

# Fibre Channel Speedmap

Live Webcast  
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11:00 am PT



# Today's Presenters



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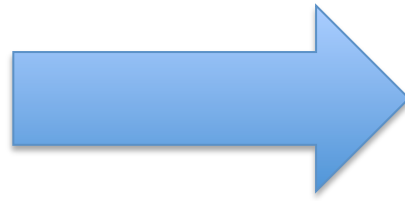
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# Agenda

- Introductions
- Discuss differences in systems and networking
- Discuss product/interface naming
- Discuss encoding and overhead
- Discuss how to compare Fibre Channel and Ethernet speeds
- Q&A!

# Bytes versus Bits

System and storage  
administrators see  
speed as...



Bytes/s

Bits/s

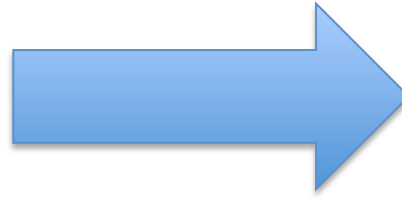


Network administrators  
see speed as...



# Raw and Payload

System and storage  
administrators see  
speed as...



Payload  
throughput

Raw  
throughput



Network administrators  
see speed as...

# Fibre Channel Goal

We care about Bytes per second...

For every 1 Gigabit of link speed, provide 100 MB/s of payload throughput

1 Gigabit = 100 MB/s

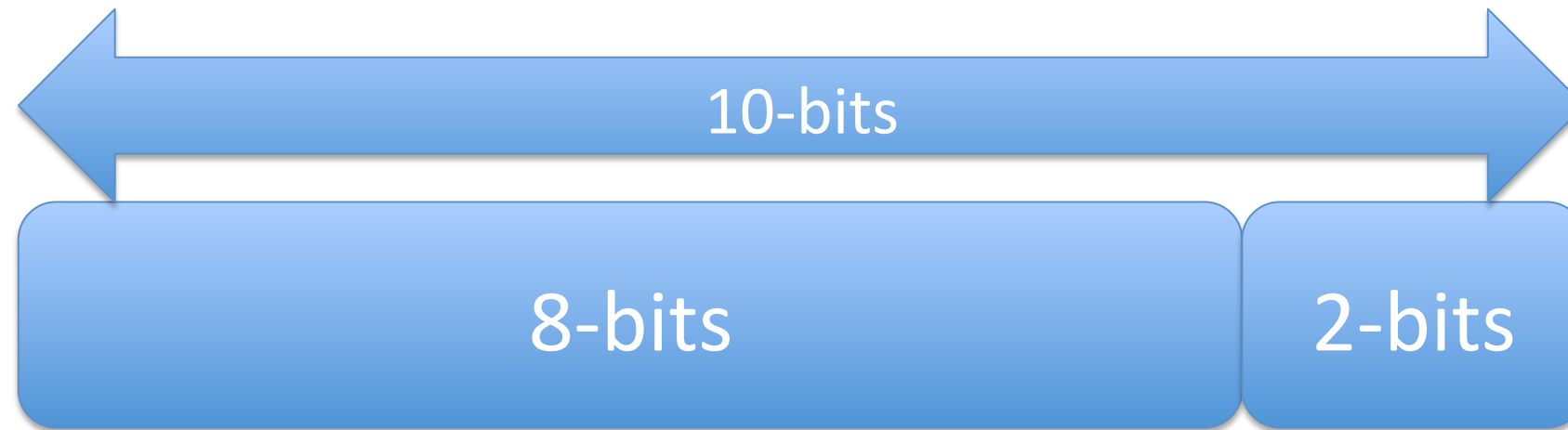
# Speed Name Misnomers

- Product Name (link speed)
  - Just the name we call it. In both Ethernet and FC, they're not accurate
- BAUD rate (how fast 1s/0s are running)
  - Doesn't account for encoding (8b/10b, 64b/66b)
  - Doesn't account for headers versus payload
- Throughput (how fast data runs through the link)
  - Raw throughput (payload+headers)
  - Payload throughput (payload)

