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Network Controller-Sideband Interface (NC-SI)

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Abstract

- In out-of-band management environments, the interface between the out-of-band Management Controller (MC) and the Network Controller (NC) is critical. In many implementations, it is desirable to accomplish the out-of-band network connection using a standalone network controller device. Proprietary solutions exist, but they are not interoperable across vendors. The Network Controller - Sideband Interface (NC-SI) specification defines a standardized interface that enables a network controller to provide network access for a Management Controller, while allowing the network controller to simultaneously and transparently provide network access for the host system. This talk provides a technical overview of the NC-SI architecture, operation, and physical transport.
- Thursday, 12/6, 11:40-12:30



Agenda

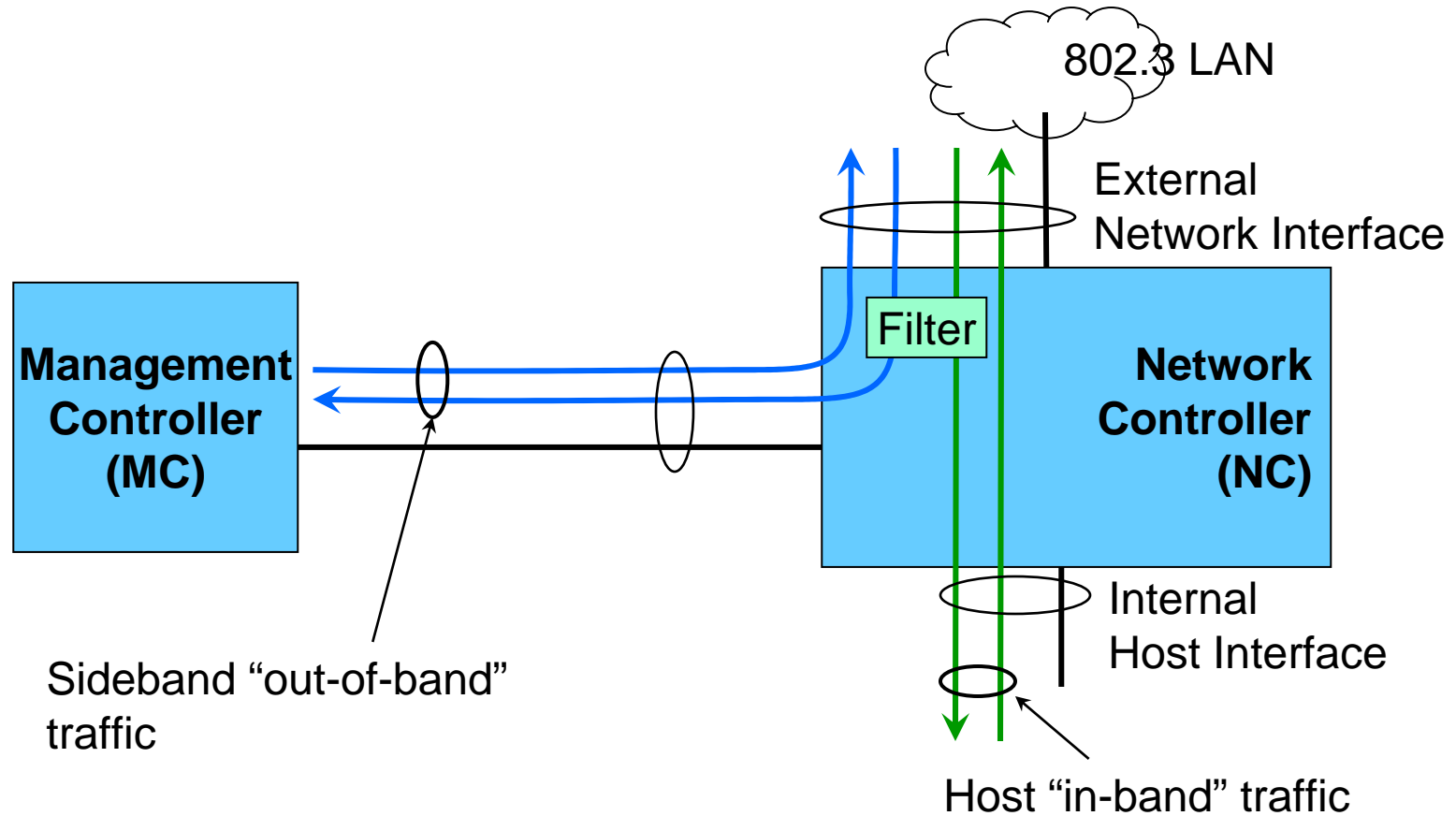
- NC-SI Intro
- NC-SI Architecture
- NC-SI Addressing & Protocol
- Summary

