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ELECTRONIC COMMERCE: A NATIONAL PERFORMANCE REVIEW INITIATIVE

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September 1995

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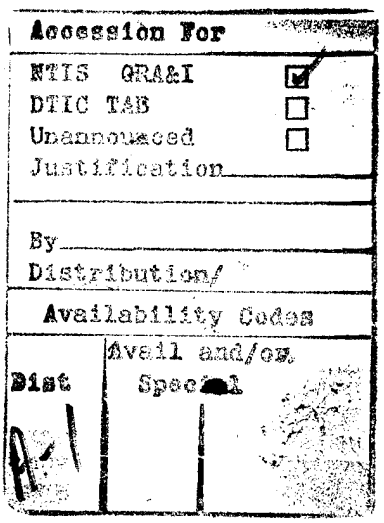
PREFACE

This paper has been prepared as part of a Central Research Project on the National Information Infrastructure (NII). The objective of the paper is to enhance IDA's understanding of the activities, organizations, and issues related to the implementation of electronic commerce, as part of the NII, so that IDA will be well prepared to support the work of the Defense Information Systems Agency.

Information presented in this paper is derived from reports issued by the Information Infrastructure Task Force (IITF), which are listed in Appendix B, minutes of various IITF committee meetings, Armed Forces Communications and Electronics Association sponsored symposiums, and personal meetings with various government representatives.

The authors thank Dr. Harry Williams and Dr. Dennis DeRiggi for their careful and thorough review of this document.



CONTENTS

PREFACE iii
I. INTRODUCTION I-1
A. Background I-1
B. Electronic Commerce I-2
C. Electronic Data Interchange I-2
II. GOALS OF ELECTRONIC COMMERCE II-1
III. ORGANIZATIONAL ACTIVITIES III-1
A. Defense Information Systems Agency III-1
B. National Institute of Science and Technology III-1
C. General Services Administration III-2
D. Information Infrastructure Task Force III-3
E. National Information Infrastructure Testbed III-3
IV. BARRIERS TO IMPLEMENTING ELECTRONIC COMMERCE IV-1
A. Security IV-1
B. Standards IV-1
C. Training and Education IV-1
D. Cost IV-2
E. Performance Assessment IV-3
F. Fragmented Implementation IV-3
G. Regulatory and Statutory Issues IV-4
V. SUMMARY AND RECOMMENDATIONS V-1
A. Improving Small Business Access V-2
B. Coordinating DoD Requirements V-2
C. Implementing Strategy V-2

APPENDICES

A. CHRONOLOGY OF KEY EVENTS A-1
B. SELECTED BIBLIOGRAPHY B-1
C. LIST OF ACRONYMS C-1

I. INTRODUCTION

A. BACKGROUND

A strategic vision of the Clinton administration is to reinvent government so that it works better and costs less. More specifically, this initiative is intended to achieve the following goals: improve government service to the citizenry, increase the competitiveness of the US manufacturing base, improve health care and reduce health care costs, and implement electronic commerce. In March 1993, President Clinton directed Vice President Gore to lead an intensive 6-month study of the federal government, a study that has become known as the Naitonal Performance Review (see Appendix A, Chronology of Key Events).

As an outgrowth of the National Performance Review (NPR), the government is seeking to use information technology to develop and implement a National Information Infrastructure (NII), or Information Superhighway, that can facilitate achieving such goals as electronic commerce. Electronic Commerce (EC) is an initiative whereby the government would use information technology to reform the expansive federal acquisition process. The administration has made developing and implementing EC throughout the federal government a top priority. The President asserted personal leadership in this area by signing an executive memorandum, dated October 26, 1993, which set forth several broad goals: streamline the acquisition process, improve customer service, and lower costs. In addition, the executive memorandum specifies the following milestones:

- By March 1994, define the architecture for the governmentwide electronic commerce acquisition system.
- By September 1994, establish an initial electronic commerce capability in the federal government.
- By July 1995, expand the initial EC capabilities to include electronic payment, document interchange, and supporting databases.
- By January 1997, complete governmentwide implementation of EC to the maximum extent possible.

