



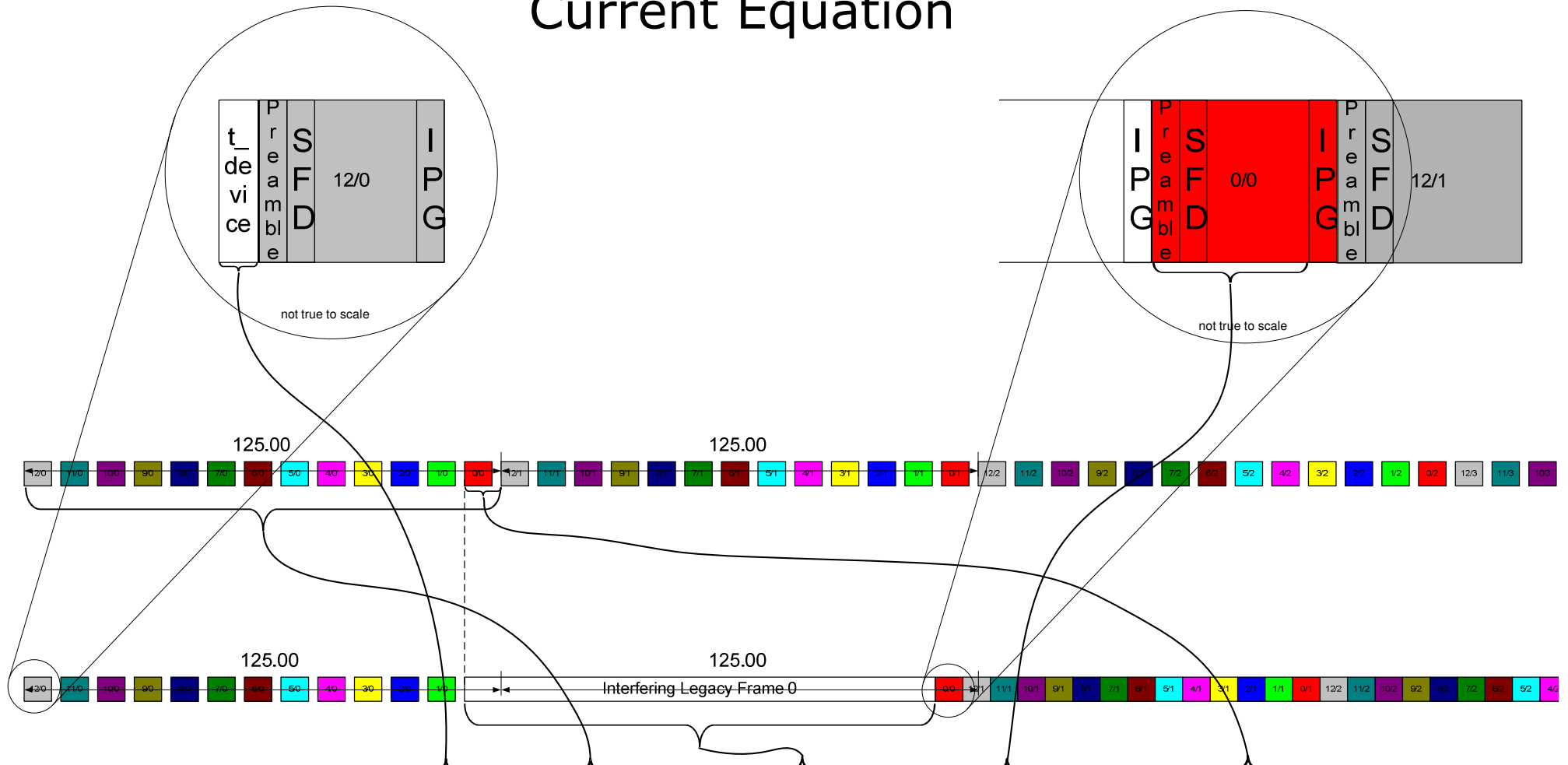
Improved Class A Talker Worst Case Latency Equation



Christian Boiger
christian.boiger@fh-deggendorf.de
IEEE 802.1 Interim Meeting
May 2011
Santa Fe, NM