Network Controller - Sideband Interface

- Defines protocols and electrical specifications for a common, RMI-based, sideband interface between a management controller and an 802.3 LAN via one or more external network controllers.
- DMTF Specification DSP0222
 - 1.0 preliminary
 - published June 2007 by the subteam of the Pre-OS Working Group

NC-SI Intro

Sideband Interface





NC-SI Intro

Why NC-SI

- Sideband interfaces existed, but were not interoperable across vendors
- NC-SI defines a common sideband interface for interconnecting management controllers and network controllers from different vendors



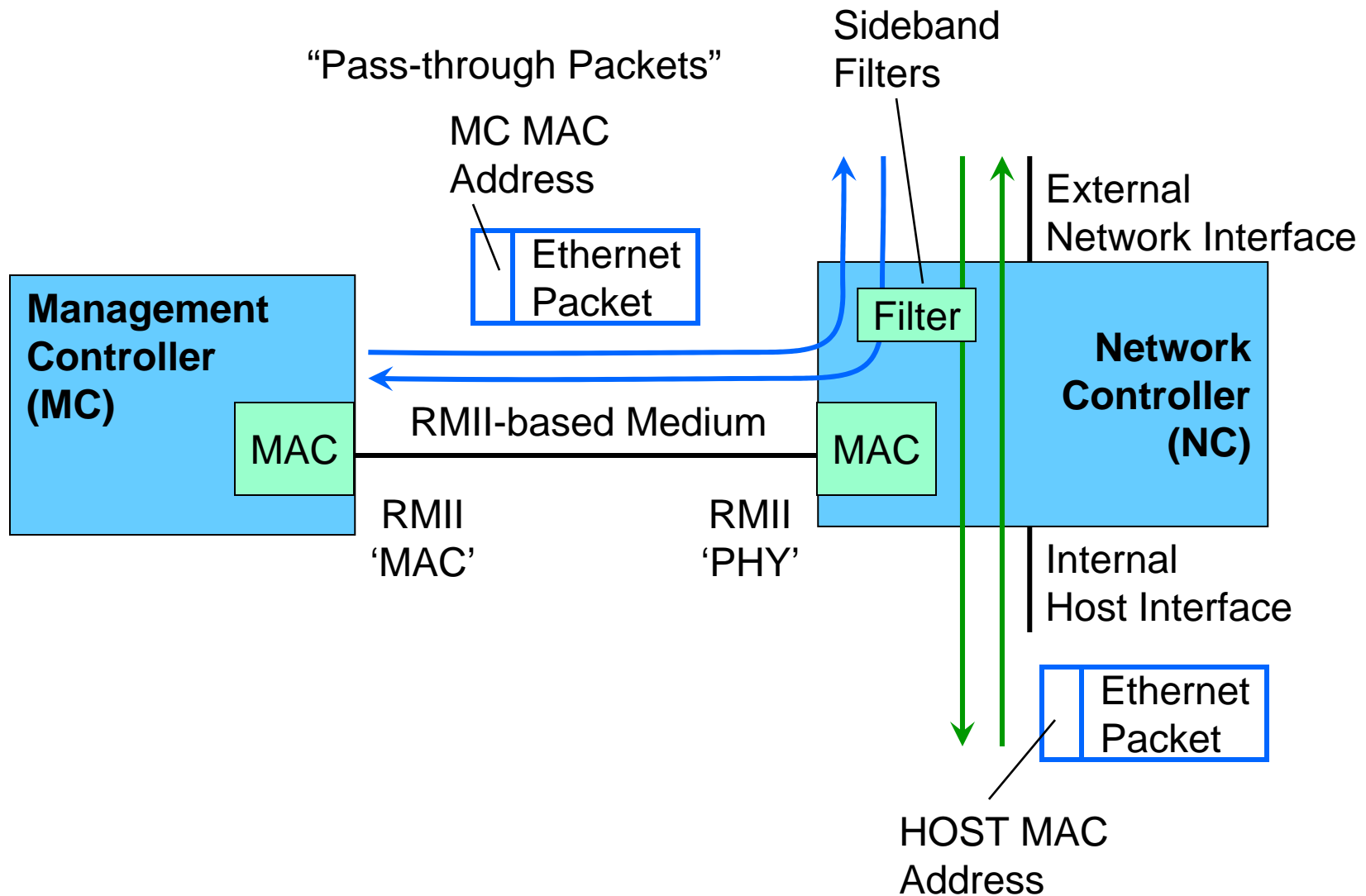
NC-SI Architecture

RMII-based Transport

- RMII - Reduced Media Independent Interconnect
 - 7 signal “MAC to PHY” interface
 - plus optional 8th receive error signal
 - From signal direction p.o.v. the Management Controller is the ‘MAC’ and Network Controller the ‘PHY’
 - Available in 3rd party microcontrollers
 - Takes advantage of integrated MAC hardware
 - Supports full-duplex transfers at 100 Mbps max
 - Meets basic performance requirements for video and media redirection
- NC-SI refines and extends RMII electrical and timing specifications to improve interoperability and support multi-drop