B. ELECTRONIC COMMERCE

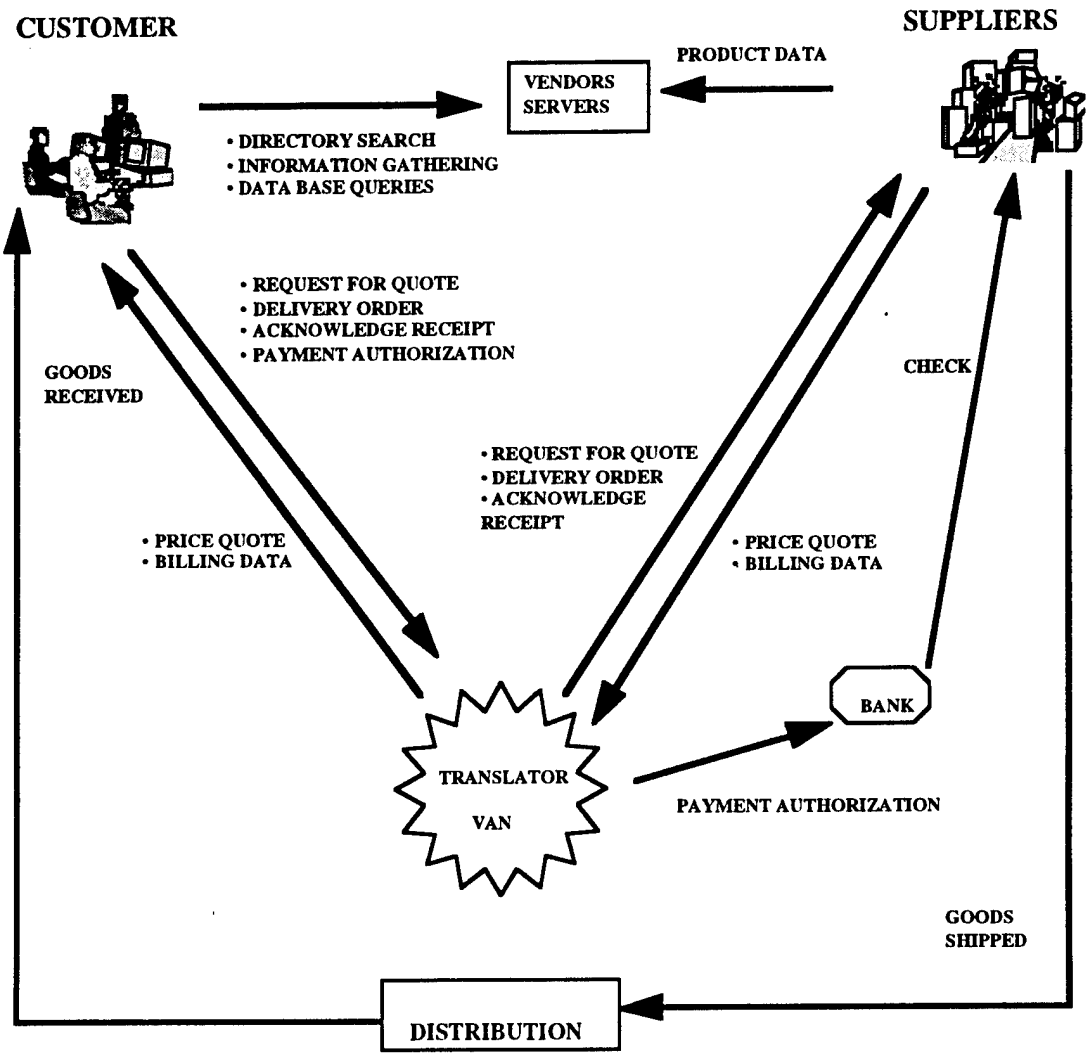
In its most basic form commerce is business activity or trade conducted under the laws, regulations, policies, processes, and procedures that constitute the business infrastructure. Electronic commerce is nothing more than conducting business via electronic means.

