



CIP pakety

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PUBLIC

Agenda

Overview - Packet Delivery Process

Locally Connected

Remotely Connected

Additional Information

CIP Packet Delivery Process

OSI 7-Layer Reference Model

EtherNet/IP™

Rockwell
Automation

Open Systems Interconnection



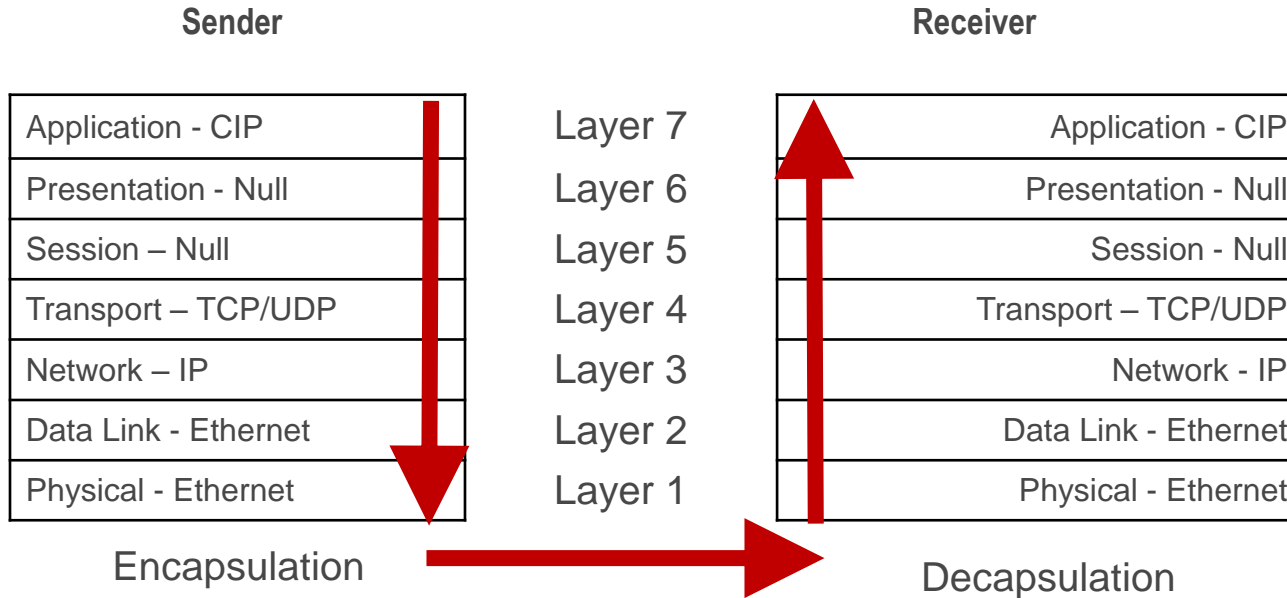
Layer Name	Layer No.	Function	Examples
Application	Layer 7	Network Services to User App	CIP IEC 61158
Presentation	Layer 6	Encryption/Other processing	
Session	Layer 5	Manage Multiple Applications	
Transport	Layer 4	Reliable End-to-End Delivery Error Correction	IETF TCP/UDP
Network	Layer 3	Packet Delivery, Routing	IETF IP
Data Link	Layer 2	Framing of Data, Error Checking	IEEE 802.3/802.1
Physical	Layer 1	Signal type to transmit bits, pinouts, cable type	TIA - 1005

Note: The Network layer (Layer 3) is associated with Routers, and the Data Link layer (Layer 2) is associated with Switches. The Physical layer (Layer 1) is associated with Cabling.

