

# Origin of Network-Centric Operation

図 2-1 ネットセントリック戦略



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# What is Network Centric Operation?

- How the Goal of Military Operation Attained.
- Victory, Scrutiny on Victory and Defeat, Why and How
- Analysis and Synthesis on Total Entities:
- Strategy, Tactics, Technology and Science, Logistics, Chain of Command, Surveillance and Reconnaissance, Communication, Weapon Systems
- NCO manifests itself as an integrated/amalgamated unison of all possible ingredients, presumably called Network Centric Warfare.

# Four Tenets as Hypotheses on Network Centric Operation

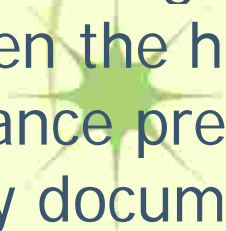
- A robustly networked force improves information sharing;
- Information sharing enhances the quality of information and shared situational awareness;
- Shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command; and
- These, in turn, dramatically increase mission effectiveness.

# Evolution of Concept

- Serendipitous evolution of a system of intelligence sensors, command and control systems, and precision weapons that enabled enhanced situational awareness, rapid target assessment, and distributed weapon assignment. (Owens)
- Full Spectrum Dominance stands for the ability of US military to dominate the battle space from peace operation through to the outright application of military power that stems from the advantage of information superiority. (Joint Chiefs of Staff Vision 2010)

# Network Centric Warfare



- A new theory of warfare derived from case studies on the business sector that uses information and communication technologies to improve situational analysis, accurately control inventory and production, as well as monitor customer relations. (Cebrowski, et.al. 1998)
  - Networking sensors, commanders, and shooters will flatten the hierarchy, reduce the operational pause, enhance precision, and increase speed of command. (US Navy document; Copernicus)
- 

# Operation of Network Centric Warfare

- Information Age Warfare is well understood by trisecting the whole into three domains; physical, information, and cognitive.
- Physical domain; Events take place and are perceived by sensors and individuals.
- Information domain; Data emerging from physical domain is transmitted.
- Cognitive domain; Data is received, processed, assessed and acted upon.
- **Information Superiority** pursued.

# Power to the Edge

- Publication of Command and Control Research Program in 2003
- Progress of modern information technology enables rapid and effective information sharing, consequently “edge entities” actually carrying out missions can get information from ubiquitous repositories, thus the commanding post may not anticipate the information needs of edge entities and push the information to edge entities. -----

**Self-Synchronization**

# Comparison of Old and New



# Traditional Strategy and Approach

- Go back to basic (basis)
- Logical and scientific reasoning
- Bird Eye View of the problem
- Trade-off
- Compromise with the boundary conditions
- Situational Awareness
- Intelligence and Information, Data base
- Analysis and Synthesis
- Estimate and Predict, Extrapolate
- Empirical Law, Make other's experience your own

# New Strategy and Approach

- Introduce the network centric concept and improve the information sharing
- Share the information by Network and Networking
- Secure the supply chain of Information and Knowledge, along or amongst, all participants.
- Raise the level of knowledge of all players.
- Build or nurture the trust amongst all players.
- Push up the **Social Capital** (intelligent level or capacity, potential) of members/players/participants

## Conventional Idea or View on Network

- Network is a necessary tool to transmit the information and data.
- Network is a communication line between person A and B, such as telephone line.
- Capability of 4CI: Control, Communication, Command, Computer and Intelligence, is conveyed through Network.

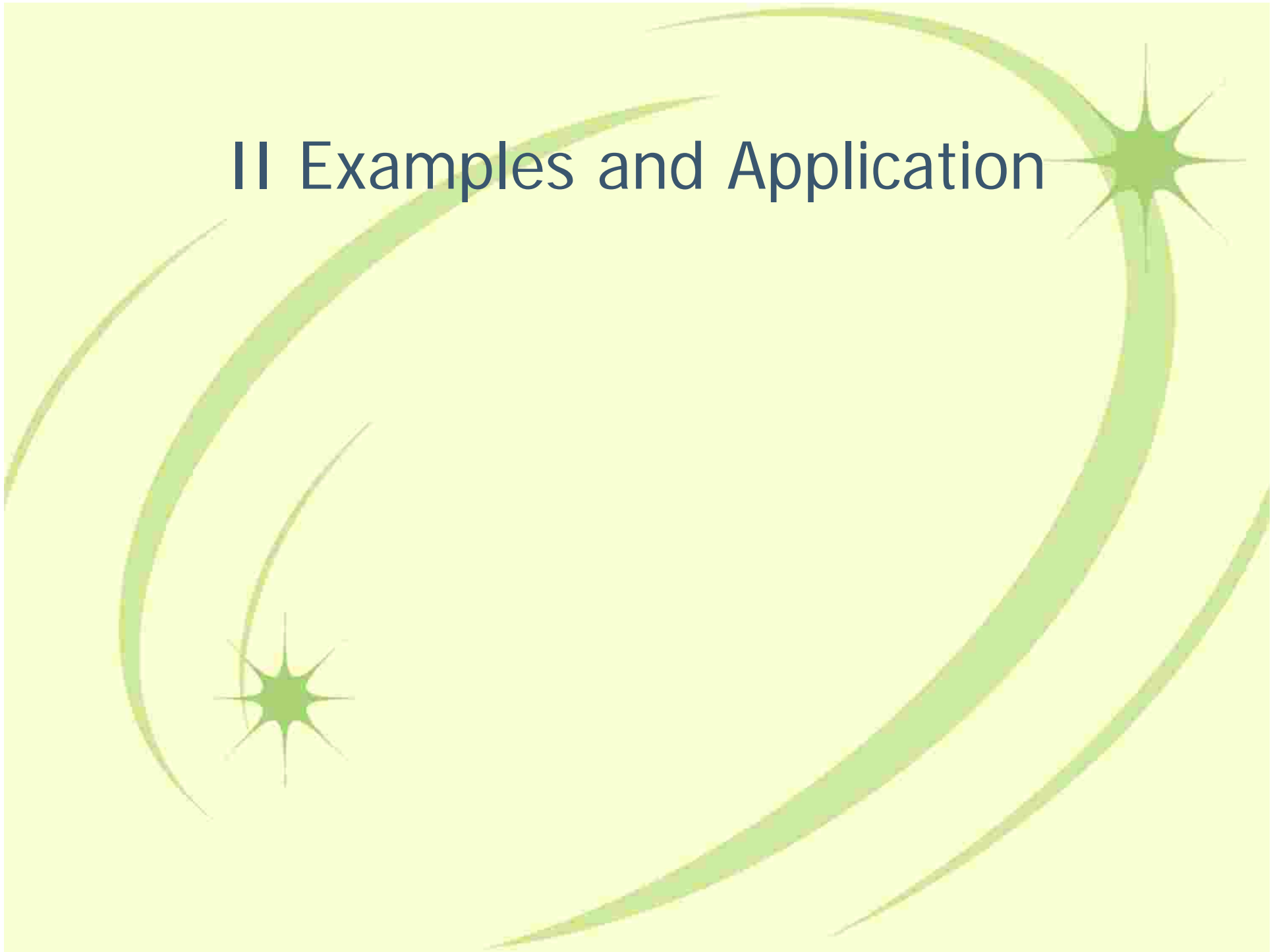
# New and Advanced Idea or View on Network

