Multi-Environment Decision Support and Knowledge Exploitation in Terrorist Emergency Responses

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Asymmetric Threats and Terrorism

- An increasingly interconnected, complex and often dangerous world
  - Increase in terrorist acts
  - Threat of rapid, globalized spread of infectious diseases
  - September 11, 2001, Etc.
- Anti- and counter-terrorism, national/public security, and collective emergency response (both crisis and consequence management) at the fore of concerns of many nations

Military forces must be prepared with robust capabilities to support the response to terrorist attacks against people and critical infrastructures

DPG 2000 Goal Three: Develop new task-tailored capabilities to deal with asymmetric threats and weapons of mass destruction

- Threats to operations, personnel, systems and facilities
- Respond to requests for assistance from civil authorities

Asymmetric Threats

A term used to describe attempts to circumvent or undermine an opponent's strengths while exploiting his weaknesses, using methods that differ significantly from the opponent's usual mode of operations.
(Definition, taken from US DoD Joint Staff; endorsed by AFC in 2000)

Categories: Hostile use of

- Information Operations (IO)
- Weapons of Mass Destruction (WMD)
- Non-conventional Operations

Weapons and tactics to foil or circumvent the technological superiority of Western nations

Terrorism

- Some definitions (U.S.):
  - The calculated use of violence or the threat of violence to inculcate fear, intended to coerce or intimidate governments or societies in pursuit of goals that are generally political, religious or ideological (U.S. DoD Joint Pub 1-02)
  - An activity that involves an act dangerous to human life or potentially destructive of critical infrastructure or key resources and is a violation of the criminal laws and is intended to intimidate or coerce the civilian population or influence a government or affect the conduct of a government by mass destruction, assassination, or kidnapping (U.S. Homeland Security Act of 2002)
- Motivated by a variety of causes: religious extremism, violent secessionist movements, state-sponsored terrorism, and domestic extremism.

Some Responsibilities of the DND (1)

International Responsibilities

- DND may be required to provide military response to direct and indirect threats to Canadian interests
- Deal with threats to DND operations, including the provision of force protection measures during collective defence and peace support operations
- When requested by DFAIT, DND will provide armed or unarmed assistance for the protection and evacuation of Canadians from areas threatened by imminent conflict

DFAIT: Department of Foreign Affairs and International Trade

Some Responsibilities of the DND (2)

Domestic Responsibilities

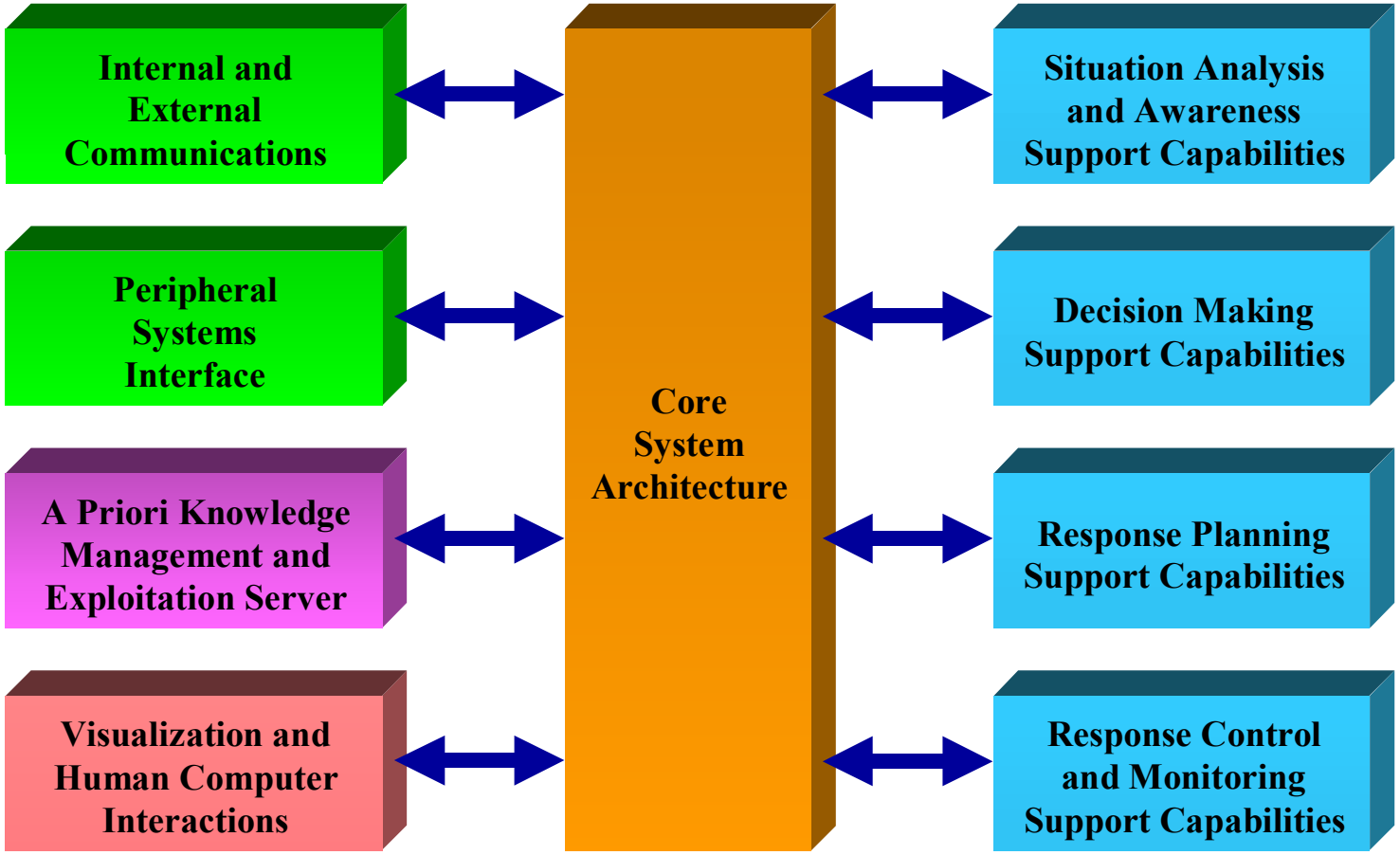
- The provinces and other federal government departments and agencies have the responsibility for preventing, deterring, crisis managing and consequence managing an asymmetric attack on Canada
- If called upon, DND will need to respond to requests for assistance from these organizations and will function in a supporting role
- The inherent flexibility of military units makes DND a potential source of assistance in all domestic emergencies and civil disturbances
  - However, the DND response is bound by legal considerations
  - Typically, DND is the Canadian government's instrument of last resort
- DND will deal with threats to DND assets, installations and operations
  - DND may be required to respond to a domestic attack designed to delay or hinder the deployment of Canadian forces overseas

