# RDMAP and DDP Overview
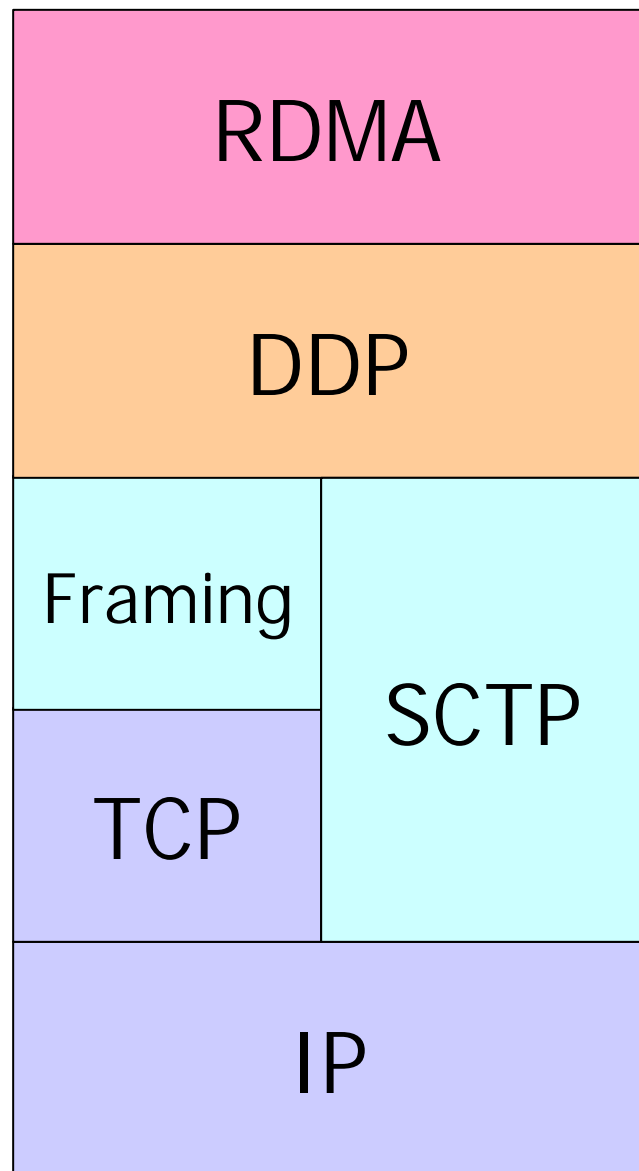
Renato Recio

# Introduction
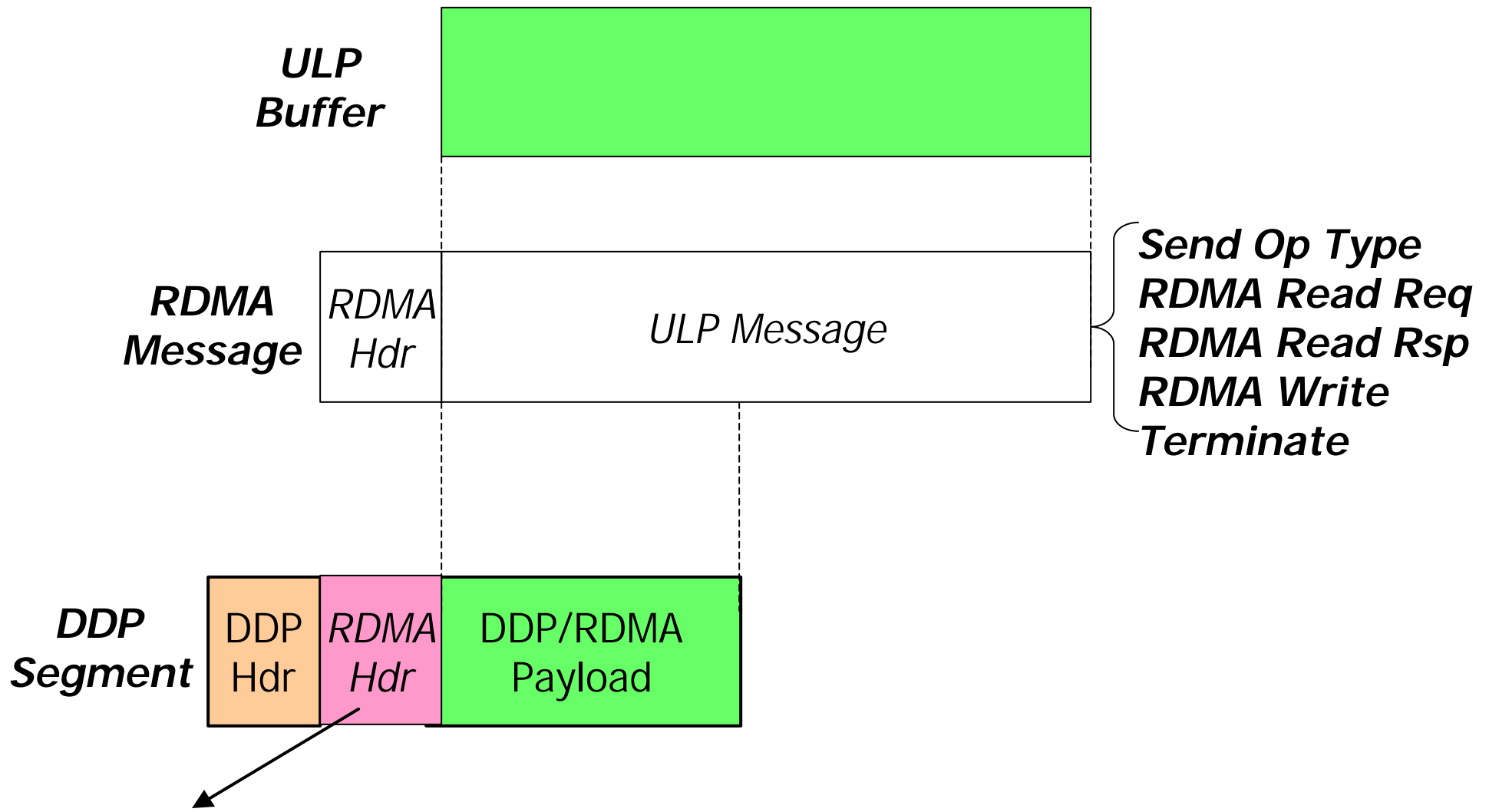
- Direct Data Placement – A mechanism whereby ULP data contained within DDP Segments may be Placed directly into its final destination in memory without ULP processing, even when the DDP Segments arrive out of order.

