MOTOROLA

DNP Plus

Integrated MDLC and DNP 3.0
System Solution

Motorola has added the DNP 3.0 protocol option to it's MOSCAD family of Supervisory Control and Data Acquisition (SCADA) products. Availability of these options allows customers to use integrated systems with MOSCAD Remote Terminal Units (RTUs) side-by-side with other vendors' DNP 3.0 capable RTUs and Intelligent Electronic Devices (IEDs). Customers, Consultants, and System integrators may continue choosing the MOSCAD RTUs, knowing that it complies with the high level of quality and performance that has been consistently demonstrated in all Motorola products and systems.

Background   The origins of the DNP 3.0 (Distributed Network Protocol) are rooted in the preliminary work performed by the International Electrotechnical Commission (IEC). This working group defined the IEC-870-5 protocol for open inter-operability between RTUs, IEDs, and Master Control Centers (MCC), primarily for the electric utility industry.

The DNP 3.0 protocol was initiated by the Harris Corporation in parallel, to development of the IEC 870-5 protocol. In 1993, following the introduction of the DNP 3.0, Harris established the DNP User Group and transferred them the DNP 3.0 protocol details for further development and market introduction.

Protocols that directly compete with the DNP 3.0 are: Utility Communications Architecture (UCA) lead by the USA Electric Power Research Institute (EPRI), and various derivations from the IEC 870-5 suit, which are supported by European SCADA vendors.

MDLC   Motorola promotes for SCADA applications the ISO 7498 based seven layers Motorola Data Link Communications (MDLC) protocol since 1991. However we learned, that customers and consultants might refrain from specifying a protocol that is supplied by a single vendor, no matter how good and suitable that protocol is.

However we felt that by offering the standard DNP 3.0 protocol, the MOSCAD might become a "me-too" type device, "stripped" from all its unique technical features that makes the MOSCAD the best-in-class RTU. This would be an unfortunate loss for many users.

DNP Plus

The DNP Plus enhances the standard DNP 3.0 protocol, with a set of features that are currently included only as a part of the MDLC protocol. Some of these features are: remote diagnostics of RTUs, efficient time synchronization, remote monitoring of applications, upload and download of updated parameters, etc.

As the DNP 3.0 protocol currently defines only the RS-232 and RS-485 type physical layers, this protocol is applicable only for lines and Multiple Address System **(MAS)** type radio.

MOSCAD RTUs in a DNP 3.0 System

This example involves MOSCAD RTUs operating in a DNP 3.0 system. The MOSCAD CPU is loaded with the DNP Slave software, which allows communicating DNP 3.0 type messages.

In order to apply the DNP Plus concept, the MOSCAD ToolBox can be connected to any of the MOSCAD CPUs (or a dedicated RF Modem), and communicate with all other MOSCAD RTUs. The MOSCAD RTUs will utilize the MDLC protocol while communicating with the ToolBox or other MOSCAD RTUs, and talk DNP 3.0 protocol while communicating with the MCC. Both the MDLC and DNP 3.0 protocols go transparently through the MAS Master. See Figure 1.
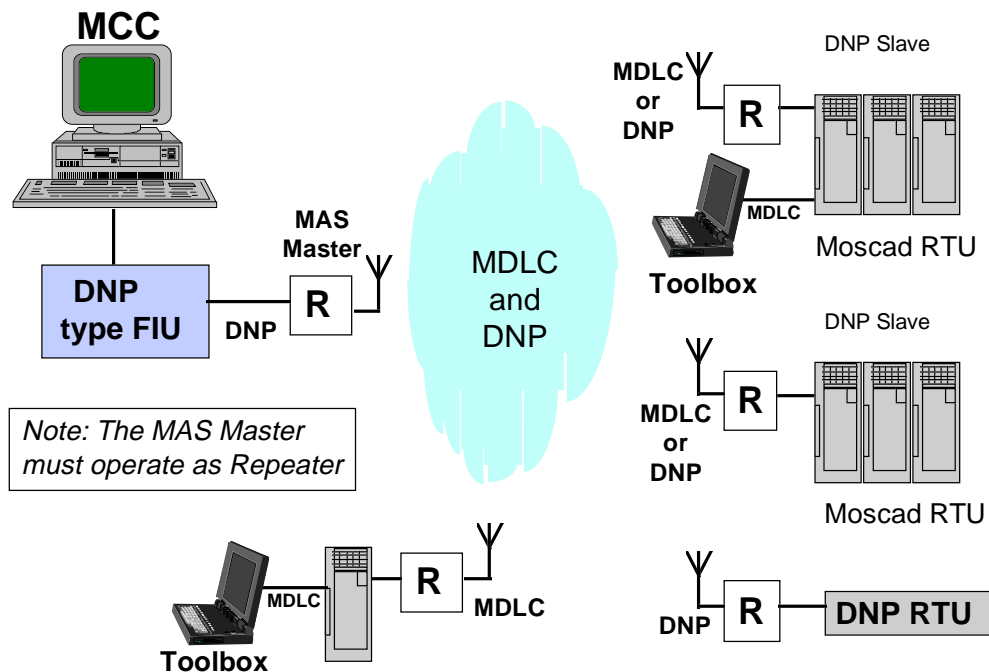

Figure 1. Implementation of the DNP-Plus concept using MAS radios.

Note: In a MAS type systems (UHF and 900 MHz), there is no <u>direct Slave-to-Slave</u> (RTU-to-RTU) link, and all communications must go via the MAS Master, that must be configured as a repeater.

