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Network Centric Warfare and Its Impact On Operational Functions

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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3 February 2003

Abstract

Network Centric Warfare and Its Impact On Operational Functions

Network-Centric Warfare (NCW), or Network-Centric Operations (NCO), is a term that evokes strong opinions. The proponents of NCW look to the future and see sensor grids, weapons platforms netted together, and the free flow of information relating the minute details of friendly and enemy forces. The opponents of NCW claim that the ability of net centric operations to give the commander detailed information about the battlespace will flatten the command hierarchy and tempt operational commanders to dabble in tactical decisions rather than concentrating on operational art.

The use of Net-centric tools in modern warfare has not hampered warfighting. On the contrary, they have provided the synthesis of information needed to conduct operations, greatly enhancing the warfighting capability of the modern commander. For NCW to mature from the current tactical to the future operational level, it must support the operational commander and his/her staff in the functions of operational art.

NCW as it exists today and in the near future can provide the Operational Commander with the tools to plan, collaborate and increase the speed with which the staff performs. It is through NCW that the Operational Commander will react quicker there-by shocking the adversary or thwarting an enemy timetable for victory. Net centric warfare will, in the future, bring these about.

Network Centric Warfare and Its Impact On Operational Functions

Network-Centric Warfare (NCW), or Network-Centric Operations (NCO), is a term that evokes strong opinions. Most people fall into one of two camps when asked if they support NCW: some are strongly for the evolution of warfare in this direction, while others claim it falls short of expectations or is too vulnerable to be of real use. The proponents of NCW look to the future and see sensor grids, weapons platforms netted together, and the free flow of information relating the minute details of friendly and enemy forces. This future-oriented outlook tries to lay the groundwork for what is needed in our acquisition process now and what shifts in our methods of training and organizing will be required.[1] The opponents of NCW claim that the ability of net centric operations to give the commander detailed information about the battlespace will flatten the command hierarchy and tempt operational commanders to dabble in tactical decisions rather than concentrating on operational art.[2] This outlook warns that NCW is not a substitute for current doctrine and should be viewed in the same light as other developments that have not stood the test of time.[3]

This friction is not new in large American organizations. The Edsel automobile, for instance, was initially marketed as "the car for Americans", offering such engineering innovations as a pushbutton, servo-operated shifting mechanism in the center of the steering wheel.[4] It was expected to sell well the first year but a troubled economy and consumer bias spelled its doom in the American market. NCW shares a similar dilemma in that it offers a capability that could revolutionize warfare if we are ready to embrace it. Proponents of NCW say we are ready, but their vision surpasses our current capability. Before the proponents of NCW carry the concept too far for the military to accept its advantages, elements of NCW/NCO should be brought into military use as quickly as possible without outpacing the military's ability to use them effectively. Several Network Centric Warfare issues must be addressed before NCW can realize its full potential, but the NCW endstate will dramatically enhance our warfighting capabilities.

The use of Net-centric tools in modern warfare has not hampered warfighting. On the contrary, they have provided the synthesis of information needed to conduct operations, greatly enhancing the warfighting capability of the modern commander. There are many examples of how staffs have used networks, computers and video teleconferencing to coordinate operations and share information. This paper will examine a few pertinent examples and look toward the near future to show how NCW will enhance the commander's ability to plan, coordinate, and orchestrate operations.

Where are we now?

Several systems in use today can be seen as rudimentary forms of NCW. Current Tactical Data Links (TADIL A & B) and Link 16 are small scale, tactical forms of netted warfare, though they do not allow a warfare commander to influence the battlespace the platforms he/she controls. Cooperative Engagement Capability (CEC) is a tactical system that I will discuss later in the paper. Although it is tactical, its potential approaches the level of NCW desired by proponents. Many innovative commands have begun working with net centric ideas of their own. One such concept is called Collaboration at Sea, which permits textual information to be stored electronically and allows action officers access to messages and files. Another innovation is called "Extending the Littoral Battlespace Advanced Concept Technology Demonstration (ELBACTD)." ELBACTD aimed establish a wide area network connecting units ranging from the Operational Commander to combat companies in the field.[5] A third concept called the Knowledge Web, or KWEB, was used to net the Command and Control of a Carrier Battle Group during OPERATION ENDURING FREEDOM. Each innovation has achieved a part of the vision of NCW, though each is very much a discrete effort.