Information Technology Support

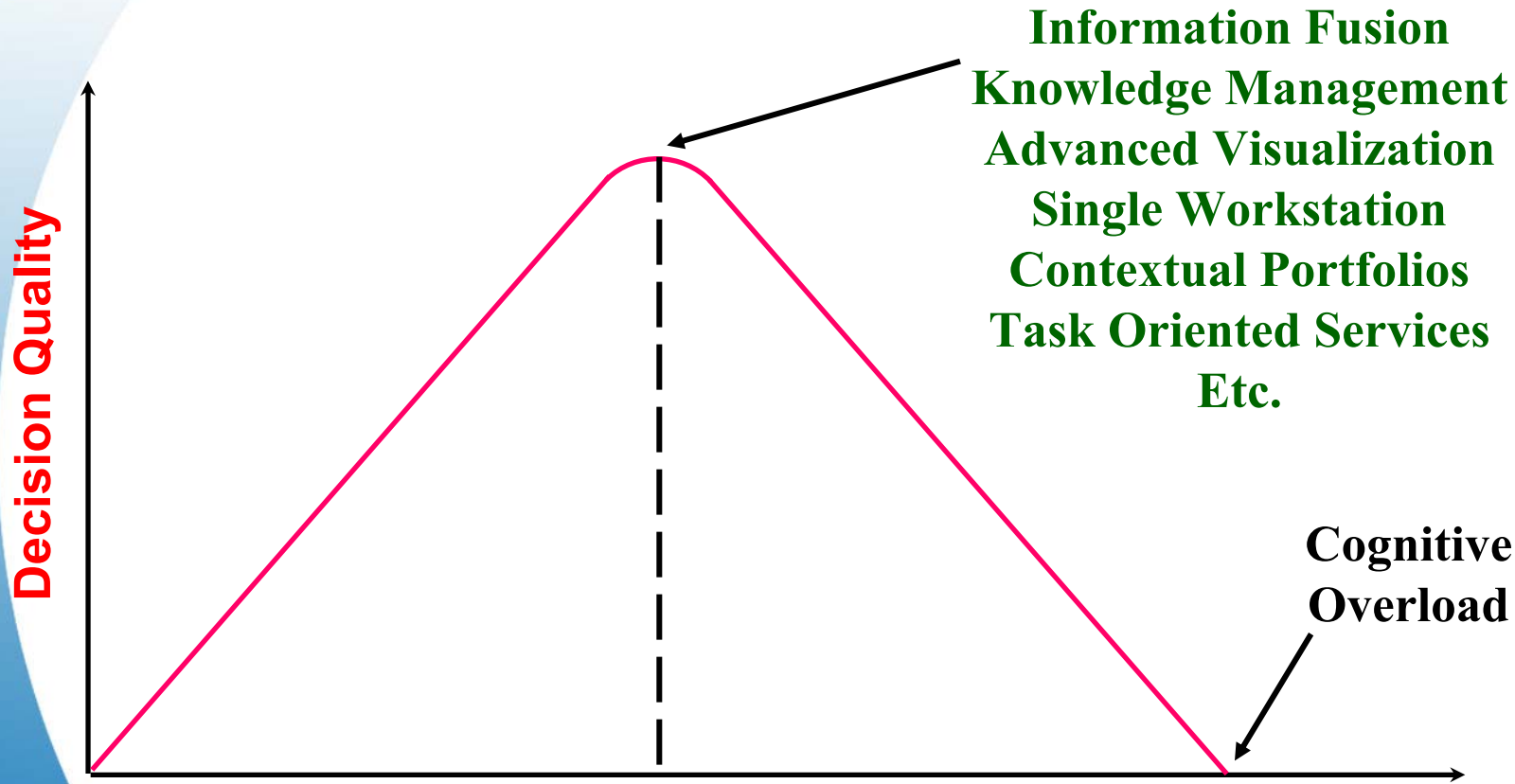
- Operational trends put the C2 process under pressure
- The technological evolution constantly increases the tempo of the response
- A huge load of uncertain data and information is generated
  - May exceed the human information processing capabilities
- Yet, the dominant requirement is the ability to perform the C2 activities quicker and better than ever
- Information technology support is typically required

