



## WHAT IS CYBERSPACE? EXAMINING ITS COMPONENTS

The ability to operate in Cyberspace is becoming a key component of national security. The *Defence White Paper 2009* places considerable importance in the ADF developing a cyber capability. As the RAAF introduces an increasingly network-enabled force, it is critical to understand cyberspace, its relationship to air power and its potential impact on operations. This requires knowledge of its components, nature and purpose.

There is increasing recognition that cyberspace is another domain in military operations. The cyberspace domain

has similarities to the traditional environmental domains of land, sea, air, and space, which are interactive and require cross-domain planning. Although these considerations also apply to cyberspace, it is distinctly different from the other domains. Cyberspace is a largely intangible domain and is not physically identifiable in the natural world while the other domains are clearly recognisable. It is essentially a networked terrain that has no geographic boundaries.

Further, it is largely owned and operated by private sector entities, many of them multinational corporations. Since it is not constrained by boundaries, cyberspace can act independently through and/or influence all other domains as depicted at right.

Very broadly, cyberspace is the collection of computing devices connected by networks in which electronic information is stored and utilised, and communication takes place. The USAF, in their doctrine document 3-12, defines cyberspace as, 'a global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers'. A useful way of understanding cyberspace is by articulating operations within it, which can be described as the processing, manipulation and exploitation of information and its

interaction with people. Information and people are central to cyberspace. Cyberspace consists of four components: information, physical systems, cognitive actions and people. These components function in a closed loop that feed back information retrieved in cyberspace to the people requesting it.

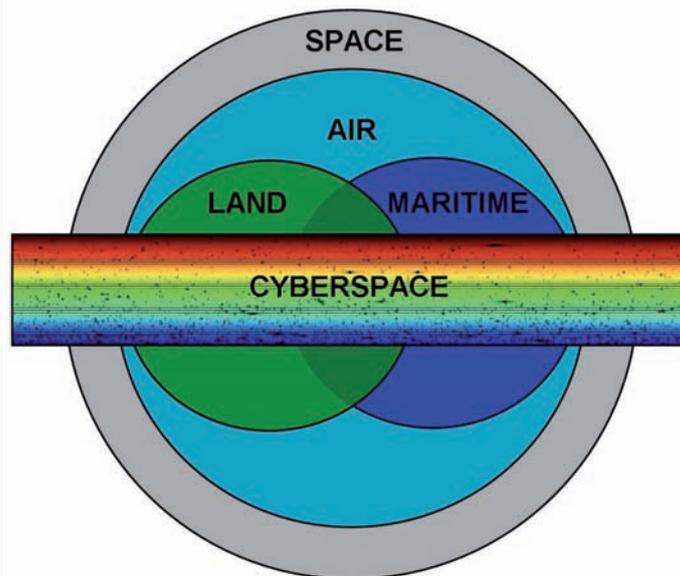
The creation, capture, storage and processing of information is central to the domain. Information in cyberspace takes many forms; it is the shared music and videos, the stored records of businesses, and all of the

pages in the world-wide web. It is online books and photographs, as well as information about information (meta-data). It is information created and retrieved when other information is looked for using online search engines.

The character of information in cyberspace (or more colloquially 'on the net') has changed greatly since computers first started working with data sets. Data was processed by isolated computers well before the capability of interconnection was

developed and stored in card decks, tapes, and later disks. Initially, data was normally static, stored and retrieved as needed. Massive archives of static information still exist, such as corporate transaction records that are now stored in 'data warehouses' and 'mined' for further information. But increasingly, information is created dynamically on demand, blurring the boundaries between storage and computation. Information is now becoming more of a personal experience, instead of a communal one. Issues of ownership, authenticity and dependability are all becoming critical challenges as more and more information moves 'online'.

The nature of cyberspace, its strengths and its limitations, derive more from the decisions made at the cognitive level rather than through the operation of physical systems. The



*Cyberspace and its relationship to the Physical Domains*

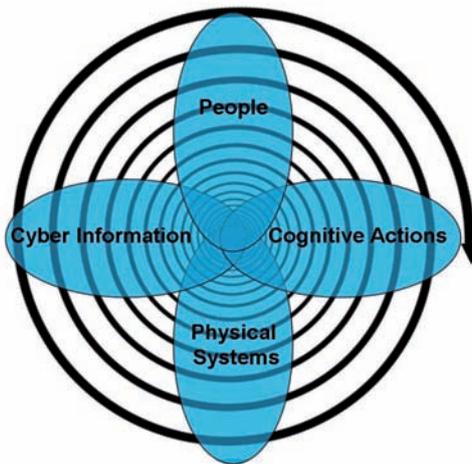
decisions that shape the Internet arise at this higher layer, where the nature of the Internet is defined. The design of the Internet results in a cyberspace that is built out of components and provides services designed so that they can be composed and combined to form more complex services.

Low level services include program execution environments, mechanisms for data transport and standards for data formats. From these are built applications, such as word processors, databases or webpages. By combining these, more complex services emerge.

For example, by combining a database with the Web, dynamic content generation and active Web objects are created. In addition, social networking services that are themselves platforms for further application development can be generated. A unique characteristic of cyberspace is the continuous and rapid evolution of new capabilities and services, based on the creation and combination of new logical constructs, all operating on top of the physical foundations.

The physical components of cyberspace are its foundation and comprise the physical devices/systems that create it. Cyberspace is a space of interconnected computing devices, so its foundations are computers and servers, supercomputers and grids, sensors, transducers, and the Internet as well as other supporting networks and communications links. Communications may occur over wires, fibre, radio transmission, or by the physical transport of the computing and storage devices from place to place. The physical component is perhaps the easiest to grasp since it is tangible and provides a geographic sense of location as physical devices such as routers or data centres exist in a place.

The most important aspect of cyberspace is the technological interconnection of people. People are not merely passive users of cyberspace, they define and shape its character by the ways they choose to use it and the decisions they make within it. People and their individual characters, which could vary with a number of factors, are an important influence on the nature of cyberspace. The unique nature of people means that each individual cyberspace user will have an individual experience. Essentially cyberspace is an expanding spiral of constantly



*The Cyber Spiral*

changing decisions and information, brought about by the interaction of its four components.

When the nature of cyberspace, and the position of different countries with respect to their place and power in cyberspace is contemplated, it must be recognised that people are as important a component of cyberspace (or more so), than are wires and protocols.

The *Defence White Paper 2009* identifies cyberspace as a capability development domain for Australia's national security. Operations in

cyberspace pose growing challenges but also provide opportunities for the RAAF and air power to contribute to and enhance national security. This requires a clear understanding of cyberspace as a domain, which is distinctly different to the conventional environmental domains. The cyberspace domain is relatively new and is largely a virtual landscape that is difficult to comprehend as opposed to physical domains. Understanding cyberspace in its basic construct of four components is essential to understanding it as a domain. It will also assist in developing more effective ways to exploit it in generating and applying air power and protecting our own capabilities from adversary cyber threats.

- *Cyberspace is a virtual domain, similar but discretely different, to the physical domains of air, sea, land and space.*
- *Cyberspace has four distinct components—Information, Physical Systems, Cognitive Actions, and People.*
- *People and their manipulation of information are central to conducting operations in cyberspace.*

*Our national security could potentially be compromised by cyberattacks on our defence, wider governmental, commercial or infrastructure-related information networks.*

Defence White Paper 2009



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