- Addition to and Modification of the Conventional One
- Network-Centric Philosophy
- Trust and Sharing of information are Keywords.
- Sharing of information means that every Node (or organization) plays dual roles of donor and recipient of information in the Network. Networking is a two-way process.
- Raising the level of Sharing of Information through the common language: Logic.
- Higher its level, higher the social capital.
- Social capital is compared to Intelligent Social Skill.

# Concept Versatility

- NCO Concept versatile to business, management of socio-economic entities
- Group or team performance enhanced
- Traditional bottom-up and top-down merged
- Still evolving
- NCO plays a key role in function and execution of social systems.
- Metaphysical aspect of the concept constitutes part of the social sciences called Organizational Behavior, Organizational Theory, Human Resource Studies, Industrial and Organizational Psychology, System of Systems Engineering.

## II Examples and Application



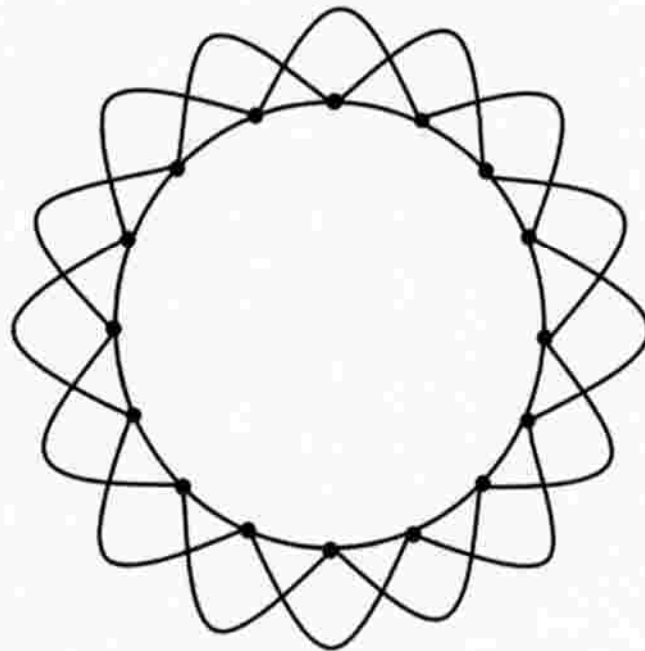
# Practice of Networking

- Enlarge the communication network; networking
- Communication with neighbors and people in the distance; around the globe.
- Topology/Morphology of communication network needs to be built, maintained, improved, changed so that group effectiveness and performance may continuously evolve.

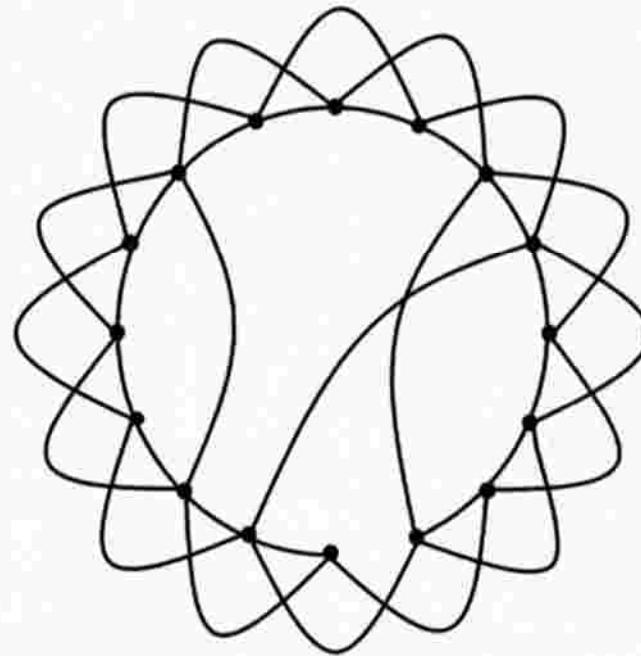
# Building Networks and Networking: Small World Network

図 1-1 スモールワールド・ネットワーク

A  
レギュラー



B  
スモールワールド



# Harbinger of Network Centric Operation (Cebrowski)



# Battle of Tsushima(Sea of Japan)

- Battleships'(Fleet) Duel during Russo-Japanese War on May 27<sup>th</sup> 1905
- The First Victory thanks to Information Superiority, Essential Feature of NCO(Information Superiority, Speed of Command and Self-synchronization)
- Information and Communication Network; Telegram in the Dawn of a New Age(Wireless Network), Wire Cables Network, Military Underwater Cables, Coastal Watch Towers.
- Typical Example of  
Technical Innovation    Process I.    Organizational I.  
Reconnaissance, Surveillance and Communication prior to  
the Battle    the Next Viewgraph