In today's market EC is carried out in a number of ways. Electronic messaging involves the use of some type of electronic format to send pertinent contract information between parties. And electronic bulletin boards have been around for several years. These systems lack security and normally stop short of payment authorizations. However, electronic bulletin boards allow the government to post small purchase order notifications, providing an opportunity for many small companies to have access to governmentwide requests for proposals. Electronic Commerce can also be conducted through Value Added Networks (VANs). VANs translate, store, and forward electronic transmissions between trading partners. Normally, trading partners will use VANs when they are not compatible with electronic data interchange (EDI), or have no EDI capability at all. Trading partners use EDI to communicate directly with each other. Since EDI techniques are a major focus of the federal government and the DoD initiatives, it is discussed in greater detail below.

Typical electronic commerce applications involve order entry and processing, invoicing, electronic payment, inventory management, cargo tracking, e-mail, electronic catalogs, and point-of-sale data gathering. An EC model developed by the Cross Industry Working Team (XIWT) consists of nine steps (Figure I-1): discovery; negotiating; ordering; billing; payment; distribution; receipt; customer service; and knowledge and information processing.

C. ELECTRONIC DATA INTERCHANGE

Electronic data interchange (EDI) is a technical implementation of electronic commerce that allows information systems to process business-type transactions electronically. EDI automates much of the paperwork common to most businesses by allowing companies to electronically exchange documents such as purchase orders, invoices, and bills of lading. Electronic payment systems close the loop by enabling companies to pay and be paid electronically, creating a new dimension to the concept of funds transfer.



Step 1 Discovery: Data base queries, directory searches, information gathering
Step 2 Information Processing: Determining product to buy and from which vendor
Step 3 Negotiation: Negotiating terms of contract (price, delivery date, etc...)
Step 4 Order: Placing delivery order
Step 5 Distribution: Shipping of goods from supplier to customer
Step 6 Receipt: Acknowledgment of receipt of goods by customer
Step 7 Billing: Submission of billing data by vendor
Step 8 Payment: Payment authorization by customer and remittance of funds by a bank
Step 9 Customer Service: Repair, troubleshooting, logistics support, etc... by vendor

Figure I-1. An Electronic Commerce Model

Electronic data interchange is the direct, computer-to-computer interchange of structured business documents in a standardized electronic format. The key to EDI is the adoption and implementation of standards developed under the auspices of the American National Standards Institute (ANSI) X12 Committee. One key initiative within DoD and the federal government is the development of standardized electronic forms that replace the paper copy formats.

The implementation of EDI serves many purposes. It eliminates keying of data by the receiving party, reduces cycle time in a competitive environment, provides increased procurement and inventory control, reduces personnel costs, and supports the replacement of paper with electronic documents. It may be most effective when used as an integral part of business process reengineering (BPR).

In EDI, the type of documents that will be used and how they will be exchanged is driven by the business and technical relationship of the trading partners. Each party must understand the data requirements of the other, how the data will be transmitted, and how the use of electronic data will affect the business process. To be EDI "enabled," a trading partner must have a communication link to the other partner, an application interface to the host application, and translation software to format outbound or inbound standard documents.