Complex situations (complex operations in complex environments) requires real-time, computer-based Decision Support and Knowledge Exploitation (DESKE) systems

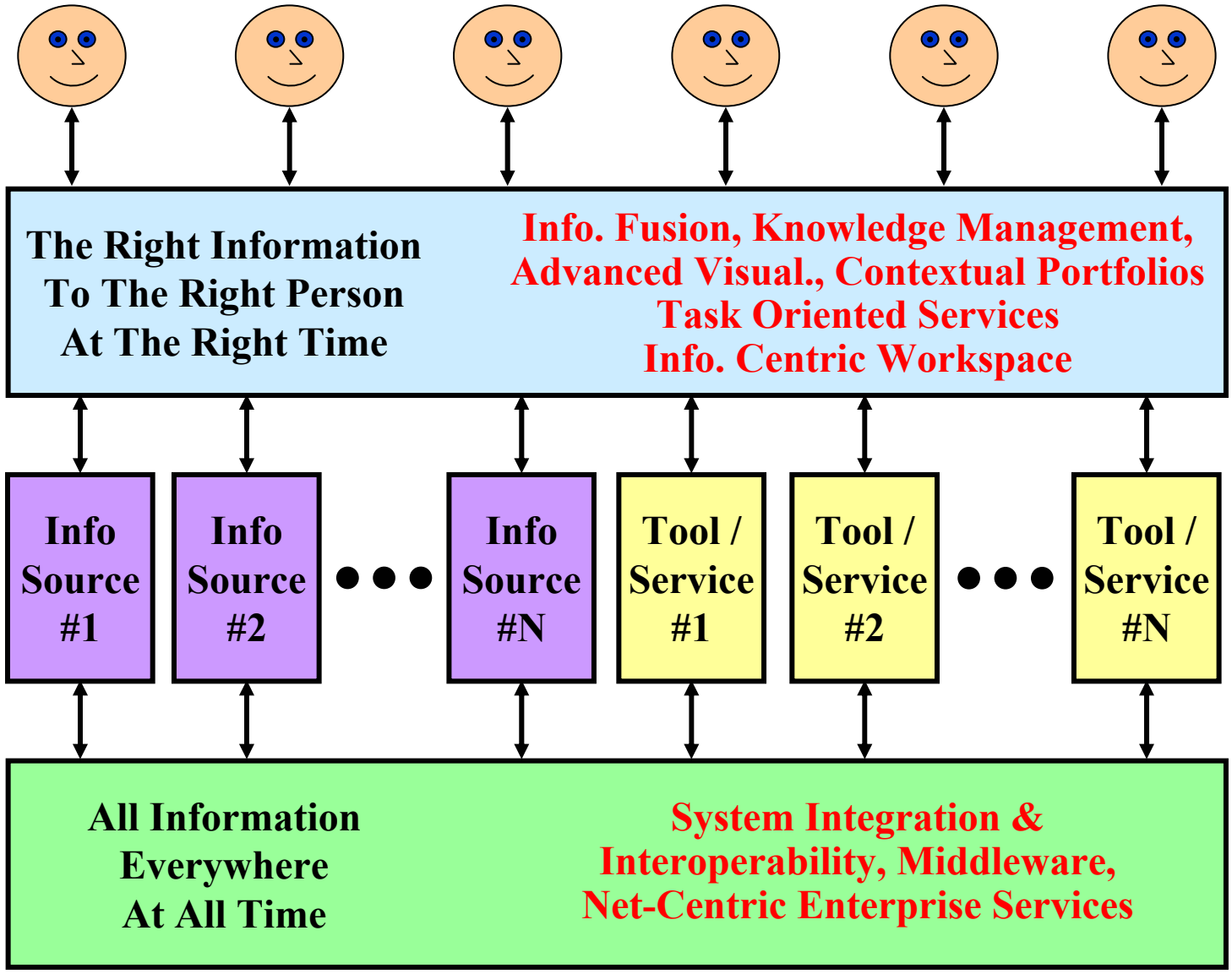
Decision Support and Knowledge Exploitation
A Generic System



All Information? The Right Information?



Exploiting Information Sources and Tools/Services



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"MUSKETEER"

MUSKETEER

Program Aim

Identify, refine, develop and integrate decision support and knowledge exploitation tools and demonstrate how these tool sets can significantly improve the military forces ability to respond to terrorist attacks.

Decision Support and Knowledge Exploitation (1)

Integrate perspectives to better interpret the situation and the problem, identify candidate actions, formulate evaluation criteria, decide on what to do, and synchronize a diverse set of plans and actions

- Build a computer-based system to support:
  - The creation, maintenance and sharing of situational awareness (i.e., a common operational picture)
  - Joint problem solving and decision making / planning / monitoring
  - At multiple echelons from responders through commanders
  - Through a set of disparate agencies at different locations.
- Create a collaborative workspace:
  - Exploit distributed collaboration technologies
  - Aid military experts to work together effectively
  - Aid the military forces to coordinate with other government agencies, civil authorities and international allies when required