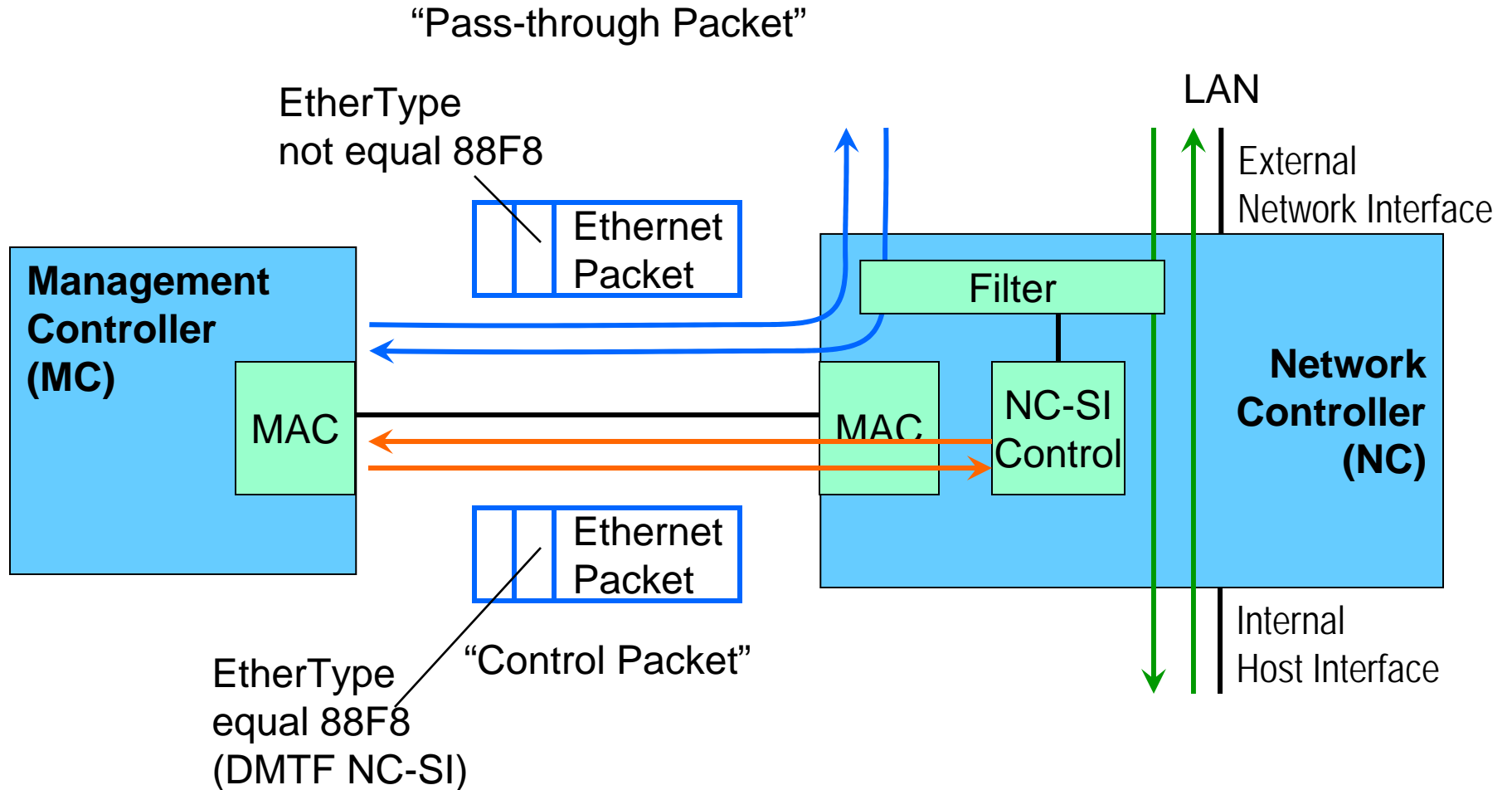
NC-SI Architecture

Basic Pass-through routing



NC-SI Architecture

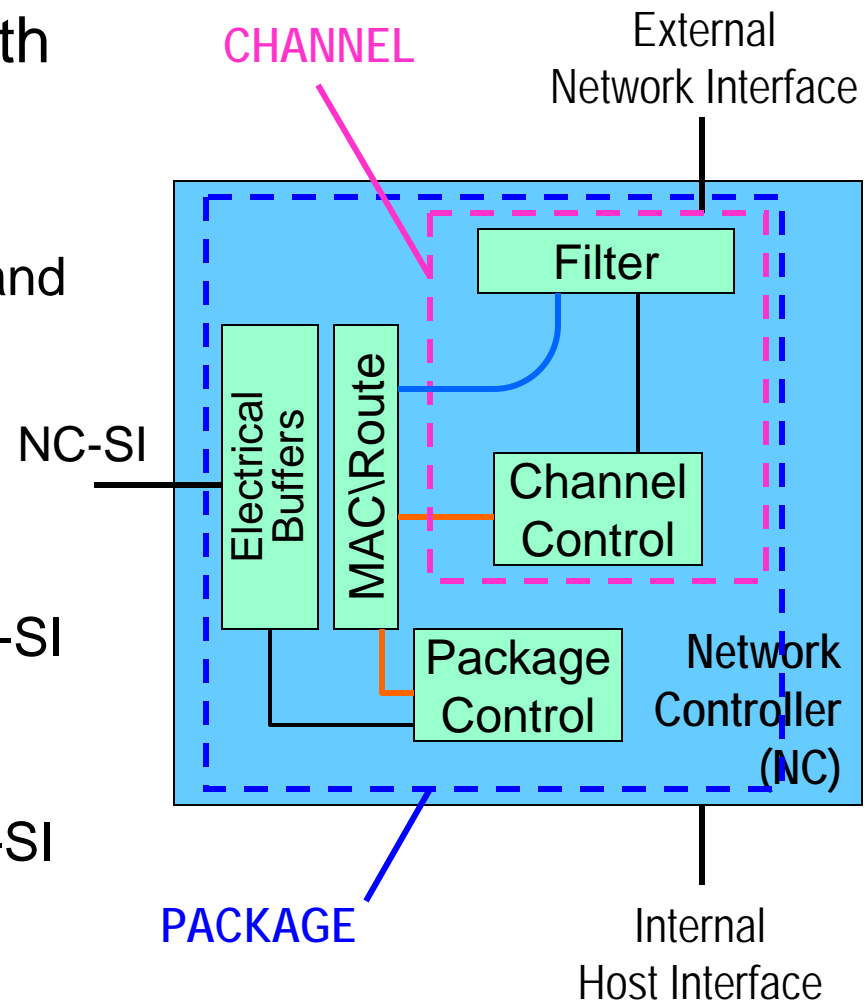
Control Packets



NC-SI Architecture

Channels & Packages

- Channel: A pass-through path between the management controller and the LAN