II. GOALS OF ELECTRONIC COMMERCE

One Clinton administration objective that has evolved from its National Performance Review is to create a national electronic marketplace that is secure, open, affordable, easy to access, and easy to use. By enabling widespread use of electronic commerce the administration hopes to streamline the federal acquisition process, improve the competitiveness of U.S. companies in general, and make electronic commerce a viable option even for small businesses. In this way all business transactions between government and industry could be conducted electronically. Thus key goals during the development of the National Information Infrastructure include the following:

- Streamline the procurement process
- Reduce procurement costs
- Standardize electronic formats
- Comply with the Paper Reduction Act
- Improve access for small businesses
- Identify policy and risk issues
- Maximize use of commercial EC/EDI products and practices

An advanced NII that supports electronic commerce applications can provide a number of benefits:

- Reduced costs to buyers from increased competition among suppliers and access providers
- Reduced errors, time, and overhead costs in information processing since it will no longer be necessary to re-enter data
- Reduced time to complete business transactions, particularly reduced time from delivery to payment
- New markets resulting from NII users' capability to easily and cheaply reach potential customers
- Reduced development time for new products

- Reduced inventories and a related reduction of risk of obsolete inventories as the demand for goods and services are electronically linked through just-in-time inventory and integrated manufacturing techniques

III. ORGANIZATIONAL ACTIVITIES

The government's vision of an advanced infrastructure for electronic commerce on a national basis cannot be realized until many technical, legal, security, financial, and regulatory barriers are resolved and technical standards for communications, information processing, and security are adopted. Numerous organizations have begun working to overcome these barriers and to develop and implement standards. This section highlights the EC-related activities of five diverse organizations—one from DoD, three from the federal government, and one from the private sector.

A. DEFENSE INFORMATION SYSTEMS AGENCY

The Defense Information Systems Agency (DISA) is the DoD organization responsible for information systems technology and is the central manager of major portions of the Defense Information Infrastructure (DII). DISA manages all phases of the information system life cycle in support of C4I requirements.

DoD has tasked DISA to develop the architecture and strategy for implementing the Defense Information Infrastructure (DII). This infrastructure, based on open standards and the employment of commercial off the shelf applications, will support the streamlining of the DoD acquisition process through the use of EC/EDI applications. The standardization of DoD processes via electronic commerce will effectively bring the DoD in-line with ongoing industry efforts.

DISA has established an EC/EDI Program to oversee the implementation of EC/EDI within the DoD and the integration of this service with other federal government agency capabilities. A major accomplishment of this office has been the establishment of a common EC/EDI infrastructure using existing DoD resources. That infrastructure consists of ANSI X12 standards for transaction sets, licensing agreements between the government and Value-Added Network (VAN) providers, and DoD Megacenter network entry points.

B. NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

The National Institute of Science and Technology (NIST) is an agency of the U.S. Department of Commerce. Its primary mission is to promote national economic growth by working with industry to develop and apply technology, measurements, and standards.

NIST has developed a smartcard which demonstrates the implementation of both the Data Encryption Standard (DES) and proposed Digital Signature Standard (DSS) in a device approximately the size of a credit card. The digital signature capabilities of the NIST smartcard represent a critical enabling technology for electronic commerce.

The Secure Messaging Support project is planned to demonstrate secure interpersonal messaging between users within government. This is a specific part of electronic commerce which seeks to use information technology and a support infrastructure to get messages securely from one person to another.

The Electronic Commerce Integration Facility (ECIF) has been established by NIST to assist in the removal of barriers that are currently preventing the transition from paper-based commerce to electronic commerce. The goals of the ECIF are to serve as a technology transfer center to assist government and industry in deploying electronic commerce applications and to conduct, in cooperation with industry, research, development, and testing of electronic commerce applications and infrastructure services.

C. GENERAL SERVICES ADMINISTRATION

The General Services Administration (GSA) is a central management agency of the federal government that sets federal policy in such areas as procurement, real property management, and information resources management.

Within GSA, Information Resource Management Services (IRMS) is engaged in several governmentwide electronic commerce initiatives which should have a major impact on the way federal agencies conduct business with the private sector. In response to the President's electronic commerce executive memorandum, IRMS is providing procurement, automated data processing, and telecommunications technical support to all federal agencies.