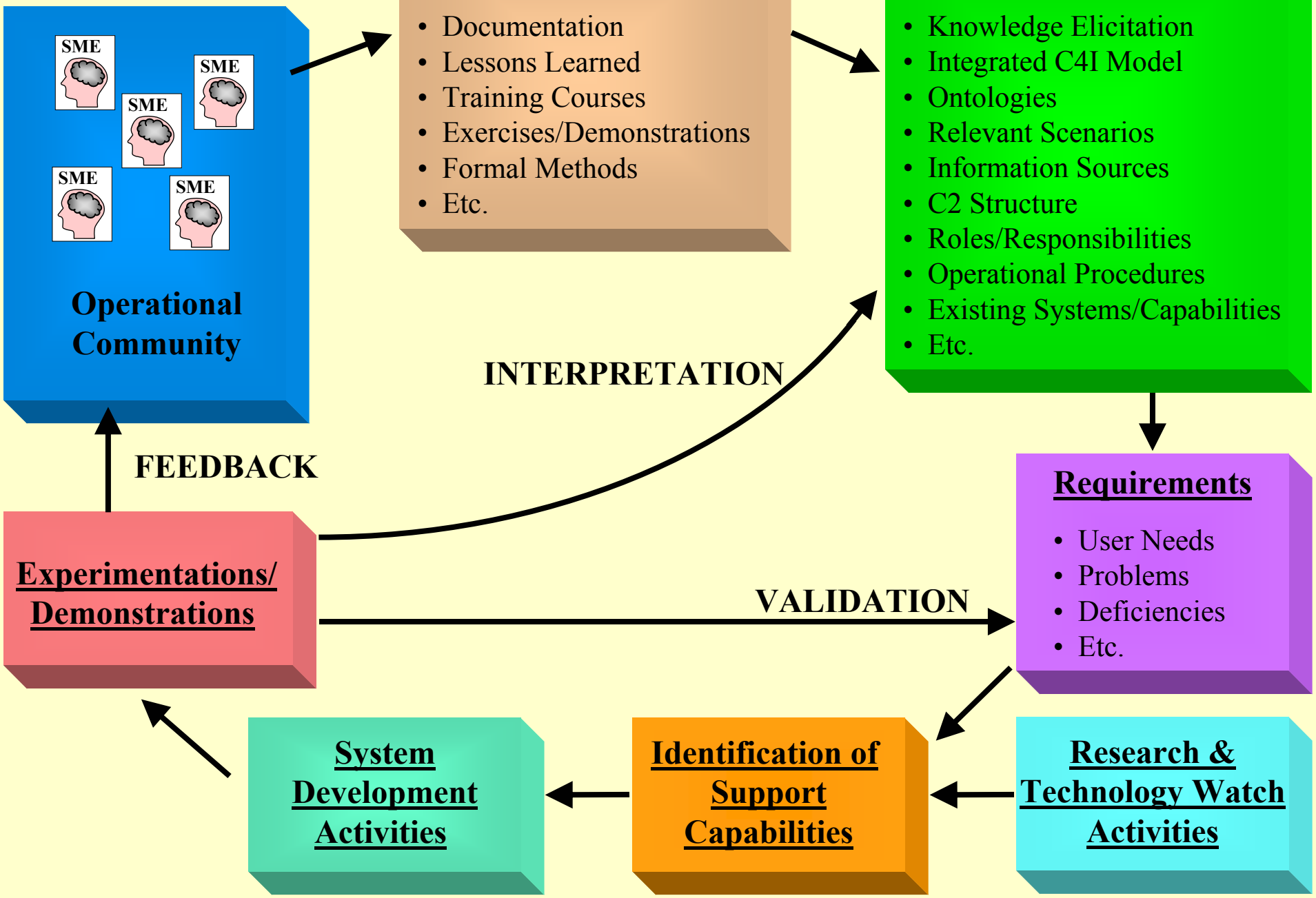
Decision Support and Knowledge Exploitation (2)

- Cutting edge ontology-based knowledge management technologies:
  - Capture and exploit lessons learned
  - Make inferences that turn data and assumptions into information
  - Data/information classification, categorization, clustering, search, etc.
  - Contextualized user-centric task-oriented knowledge services (web services and portal technologies)
- Advanced geomatics
- Innovative visualisation and human-computer interaction devices
- Information management concepts and sufficient mechanisms (i.e., a compliant architecture) for the military forces to effectively interoperate:
  - Across a wide range of disparate hardware/software systems
  - Between the land/air/sea/joint environments
  - With other government departments, civil authorities at all levels and international allies
  - With appropriate system and data security

Decision Support and Knowledge Exploitation (3)

- Many critical issues:
  - Common data and service access
  - Information exchange/sharing
  - Data formats
  - System and data security
  - Privacy and confidentiality and authentication
  - Etc.

A Multi-Disciplinary Program…


Domain Requirements Capture
• Documentation
• Lessons Learned
• Training Courses
• Exercises/Demonstrations
• Formal Methods
• Etc.
Domain Rqts. Understanding
• Knowledge Elicitation
• Integrated C4I Model
• Ontologies
• Relevant Scenarios
• Information Sources
• C2 Structure
• Roles/Responsibilities
• Operational Procedures
• Existing Systems/Capabilities
• Etc.
SME
SME
SME
SME
SME
Operational Community
INTERPRETATION
FEEDBACK
Requirements
• User Needs
• Problems
• Deficiencies
• Etc.
Experimentations/ Demonstrations
VALIDATION
System Development Activities
Identification of Support Capabilities
Research & Technology Watch Activities

Information / Relationship Requirements: Defining What Content is Needed for Effective Decision-Making

Supporting Information Needs

D1b.1 Location of combat resources currently which have combat power ranges/effectiveness that include the specified point in time and space.
aim such combat, if required.
D1b.3 Measures of combat power of the combat resources currently within range of the specified point in time and space. (this one needs help)

Decision Requirements

Abstracted Decision
D1-"Choose combined combat power to achieve the objectives at a specific point in time and space."