Figure 2-1 Submarine cable in the Far East

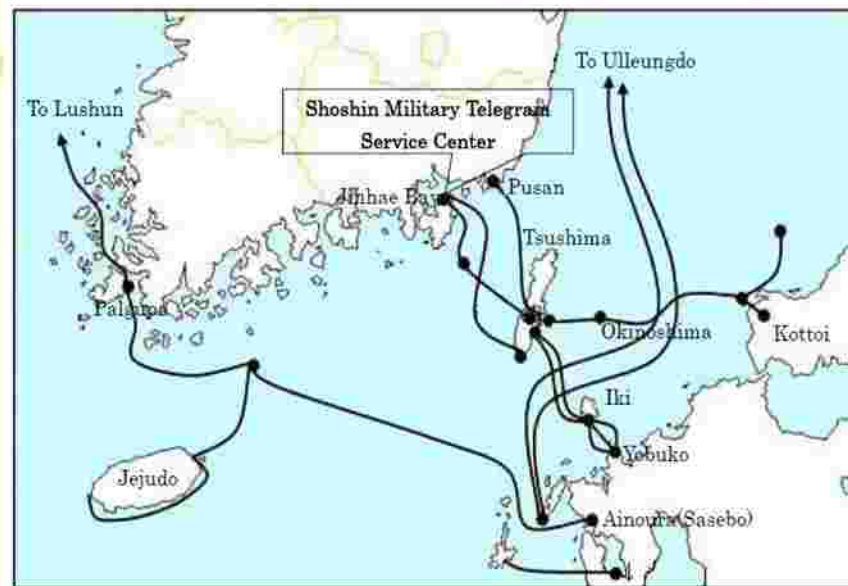


Figure 2-2 Military Water Bottom Cable



Figure 2-3 Coastal Watchtowers

# Development History

- 1895 Marconi invented wireless telegram.
- 1895 Marconi succeeded in 2km communication test.
- Matunosuke Matsushiro (松代松之助) started the research on wireless telegram.
- 1897 Success in 1.8km communication between Tsukishima (月島) and Kanasugioki (金杉沖、現港区芝町沖).
- 1897 Success in 3.4km communication between Tsukishima (月島) and Daigodaiba (第五台場).
- 1899 Marconi succeeded in Dover Strait communication.
- 1903 36Type telegram machine (三六式無線電信機) completed(370km range), its installation on combat ships started.
- 1905 Installation on all battleships and 85% of destroyers completed just prior to the War.

# Time Line to Victory

- May 27<sup>th</sup> 1905
- 0445 Shinano-Maru sighted Baltic Fleet
- 0505 Mikasa, Flag Ship of Fleet, Received Signal
- 0515 Order Announced to All Ships to Depart for Attack
- 0605 Mikasa, Flag Ship of Fleet, Departure
- 0645 Fleet Departure
- 0740 Signal arrived at Tokyo Headquarters.
- 0955 Encounter of Two Fleets
- 1408-1410 Both Sides Opened Fire

# The Most Distinguished Contributor to Spectacular Victory over Baltic Fleet



36 Type Telegram Machine



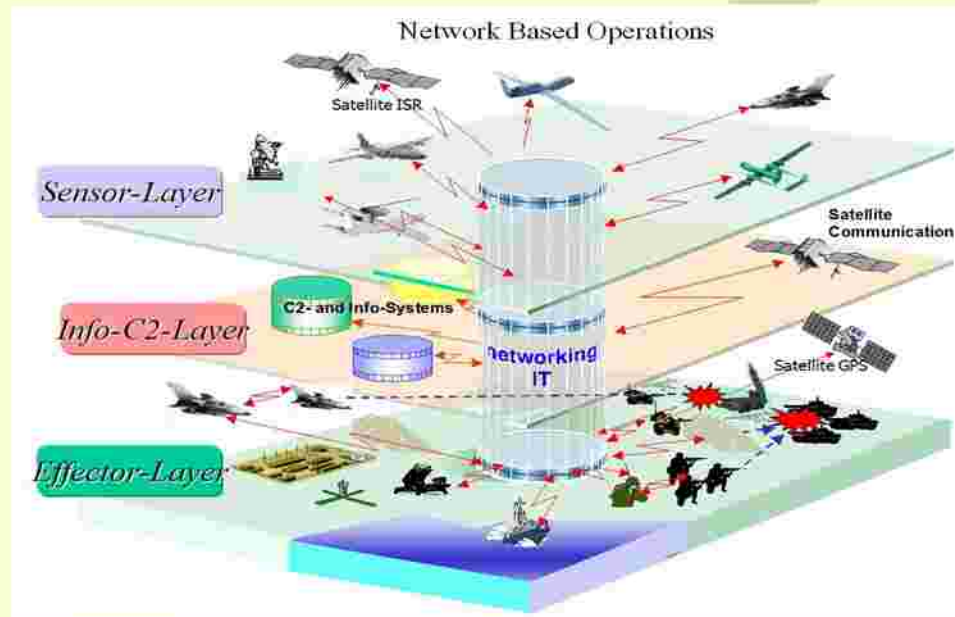
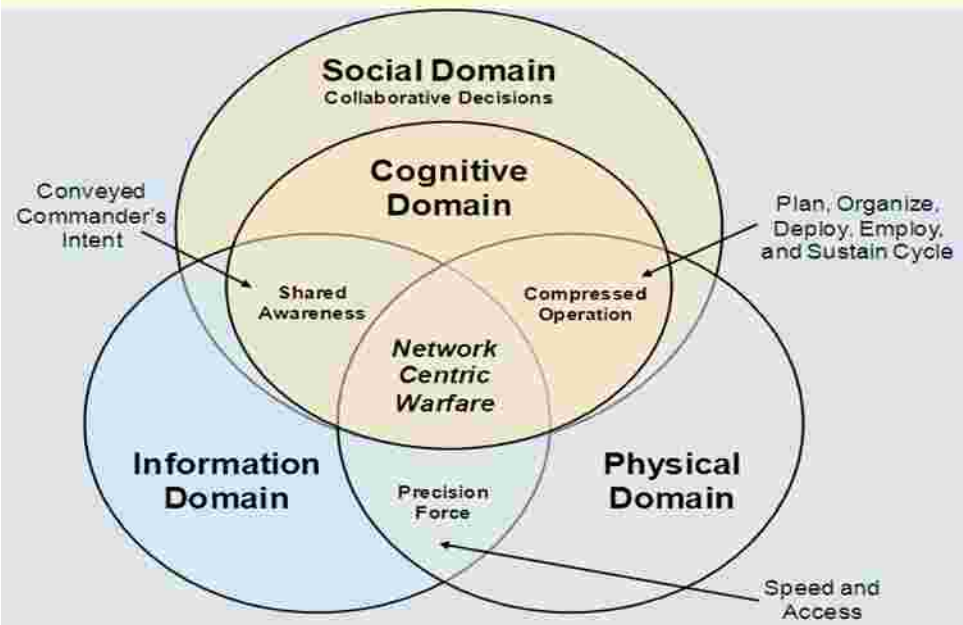
バルチック艦隊