- DDP – A wire protocol that supports Direct Data Placement by associating explicit memory buffer placement information with the LLP payload units.
  - Alone, supports write only.

- Remote Direct Memory Access – A method of accessing memory on a remote system in which the local system specifies the remote location of the data to be transferred.
  - Supports, read and write.

- RDMAP – A wire protocol that supports RDMA Operations to transfer ULP data between a Local Peer and the Remote Peer.

# Layering Overview

RDMA

DDP

Framing

SCTP

TCP

IP

- RDMA – Converts RDMA Write, RDMA Read, and Sends into a DDP Message(s).

- DDP – Segments outbound DDP Messages into 1 or more DDP Segments; reassembles 1 or more DDP Segments into a DDP Message.

- DDP places a set of requirements on the transport, which include:
  - Reliable delivery
  - Preservation of DDP Segment and Message boundaries
  - Strong digest
  - May provide data out of order, but must specify the sender specified order.
  - Length of incoming DDP Segments

# RDMA/DDP Header Format
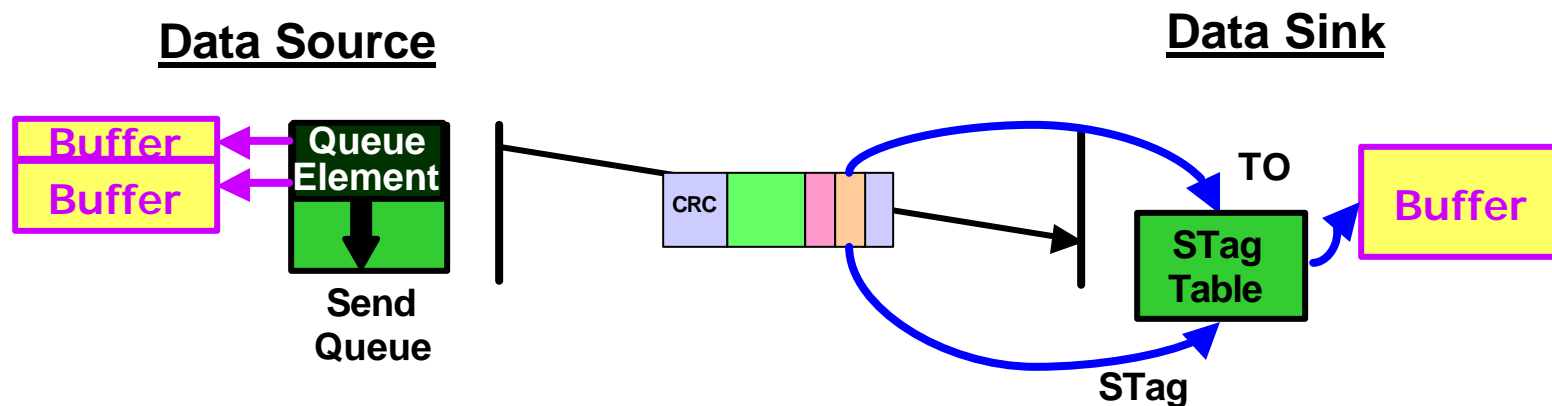


**ULP Buffer**

**RDMA Message** | RDMA Hdr | ULP Message

Send Op Type
RDMA Read Req
RDMA Read Rsp
RDMA Write
Terminate

**DDP Segment** | DDP Hdr | RDMA Hdr | DDP/RDMA Payload

*Note: The RDMA header is not needed for all RDMA Messages.*

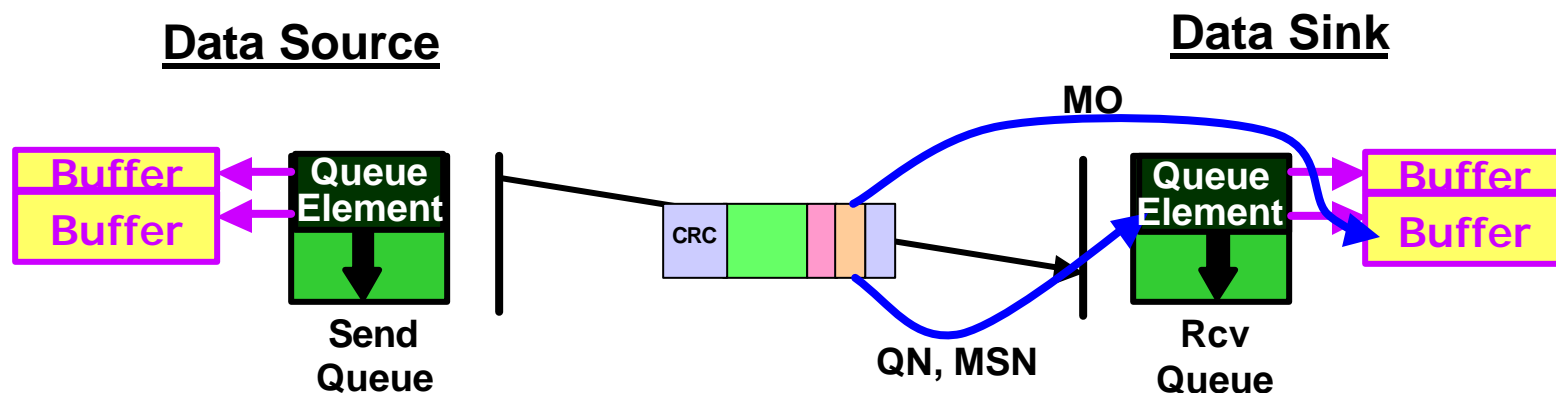# DDP Overview

- DDP supports two data transfer models:
  - Tagged Buffer data transfer model
    - Data Sink advertises an identifier (STag) for the ULP buffer.
    - Data Source specifies STag and Tagged Offset (TO) to transfer data to a portion of the Tagged Buffer.
    - Allows multiple DDP Messages targeted to a Tagged Buffer with a single buffer advertisement.



**Data Source**

Buffer
Buffer
Queue Element
Send Queue

CRC

**Data Sink**

TO
STag Table
Buffer
STag

# DDP Overview (Continued)

◆ Untagged Buffer data transfer model

　★ Enables data transfer without requiring buffer advertisement.

　★ Receiver can queue up a series of ULP buffers to specify the order in which the buffers will be consumed.

　★ Each Untagged DDP Message from the Data Source consumes an Untagged Buffer at the Data Sink