Interface Name	Encoding	Throughput	Baud (Gigabaud)
1GFC	8b/10b	100 MB/s	1.0625
1 Gbit Ethernet	8b/10b	125 MB/s	1.25

# 8b/10b Encoding

- For every 8 bits, 2 extra bits are sent
  - Balances the 1s and 0s
  - Clock recovery
  - Lose 20% to overhead





# 8b/10b Encoding Strategy

## Fibre Channel

- 1 Gigabit speed, 1.0625 Gbaud rate
- 100 MB/s payload throughput
- No increase in speed to make up for the overhead in 8b/10b encoding
- Slight increase in speed (6.25%) to make up for headers

## Ethernet

- 1 Gigabit speed, 1.25 Gbaud rate
- 20% increase in speed to make up for the overhead in 8b/10b encoding
- No increase to make up for headers

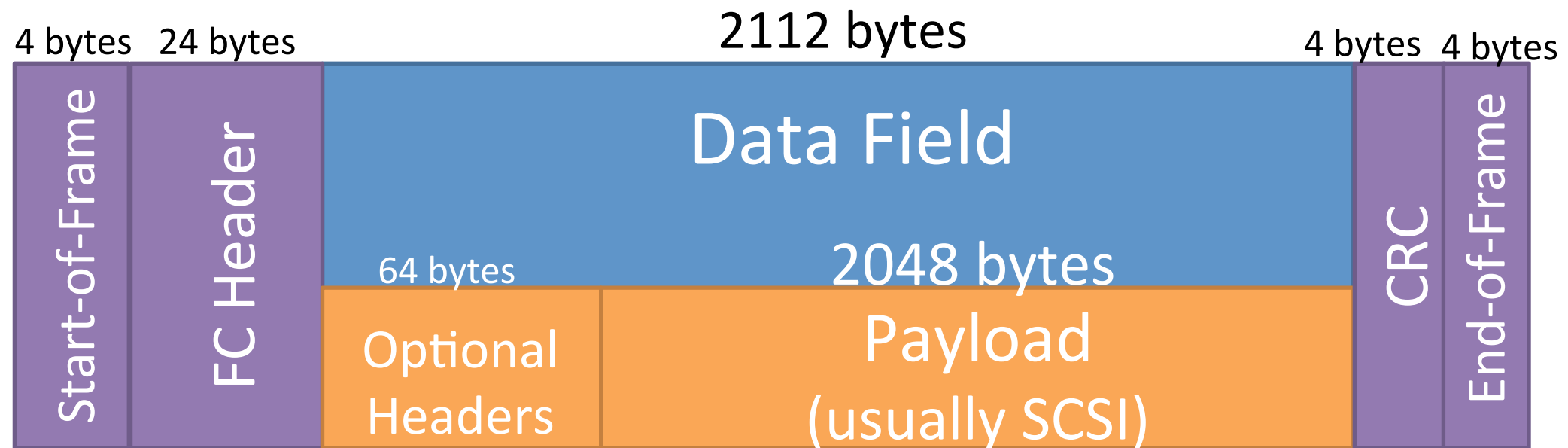
$$(1000 \text{ Mb/s}) / \blacksquare 8 \text{ bits/byte} = 125 \text{ MB/s}$$

Protocol	Encoding	Transfer speed	Baud (Gigabaud)
1GFC	8b/10b	100 MB/s	1.0625
1 Gbit Ethernet	8b/10b	125 MB/s	1.25

# Payloads: Fibre Channel

Historically Fibre Channel  
payloads have been....