Current Equation

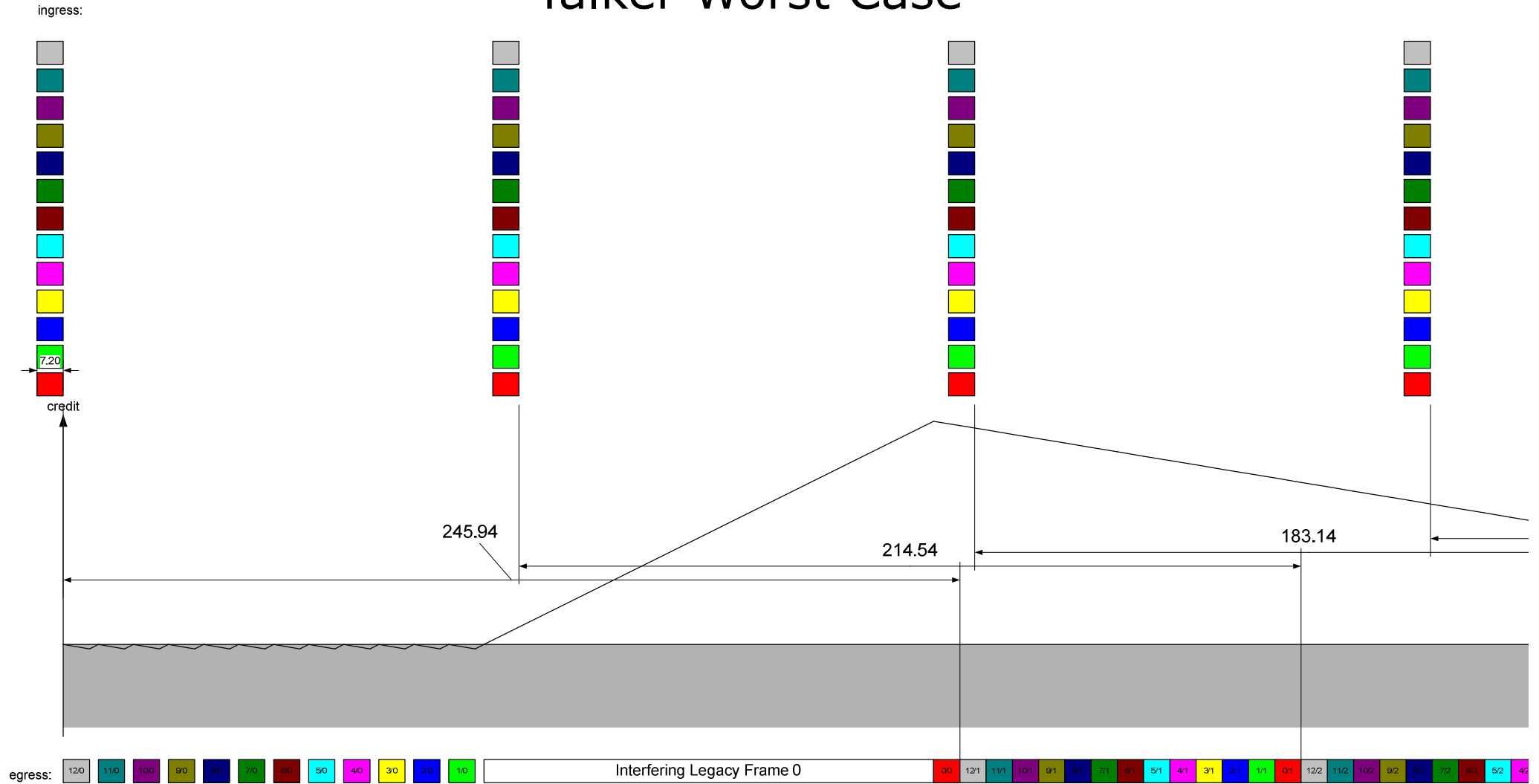


$$\text{Equation: Max Latency} = t_{\text{Device}} + t_{\text{Interval}} + t_{\text{MaxFrameSize}} + t_{\text{Stream}} - t_{\text{(Stream+Gap)}} * 1.333$$

(incl. Preamble, SFD, IPG) (incl. Preamble+SFD) (incl. Preamble, SFD, IPG)