In "Joint Vision 2010" (JV2010), the Chairman of the JCS envisioned commanders and their staffs accessing a "system of systems" to gain dominant battlespace awareness over an opponent.[6] The Naval War College used the Global wargame series to address aspects of the JV2010 NCW vision. During Global Wargame 2000, the war game designers tested whether NCW would speed up military operations and, if so, whether the staffs could keep up with the

pace.[7] The game involved a "Knowledge Wall" made up of screens for each functional area, fed by anchor desks for each area surrounding two large screens for the display of data or graphics. The Knowledge Wall was linked to players playing component commanders and to Commander, THIRD Fleet acting as the CinC. Using available technology, a network was developed to exchange information in real time, increase the speed with which information was passed from commander to commander, and speed the planning of operations. The Battle Group staff that played the Commander, Joint Task Force staff in Global and used the Knowledge Wall then took this idea to sea and built the "Knowledge Web" based on the Global Wargame 2000 model. Using the Internet Protocol based Information Technology for the 21st Century (IT-21) tools and the Secure Internet Protocol Network (SIPRNET), they developed a rudimentary form of the Network Centric Operations envisioned by JV2010.

The Knowledge Web was easily adapted to current technology and loaded onto each ship in the battle group, including submarines and auxiliaries, with the support of Office of Naval Research and Space and Naval Warfare Systems Command.[8] The versatility and adaptability of the web based information architecture was quickly realized. Subordinate commanders within the Battle Group used the KWEB to access current guidance and Commander's Intentions on one page, with selectable links to gain more detailed information, or "drill down" on the link. The same highly detailed intelligence information discussed at the admiral's morning meeting was available to every watchstander in the battle group with access to the classified web. Even the submarines, the most isolated of ships within the battlegroup with respect to information, were able to access the same information available to the commander. Supply officers were able to track and locate spare parts and stores. The level of shared information and situational awareness by Tactical Action Officers, Commanding Officers and Operations Officers aboard US ships was unprecedented. Rear Admiral Robert Nutwell foresaw this opportunity as long ago as 1998, where he wrote about an IP based information backbone that would make "mission critical information readily available to the warfighter."[9] Much of what was born during the wargames at the Naval War College and subsequently taken to sea as KWEB was sketched out in this article three years before the KWEB

served as the Command and Control conduit for Commander Task Force 50 (CTF 50) during OPERATION ENDURING FREEDOM (OEF). Although the KWEB resided at the tactical level (CTF 50 commanded three carrier battle groups, Middle East Force deplorers and coalition navy vessels), it would translate easily to the next level: Operational Command.

Operational Functions

For NCW to mature from the tactical to the operational level, it must support the operational commander and his/her staff in the functions of operational art. NCW as it exists today and in the near future can provide the Operational Commander with the tools to plan, collaborate and increase the speed with which the staff performs. Using the operational functions of C2, Intelligence, Fires, Logistics and Force Protection I will show where today's capability of netting forces can and does aid the operational commander.

C2

What NCW can do for Command and Control. C2, where the commander exercises his authority by communicating his desires to subordinates, will gain the most from the current tools for NCW. It is critical that his message be clear, concise and interpreted identically by all subordinate commanders; NCW will facilitate and spread this function. Net centric tools will aid in centralized planning and observing the execution of orders by subordinate commanders. Further, it will enhance C3 (command, control and communications) to ensure the effective flow of intelligence information, coordinated fires, sustainability and operational protection for the commander's netted forces. But the open architecture of the net centric tools also allows senior and peer commanders access to that same information, with information flowing freely up and down the chain of command as well as laterally. Netted forces are more likely to realize effective unity of command due to the wider span of control allowed by networked systems. By reducing duplication of effort, the networks allow members to achieve greater results.