 - and associated configuration and control functions
- Package:
 - the set of NC-SI functions in a network controller that are accessed through a single NC-SI connection.
 - A package is a domain for electrical buffer control on NC-SI and for Channel addressing

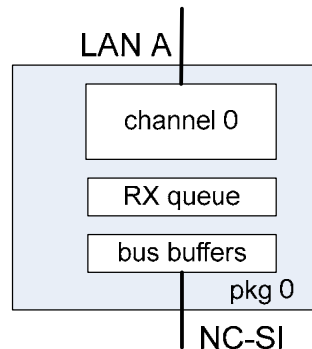


NC-SI Architecture

Channel & Package Implementations

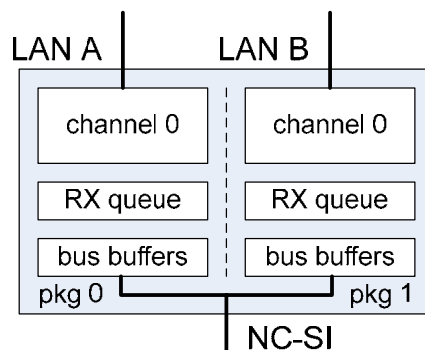
SINGLE

S : Single Package, Single Channel

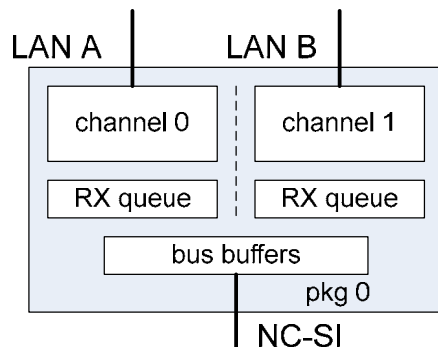


INTEGRATED

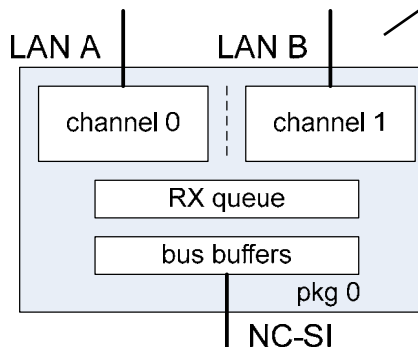
A : Multiple Logical Packages, Separate bus buffers