Secondary Decisions:
D1a- "Monitor the enemy's state after the enemy reaches the specific point in time and space." (Goal Satisfaction Monitoring)

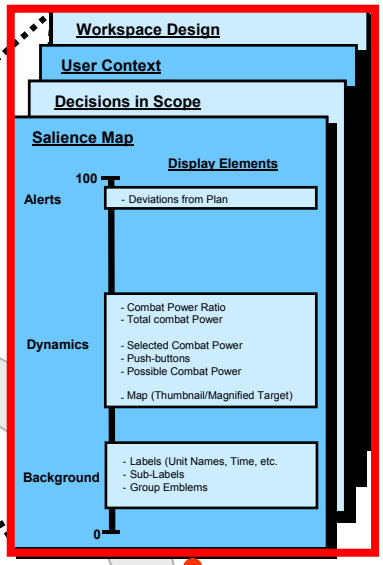
D1b - "Choose among the combat resources that can bring their combat power to bear on the specific point in time and space." (Planning process availability)

D1c -"Estimate the Enemy's state after the application of the chosen combat power at the specific point in space and time." (Planning choice among alternatives)

D1d - "Determine how the selected combat power is initiated and executed." (Control process control)

D1e -"After initiation of combat power, determine if it is currently achieving its objectives." (Feedback Monitoring)

Side Effects (Other Impacted Goals):
What will the impact be of moving combat power (a) to a specific point in space and time. (i.e., what else were they doing and what will happen if they change assignment?)

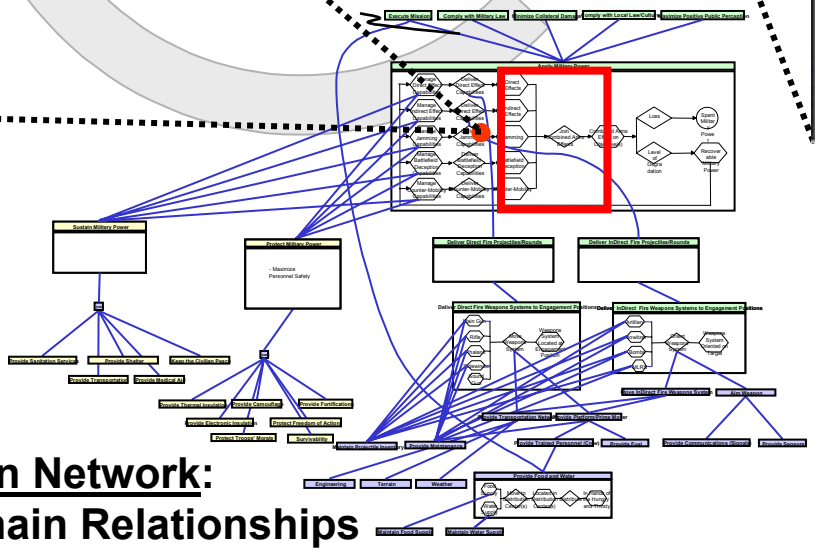


Representation Design Requirements: Defining Relationship Between Requirements and Visualization Concept

ACWA

Presentation Design Concepts: Making the Problem Transparent

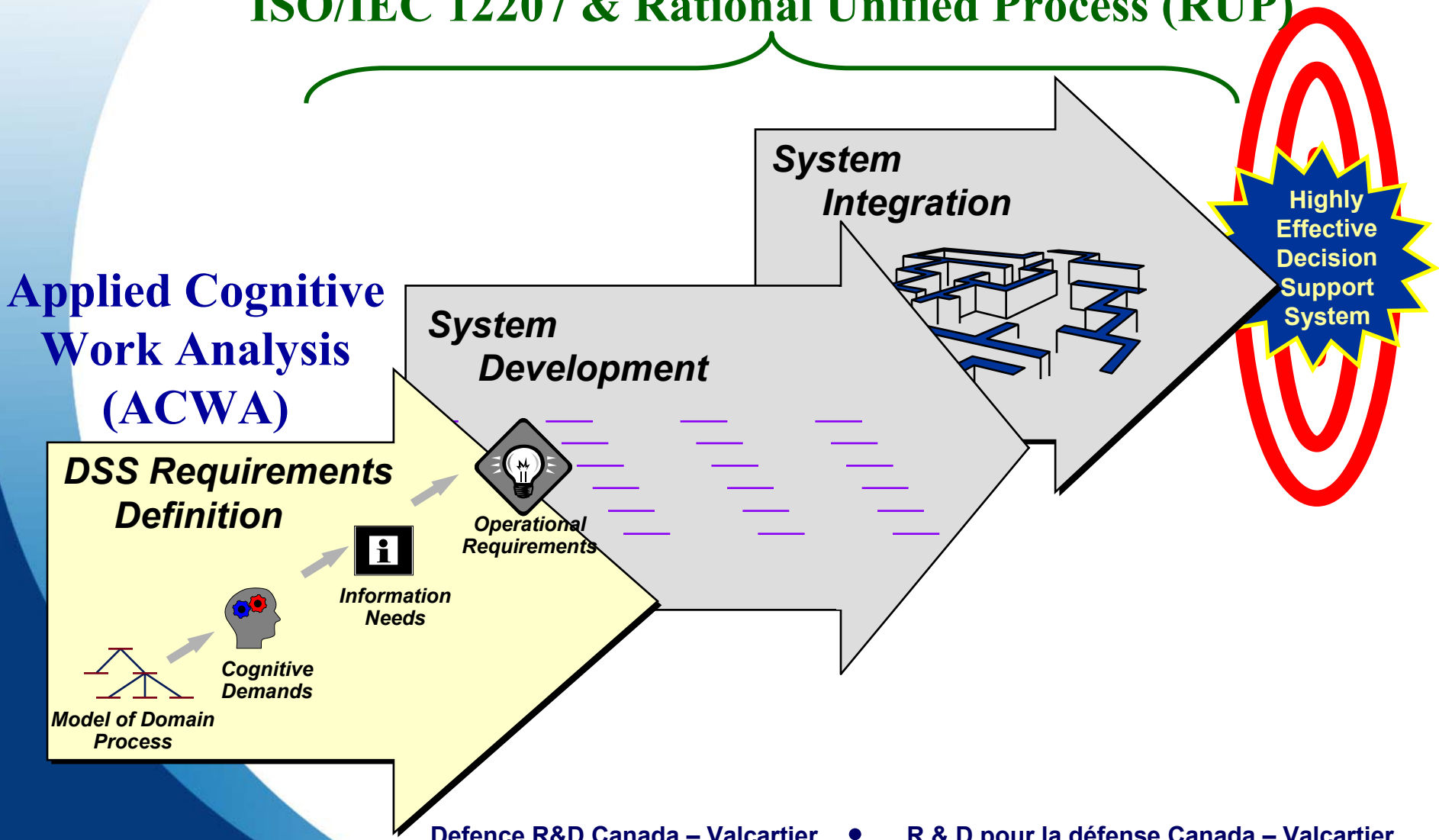
Cognitive Work Requirements: Identifying the Cognitive Demands of the Problem Space



