



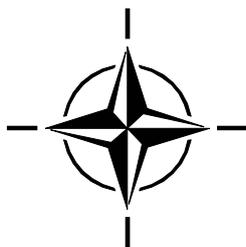
RTO TECHNICAL REPORT

TR-IST-030

Information Management over Disadvantaged Grids

(Gestion des informations sur des
maillages désavantagés)

Final Report of the RTO Information Systems Technology
Panel Task Group IST-030/RTG-012.



Published December 2007





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- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

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List of Acronyms

ACK	Acknowledgement
ARDS ADM	Artillery Regimental Data System Advanced Development Model
ARM	ATCCIS Replication Mechanism
ATCCIS	Army Tactical Command and Control Information System
BER	Bit-Error Rate
C2	Command and Control
C2IEDM	Command and Control Information Exchange Data Model
C2IS	Command and Control Information System
CCM	CORBA Component Model
CORBA	Common Object Request Broker Architecture
CSMA/CA	Collision Sense Multiple Access / Collision Avoidance
DACCIS	Danish Army Command and Control Information System
DBMS	Database management system
DC	District of Columbia
DCE	Distributed Computing Environment
DCOM	Distributed Component Object Model
DP	Data Provider
DR	Data Receiver
DRDC	Defence Research and Development Canada
FEC	Forward error correction
FGAN	Forschungsgesellschaft für Angewandte Naturwissenschaften
FhG	Fraunhofer-Gesellschaft
FKIE	Forschungsinstitut für Kommunikation, Informationsverarbeitung und Ergonomie
FOKUS	Fraunhofer Institut Offene Kommunikationssysteme
GPS	Global Positioning System
HQ	Headquarters
HTML	Hyper Text Markup Language
IEEE	Institute of Electrical and Electronics Engineers
IM	Information Management
IP	Internet Protocol
ISO	International Standards Organization
IST	Information Systems Technology
JMS	Java Message Service
JTRS	Joint Tactical Radio System
JXTA	Juxtapose
Kbps	Kilobits per second
LAN	Local Area Network
LBTB	Low Bandwidth Test Bed

LC2IEDM	Land Command and Control Information Exchange Data Model
LOS	Line of sight
MAC	Media Access Control
MANET	Mobile Ad Hoc Network
Mbps	Megabits per second
MIP	Multilateral Interoperability Programme
MTIR	MIP Tactical C2IS Interoperability Requirement
MTU	Maximum Transmission Unit
MVD	Majority Vote Detect
NATO	North Atlantic Treaty OrganiSation
NSA	National Security Agency
ODB	Operational Database
OFDM	Orthogonal Frequency Division Multiplexing
OGSA	Open Grid Services Architecture
OMG	Object Management Group
OSF	Open Software Foundation
OSI	Open Systems Interconnection
OWG	Operational Working Group
P2P	Peer to Peer
P2PS	Peer-to-Peer System
PDU	Protocol Data Unit
PfP	Partners for Peace
QoS	Quality of Service
RM	Replication mechanism
RMI	Remote Method Invocation
RTCORBA	Real-Time CORBA
RTG	Research Task Group
RTL	Replication Transport Layer
RTO	Research and Technology Organisation
SGML	Standard Generalized Markup Language
SINCGARS	Single Channel Ground and Airborne Radio System
SIP	Session Initiation Protocol
STN	Simulated Tactical Node
TCP	Transport Control Protocol
TD	Technology Demonstration
TNO	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek
UDP	User Datagram Protocol
UHF	Ultra High Frequency
VHF	Very High Frequency
WANODE	Wide Area Network for Operational Data Exchange
XML	Extensible Markup Language
zlib	Name of open-source lossless data compression algorithm

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- Military Institute of Technology, Warsaw, Poland;
- DRDC Valcartier, Québec City, Canada;
- FGAN/FKIE, Wachtberg, Germany; and
- Naval Research Laboratory, Washington, DC, USA.

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The Task Group hopes that its study has served to make a contribution to the understanding of a complex but under-appreciated problem of importance to all NATO forces, namely managing data flow over disadvantaged tactical wireless communications networks in a way that takes into account network state, battlefield state and operational importance of the data being transmitted.

Allan Gibb, Ph. D.
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February 2007

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Command and control	Information management	Radio communication	
Computer networks	Information systems	Radio links	
Cross-layering	Integrated systems	Requirements	
Data links	Low bandwidth	Tactical communications	
Data replication	Managed information exchange	Tactical radio	
Data transmission	Military communication	Wireless network	
Disadvantaged grid			
14. Abstract			
<p>This report summarizes a four-year study carried out by NATO RTG-012/IST-030 Research Task Group on the problem of "Information Management over Disadvantaged Grids". Such disadvantaged grids (e.g., tactical ad hoc military radio networks) are characterized by low bandwidth, variable throughput, unreliable connectivity, and energy constraints imposed by the wireless communications grid that links the nodes. The scope of this study was limited to land-based digital data exchange below brigade level where all nodes are mobile and the exchange medium is combat net radio. Managed information exchange in this communications environment was analyzed from three different perspectives within a system architecture: the application level, the middleware level and the network level. Due to the highly variable quality of the tactical communications channels and the unpredictable nature of the tactical battlefield, it was concluded that dynamic adaptation to rapid changes in either the communications or battlefield environment, without user intervention, was key to achieving optimum information exchange. This report identifies functional and performance objectives for the application, middleware and network levels that enable the levels to cooperate to detect and adapt to those changing environments in a way that will enhance delivery of data of highest operational importance.</p>			





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