©日本海軍艦隊100周年記念実行委員会



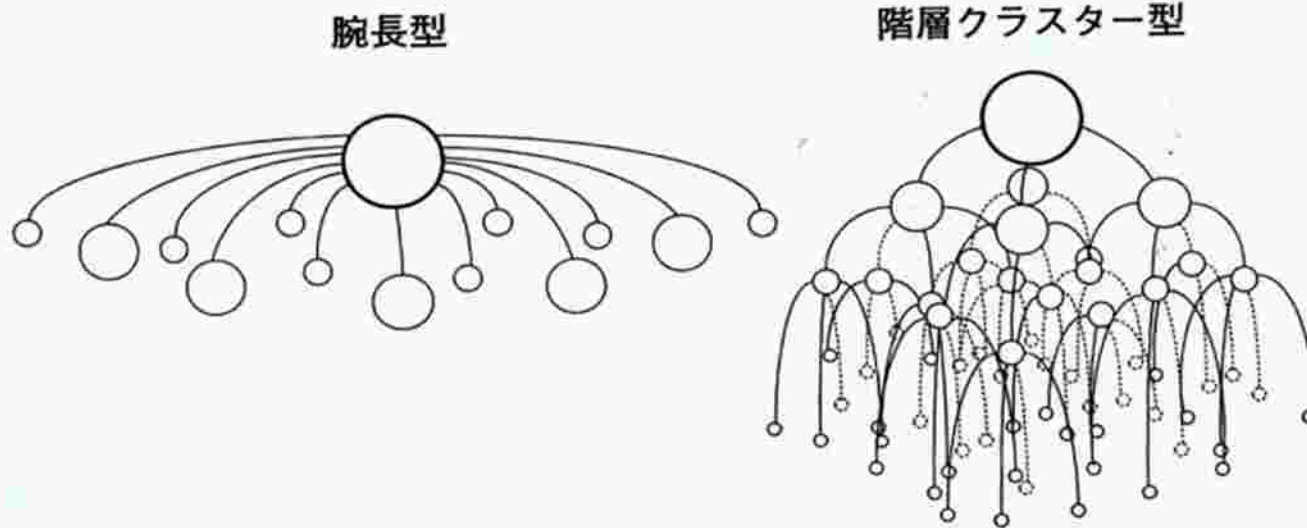
# Network Centric Warfare in Action

- Afghanistan and Iraq campaign
- Small ground units, strategic bombers, precision weapons=close air support
- Long-range UAVs, controlled from afar  
=strategic intelligence, surveillance and reconnaissance
- Responsive UAVs, in support of maneuver forces



# Business Model(Toyota): Supplier Chain of Autoparts

図 3 - 1 2つのサプライヤー・ネットワーク



# Toyota Approach

- Hierarchical(layered) Cluster Type(Toyota)
- Indirect Rule
- Easy to Bypass and Rewire(Networking),  
Bilateral/Multilateral Relationship, Autonomous  
Organizing
- Networking is not limited to the supply(hardware) chain,  
but expanded to the general information.
- Arm's Length Type(Classical)
- Divide and Rule
- Multiple Sourcing

# Toyotism: Doctrine of Toyota

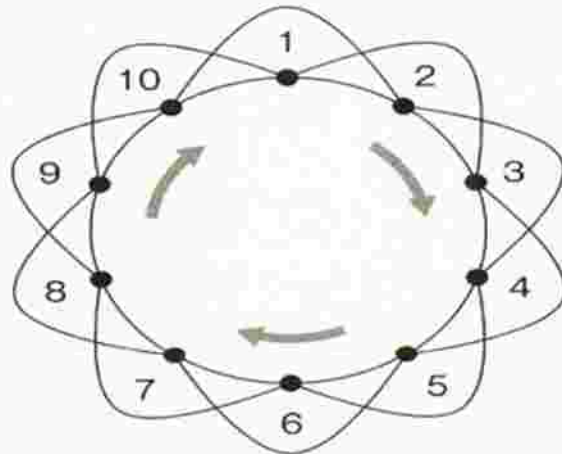
- Five Whys, Search Root Cause
- Six Degrees of Separation
- Win-Win Relationship
- Trust with and amongst Contractors/Subcontractors
- Customer Satisfaction
- Success story of Toyotism

Recovery to normal production by 10 days after Fire Accident of Aishin-seiki(one of suppliers to Toyota) in February 1997