5-Layer TCP/IP Model

CIP Packet Delivery Process

Protocol Stack



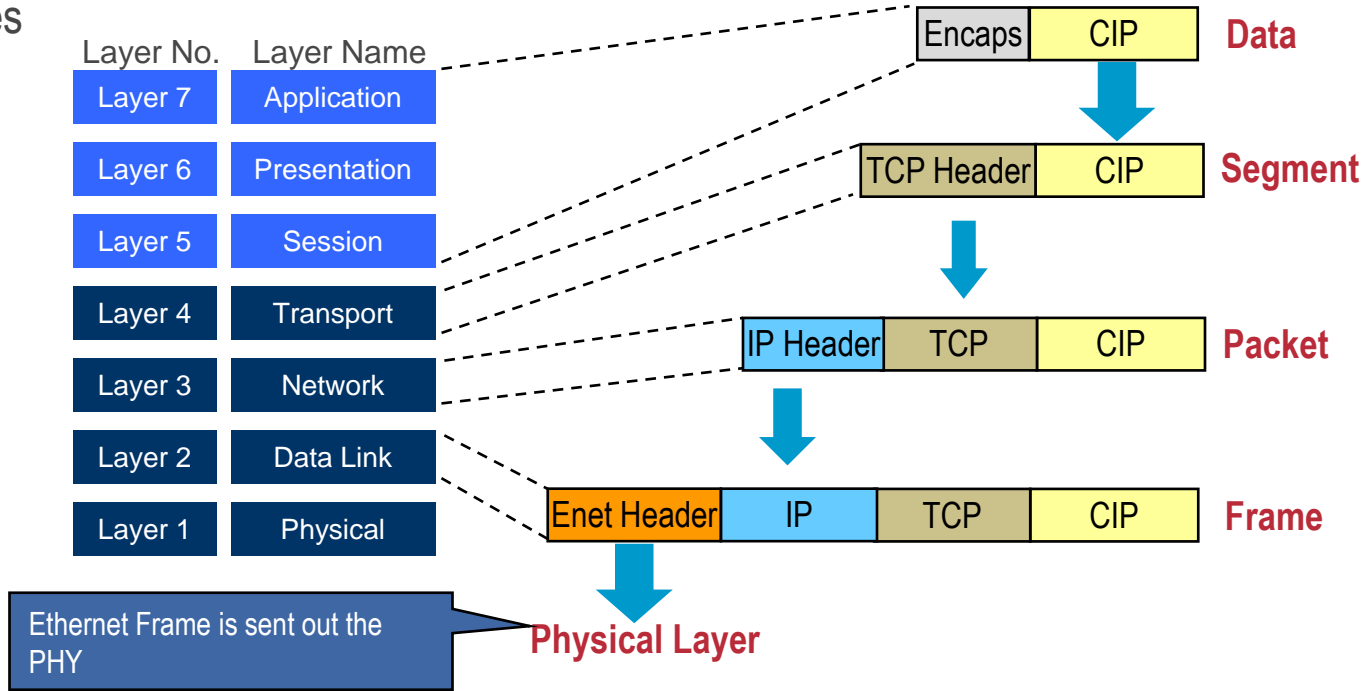
CIP Packet Delivery Process

Protocol Stack Example - Encapsulation

EtherNet/IP™

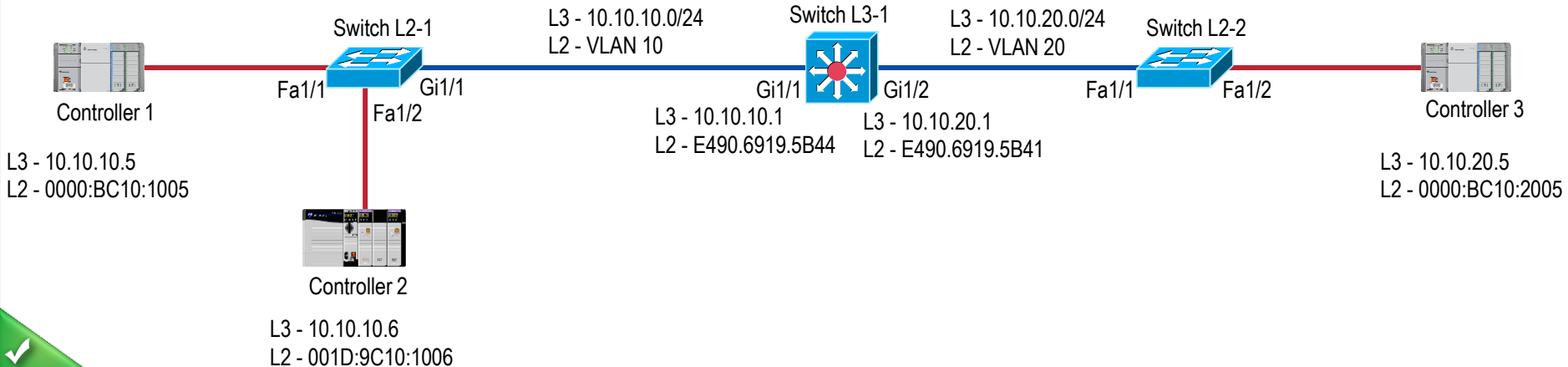
Rockwell
Automation

- The Ethernet message structure is a concatenation of protocols
 - EtherNet/IP defines an Encapsulation protocol that sets up the TCP resources



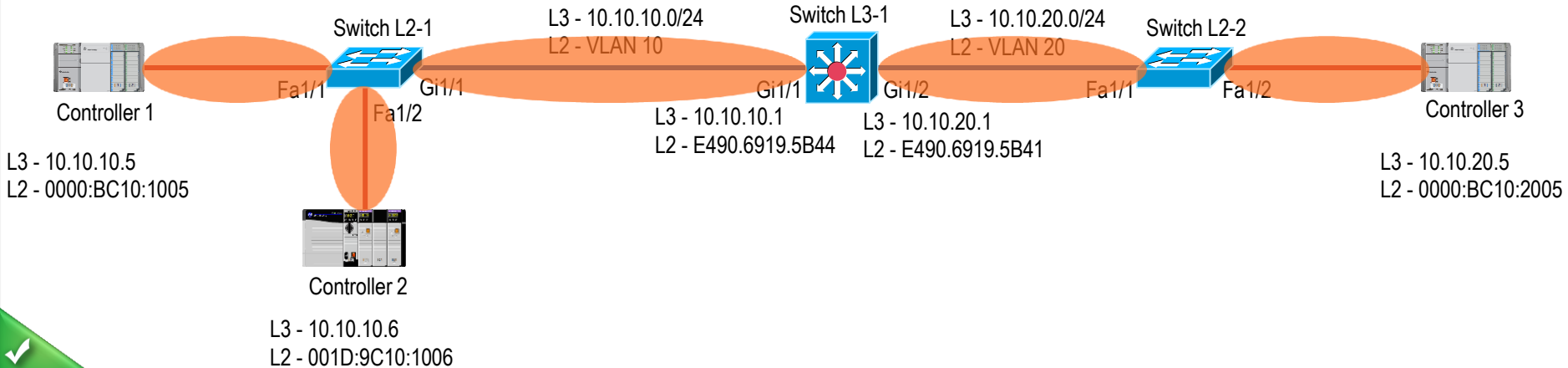
CIP Packet Delivery Process

- Scenario 1 - Locally Connected - Controller 1 to Controller 2
- Scenario 2 - Remotely Connected - Controller 1 to Controller 3