SCSI



2148 Bytes total MTU

# Payloads: Ethernet

**Historically Ethernet  
payloads have been....**

IPv4, IPv6, ICMP, Fibre  
Channel (FCoE), HTTP, FTP,  
SNMP... a variety



# Payload Throughput versus Raw

## Payload Throughput (FC)

- Payload only
- Reasonable choice in mono-traffic environment
- Actual speed is increased slightly to accommodate headers
  - We see this on switch backplanes, increasing speeds to accommodate internal encapsulations such as HiGig2 for Broadcom

## Raw Throughput (Network)

- Payload + Headers
- Reasonable choice when there are multiple headers (TCP, IP, Ethernet)
- Reasonable choice when for multiple types of traffic (with different header lengths)
- Reasonable choice when there are variable length headers (HTTP, FTP, Layer 7)



# Move to 64b/66b Encoding

- With 16GFC (and 10GFC), encoding moved to 64b/66b encoding
  - For every 64 bits, 66 bits are sent across the wire
  - Only 3.125% overhead instead of 20%, much more efficient
- The goal of providing 100 MB/s of payload throughput per “Gigabit” never changed in Fibre Channel
- 16GFC = 1600 MB/s = 14.025 Gbaud



# Fibre Channel Speeds and Feeds

Product Name	Payload Throughput
1 Gigabit	100 MB/s
2 Gigabit	200 MB/s
4 Gigabit	400 MB/s
8 Gigabit	800 MB/s
16 Gigabit	1600 MB/s
32 Gigabit	3200 MB/s
128 Gigabit	12800 MB/s

# Fibre Channel Speeds and Feeds

Product Name	Payload Throughput	GBaud
1GFC	100 MB/s	1.0625
2GFC	200 MB/s	2.125
4GFC	400 MB/s	4.25
8GFC	800 MB/s	8.5
16GFC	1600 MB/s	14.025
32GFC	3200 MB/s	28.05
128GFC	12800 MB/s	112.2

With Fibre Channel, the key figure is  
(payload) throughput

# Comparing Ethernet and Fibre Channel

Protocol	Encoding	Transfer speed	Baud (Gigabaud)
1 Gbit FC	8b/10b	100 MB/s	1.0625
1 Gbit Ethernet	8b/10b	125 MB/s	1.25
2 Gbit FC	8b/10b	200 MB/s	2.125
4 Gbit FC	8b/10b	400 MB/s	4.25
8 Gbit FC	8b/10b	800 MB/s	8.5
10 Gbit Ethernet	64b/66b	1250 MB/s	10.3125
16 Gbit FC	64b/66b	1600 MB/s	14.025
32 Gbit FC	64b/66b	3200 MB/s	28.05
40 Gbit Ethernet	64b/66b	5000 MB/s	41.25
100 Gbit Ethernet	64b/66b	12500 MB/s	103.125
128 Gbit FC	64b/66n	12800 MB/s	112.2



# Comparing Ethernet and Fibre Channel

Product Name	Encoding	Throughput	Gbaud
8GFC	8b/10b	800 MB/s	8.5
10 GigE	64b/66b	1250 MB/s	10.3125
16GFC	64b/66b	1600 MB/s	14.025
25 GigE	64b/66b	3125 MB/s	25.78125
32GFC	64b/66b	3200 MB/s	28.05
40 GigE	64b/66b	5000 MB/s	41.25
100 GigE	64b/66b	12500 MB/s	103.125
128GFC	64b/66b	12800 MB/s	112.2

Compare throughput to compare speeds  
with Ethernet and Fibre Channel

# Conclusion

- Fibre channel and Ethernet discuss speeds differently
  - Historical reasons behind it
- To compare speed of Ethernet and Fibre Channel, look at throughput rates
- Consider that throughput rates are payload (Fibre Channel) and raw (Ethernet)

# Q&A

# After this Webcast

- Please rate this event – we value your feedback
- We will post a Q&A blog at <http://fibrechannel.org/> with answers to all the great questions we received today
- Follow us on Twitter @FCIAnews
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**Fibre Channel Fundamentals**

**June 15, 2017**

**11:00 am PT**

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*Thank you!*