The impact as NCW is realized. These networks will allow commands to work in a truly collaborative environment, with planners able to reach supporting commands quickly and early in the planning process. If planning time can be reduced, there is more time for the operational aspect

of the plan – force movement, sustainment – to be put in place. The information stored on the net would be more valuable and accessible to the customer than ever before, as planners and those executing the mission will have access to vital information immediately and in great detail. Tactical commanders will be able to reach back to the operational staff for timely information or clarification, or outside the command structure for support information such as weather or systems data from engineers who designed those systems. Greater destructive power can be delivered more accurately and in a timelier manner than before with the decreased time between a sensor detecting the target and the information getting to the shooter. An example of controlling firepower through netted forces was seen during the experimental phase of exercise KERNEL BLITZ 2001. During this exercise an Army commander departed from the norm of attacking with a 3:1 advantage over the opposing force and used a company-sized force to attack another company-sized force. He was assisted in this effort by the net centric tools and netted forces, which rapidly passed him timely and accurate intelligence on the enemy's strength, location and the availability of supporting firepower.[10]

The challenge to make NCW useful for C2. NCW needs to combine the access to information enjoyed by strategic level commanders with the high granularity available to tactical commanders on tactical nets. Just as operational art serves as the bridge between the strategic and tactical level, so must NCW bridge these levels to serve the operational commander. Many obstacles will need to be overcome along the way. First, increasing demand for information means increased demand for bandwidth. A more efficient way to transfer greater amounts of data will need to be developed and fielded. Second, current systems are not compatible across the joint spectrum. Future acquisition strategies must insist on systems that truly work together – integrated vise merely interoperable - to avoid the necessity of "middleware" software to translate one system language to another. Just as bits of information are lost in spoken language translation, so are bits of information lost in machine language when translated with middleware. Third, greater shared information also means greater visibility for higher headquarters on the success or failure of a mission, and thus the temptation to micromanage by higher commanders when given access to more

information. This was, of course, an issue long before NCW was introduced. As it was handled in the past so should it be handled in NCW: with trust and sound leadership. Ideally, given shared awareness and greater access to commander's intent from headquarters, a commander's decision to reach down and give "guidance" will be understood in light of his expressed intent rather than perceived as micromagement.

Intelligence

Accurate intelligence is a must for any operational commander. Good intelligence is required for planning, assessing courses of action and shaping the Commander's Intent. At the operational level, intelligence is the fusion of vast amounts of disparate information from a wide variety of sources, analyzed and refined to concise, relevant information needed to run an operation and support the tactical commander.

What NCW can do for Intelligence. At its full potential, NCW gives a larger, longer view of the theater of operations and, more importantly, of the enemies. Netted intelligence centers can share more information in a format more readily understood and assimilated than text message allows. Instead of transposing text messages onto charts for briefs, graphic images with detailed textual information can be accessed through web-based databases and made available to more users. With this advance in sharing data, less time is wasted reconstructing briefs and graphics and more time can be devoted to fusing strategic and tactical intelligence into a solid, usable operational intelligence picture.

Returning to the discussion of the KWEB, CAPT Mackrell, the Intelligence Officer from the CTF 50 Battle Group staff, has written an article, "Net-Centric Intelligence Works" describing the utility and versatility of the Kweb in her job.[11] In this article she outlines how the intelligence picture was made available to the tactical commanders through net centric operations during OPERATION ENDURING FREEDOM. Internet "chat" on the classified SIPRNET, for example, was a primary vehicle to push intelligence information to tactical users. Routine radio traffic is virtually illuminated and clearer, more concise information is exchanged between action officers. Chat allows a more informal and open forum for questions and answers without the stigma of talking on the tactical or

administrative circuits. This enabled intelligence watchstanders, for instance, to exchange detailed intelligence information in an Intel chat room, while passing concise value-added analysis to the Tactical Actions Officers in the Battle Force 50 chat room. The benefit is stated in her words:

> When routine operational [situation reports] were also shifted from Battlegroup Command [radio circuits] to secure chat rooms, the reduction in chatter on this key net was immediate and dramatic. As a consequence, when word was passed on Battlegroup Command, everyone listened up, since constant chatter (like the hum of the air-conditioning) was no longer part of the background noise."[12]

As stated above, intelligence support needed for planning and refining the intelligence product to the customer's needs is just as important as the information provided. Using the benefit of collaboration gained from being netted with subordinate commands, the intelligence teams were able to provide better support and awareness to tactical decision makers:

> The [intelligence watch officer's] presence and participation in the [Tactical Action Officer] chat room, like my own participation in staff planning meetings, helped to keep Intel and ops synched up and allowed us to anticipate what was coming and what Intel support would be needed…Key to tailoring [fusing information from higher levels to the tactical level] was to make the info as user-friendly as possible so it could be pulled rapidly by ships without the huge bandwidth available on VINSON.[13]

It does not take a big leap of faith to envision netted forces, from the operational commander to the tactical forces, maintaining the momentum and rhythm of combat operations through sharing information and intent. This is the synergy NCW strives to attain. With technology available today and the innovative spirit of energetic operators, this synergy was attained at a rudimentary level, achieving exceptional results.

The Challenge of NCW to support Intelligence. Recent years have brought a vast proliferation of sensors available from which to draw data. More data means more information to cull and analyze and fuse into a final product. NCW's conceptual bar of "sensor to shooter" is

becoming too high to be attainable. How fast can the imagery or information obtained by national level sensors be pushed to the end user? How much tactical imagery from UAV's can be pushed up the next to higher level? The dilemma still lies with the Operational Intelligence Officer to fuse the data collected from sensors optimized for CONUS and meant for strategic intelligence nodes with the data collected from sensors optimized for perishable, tactical intelligence. NCW gives access to data previously unavailable – thus a better chance of providing what the commander needs to know. But, technical tools need to be developed to assist with analysis, target recognition, data mining, etc to further enhance intelligence.

Fires

The vision of NCW has all sensors and shooters connected via a net where a central staff coordinates operational fires and other fires are handled from the observer on the ground or air. This is the holy grail of the NCW visionaries. Unfortunately, current and near-future weapon and information systems are not at this level, nor are they expected to be there in the next FYDP.[14] The closest netted fires systems in effect today are the Tactical Data Links as discussed above, Cooperative Engagement Capability (CEC) and the Navy Fires Network (NFN). Though not "fires" in an operational context, CEC is the system closest to the vision of netted fires and can be used as an operational force defense system. It will be further discussed in Operational Protection below. NFN is the system closest to the "sensor to shooter" vision enhancing real-time engagement of time critical targets.[15]

What NCW can do for Operational Fires. The intent of operational fires is to lethally or non-lethally prevent men or material from aiding the enemy on the battlefield. There is nothing now in existence, or programmed for the near future, that will truly net platforms, commanders and

sensors to affect fires at operational or strategic depth. However, even now, through the synthesis of C2 and Intelligence nodes, information from national sensors is being fused at the operational level and fed to a shooter in time-critical strike on a time sensitive target. In the current war in Afghanistan, strike aircraft took off without a pre-planned target and were fed their targets enroute.

What is the impact? This gap should be addressed and a solution found to organize and coordinate fires in a planned and precise way. The U.S. has been fortunate that the last few conflicts have been with less capable and we have rapidly acquired and used complete air supremacy to deliver airdropped precision ordnance. However, if we face a military peer competitor, we will need to bring operational fires (from all sources) to bear to shape the battlefield.

The Challenge for NCW to orchestrate Operational Fires. The challenge is to net forces together in a common language to coordinate fires in a joint environment, therefore synchronizing the forces. The process of self-synchronization is a theory touted as an advantage of NCW.[16] The theory of subordinate commanders seeing a common picture and redirecting effort toward the enemy without input or guidance from higher authority has been discussed and field exercises have been run to explore its benefits.[17] The flaw in this vision is the thought that all commanders will work and think in the exact same manner toward the common goal. If two commanders are under attack and desire assistance or support within the netted system, both commanders will feel they should be the priority for fires or support. Alternatively, two commanders could interpret the same information differently, therefore not "synchronizing" as one with the netted force. Additionally, if the directional thrust of an operation is toward the objective and a target or branch objective appears, the senior commander will need to decide which direction to proceed, vice the group of individuals trying to reach a consensus. The need for an overall commander is not negated just

because of a common operational picture. There still needs to be a senior decision maker in operational command to orchestrate the direction and flow of the battle.