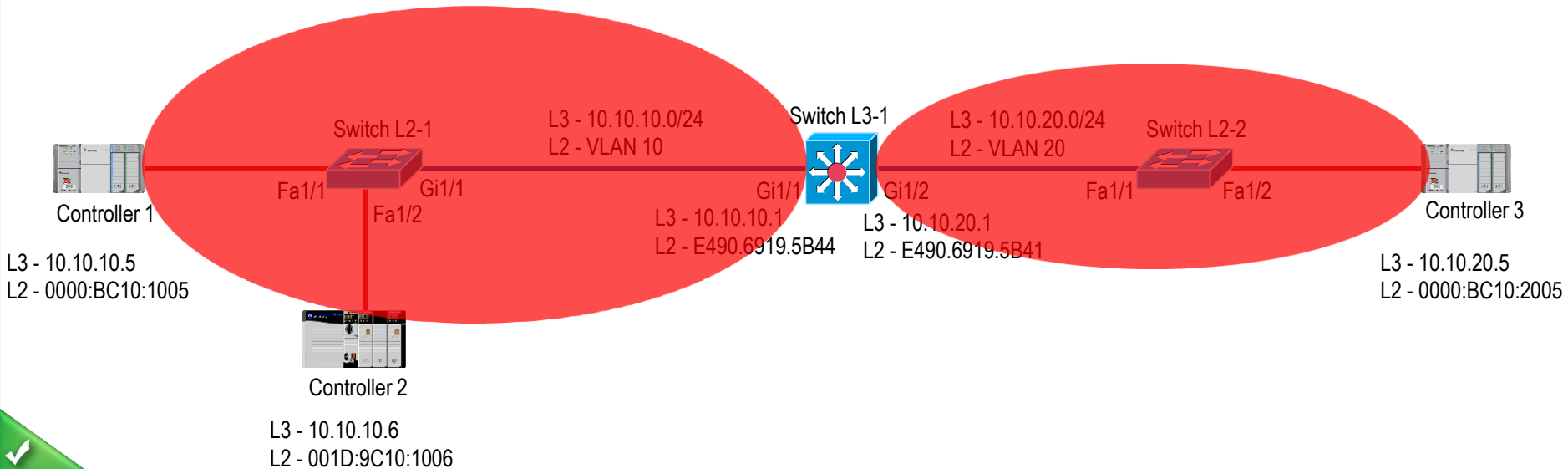
CIP Packet Delivery Process

- Layer 2 Collision Domains

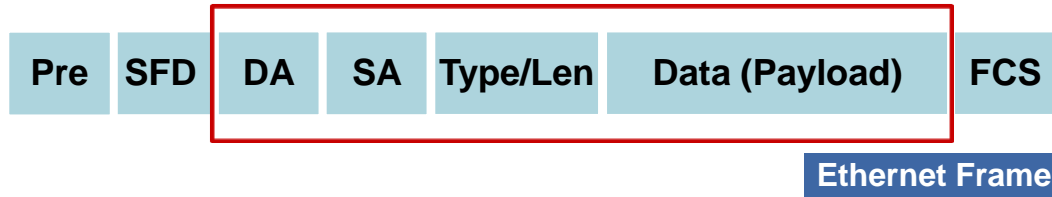
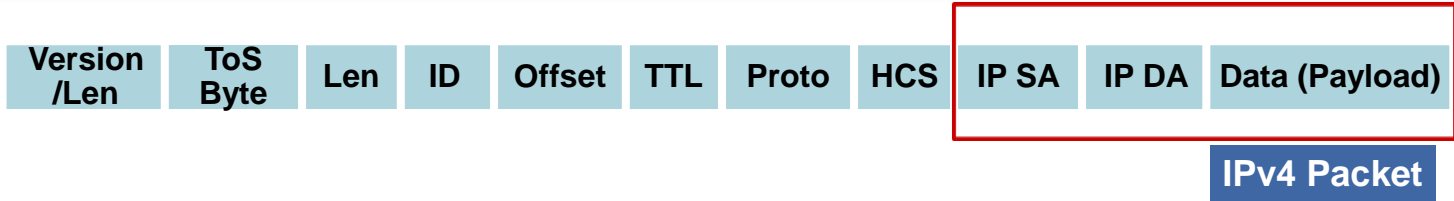