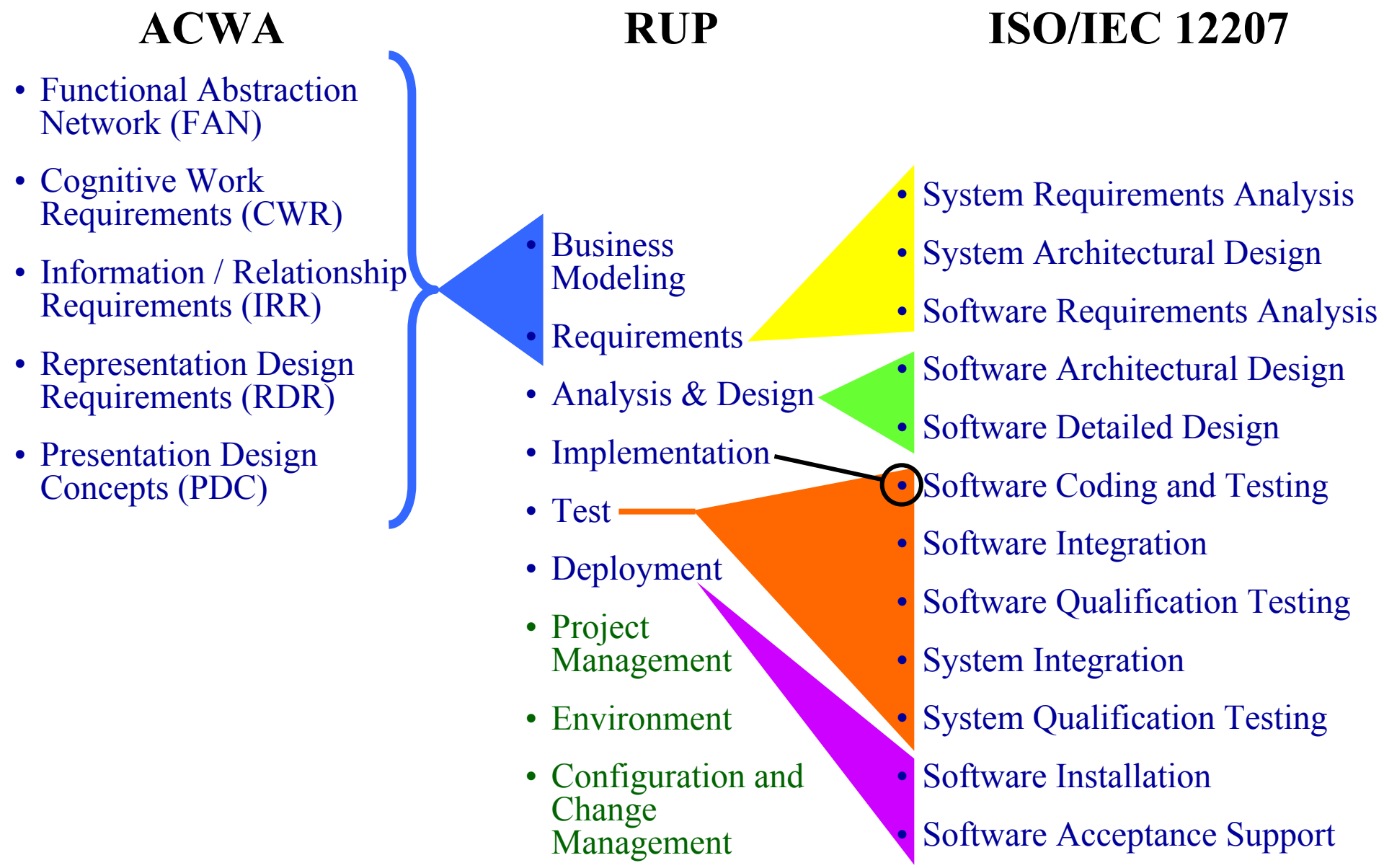
Functional Abstraction Network: Modeling Critical Domain Relationships