B : Single Package, Common bus buffers, Separate Rx Queues



C : Single Package, Common bus buffers, Shared Rx Queue



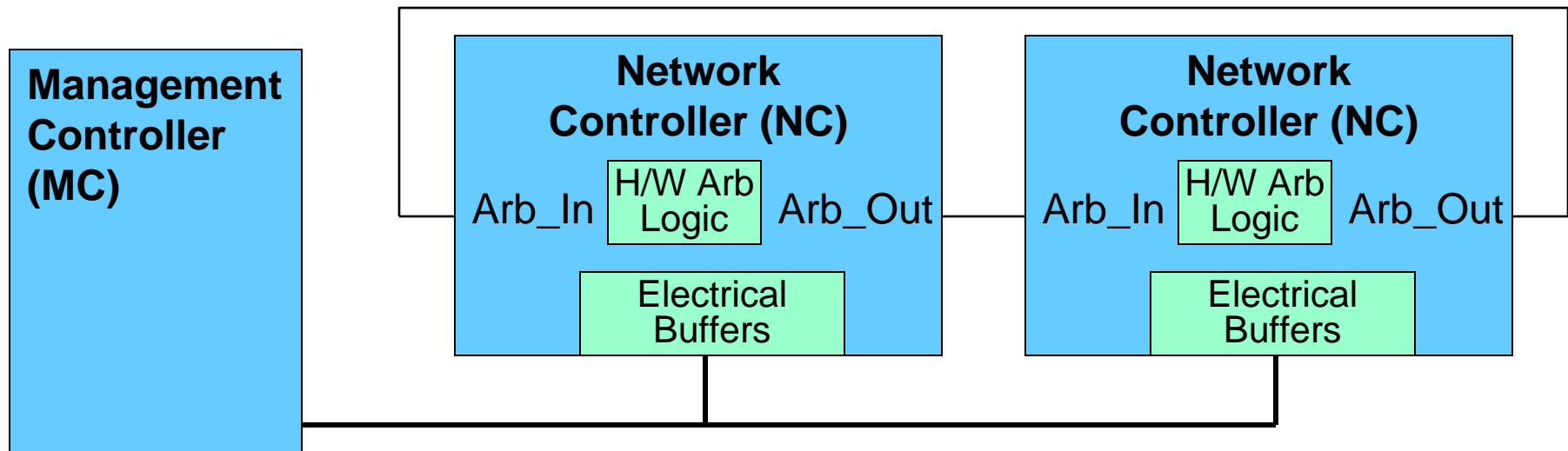
An NC-SI Package can contain more than one channel.

A physical device may include more than one NC-SI Package

Channels within a package may share Receive (RX) buffers

NC-SI Architecture

Multi-drop



- NC-SI defines commands and electrical behaviors to enable more than one NC to reside on the bus' RX lines without conflict
- Additional hardware arbitration signals and state machine can be implemented to improve performance when enabling simultaneous (interleaved) reception from more than one Network Connection
 - Uses a circulating “Op-code” in a token-passing ring arrangement
- All network controllers on the bus simultaneously receive all outgoing pass-through and control packets from the MC



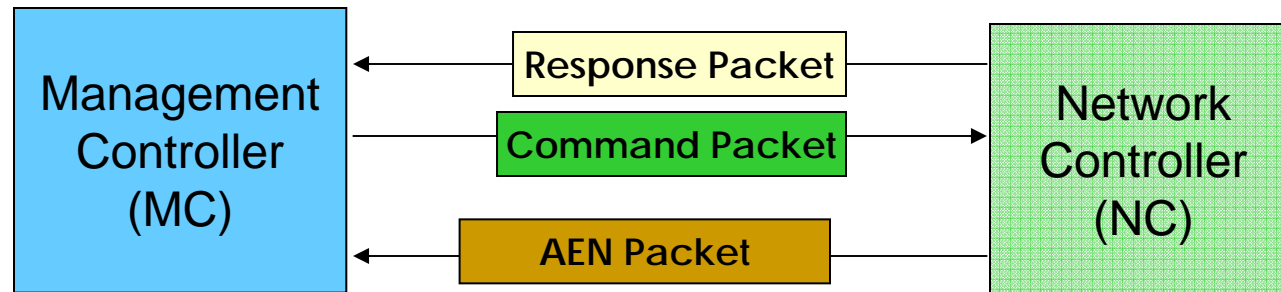
NC-SI Protocol

Addressing

- NC-SI uses a “Channel ID” to route Control packets
 - The ID consists of two subfields: A 3-bit “Package ID” field and a 5-bit “Internal Channel ID” field
- NC-SI Channel ID addressing can support:
 - up to 8 packages (addressing for 4 req’d)
 - up to 31 channels within a package
 - Value 1Fh is reserved for commands that are targeted to the package itself, rather than a channel within the package

NC-SI Protocol

Control Packets



- All NC-SI packets are 802.3 Ethernet conformant frames
 - Overall Ethernet CRC protects against transmission errors on the RMII bus
- Request / Response protocol
 - Functions: Control, Configuration, Status, Statistics etc.,
- Supports retries for reliable communications
 - Uses an “Instance ID (IID)” number to differentiate new requests from retries