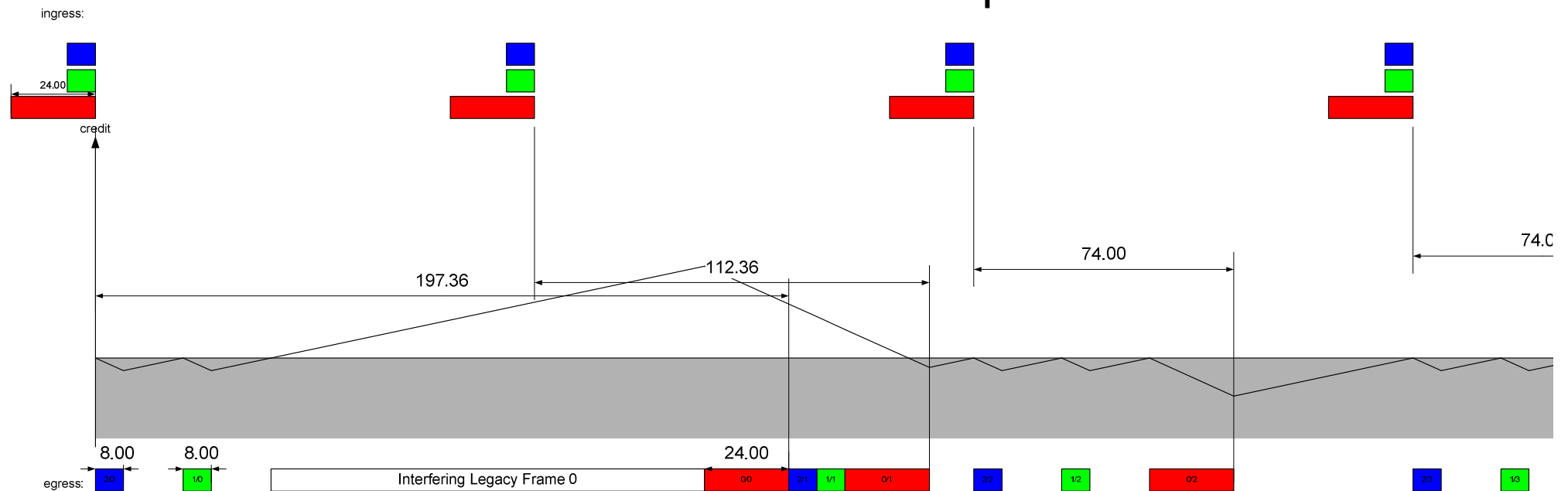


Talker Worst Case





Talker Worst Case Example 1



$$\begin{aligned}
 \text{Worst Case Latency} &= 197.36\mu\text{s} - t_{\text{IPG}} + t_{\text{Device}} \\
 &= 197.36\mu\text{s} - 0.96\mu\text{s} + 5.12\mu\text{s} \\
 &= 201.52\mu\text{s}
 \end{aligned}$$

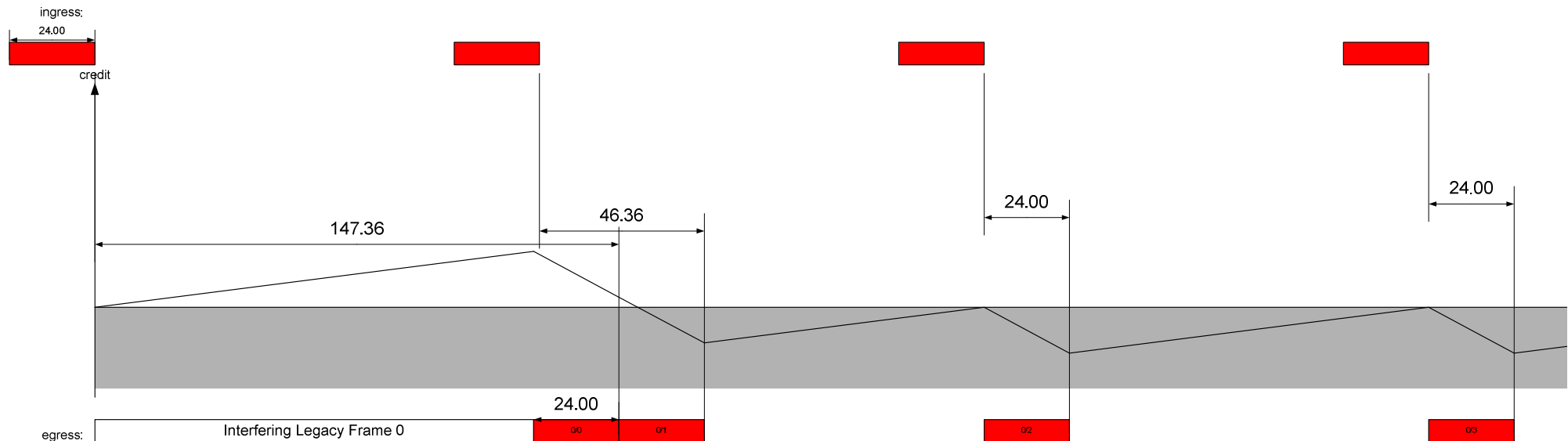
Current Worst Case Latency Equation:

$$\begin{aligned}
 \text{Worst Case Latency} &= t_{\text{Device}} + t_{\text{Interval}} + t_{\text{MaxFrameSize}} + t_{\text{Stream}} - t_{\text{(Stream+Gap)}} * 1.333 \\
 &= 5.12\mu\text{s} + 125\mu\text{s} + 123.36\mu\text{s} + (24\mu\text{s} - 0.96\mu\text{s}) - 24\mu\text{s} * 1.333 \\
 &= 244.52\mu\text{s}
 \end{aligned}$$





Talker Worst Case Example 2



$$\begin{aligned}
 \text{Worst Case Latency} &= 147.36\mu\text{s} - t_{IPG} + t_{Device} \\
 &= 147.36\mu\text{s} - 0.96\mu\text{s} + 5.12\mu\text{s} \\
 &= 151.52\mu\text{s}
 \end{aligned}$$

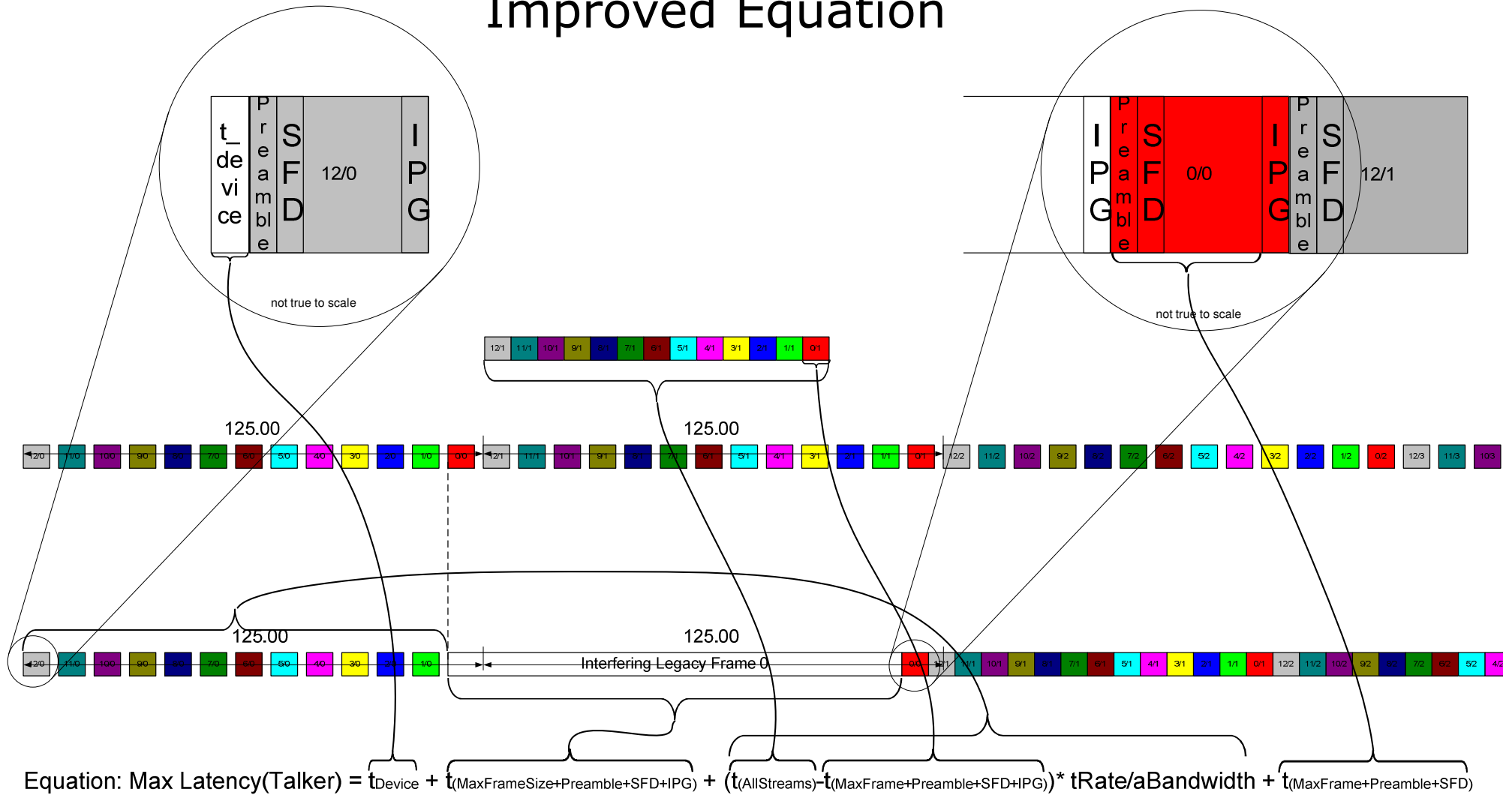
Current Worst Case Latency Equation:

$$\begin{aligned}
 \text{Worst Case Latency} &= t_{Device} + t_{Interval} + t_{MaxFrameSize} + t_{Stream} - t_{(Stream+Gap)} * 1.333 \\
 &= 5.12\mu\text{s} + 125\mu\text{s} + 123.36\mu\text{s} + (24\mu\text{s} - 0.96\mu\text{s}) - 24\mu\text{s} * 1.333 \\
 &= 244.52\mu\text{s}
 \end{aligned}$$



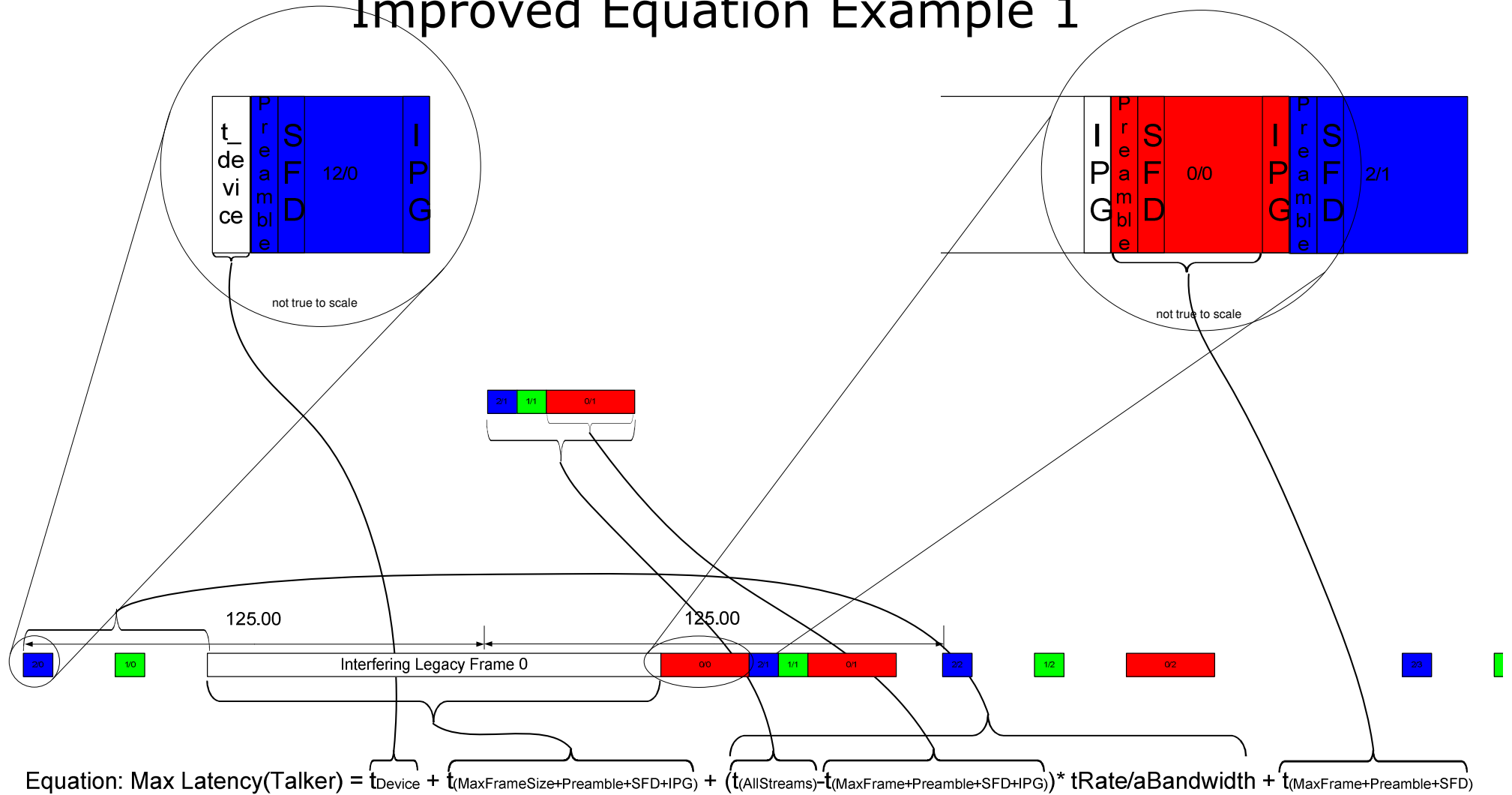


Improved Equation



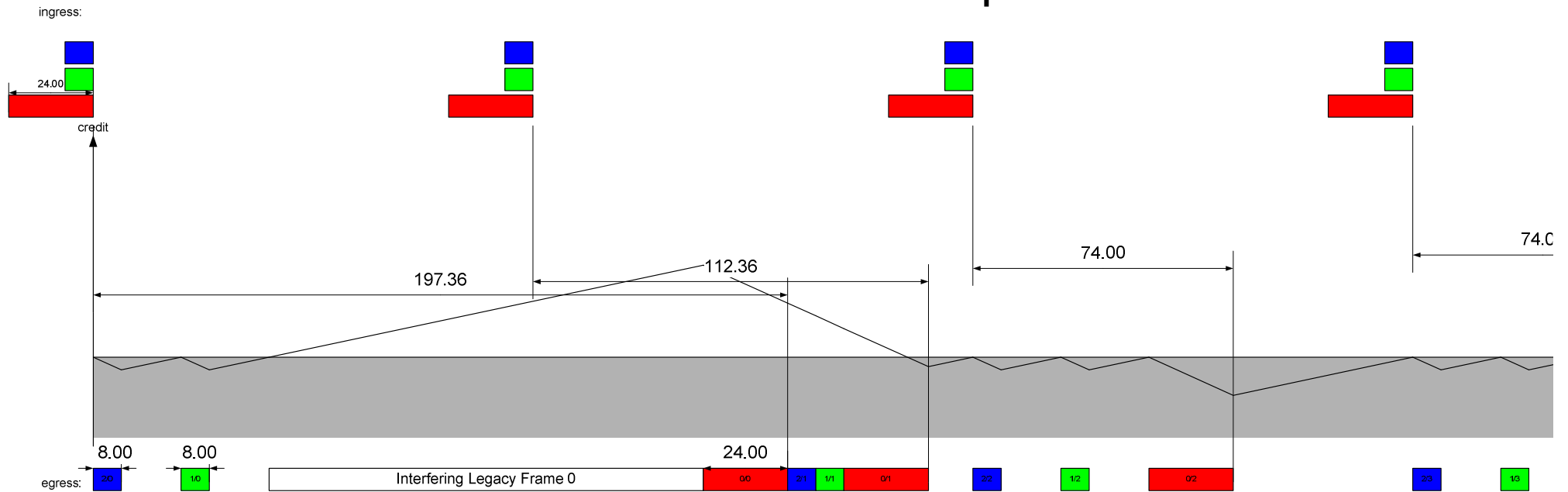


Improved Equation Example 1