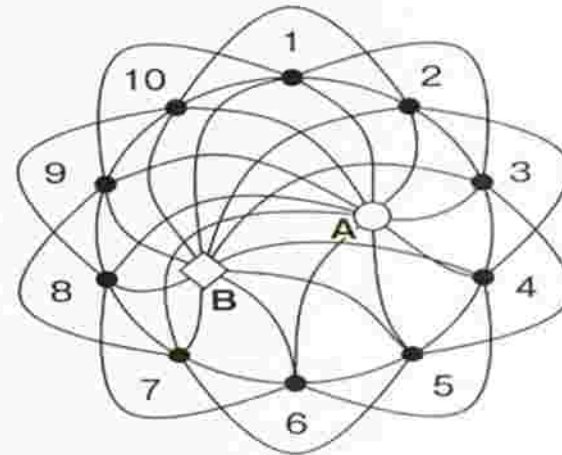
# Organizing Model: Development Team

図3 2つの開発チーム

継時型  
レギュラー・ネットワーク



部門横断型  
スモールワールド・ネットワーク



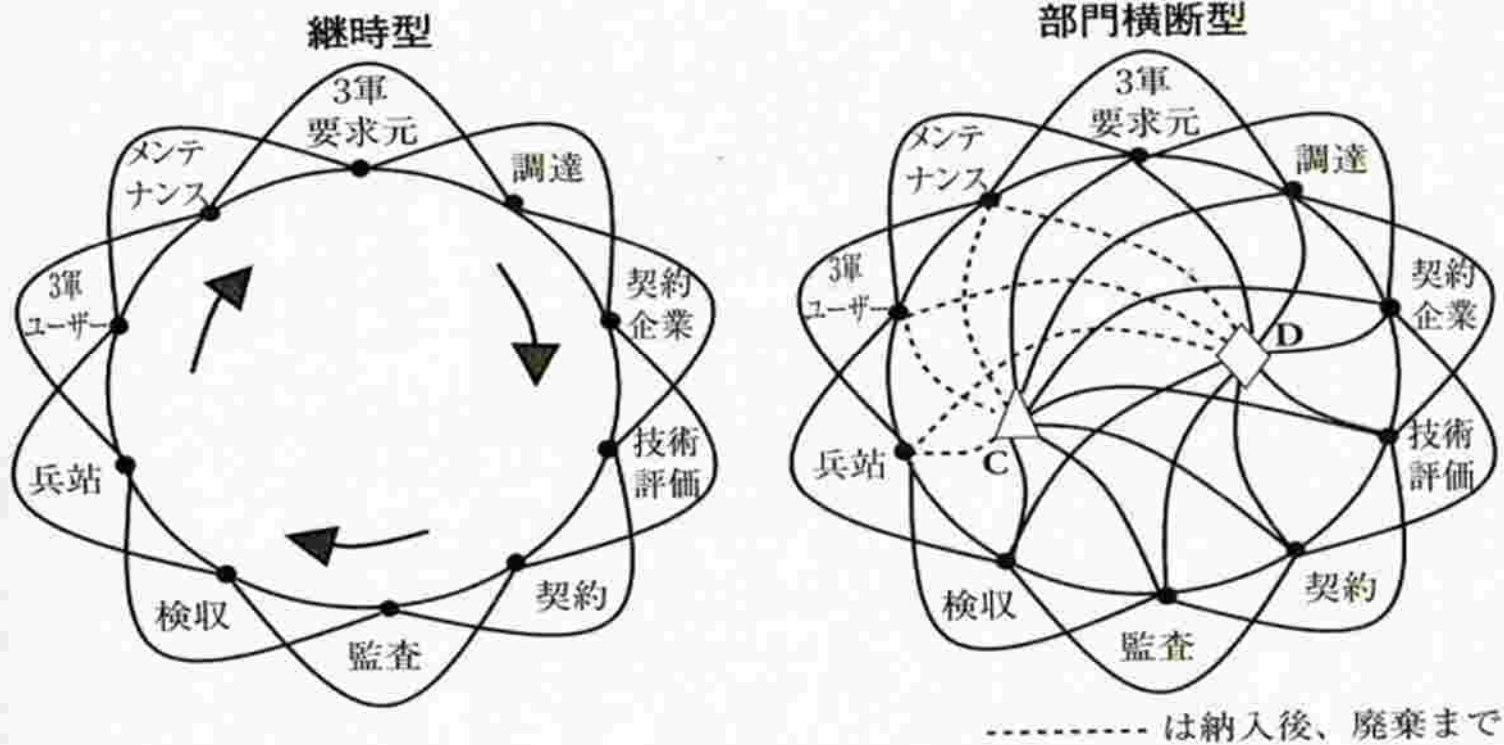
	1	2	3	4	5	6	7	8	9	10
新車開発	企画	先行開発	設計	試作	技術	製造	購買	部品メーカー	品質管理	販売
防衛装備開発	三軍要求元	調達	契約企業	技術評価	契約	監査	検収	兵站	三軍ユーザー	メンテナンス

# Common Practice in Auto-Manufactures

- Small World Network(Current)
- Multiple networking, cross-division operation
- Time sharing(parallel) flow
- Intermediate Node A and B(leader or chief) can play a role of catalysis in information domain and physical domain as well.
- Highly resilient or responsive to cope with the unexpected or unknown.
  
- Regular Network(Classical)
- Fixed/Rigid networking
- Sequential flow

# Management Model(UK DoD): Defense Procurement Flow

図 6 - 2 防衛装備開発組織



# Application to Space Environment Utilization Research

- What are space environment?
- Space development and space utilization
- Category of Space utilization

3 kinds: Strategic (Programmatic) use, Scientific, Commercial

- Problems and Issues

Big/National project, it is impossible for any individual or a single organization to look at the whole picture.

Budget, Long term, management, limited opportunity, inadequate technology

# Goal and Objective of Space Environment Utilization Research

- Goal and Objective  
Effective Execution of Space Environment Utilization Research  
And Achievement of World Class Scientific Results

# Nature of the Major Problems

- Management Structure
- Speaker's Experience in NASDA/JAXA
- What to manage?
- Science, Technology and Program Control (Management) = Triad, Trinity
- Who oversees Totality of Triad?

# Duty or Task Delegation (Assignment) in Japan(1990)

- Science, Scientific Research  
Universities, Research Institutes
- Technology, Engineering, Hardware & Software Development, Mission Operation  
Space Development Agency, Contractors
- Program Control  
Governmental Office (Usually delegated to Space Agency)

# Practical Problems due to Lack of Total Management

- Users (JEM experimenters) need to knock the door of multiple offices, users get just perplexed.
- Programmatic decision is delayed due to the Coordination amongst Triad, Opportunity is lost on international collaboration.
- Flight mission can not be carried out effectively and efficiently. Scientific achievement level stays lower than expected by the scientist, even if the hardware functions properly. Feeling of dissatisfaction (discontent) prevails amongst players.
- Strategic approach such as prioritizing the research areas and topics looks difficult, effective spending and investment can not be executed.

# Recommendation to Space Environment Utilization Research Activities

- Adopt Network Centric Operation Concept
- Establish Communication Line(Network) amongst scientists, engineers and program managers.
- Share the information through the network individually and organizationally.
- Build the trust amongst all players; participating individuals and organizations.

# Networking in Space Environment Utilization Research



- Information sharing amongst Scientists, Engineers and Program managers.
- Establish firm communication line amongst three parties which serves as an artery or supply chain of knowledge.
- Raise the level of Information Sharing.
- Scientists should know engineering and program management.
- Engineers should know science and program management.
- Program managers should know science and engineering.
- Three parties may render their problems on the communication line, and extract the best possible solution from the network.

# Potential Applications On Behavioral Guidance

- Individuals and Groups/Organizations
- Graduate Students and Professors
- Professionals; Engineers, Scientists, Specialists
- Law and Policy Makers/Legislators
- Business and Industrial Sectors
- Public and Governmental Organizations
- Entrepreneurs and Corporative Ventures
- Non-Profitable and Volunteer Organizations

# Benefits

- Building, Expanding and Metabolizing the Supply Chain of Knowledge and Information
- Flexible/Adaptive and Ever Morphing Space-wise/Time-wise Management Structure
- Synonymously, Refer to Network Centric Operation as Knowledge Centric Operation or Information Centric Operation

# III Conclusions

- Network Centric Operation, i.e., Information sharing is a key practice of social capital and social skill.
- Harmony with Chain of Command Systems, if any.
- Nurture the Trust.
- Value every encounter with people and organization (一期一会) and trust.
- Logical and Scientific Reasoning.
- Always stay cool (calm), Don't get panic.
- Discipline (Drill) psychological toughness.
- Considerations to Coworkers and Neighbors.