IRMS is also redesigning and implementing an automated procurement system for GSA that will include the automated preparation of a purchase requisition and the electronic transmission of a purchase order, either using EDI, e-mail, or fax. Once the order is completed the vendor will electronically transmit its invoice, which will be electronically matched with the purchase order and receiving report. The payment to the vendor will then be made through electronic fund transfer (EFT).

D. INFORMATION INFRASTRUCTURE TASK FORCE

In September 1993, the President convened the Information Infrastructure Task Force (IITF), an interagency entity, to articulate and implement the administration's vision for the National Information Infrastructure (NII). Chaired by the Secretary of Commerce, the task force consists of high-level representatives of the federal agencies that play a major role in developing and applying information and telecommunications technologies. Working together with the private sector, the IITF participating agencies are working towards developing comprehensive telecommunications and information policies that support the Clinton administration's strategy for the NII.

The role of the IITF is to forge interagency consensus on critical implementation and developmental issues. To accomplish this goal the IITF has formed three committees: the Committee on Information Policy, the Committee on Applications and Technology, and the Committee on Telecommunications Policy. In order to carry out its mission, the IITF and associated committees hold open forum meetings, submit reports for public comment and input, publish reports and work closely with the private sector.

The task force has undertaken a wide-ranging examination of all issues relevant to the timely development and growth of the NII. With regard to the electronic commerce initiative, the IITF Committee on Information Policy is developing proposals for protecting copyrights and other intellectual property rights in an electronic world, protecting personal data, and promoting dissemination of government data in electronic format.

E. NATIONAL INFORMATION INFRASTRUCTURE TESTBED

The National Information Infrastructure Testbed (NIIT) is an industry-led consortium established in September 1993 to bring together industry, government, and academia to collaborate, integrate technology, and share results on a series of real-world application projects. The primary mission of the NIIT is to create a new information infrastructure industry and to rapidly mainstream high performance distributed communications and computing technology for a set of market-driven applications.

A key feature of the NIIT is the prototyping of new applications through real-world testbed demonstrations. To date, the NIIT has run two application testbeds. One involved earth data science, which was recently demonstrated at the G-7 conference in Brussels in February 1995; the other involved telemedicine.

Currently the NIIT is in the process of establishing an application working group for electronic commerce. This working group has developed a draft charter, and is

working to develop a set of goals and objectives, as well as milestones for conducting an electronic commerce prototype demonstration. The NIIT electronic commerce working group considers EDI to be one way, but not the only way, to conduct electronic commerce. This working group has agreed to use the Cross Industry Working Team's (XIWT) electronic commerce model, discussed in Section I.B, as an initial starting point in building the EC prototype application.

IDA became a member of the NIIT in November 1994. An IDA representative attended the first two meetings of the electronic commerce working group and will participate in the working group, as time permits.

IV. BARRIERS TO IMPLEMENTING ELECTRONIC COMMERCE

A. SECURITY

The absence of security management and user authentication are two of the most challenging issues related to distributed networks and to applications running on these networks. Security management ensures that no one can tamper with, or intercept information transmitted on, the network. User authentication verifies the identities of parties on both sides of an electronic transaction. Customers on distributed networks are reluctant to exchange sensitive information, such as credit card numbers, bid amounts, and other private data over a non-secure network.

Government and industry most likely will not accept electronic commerce unless electronic transactions are secure. There are clear requirements for authenticating the source of a transaction, verifying the integrity of the transaction, preventing disclosure of the transaction to unauthorized users, and verifying receipt of the transaction by the intended trading partner.

B. STANDARDS

Standards are the technical documentation approved by appropriate national organizations that specify the structure for EC transaction sets, data elements, code sets, and interchange control. Standards provide the framework for how a specific EDI message will be formatted for transmission. Without standards EC applications will be developed in a proprietary environment that will lead to incompatibility between the applications themselves and between the public and private telecommunications networks.

C. TRAINING AND EDUCATION

Testbeds and pilot projects are revealing that it takes much longer than expected to position an entire organization to benefit from electronic information management and commerce. Reengineering paper-driven processes and convincing people to use the new systems regularly are slowing the pace of implementation.