Talker Worst Case Example 1



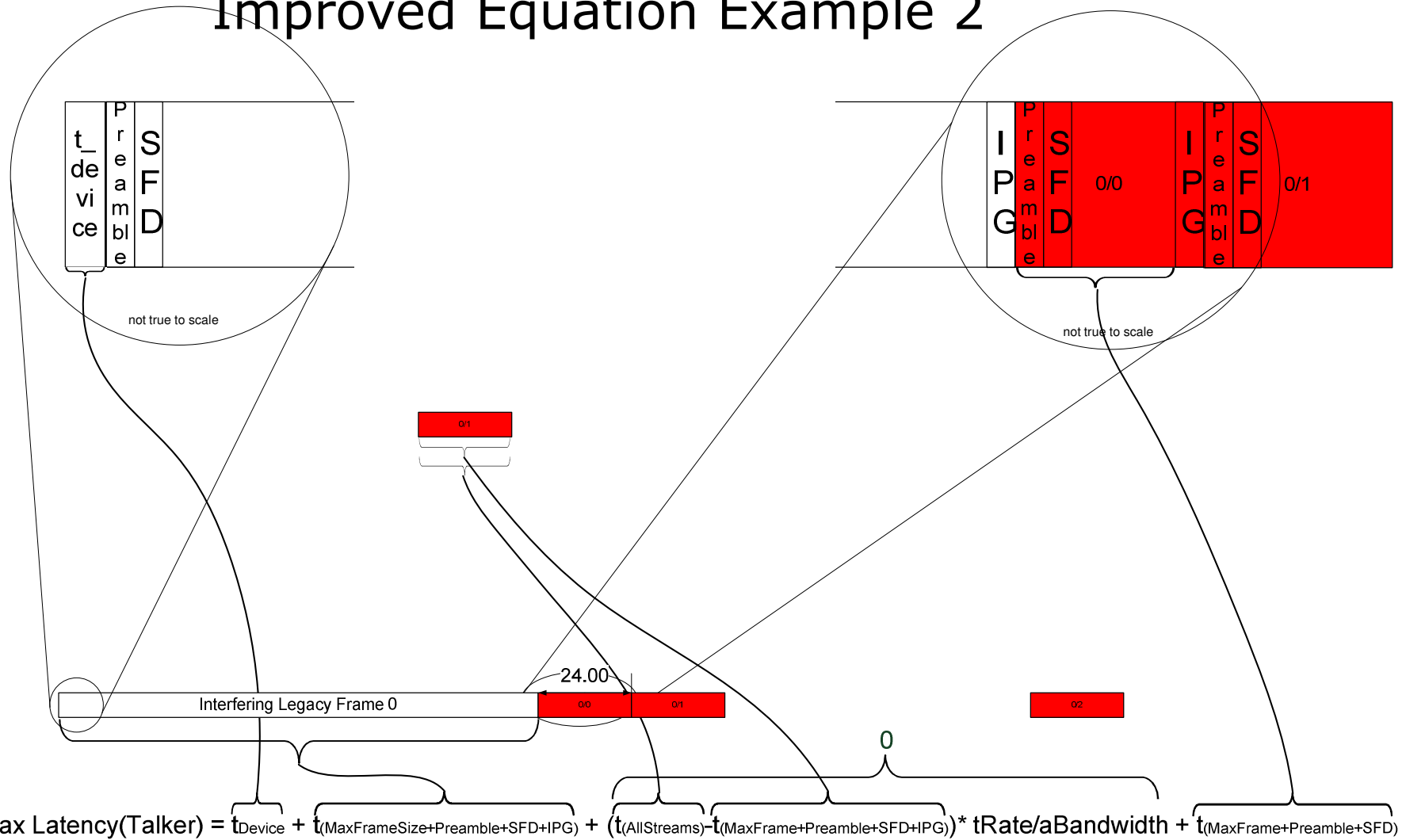
$$\begin{aligned}
 \text{Worst Case Latency} &= 197.36\mu\text{s} - t_{\text{IPG}} + t_{\text{Device}} \\
 &= 197.36\mu\text{s} - 0.96\mu\text{s} + 5.12\mu\text{s} \\
 &= 201.52\mu\text{s}
 \end{aligned}$$

Improved Worst Case Latency Equation:

$$\begin{aligned}
 \text{Worst Case Latency} &= t_{\text{Device}} + t_{(\text{MaxFrameSize}+\text{Preamble}+\text{SFD}+\text{IPG})} + (t_{(\text{AllStreams})} - t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD}+\text{IPG})}) * \text{transmissionRate}/\text{maxAllocatableBandwidth} + t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD})} \\
 &= 5.12\mu\text{s} + 123.36\mu\text{s} + (40\mu\text{s}-24\mu\text{s}) * 100\text{MBit/s} / 32\text{MBit/s} + (24\mu\text{s}-0.96\mu\text{s}) \\
 &= 201.52\mu\text{s}
 \end{aligned}$$