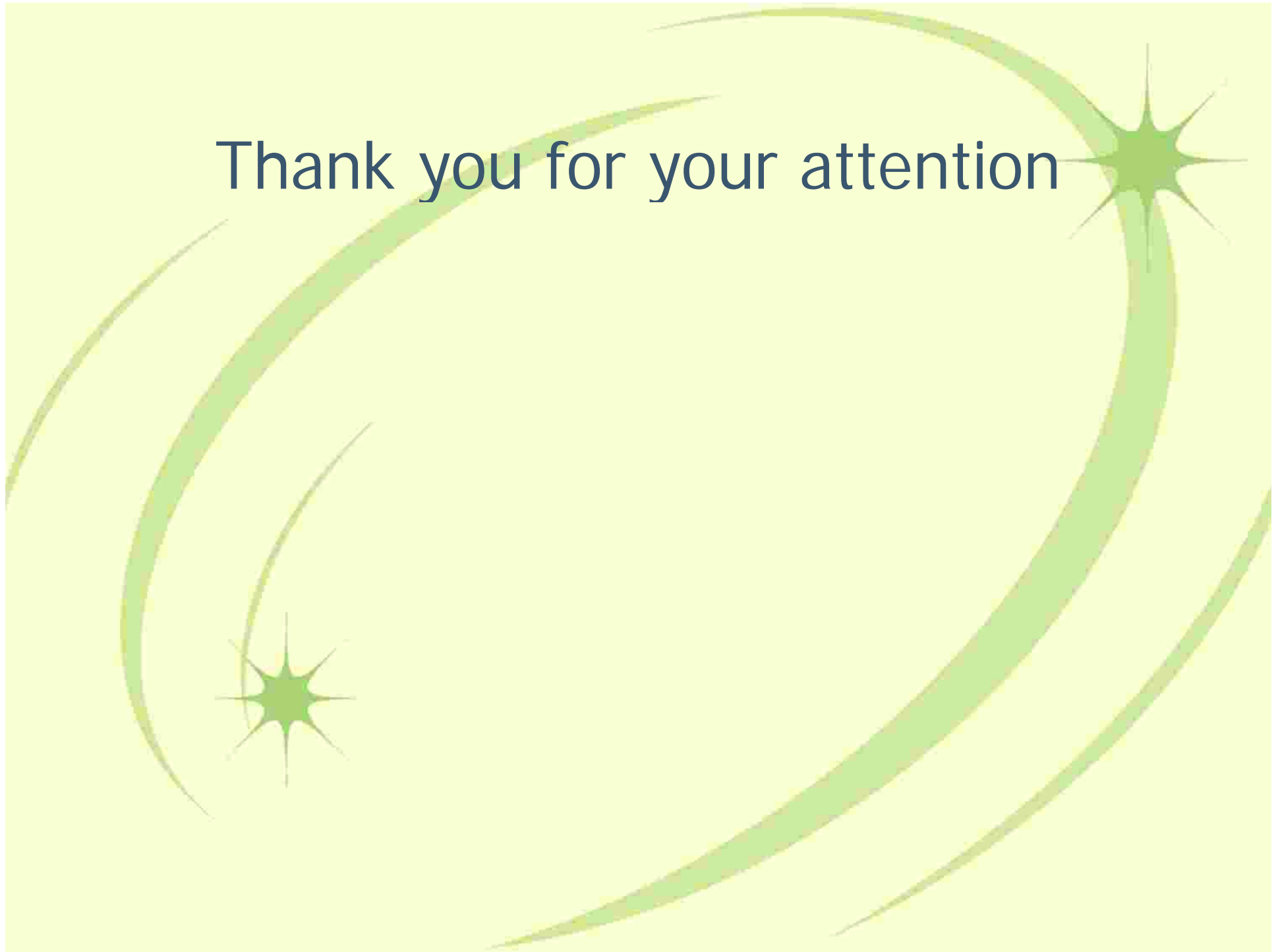
## Conclusions continued

- Know, Like, Enjoy(子曰、知之者不如好之者、好之者不如樂之者 ).
- Life is to enjoy, Please enjoy!
- Find out fun in your profession, assignment, or work & job.
- You need to be prepared to find pleasure or amusement in your work.
- Posses curiosity on allover the subjects, especially intelligent curiosity.

# Recommended References

- Concept sprouts up from military and some from business sectors.
- Two notable Pioneers:
- Admiral William A. Owens, United States Navy, proposed “System of Systems” in 1996
- Vice Admiral Arthur K.Cebrowski, United States Navy, proposed “Netcentric Warfare” in 1998
- 現代版孫子の兵法、諸葛孔明の兵法
- 参考書 :西口敏宏著
- 遠距離交際と近所づきあい NTT出版
- ネットワーク思考のすすめ 東洋経済新聞社

Thank you for your attention



# Back Up Charts

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# Miscellaneous Remarks and Terminologies

- Prepositions:
- Data Base: Fact base, Piece of Information, Measurable
- Rule Base: Rule or Regulation base, Capability to Apply, Measurable
- Knowledge Base: Wisdom, Intelligence, Wit, Total Capability to Judge, Immeasurable
- Usually KNOWLEDGE BASE is emphasized
- Three bases transmitted from A to B is defined as information.