CIP Packet Delivery Process

- Layer 2 Broadcast Domains



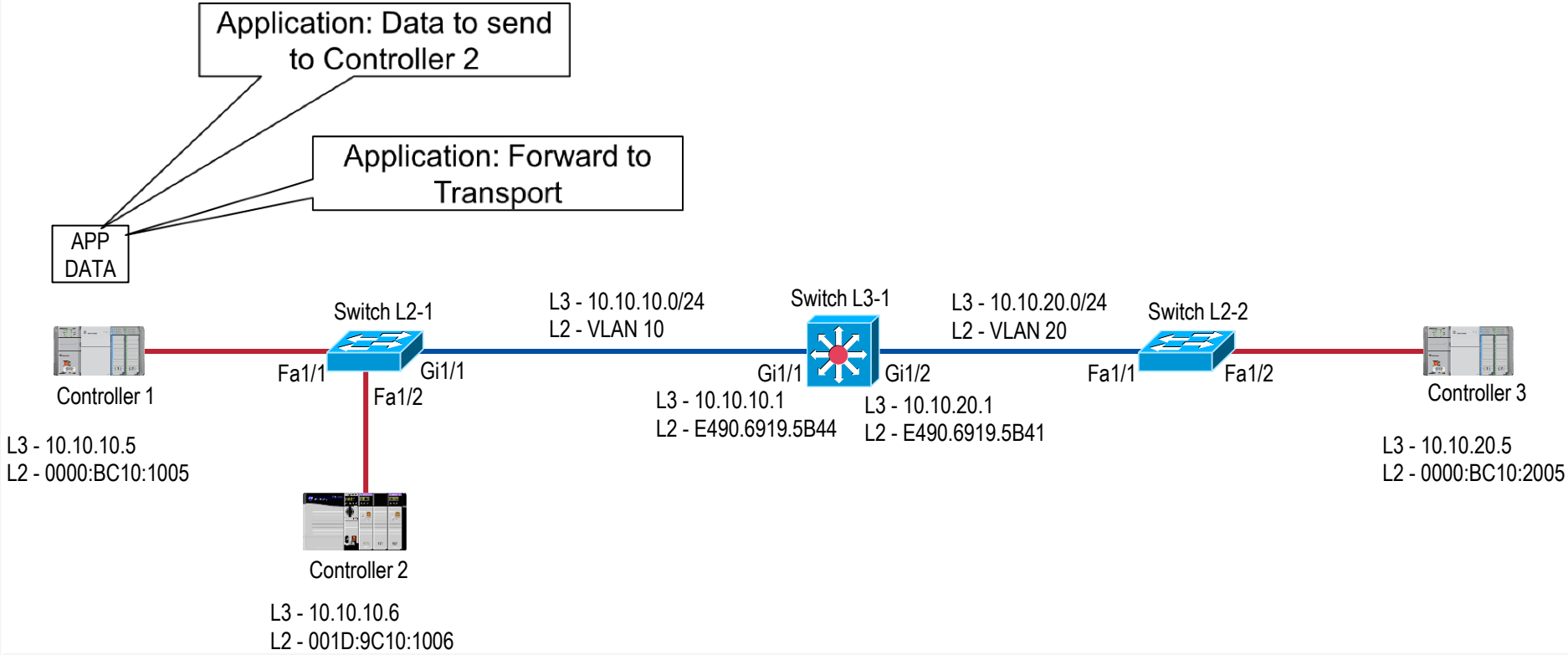
CIP Packet Delivery Process



- Allen-Bradley is **00:00:BC:XX:XX:XX** and **00:1D:9C:XX:XX:XX**
- Representations - 00:00:BC:03:52:A9, 00-00-BC-03-52-A9, 0000.BC03.52A9

Locally Connected - Controller 1 to Controller 2

Packet Delivery Process



Locally Connected - Controller 1 to Controller 2

Packet Delivery Process

Transport: Use TCP

APP DATA

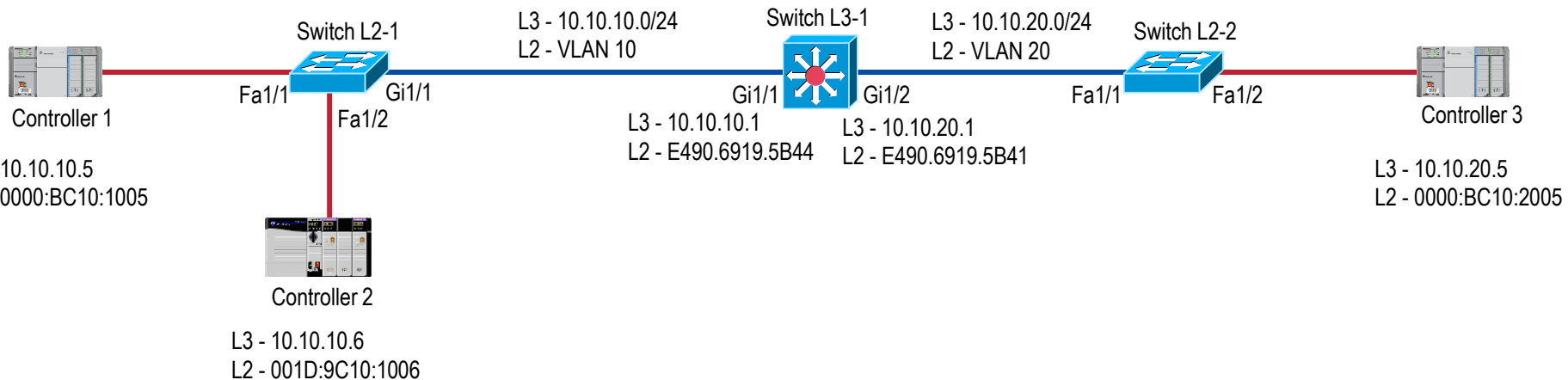
TCP: Encapsulate APP DATA into TCP Segment

TCP HDR APP DATA

TCP: Network, send to 10.10.10.6

SRC IP	DST IP	TCP HDR	APP DATA
10.10.10.5	10.10.10.6		

IP: Encapsulate TCP Segment into IP Packet



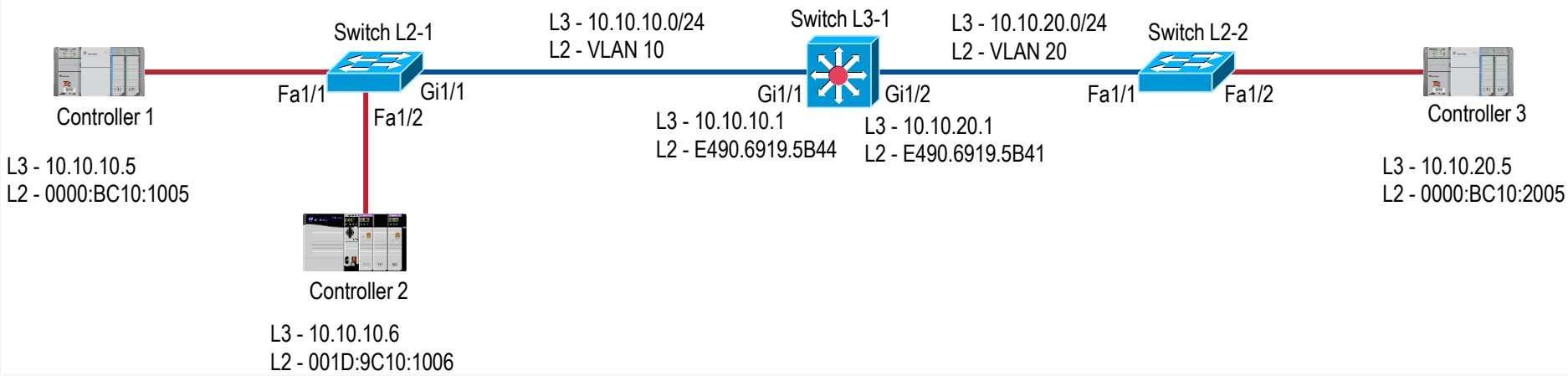
Locally Connected - Controller 1 to Controller 2