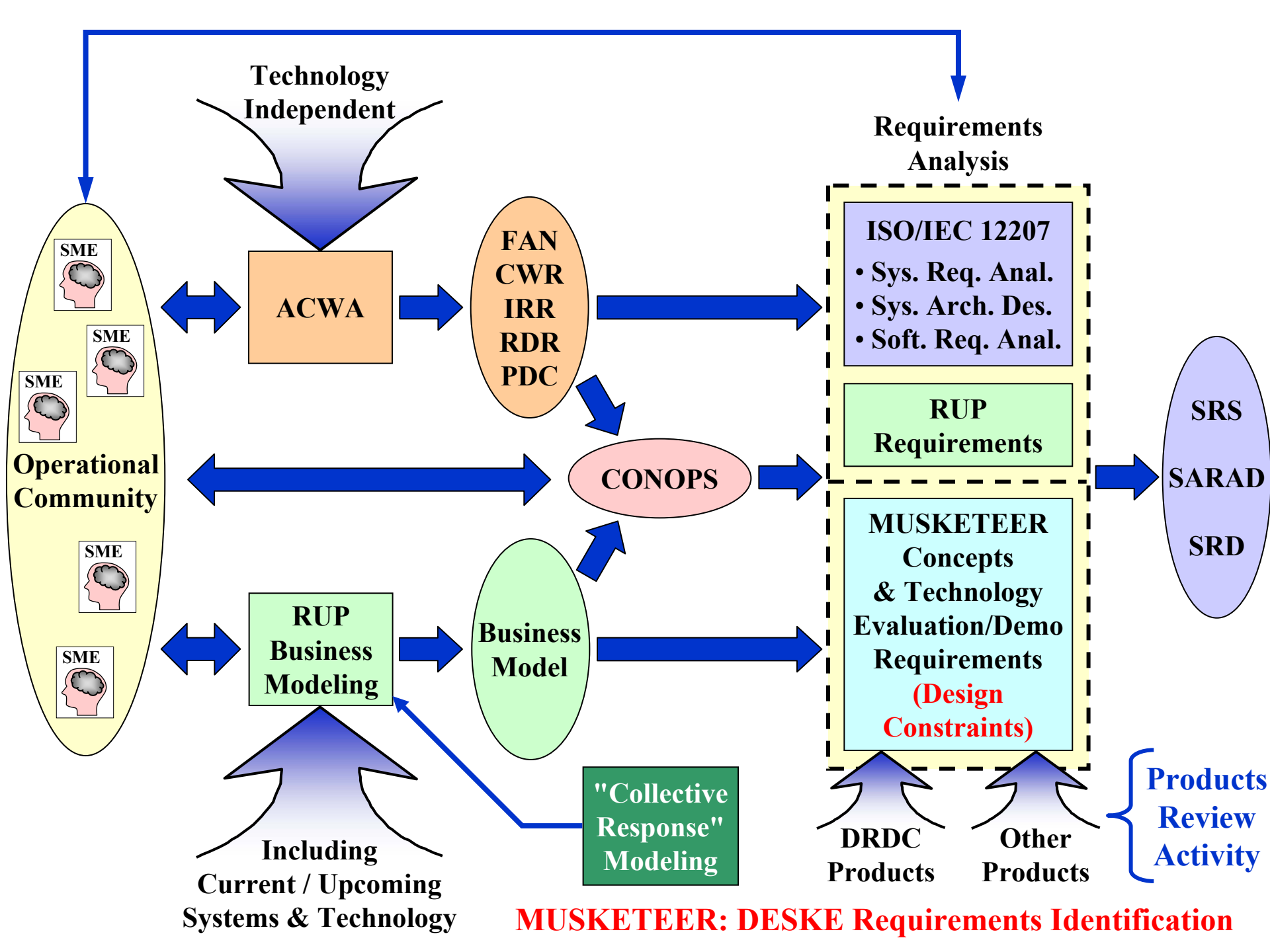
DSS Development Process

ISO/IEC 12207 & Rational Unified Process (RUP)



Decision Support System Development Activities




Technology Independent
Requirements Analysis
SME
SME
SME
SME
SME
Operational Community
ACWA
FAN
CWR
IRR
RDR
PDC
ISO/IEC 12207
• Sys. Req. Anal.
• Sys. Arch. Des.
• Soft. Req. Anal.
RUP Requirements
CONOPS
MUSKETEER Concepts & Technology Evaluation/Demo Requirements (Design Constraints)
SRS
SARAD
SRD
RUP Business Modeling
Business Model
"Collective Response" Modeling
Including Current / Upcoming Systems & Technology
DRDC Products
Other Products
Products Review Activity
MUSKETEER: DESKE Requirements Identification

Collective Response Modeling and Scenario Development

- Obtain a deep understanding of the roles and responsibilities of DND in the collective response to large-scale terrorist emergencies