DNP 3.0 units in a MOSCAD System

This configuration shows an expansion of a MOSCAD based system with DNP 3.0 type RTUs or IEDs using a MODBUS or TCP/IP based MCC. The programming ToolBox, can be connected to the MOSCAD FIU, TCP/IP Gateway or to any MOSCAD RTU in the network. The MOSCAD FIU sends and receives MDLC type messages while talking with MOSCAD RTUs, and via the same port (MAS radio), it communicates DNP 3.0 type messages while talking with DNP capable devices linked to the network. See Figure 2.

The same figure shows a MOSCAD CPU loaded with "DNP Master", which is connected via RS-485 port to MOSCAD RTUs and DNP 3.0 capable RTUs or IEDs. Communication between that MOSCAD CPU and DNP capable devices may use only the DNP 3.0 protocol.

Communication with MOSCAD RTUs linked to the same RS-485 port may use both the MDLC and the DNP 3.0 protocols. In case a MOSCAD RTU must communicate using the DNP 3.0 protocol (for whatever reason), needs to be loaded with "DNP Slave" software.
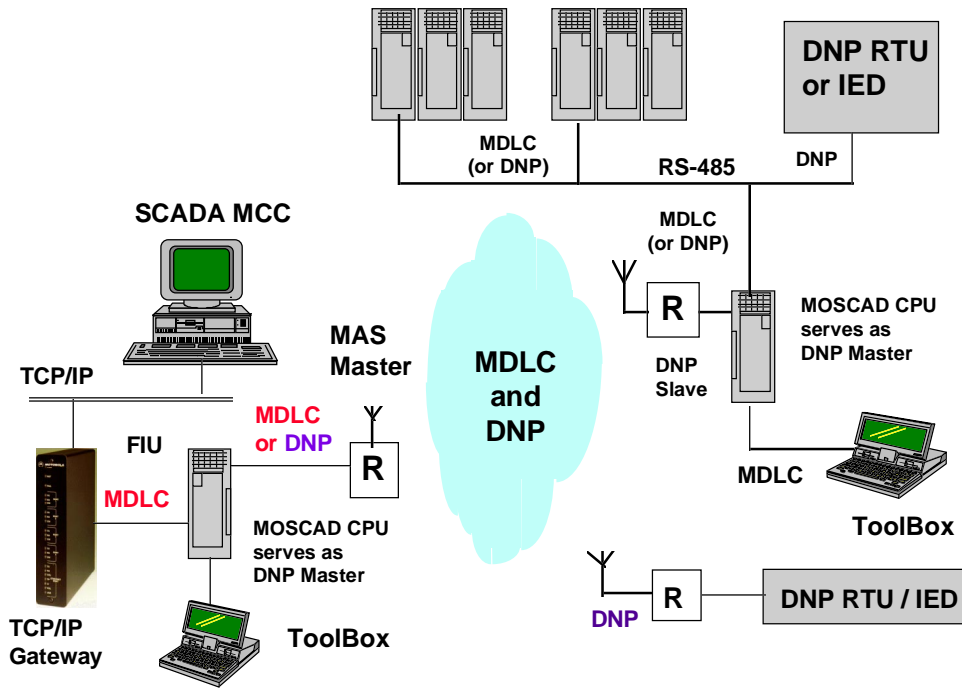

Figure 3. DNP capable RTUs in MOSCAD Environment

Note: The MOSCAD RTU equipped with the "DNP Master Driver" performs S&F function (Routing) via the RS-485 port to other MOSCAD RTUs using the MDLC protocol. During communication with the DNP type RTUs / IEDs, that MOSCAD CPU performs message forwarding by its application program using the same port.

System Expansion	Integration of MOSCAD RTUs into DNP 3.0 based systems, allows expanding MAS networks with a voice-grade RF network. Here the MOSCAD CPU serve as a node for connecting the MAS network (for the MDLC or DNP 3.0 devices) with RTUs using the MDLC protocol.
	These MDLC capable RTUs may operate over a Conventional or Trunked RF network, normally serving voice users. Expansion of a system with conventional radio, requires no special infrastructure, and the same frequency can be re-used for multiple RTUs.
Data Collision Avoidance	As for any pair of RTUs using RF or RS-485 communication (regardless of the protocol), a collision can occur if two stations start transmitting data exactly at the same moment. When a collision occurs, the communications immunity depends on the ability of RTUs and the data protocol to cope with such conditions. The MOSCAD is designed to cope with such situations.
Summary	Introduction of the DNP Plus solution by Motorola represents a winning situation for all parties involved in a SCADA project: Consultants, Customers and Motorola.

a) Consultants can now specify the MOSCAD RTU and the MDLC protocol knowing that same RTU may also communicate using the industry accepted DNP 3.0 protocol.

b) If required, customers can expand their MDLC based system, with DNP 3.0 capable devices supplied by other vendors. In such cases the system can use either a DNP 3.0 protocol, or it may use both the MDLC and the DNP 3.0 protocols.

c) MOSCAD RTUs can be used as an expansion to an already installed DNP 3.0 based system, using MAS type communications. Here the customer will benefit from availability of the MDLC features for those sites that use the MOSCAD platform.

For more information contact the Motorola regional sales office in your region:

North America:	**Europe:**	**Latin America:**	**Asia & Pacific:**
Tel: +1-847-576-5193	Tel: +441-256-484-341	Tel: +954-928-2099	Tel: +8522-966-4368
Fax: +1-847-576-0543	Fax: +441-256-330-296	Fax: +954-928-2013	Fax: +8522-966-4388
ymct05@ email.mot.com	bcms94@ email.mot.com	c15665@ email.mot.com	bcms87x@ email.mot.com

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Web site:
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