Packet Delivery Process

SRC IP	DST IP	TCP HDR	APP DATA
10.10.10.5	10.10.10.6		

IP: Controllers 1 & 2 are on the same subnet - 10.10.10.0/24, forward to Data Link

Ethernet: ARP, no MAC address mapping for 10.10.10.6, hold the Packet, issue ARP request



Locally Connected - Controller 1 to Controller 2

Packet Delivery Process

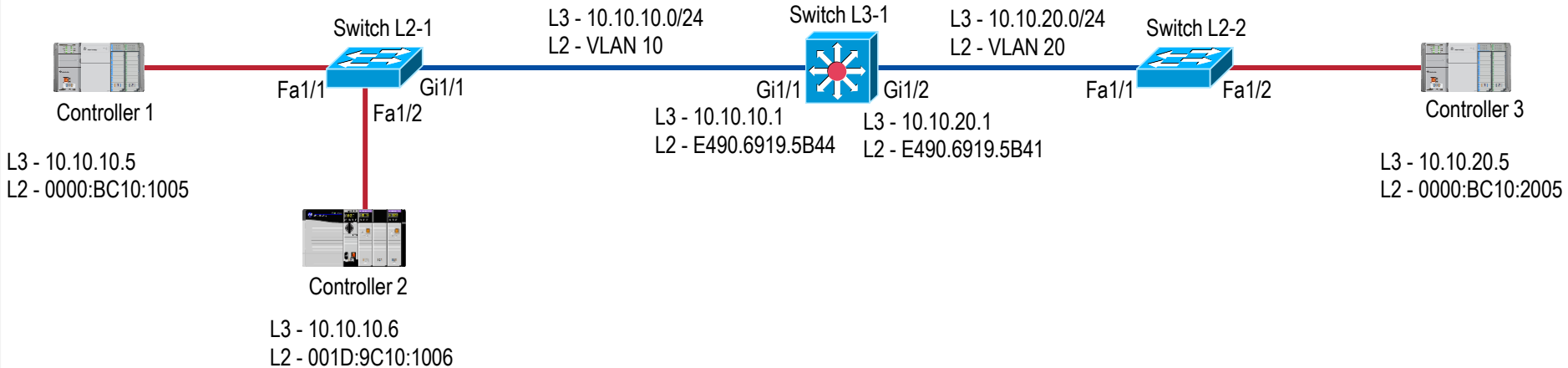
Parking Lot

Packet

ARP Request

DST MAC Broadcast	SRC MAC 0000:BC10:1005	ARP Request
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Ethernet: Encapsulate ARP Request into Ethernet Frame