Clearly, education and training can facilitate implementation, but their value is moot if organizations lack the significant resources required for electronic information management and commerce. The investment to convert information into a useful electronic format and to develop new methods to conduct paper-based processes electronically may be relatively modest for a large organization, but it can be a major barrier for smaller ones. Still, large organizations may be saddled with significant hardware, old software, and paper documents that do not meet the required electronic formats and standards. Organizations may not be able to afford to replace these systems and will be forced to adapt them to the new business processes and practices.

In addition to cost concerns, organizations face the resistance to change which is common in every sector. For electronic information management and electronic commerce, users are finding resistance both within their organizations and among customers and suppliers.

Electronic commerce does not automatically make a user's operation more efficient. In fact, life could be more difficult if the manual system runs alongside the EC system; the two will often conflict with each other. When implementing an EC system, it is essential to include EC as part of an organization's total plan for reengineering its business process.

D. COST

Many companies and government agencies are, or will be, using electronic commerce applications to facilitate internal operations and interactions with their trading partners. While a wide variety of transactions already occur electronically, the performance of electronic commerce applications usually requires highly structured, previously established arrangements and, for the most part, dedicated lines provided by Value-Added-Networks (VANs).

The common denominator of EC/EDI is what is called translation and mapping software. This software runs on computers within a given organization and its trading partners. In the past federal agencies have implemented EC/EDI through host-based, point-to-point solutions that linked trading partners via dedicated transmission links. These types of solutions are extremely costly, with high-end mainframe systems running as much as $130,000. These costs frequently create investment barriers and retard widespread use of electronic commerce applications by small- and medium-sized companies.

E. PERFORMANCE ASSESSMENT

When organizations conduct economic performance assessments to determine the viability of investing in NII applications, they often fail to understand or even consider the potential long-term advantages. The costs of designing and implementing a new information management system are usually fixed and easy to determine at the outset. The benefits, however, often accrue based on how much an organization uses the application, and how much it integrates those applications with new ways of doing work. Difficulty in measuring the benefits against the costs of new applications makes the initial investment harder to justify.

Organizations conducting a cost-benefit analysis of NII applications should consider more than monetary savings. Improved information management, better customer service, and employee efficiency are other spillover benefits, though difficult to measure. Excessive concern with immediate cost savings or short-term marginal efficiency gains may cripple an organization's potential for long-term benefits, causing it to forgo electronic commerce applications altogether, or to implement only some of the EC applications.

The following factors should be considered in an economic performance assessment for implementing an EC/EDI capability:

Benefit	Cost
Reduced Postage and Paper	Initial Capital Investment
Inventory Reductions	Maintenance
Better Utilization of Resources	Telecommunications
Lower Transaction Costs	Training
Possible Manpower Savings	Consultants
Reduced turnaround/processing time	Transition to EC

F. FRAGMENTED IMPLEMENTATION

Numerous government and private organizations are involved in developing and implementing a national electronic commerce capability. Federal government agencies are developing new policies and procedures, funding demonstrations and testbed projects, assisting in the development of standards, resolving regulatory and statutory issues, and

implementing the Clinton administration's vision of reinventing government. Industry is designing, building, and marketing new electronic commerce and electronic data interchange applications.

Opinions will vary on how well these activities are being coordinated, but better coordination among organizations is certainly warranted. Testbed and demonstration projects run by private organizations, such as the NIIT, are not officially connected with the Information Infrastructure Task Force (IITF), the body charged with implementing the administration's vision for a National Information Infrastructure. And the efforts of DoD, the IITF, and the NIIT are not officially coordinated with the efforts of the Industry Advisory Council, a group that is developing private sector positions on legislative, regulatory, and statutory issues with regard to information technology applications.