　★ Requires associating a receive ULP buffer for each DDP Message

　　▲ If an Untagged DDP Message arrives without an associated Untagged Buffer, the DDP Message is dropped and DDP Stream is terminated .
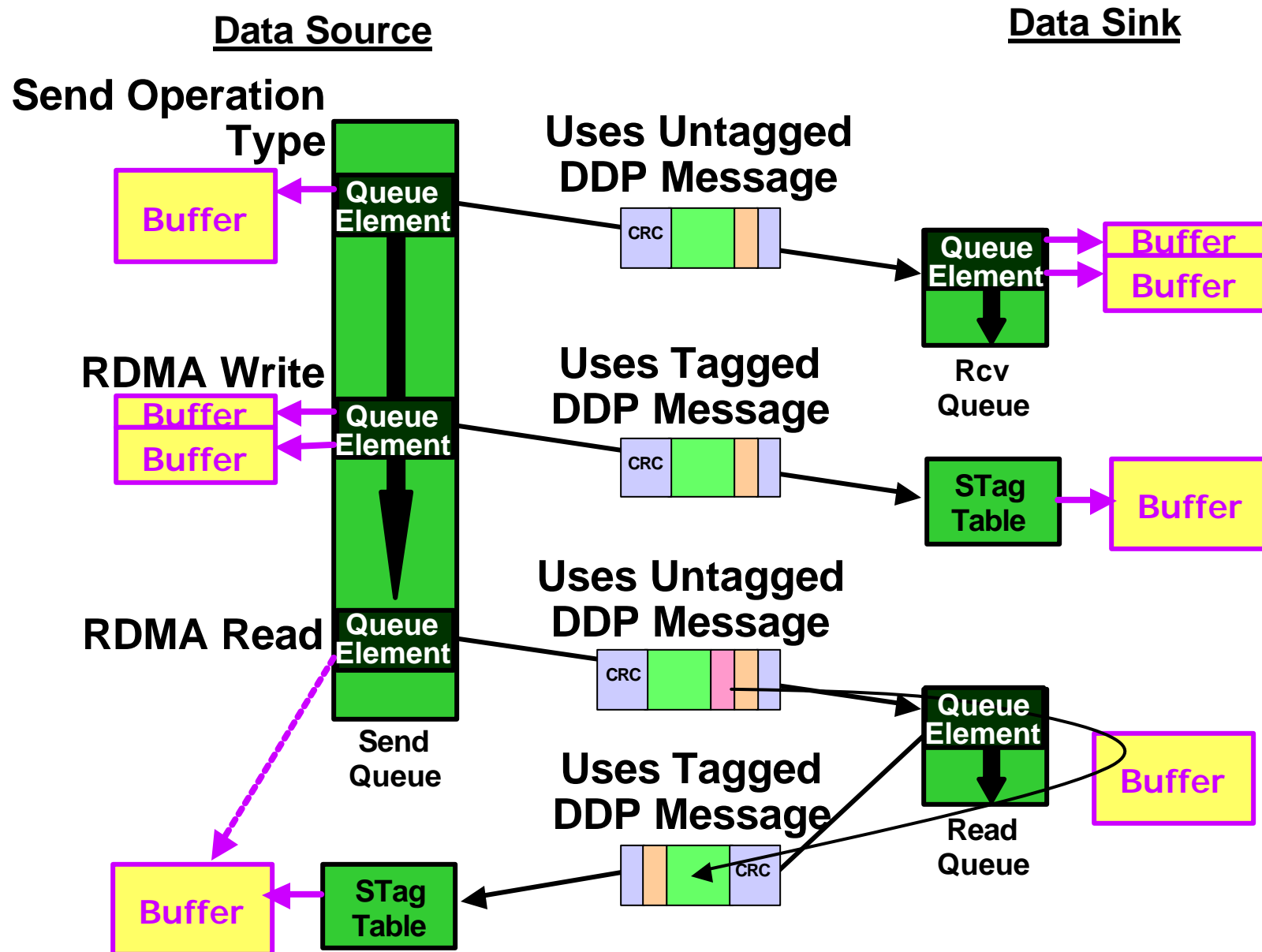
**Data Source**　　　　　　　　　　　　　　　　　**Data Sink**

MO

| Buffer |
| Buffer |

Queue Element

**Send Queue**

CRC

QN, MSN

Queue Element

**Rcv Queue**

| Buffer |
| Buffer |

# RDMAP Function

■RDMAP enables receive side, data copy removal through the use of the following operations:

  ◆Send Operation Type – Transfers data from a local buffer to a remote buffer that has not been explicitly advertised.

  ◆RDMA Write – Transfers data from a local buffer to a remote buffer that has been explicitly advertised.

  ◆RDMA Read – Retrieves data from a remote buffer that has been explicitly advertised and places it into a local buffer.

  For each of the above, the data transfer length can be up to $2^{32} - 1$ octets.

■RDMAP also provides a Terminate operation that transfers information associated with a local error.

# RDMA Data Transfer Mechanisms



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11/22/2002

# Documents

- RDMA:
  - draft-recio-iwarp-rdma-01.txt

- DDP
  - draft-shah-iwarp-ddp-01.txt