Locally Connected - Controller 1 to Controller 2

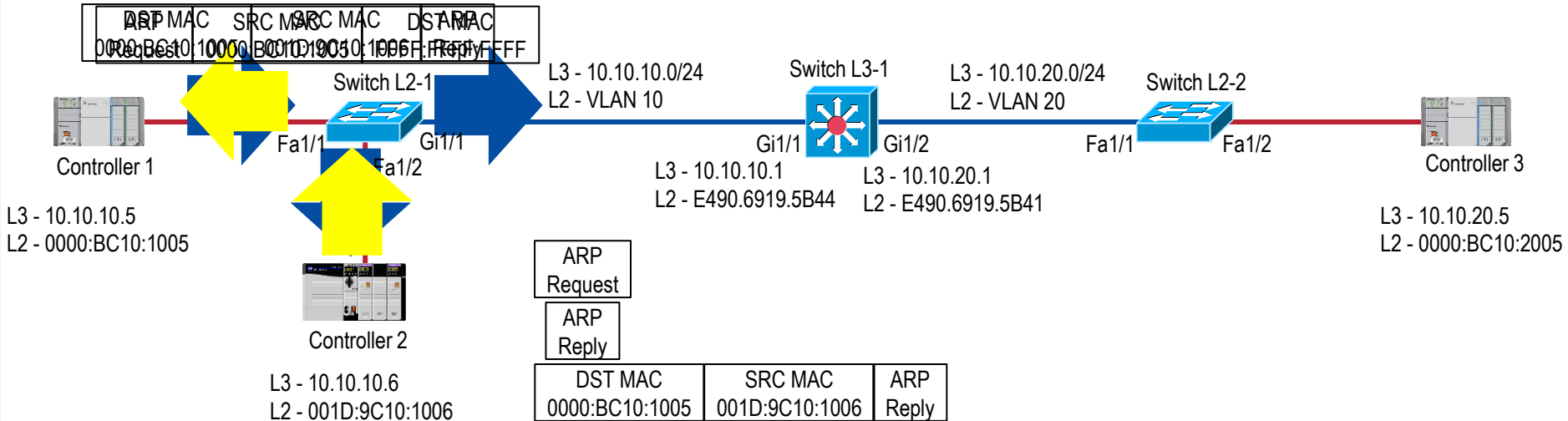
Packet Delivery Process

Parking Lot

Packet

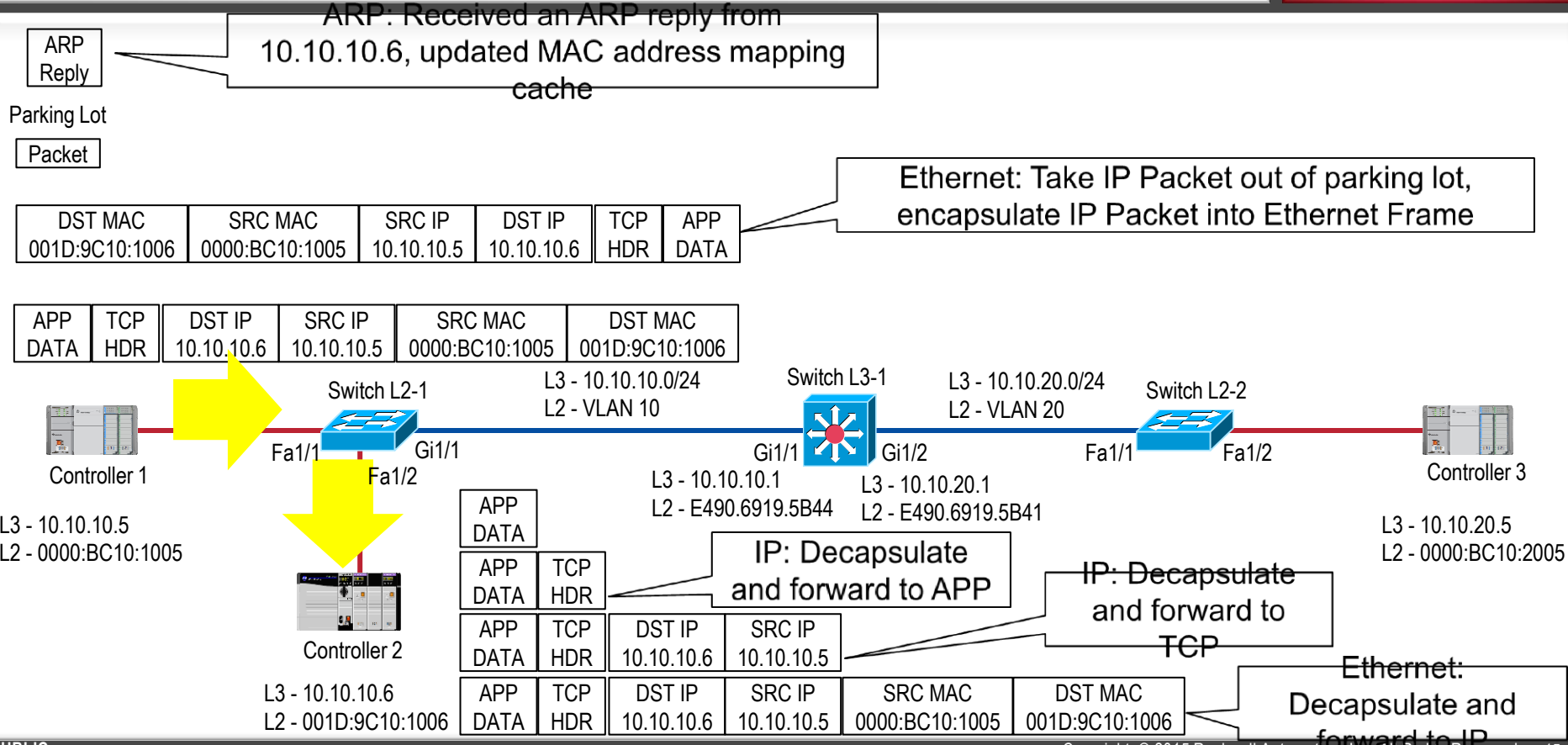
Switch L2-1 MAC Address Table

MAC Address	Port
0000:BC10:1005	Fa1/1
001D:9C10:100	Fa1/2



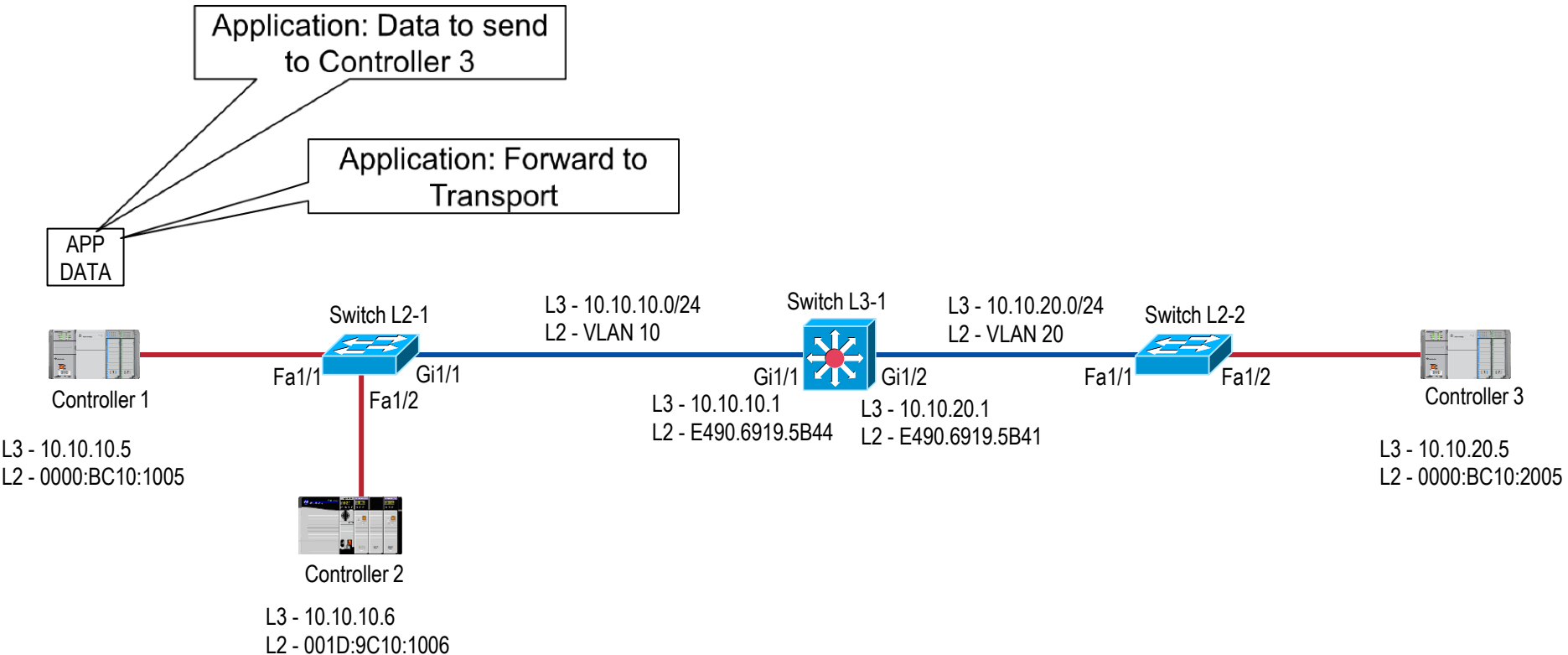
Locally Connected - Controller 1 to Controller 2