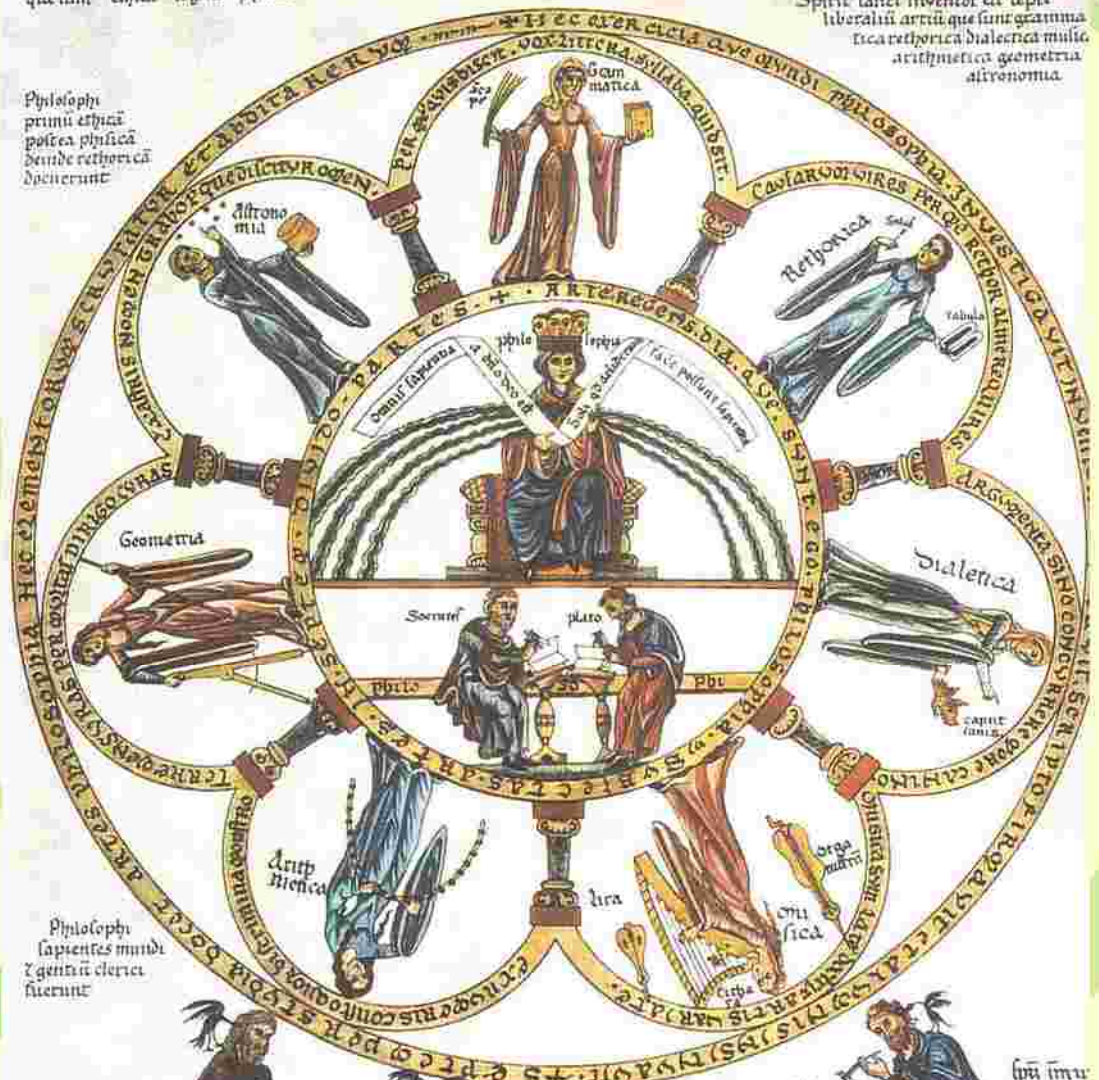
# Miscellaneous Remarks and Terminologies Continued

- Consideration Factors:
- Liberal Arts and Professional Expertise
- Capability and Adaptation, Aptitude
- Capability: Its peak value and spectrum
- Higher the peak, Wider the spectrum
- Uni- or Multiple- Skill
- Requirements to perform the job
- Single or team player, Solo or Chorus

Philosophia dividitur in tres partes  
que sunt ethica logica physica

Philosophi  
primu ethica  
postea physica  
deinde rethorica  
docuerunt

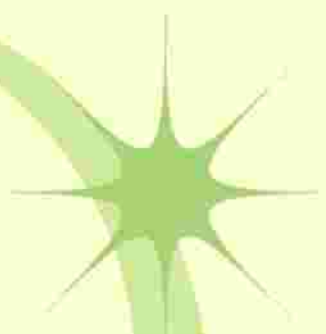
Septē fontes sapientie fluunt de philoso  
phia que dicuntur liberales artes  
Spiritus sanctus inventor est septē  
liberalium artium que sunt gramma  
tica rethorica dialectica musica  
arithmetica geometria  
astronomia.



Philosophi  
sapientes mundi  
et gentium clerici  
fuerunt



Illi immundis spiritibus inspirati  
scribunt arte magica et poetria  
id est fabulosa commenta



# Liberal Arts of Universities in the Medieval Age

- Trivium(Lesser, Introductory)、3教科
  - Grammar、文法
  - Logic、論理
  - Rhetoric、修辭
- Quadrivium(Advanced)、4教科
  - Arithmetic、算数
  - Astronomy、天文
  - Music、音樂
  - Geometry、幾何
- Professional Courses: Medicine, Law, Theology, Philosophy
- 專門課程 :医学、法律、神学、哲学、

# Social System

- Social System の定義
- 「ある共通目的のために、意識的に調整された、2人以上の人間の、協働活動や諸能力・機能の体系」
- 人々の任意なグループ、組織体、会社、軍隊、NPO、
- 問題 :以下はSocial Systemか
- 映画館の前で入場券購入のため待つ人々
- 行き倒れの人を助ける不特定複数の諸個人

# Network and Social System



- Network and Networking is a major ingredient of the social system.
- What is the social system?
- Social system is fully dependent upon Network and Networking

# Definition of Social System

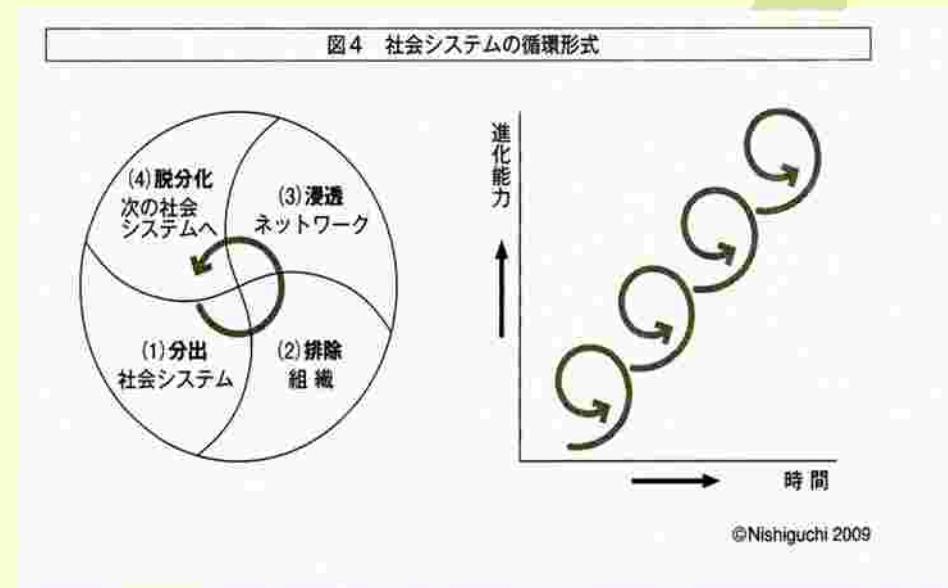
- To pursue the common goal, more than 2 persons' group are intentionally coordinated and cast in the system to perform collaborative activities depending upon its various capabilities and functions.
- Arbitrary or voluntary group, Organizations, Corporations, Armed forces, NPOs,,, are all classified social system.