Logistics

What NCW can do for sustainment. Logistics is one of the most important pieces of operational planning. Without properly planning for men and material, an offensive or campaign may reach its culminating point and stall.[18] Or, increased commitments worldwide may tax the limit of strategic lift forcing commanders to carefully prioritize what cargo is being moved to which location and by what means. The advantage NCW affords to the logistician is much like the advantage that C2 is to the commander. Through the sharing abilities described above, sustainment, spare parts and support can be tracked and provided in near real time. Many books written on the flow of supply and demand for the commercial sector discuss the benefits gained by having stores and inventory connected via a network. As a product is purchased and removed from inventory, the reduction in quantity is transmitted directly to the supplier of the product. When the product reaches a predetermined level established between factory and customer, an order to produce and/or ship additional products to the store is automatically generated. This increases the flow of material and reduces the need to maintain a large stock of unused inventory. This obviously can be applied to military logistics today. As items are drawn from the supply system, they can be requested via the net to the entity that produces the item or to a central controlling agency. By using this model large stocks of inventory can be reduced and moved to the customer more efficiently.

To ensure movement and the steady flow of supplies, collaboration between planners and logisticians is as important as planning fires. The technology exists today to have visibility of materiel in transit, to aid in predicting usage rates and to help the commander determine when an operational

pause is necessary or when the culminating point is approaching.[19] With the clarity NCW brings to tracking sustainment, distribution of supplies can become more efficient, delivering the right item to the right unit as a matter of routine. Reliable and predictable sustainment would reduce urgent lift requirements keeping the supply flow steady and smooth. Clearly, net enabled collaboration early and often is the key to logistics success.[20]

Another great byproduct of NCW in logistics is the ability to have direct contact between technician and engineer/designer in the maintenance and sustainment of machinery and equipment. This concept falls to the tactical level but directly affects operations. With equipment spending more time functional rather than waiting for technical assistance or the arrival of an engineer to remedy a problem at a remote deployment site, operational readiness of a unit remains high, likely allowing a higher operations tempo.

The challenge to link logistics to the commander. In order to collaborate, the logisticians must work on the same web environment as the planners. However, most logisticians today work on the unclassified web since few suppliers can access the SIPRNET. Operational planners, on the other hand, inhabit the SIPRNET would almost exclusively. This problem is not insurmountable – a network allowing multiple-level secure information flow would solve it – but it is as important as integration.

Operational Protection

In its broadest sense, operational protection, as Professor Vego writes, means preserving the effectiveness and survivability of forces.[21] This covers the entire spectrum from cyber attack to individual attacks on units at assembly points or while moving to contact. NCW can assist by

providing a vehicle to share threat related information as well as what others have learned from doing similar operations.

What NCW can do for operational protection. NCW, through the architecture of CEC, can extend the defensive ring of air defense to encompass the operational center of gravity when conducting maritime operations. With just a few improvements, a CEC program currently available at sea could integrate land based air defense and extend the defensive ring to the forces ashore as long as forces ashore and at sea can support each other. The information provided by CEC is the processed data from multiple sensors combined to form a single, cohesive picture of what is detected. By extending the sensor grid to shore and netting the forces ashore to those afloat, this combined picture would display the most accurate and complete data to the functional commanders defending the battlespace.

Maintaining easily accessible databases of post-mission reports for ongoing Maritime Interdiction Operations (MIO) and Leadership Interdiction Operations (LIO) allows the benefit of prior experience to be gained by others. The ongoing mission in the Arabian Gulf of boarding and inspecting suspect vessels is one fraught with danger, particularly when a new ship arrives on station to assume intercept duty. Were boarding teams able to access a data base of suspect vessels and pull information on a specific hull before they boarded, the team could be armed with information that could make the boarding less stressful. For example, if the master of a given cargo vessel was particularly belligerent and has displayed this attitude toward other teams, a new team would not likely know that information if just given the routine one-day turnover on station. However, if that new team could review a history of reports concerning that same master, they would know he was difficult and could perhaps deescalate a tense situation before it starts. In similar fashion, when a

boarding team conducts LIO operations, other agencies may pull the reports they post to databases for suspicious individuals.