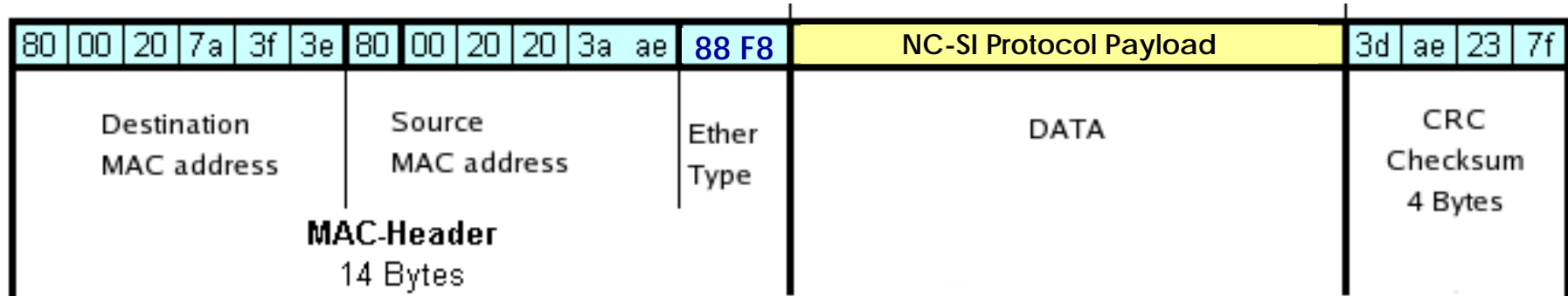
NC-SI Protocol

Control Packets

- Asynchronous Event Notifications (AENs)
 - Provide lower-latency notification of status changes in the network controller
 - Configuration Required (an event in the network controller caused an asynchronous change to its NC-SI configuration that may require MC to reconfigure)
 - Link Status change (e.g. link lost, link established)
 - Host NC Driver Change (e.g. the driver running / driver status unknown)



NC-SI Protocol Control Packet Format



MC ID	Header Revision	Reserved	IID
Command	Channel ID	Reserved	Payload Length
Reserved			
Reserved			
Data3	Data2	Data1	Data0
...			
DataN-1₃	Word Pad (as required)		
2s Complement Checksum (optional)			
Ethernet Packet Pad (as required)			

for NC-SI Responses:

Response Code (16-bits)	Reason Code (16-bits)
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NC-SI Protocol

Control Packet Fields

- **Header Revision** - Version number for the NC-SI Packet header
- **MC ID** - Management Controller ID
- **Channel ID** - 3-bit Package ID + 5-bit Internal Channel ID
- **Command** - Command value for commands and responses. 0xFF identifies an AEN packet.
- **IID** - Instance ID. Used with requests to differentiate a new request from a retry. Returned in response to help match response to request. Always 0x00 for AEN packet.
- **Response Code, Reason Code** - Codes returning OK or error status
- **Data** - parametric data that is specific to the command, response, or AEN packet.
- **Word Pad** - A zero-pad of the data so that the Checksum field is 32-bit aligned.
- **Checksum** - Optional. 0x0000 if not used.
- **Ethernet Packet Pad** - Padding to meet 802.3 Minimum Frame Size requirement of 64 bytes overall length from Dest. Address to FCS.



NC-SI Filtering

- NC-SI Spec supports filtering incoming Pass-through Packets by:
 - Unicast, Multicast, and Broadcast MAC Address
 - VLAN ID
 - ARP broadcast, DHCP server, DHCP client, NetBIOS protocol
- Outgoing Pass-through Packets are not filtered
 - All NC receive outgoing pass-through packets from MC simultaneously
 - Individual channels can be enabled or disabled from transmitting them onto the LAN

Summary

- NC-SI specifications provide the foundation for common, interoperable sideband interfaces
- NC-SI multi-drop and multi-channel supports fail-over and multi-LAN configuration using a single RMII-based interconnect
- NC-SI is derived proven technologies and specifications such as RMII and IEEE 802.3