- **Review emergency response plans and scenarios**
  - Processes (activities), the interaction between these processes/activities, the information flow, the existing strategic, operational and tactical C2 processes
  - Identify basic scenario components (ER domain), typical terrorism and asymmetric threat elements
- **Characteristics of asymmetric threats and terrorist activities**
  - Nature, sequence of events/activities, preparation, impact, etc.
  - Complex situations (complex operations in complex environments)
    - Asymmetric threats
    - Natural disasters
    - Peace support operations
- **Develop a collective response model**
- **Develop generic scenarios of emergency response**
  - Domestic operations: high-density urban area / DND assets and CF operations
  - International operations: CA-US cross-border emergency / CF deployment abroad

Collective Response Model

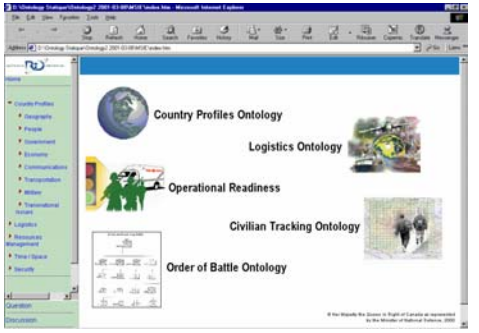
- A generic emergency response framework:
  - Summarize and integrate the main characteristics
  - Give an integrated view of all activities that could be involved in a generic collective ER
- Identify and highlight:
  - The different roles/responsibilities of the various responders
    - Focus on and emphasize the roles and responsibilities of the DND
  - The processes associated with each role, the activities occurring within each process, and the aspects relevant to the realization of each activity
  - The many Emergency Operation Centres (EOCs)
  - The challenges in inter-agency co-operation, co-ordination, interoperability and decision making.
  - The C2 requirements of the operational communities at federal, provincial and municipal levels
  - The role and issues pertaining to information system technologies

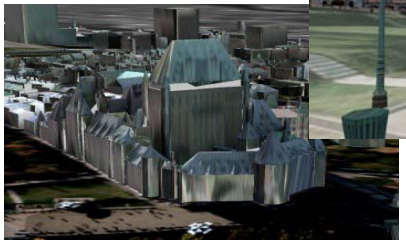
Products and Systems Review Activity

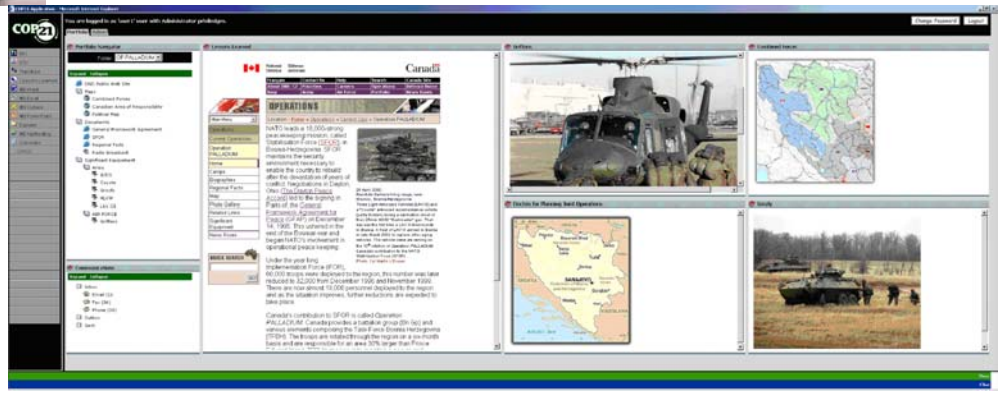
- Computer-assisted decision support and knowledge exploitation (DESKE)
- Relevant to terrorist emergency response (ER)
- Harness existing capabilities to achieve some leveraging
- Capitalize on relevant and unique concepts and products already developed
- Refinement, adaptation, incremental integration and use in MUSKETEER

- **Review and positioning of the DESKE and ER technologies**
- **Detailed search for relevant products and systems (inventory)**
- **Review and description of the products and systems**
  - Technical specifications, features, system requirements, etc.
  - Review matrix
  - Global capability matrix
    - Regroup capabilities in functional categories (e.g., situation analysis, decision support, visualisation, etc.)
- **Analysis and synthesis**
  - Trends, outstanding findings, user satisfaction, most promising products and systems (and those that should be avoided), products and systems evolution (foreseen development), etc.

Examples of Existing Products/Systems Developed At DRDC Valcartier







Demonstrations and Field Experiments

- **Activity 1** – Organize and conduct a CT-AT **workshop** involving key org and pers identified by the project sponsor to **identify** critical issues, processes, ERPs through short scenario-based case studies
- **Activity 2** – Participate to a major existing **experiment/exercice** to **capture** domain specific joint operational requirements and **demonstrate** initial MUSKETEER prototype functionalities
- **Activity 3** – Participate to CT-AT **exercice** aimed at **developing** the MUSKETEER target Operational Architecture (concepts, sources, organisations, business processes) and **demonstrate** the initial MUSKETEER Command Environment (MCE) capabilities
- **Activity 4** – Simulation-based, combined laboratory **tests** aimed at **validating** MCE functionalities supporting the C2 process of a Unified Command Center (UCC)
- **Activity 5** – **LOE** to **capture** & **validate** functional and operational requirements for the development of advanced DESKE tools for MUSKETEER
- **Activity 6** – **Evaluate** & **measure** within a suitable **experimental** context the validity and effectiveness of DESKE tools provided within a UCC

" All for one, one for all "

MUSKETEER

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