Packet Delivery Process



Controller 3

Packet Delivery Process



Controller 3

Packet Delivery Process

Transport: Use TCP

APP
DATA

TCP: Encapsulate APP
DATA into TCP Segment

TCP
HDR APP
DATA

TCP: Network, send to
10.10.20.5

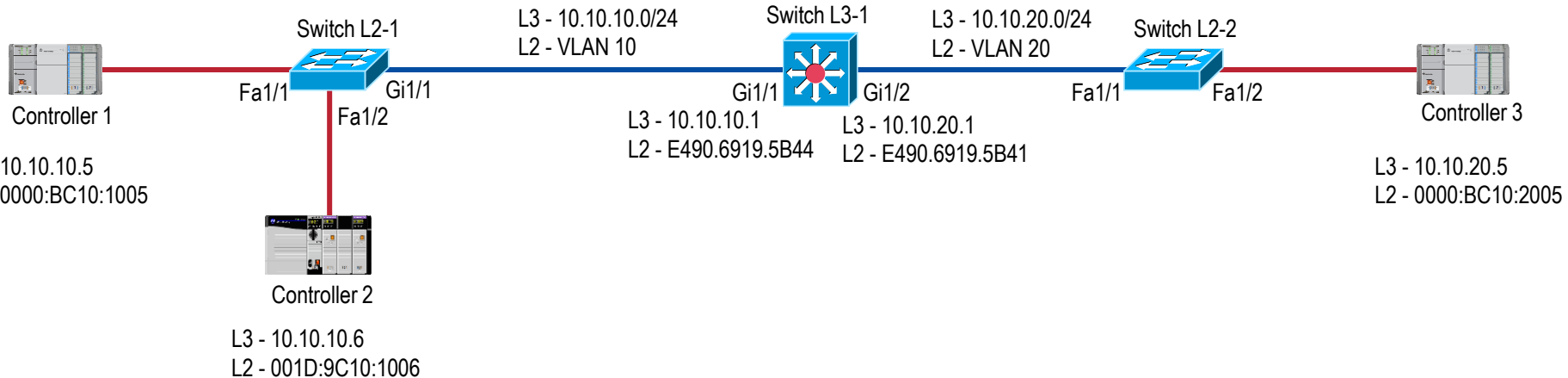
SRC IP
10.10.10.5

DST IP
10.10.20.5

TCP
HDR

APP
DATA

IP: Encapsulate TCP
Segment into IP Packet



Controller 3

Packet Delivery Process

SRC IP	DST IP	TCP HDR	APP DATA
10.10.10.5	10.10.20.5		

IP: Controllers 1 & 3 are on different subnets, use default gateway, forward to

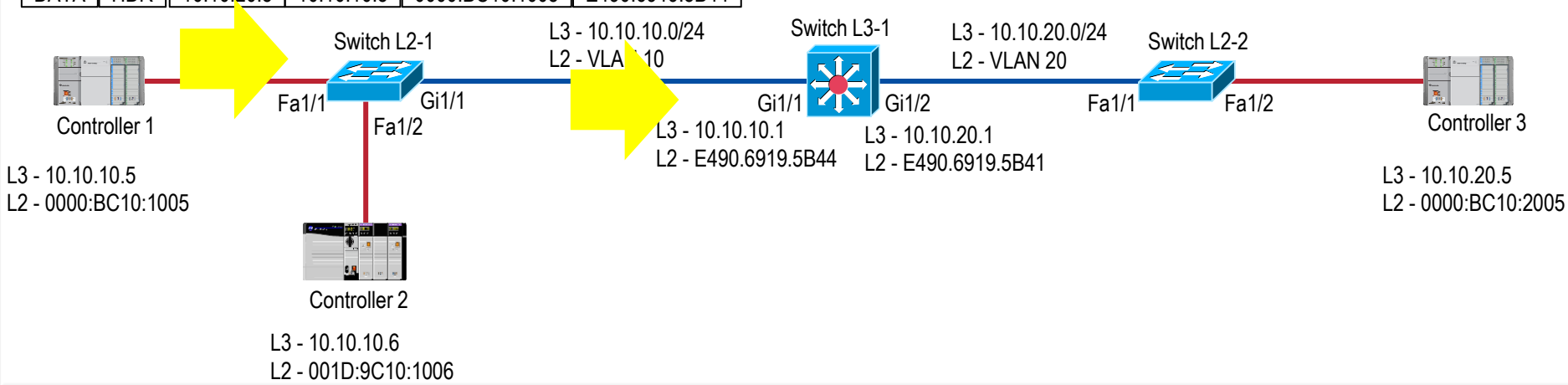
Data Link

Ethernet: ARP, MAC address mapping for 10.10.10.1 is E490.6919.5B44

DST MAC	SRC MAC	SRC IP	DST IP	TCP HDR	APP DATA
E490.6919.5B44	0000:BC10:1005	10.10.10.5	10.10.20.5		

Ethernet: Encapsulate IP Packet into Ethernet Frame

APP DATA	TCP HDR	DST IP	SRC IP	SRC MAC	DST MAC
		10.10.20.5	10.10.10.5	0000:BC10:1005	E490.6919.5B44



Controller 3

Packet Delivery Process

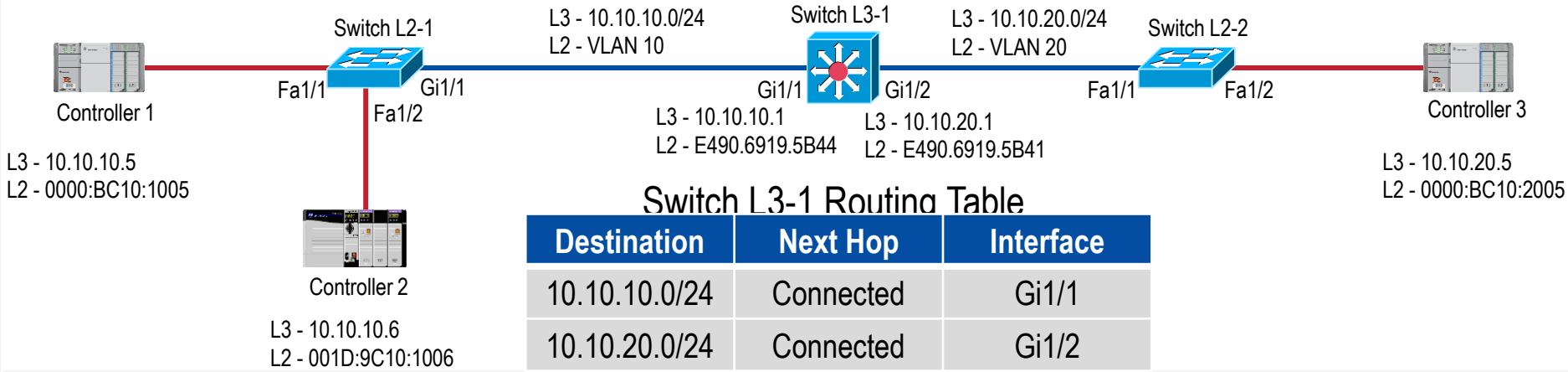
APP DATA	TCP HDR	DST IP 10.10.20.5	SRC IP 10.10.10.5	SRC MAC 0000:BC10:1005	DST MAC E490.6919.5B44