Finally, moving information on anti-terrorism resembles interior lines in defense against terrorism. If information on terrorists can move faster than the terrorist, friendly forces can act on that information to defeat the intent of the terrorist. NCW provides the fastest vehicle for anti-terrorist interior lines. Using the KWEB again for another example, the Force Protection exercise conducted for the CARL VINSON Battle Group during workups posed a new challenge, since the exercise took place on the heels of the attack on USS COLE and vast changes in the AT/FP environment. The carrier intelligence center developed a 24-hour analytical center called Battle Group Anti-Terrorist Analysis Cell (BG ATAC) that reviewed the information and pictures e-mailed to the BG ATAC from sentries on ships "separated" geographically. From this information and the "host nation" intelligence brief, the intelligence officers were able to identify with assistance from "other agencies" the (exercise) terrorists who were probing the ships. In addition, they designed a chronological log sheet with detailed information, such as color of clothing and vehicles driven, with pictures and links that were accessible to every ship in the BG as well as the JTF commander and were also provided to the host nation. Their innovations provided instant access to processed, vital information usable to ships and operational staffs alike. By moving inside these "interior information lines" the agencies monitoring the long-term activities of these terrorists could see when an action was probable and take action before the terrorist. Will this work every time? Probably not, but it is a promising road to explore in the war on terrorism.

The challenge for NCW for operational protection. The challenge for the information-based protection concepts is to build and maintain these databases and make them accessible to the

forces that need them. That is a daunting task but a worthwhile one. Such a database would serve two purposes: it would directly assist teams conducting boardings, and would also allow the MIO commander (or other analysts) to review historical data on boardings to look for trends. This may also serve to improve MIO success. The crucial challenges for LIO, on the other hand, is to identify suspect individuals before they pass through the inspection teams. Such a task mandates close collaboration between the national agencies with an interest in apprehending suspects and deployed forces; however, the potential gain is well worth such an effort.

CEC posses a different set of challenges. As the netted forces grow in size, so do the bandwidth requirements. The concept is valid but to be a viable system for NCW it must make better use of data flow. Also, CEC is currently limited to line of sight communications; in order to grow beyond the tactical level of protection, it will need to overcome this limitation. The next step in the concept of netted forces connected by a CEC type architecture would be to allow platforms other than the shooter to control the fired weapon, but that is beyond the scope of this paper.

There are many systems today that decrease planning time and push sensor data to the shooter faster that were before possible. These systems allow the commander to plan in a collaborative environment, access intelligence previously not accessible, and use the versatility of networks to defend friendly forces. But, as discussed above, there are many generations of technology to be developed before we achieve the netted forces envisioned for the future.

Conclusion

Contrary to current writings, NCW does not represent the "Death of Operational Art". There will always be a need for an intermediary between the strategic and tactical levels. The doctrine of span of control dictates this. Netted forces will have a greater ability to manage and

share information, but the level of command will always drive the focus of the staff. A command more at the tactical level will be more concerned with movement of parts and people to the line of contact. The strategic staff will always be primarily interested in the political outcome. The operational staff will still focus on flowing assets and information between the strategic and tactical levels because that is where their interest lies. Having greater visibility on logistics, planning and fires will only aid the operational commander in his job, not put him out of a job.

NCW is not a panacea for warfare or the future of warfare. Networked systems are complex; they have vulnerabilities that must be addressed. Why are they vulnerable? Our desire for information is thus far unbounded, and information flow needs bandwidth. Video streams and high-resolution graphics can stress the best communications capabilities. Technical solutions allowing faster data flow – laser communications, meteor-burst communications – must be developed and funded. Additionally, nets are vulnerable to exploitation; human errors or system viruses can render a network useless; and machines can always fail.

Clauswitz wrote of the fog of war, the purple blur where blue comes into contact with red. The force that is best able to manage and use the information that arises from the point of contact will most likely be the side that is victorious. Early elements of true NCW, such as CEC and NFN, allow a force to extend sensors further providing better awareness and control over the battlespace.

We must not lose focus of what NCW is intended to do. The time required for sharing, approving and collaborating plans or schedules is shortened. Fires can be coordinated and directed from commanders in the field making more effective use of forces at hand. Logistics will flow more efficiently sustaining forces in theater. Intelligence information will move faster, providing time critical details of the battlefield needed by tacticians and operators alike. It is through NCW that the

Operational Commander will react quicker there-by shocking the adversary or thwarting an enemy timetable for victory. Net centric warfare will, in the future, bring these about.

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