# Example of Social System

- Group of people lining up in front of the ticketing office of the movie theater
  - Disorderly crowd, not a social system
- Group of people helping the stranded one on the street, calling the police station or ambulance, bringing the stretcher, watching the belongings,,,
  - A social system

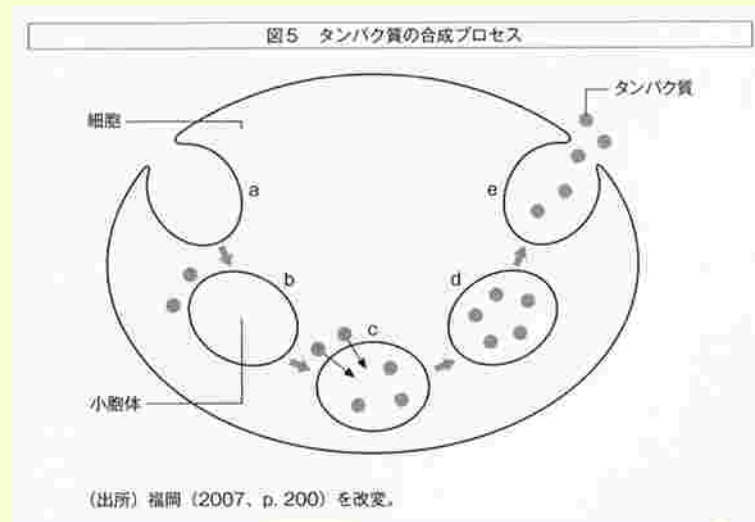
# Development of Social System

- 分出, Differentiation
- 排除, Exclusion
- 浸透, Permeation
- 脱分化, De-differentiation



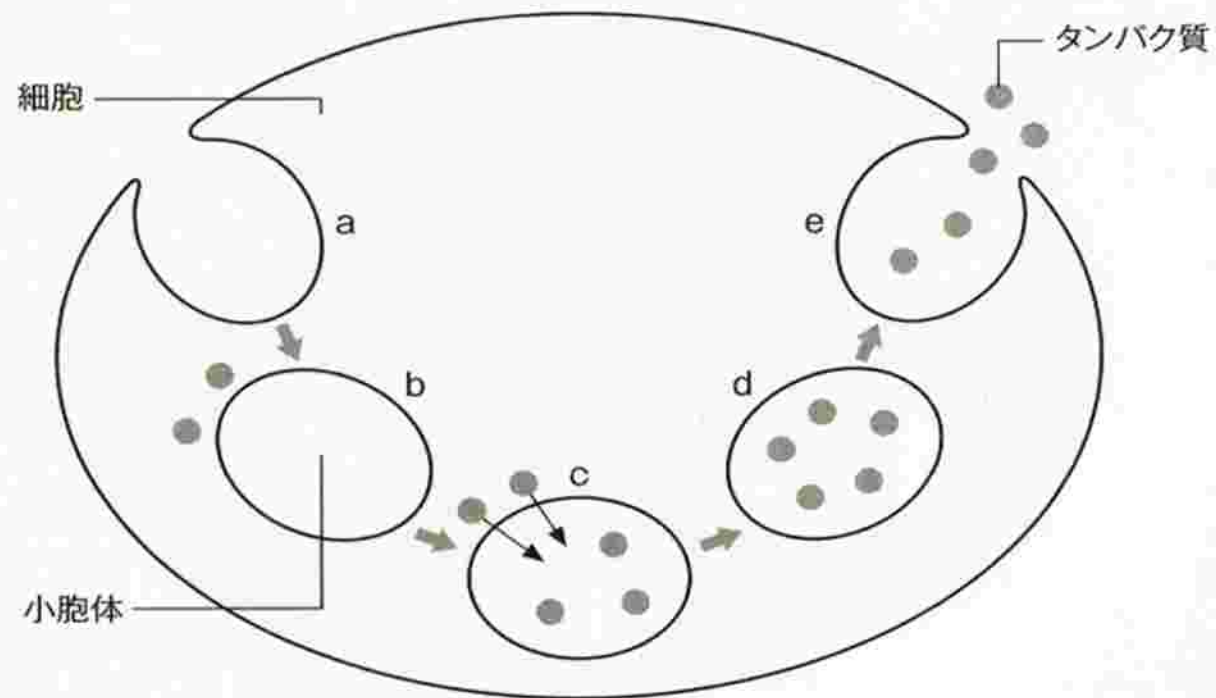
# Biological Analogy :タンパク質の合成

- 細胞外部壁陥没(a)、小胞体形成(b)
- 小胞体表面でタンパク質合成(c)、小胞体内部へタンパク質取り込み(d)、
- 小胞体外部壁と融合、タンパク質外部へ放出(e)



# Synthesis of Protein in the Cell

図5 タンパク質の合成プロセス



(出所) 福岡 (2007、p. 200) を改変。

# Biological Analogy: Synthesis of Protein

- Depression of cell external wall (a)
- Endoplasmic reticulum formation (b)
- Synthesis of protein on the surface of endoplasmic reticulum (c)
- Absorption of protein into the interior of endoplasmic reticulum (d)
- Merger of endoplasmic reticulum and cell external wall, protein is ejected outside the cell (e)

# Basis of Social System

- Network and Networking
- Social Capital、民度
- Trust amongst Nodes、構成員間の信頼
- Requisite Surplus and its Use、最少有効余剰、の活用
- Balance of Exhibition (顕示) and Recognition (認知)
- Sharing Sense of Values、価値観の共有

# Social Capital

- Social capital is an interdisciplinary social science concept that brings together aspects of social behavior, such as trust and cooperation, relationships, networks and social solidarity that may be expected to contribute to the well-being of a community.

# Social Skills

- A social skill is any skill facilitating interaction and communication with others. Social rules and relations are created, communicated, and changed in verbal and nonverbal ways. The process of learning such skills is called socialization. The rationale for this type of an approach to treatment is that people meet a variety of social problems and can reduce the stress and punishment from the encounter as well as increase their reinforcement by having the correct skills.

## When and where you come up with the excellent idea?

- In Japan: 三上、枕上、鞍上、厠上
- In the bedroom, On the horse back, In the restroom
- In English speaking community, : 3B
- In the bedroom, In the restroom, At the bus-stop
- In Korea?