G. REGULATORY AND STATUTORY ISSUES

The current body of law, including the Uniform Commercial Code that governs many business transactions, was written prior to the development of EC. It makes no allowances for the electronic transmission and receipt of orders, payments, or contracts. A few States have acted on this issue and have ruled, for instance, that an electronic signature is valid. However, trading partners doing business through electronic commerce should prepare Trading Partner Agreements that define various responsibilities and liabilities for each party. More significantly, the federal government needs to update existing statutes in such areas as copyright law, licensing agreements, and royalties.

V. SUMMARY AND RECOMMENDATIONS

Numerous organizations will be impacted by the full implementation of the Clinton administration's electronic commerce initiative. Both federal agencies and vendors that conduct business with the federal government need to agree on data formats in order to successfully engage in EC. The government needs to develop policies on security, intellectual property rights, and privacy, and the private sector needs to develop applications that support these policies. In addition the private sector needs to develop EC/EDI tools and open systems that provide interoperable and secure applications.

Obviously, the issue is not whether the Department of Defense should adopt electronic commerce; the administration has mandated that the federal government will use electronic commerce in the acquisition process. The issue is *how* the DoD and the DISA will develop and implement an electronic commerce architecture.

Research on the NII revealed a multitude of public, government, academic, and private organizations which are engaged in activities related to electronic commerce. But just as important as the large amount of resources being expended to achieve the NII, it is critical that this effort be collaborative, cohesive, and synergistic to ensure attainment of NII's full potential to support electronic commerce.

A critical step in the successful implementation of the electronic commerce initiative is the identification of barriers that may hinder ubiquitous EC capability. When barriers have been identified, remedial courses of action should be developed and assigned to participating organizations for implementation.

With the multitude of organizations involved with the National Information Infrastructure and with the electronic commerce initiative, the three steps outlined above will not be simple to accomplish. The Institute for Defense Analyses, as an independent third party, can assist some of these organizations in identifying barriers to electronic commerce and in developing solutions to removing those barriers based on analytical studies.

The Institute for Defense Analyses can assist the Department of Defense and the Defense Information Systems Agency in the implementation of electronic commerce in several ways. Following are brief descriptions of potential roles for IDA.

A. IMPROVING SMALL BUSINESS ACCESS

One of the barriers to implementing a full-scale national electronic commerce capability is the limited access that small businesses have to an electronic commerce capability. Improving the access to electronic commerce for small businesses is one of the NPR objectives, as stated in the Department of Commerce document *Putting the National Information Infrastructure to Work.*

With the emphasis within the DoD to implement electronic commerce as an application provided by the services of EDI, there is a need to determine the economic impact of implementing this strategy for all companies doing business with the DoD. IDA could assist in this area by performing an economic benefit analysis and investigating alternative solutions for small businesses. Considering the percentage of US companies that have fewer than 100 employees, an economic analysis is essential for the Department of Defense as well as other federal Agencies.

B. COORDINATING DOD REQUIREMENTS

The private sector needs to develop information technology products that support the identified requirements of the DoD, the government, and the public sector. IDA, as a member of the NIIT consortium, could couple the efforts of the DISA and the DoD with that of the private sector. IDA can draft an electronic commerce testbed application which is of interest to DISA. This can be submitted to the NIIT for incorporation into one of it's prototype demonstrations. IDA could also review industry's status and evaluate specific EC/EDI products' ability to support DoD requirements.

C. IMPLEMENTING STRATEGY

The DoD and DISA strategy for implementing electronic commerce centers on the maximum use of commercial products and practices and the utilization of electronic data interchange and Value-Added Networks.

Based on the cost for an organization to implement EDI, or to obtain services from a VAN, not all companies want, or need, to be EDI compliant. Today in the private sector there is strong support for implementing an EC application via electronic messaging instead of EDI. In fact, one research group has predicted that electronic messaging will surpass EDI.