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Ethernet: Decapsulate Ethernet Frame, forward IP Packet to IP (Router)

APP DATA	TCP HDR	DST IP 10.10.20.5	SRC IP 10.10.10.5
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IP (Router): IP address is not Routers', forward (route) IP Packet based on routing table

IP (Router): Subnet 10.10.20.0/24 directly connected to interface Gi1/2, can send packet directly to 10.10.20.5, forward IP Packet to Ethernet



Switch L3-1 Routing Table

Destination	Next Hop	Interface
10.10.10.0/24	Connected	Gi1/1
10.10.20.0/24	Connected	Gi1/2

Controller 3

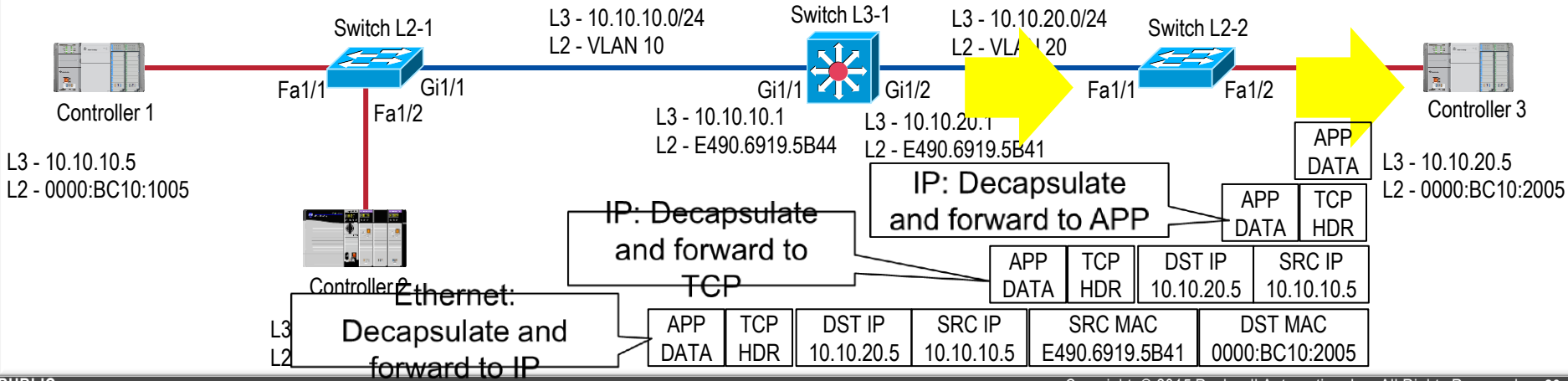
Packet Delivery Process

SRC IP	DST IP	TCP	APP
10.10.10.5	10.10.20.5	HDR	DATA

DST MAC	SRC MAC	SRC IP	DST IP	TCP	APP
0000:BC10:2005	E490.6919.5B41	10.10.10.5	10.10.20.5	HDR	DATA

Ethernet: Encapsulate IP Packet into Ethernet Frame

APP	TCP	DST IP	SRC IP	SRC MAC	DST MAC
DATA	HDR	10.10.20.5	10.10.10.5	E490.6919.5B41	0000:BC10:2005





Dotazy? Děkuji za pozornost!



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