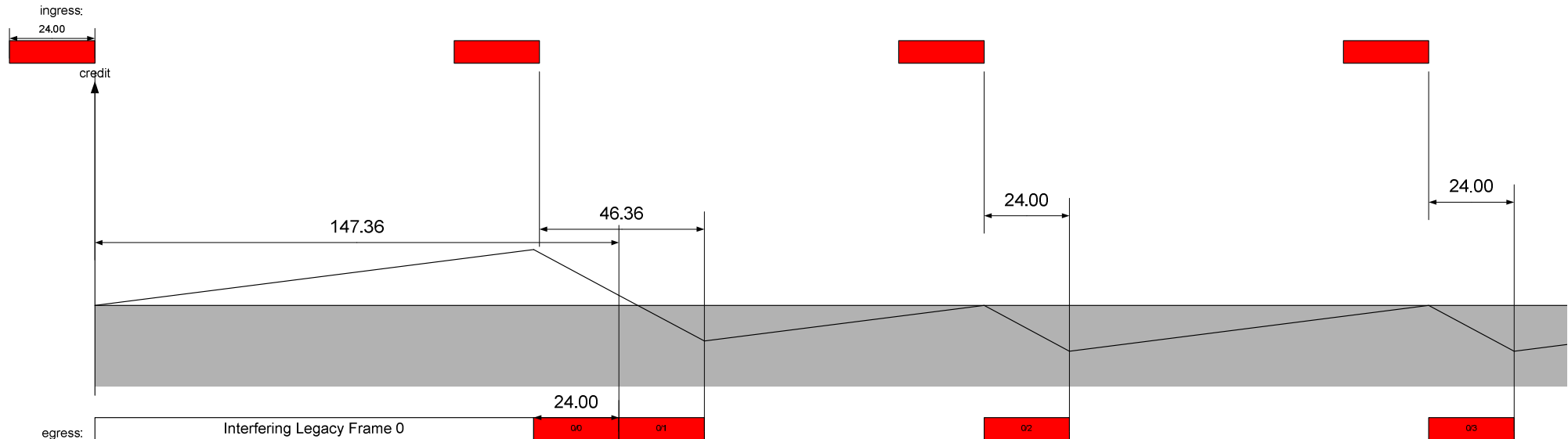


Improved Equation Example 2





Talker Worst Case Example 2



$$\begin{aligned}
 \text{Worst Case Latency} &= 147.36\mu\text{s} - t_{\text{IPG}} + t_{\text{Device}} \\
 &= 147.36\mu\text{s} - 0.96\mu\text{s} + 5.12\mu\text{s} \\
 &= 151.52\mu\text{s}
 \end{aligned}$$

Improved Worst Case Latency Equation:

$$\begin{aligned}
 \text{Worst Case Latency} &= t_{\text{Device}} + t_{(\text{MaxFrameSize}+\text{Preamble}+\text{SFD}+\text{IPG})} + (t_{(\text{AllStreams})} - t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD}+\text{IPG})}) * \text{transmissionRate}/\text{maxAllocatableBandwidth} + t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD})} \\
 &= 5.12\mu\text{s} + 123.36\mu\text{s} + (24\mu\text{s} - 24\mu\text{s}) * 100\text{MBit/s} / 19.2\text{MBit/s} + (24\mu\text{s} - 0.96\mu\text{s}) \\
 &= 151.52\mu\text{s}
 \end{aligned}$$



Improved Equation

MaxLatency(Talker)

$$\begin{aligned} &= t_{\text{Device}} + t_{(\text{MaxFrameSize}+\text{Preamble}+\text{SFD}+\text{IPG})} + (t_{\text{AllStreams}} - t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD}+\text{IPG})}) * \\ &\text{transmissionRate}/\text{maxAllocatableBandwidth} + t_{(\text{MaxFrame}+\text{Preamble}+\text{SFD})} \\ &= t_{\text{Device}} + t_{(\text{MaxPacketSize}+\text{IPG})} + (t_{\text{AllStreams}} - t_{(\text{MaxStreamPacket}+\text{IPG})}) * \\ &\text{transmissionRate}/\text{maxAllocatableBandwidth} + t_{\text{MaxStreamPacket}} \end{aligned}$$

t_{Device} = the internal delay of the device (in slot times, i.e., increments of 512 bit times)

$t_{\text{MaxPacketSize}}$ = the transmission time for a maximum size interfering packet (maximum size interfering packet (1530 octets to 2008 octets)) plus IPG

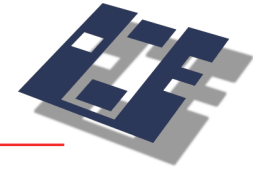
$t_{\text{MaxStreamPacket}}$ = the transmission time for the maximum packet size of the stream that is being reserved

transmissionRate = transmission rate of the medium

maxAllocatableBandwidth = the maximum amount of Class A stream bandwidth the talker is able to allocate

$t_{\text{AllStreams}} = (\text{maxAllocatableBandwidth} * t_{\text{Interval}})/\text{transmissionRate}$

t_{Interval} = the Class A observation interval or 125 μs



Thank You