IDA can assist DISA by developing alternative solutions for implementing electronic commerce, not just for small businesses as discussed in Section A, but for

industry in general. As an active participant in the National Information Infrastructure Testbed Electronic Commerce Working Group, IDA can assist DISA in employing the best electronic commerce products and practices being developed by industry.

APPENDIX A

CHRONOLOGY OF KEY EVENTS

Appendix A
CHRONOLOGY OF KEY EVENTS

February 22, 1993	President Clinton's Administration issues report *Technology for America's Economic Growth* stating the development of a National Information Infrastructure is a top Administration priority.
March 3, 1993	President Clinton announces a 6-month review of the federal government to be led by Vice President Gore. This becomes known as the National Performance Review.
September 1993	The White House through the Office of Science and Technology Policy establishes the National Information Infrastructure Task Force (IITF). The IITF is to articulate and implement the Administration's vision for the NII.
September 1993	The National Information Infrastructure Testbed (NIIT), an industry led consortium, is formed. The mission of the NIIT is to create new jobs, new business opportunities, and spur the growth of a new information infrastructure industry, by accelerating the development of high performance computing and communications technology.
September 7, 1993	The Report of the National Performance Review *From Red Tape to Results: Creating a Government that Works Better & costs Less* is released.
September 15, 1993	President Clinton via Executive Order 12864 establishes within the Commerce Department the United States Advisory Council on the National Information Infrastructure. The Council shall advise the Secretary on matters related to the development of the NII.
September 15, 1993	The IITF report *The National Information Infrastructure: Agenda for Action* is released.
October 26, 1993	President Clinton's Executive Memorandum *Streamlining Procurement through Electronic Commerce* is released.
January 1994	The IITF report *What it Takes to Make it Happen: Key Issues for Applications of the National Information Infrastructure* is released.
May 1994	The IITF report *Putting the Information Infrastructure to Work* is released.
December 1994	A conference Report by the Council On Competitiveness *Breaking the Barriers to the National Information Infrastructure* is released.
March 1995	NIIAC report *common Ground: Fundamental Principles for the National Information Infrastructure* is released.

APPENDIX B

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Appendix B
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APPENDIX C

LIST OF ACRONYMS

Appendix C
LIST OF ACRONYMS

ANSI	American National Standards Institute
BPR	Business Process Re-engineering
DES	Digital Encryption Standard
DII	Defense Information Infrastructure
DISA	Defense Information Systems Agency
DoD	Department of Defense
DSS	Digital Signature Standard
EC	Electronic Commerce
ECIF	Electronic Commerce Integration Facility
EDI	Electronic Data Interchange
EFT	Electronic Fund Transfer
GSA	General Services Administration
IITF	Information Infrastructure Task Force
IRMS	Information Resource Management Services
NII	National Information Infrastructure
NIIT	National Information Infrastructure Testbed
NIST	National Institute of Science and Technology
NPR	National Performance Review
NSTAC	National Security Telecommunications Advisory Committee
VAN	Value Added Network
XIWT	Cross Industry Working Team

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13. ABSTRACT ***(Maximum 200 words)***

This study of the National Information Infrastructure (NII) was conducted as part of IDA's Central Research Program. Electronic commerce is one of seven key initiatives that the National Performance Review (NPR) believes can be impacted through the implementation of advanced information technology. In its most basic form commerce is the laws, regulations, policies, processes, and procedures that constitute the way we conduct business. Electronic commerce is nothing more than conducting business via electronic means. An outgrowth of the NPR, the electronic commerce initiative, commits the government to using information technology to reform the federal government's expansive acquisition process. Numerous agencies within the government, private, and public sectors are committed to implementing electronic commerce throughout the United States. The objective of this paper is to enhance IDA's understanding of the activities, organizations, and issues related to the implementation of electronic commerce, as part of the NII.

14. SUBJECT TERMS
electronic commerce, EC, electronic data interchange, EDI, information technology, National Information Infrastructure, NII, National Performance Review, NPR

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