

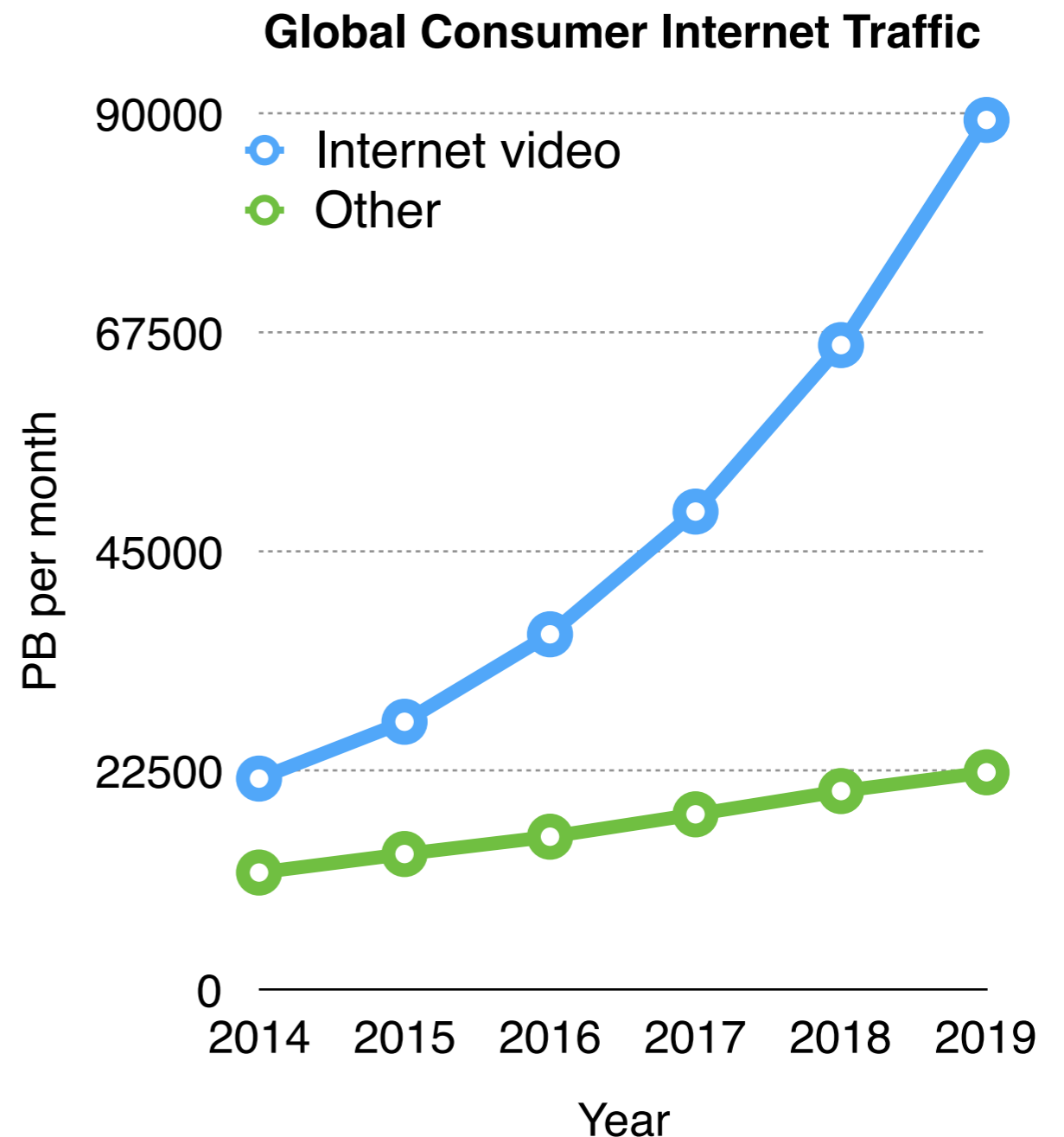
TCP Goes to Hollywood

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Multimedia Applications

- Significant and growing percentage of all Internet traffic
- Sensitive to latency, as well as loss
- Must use either TCP or UDP, and TCP when UDP not available



Cisco Visual Networking Index 2014-2019

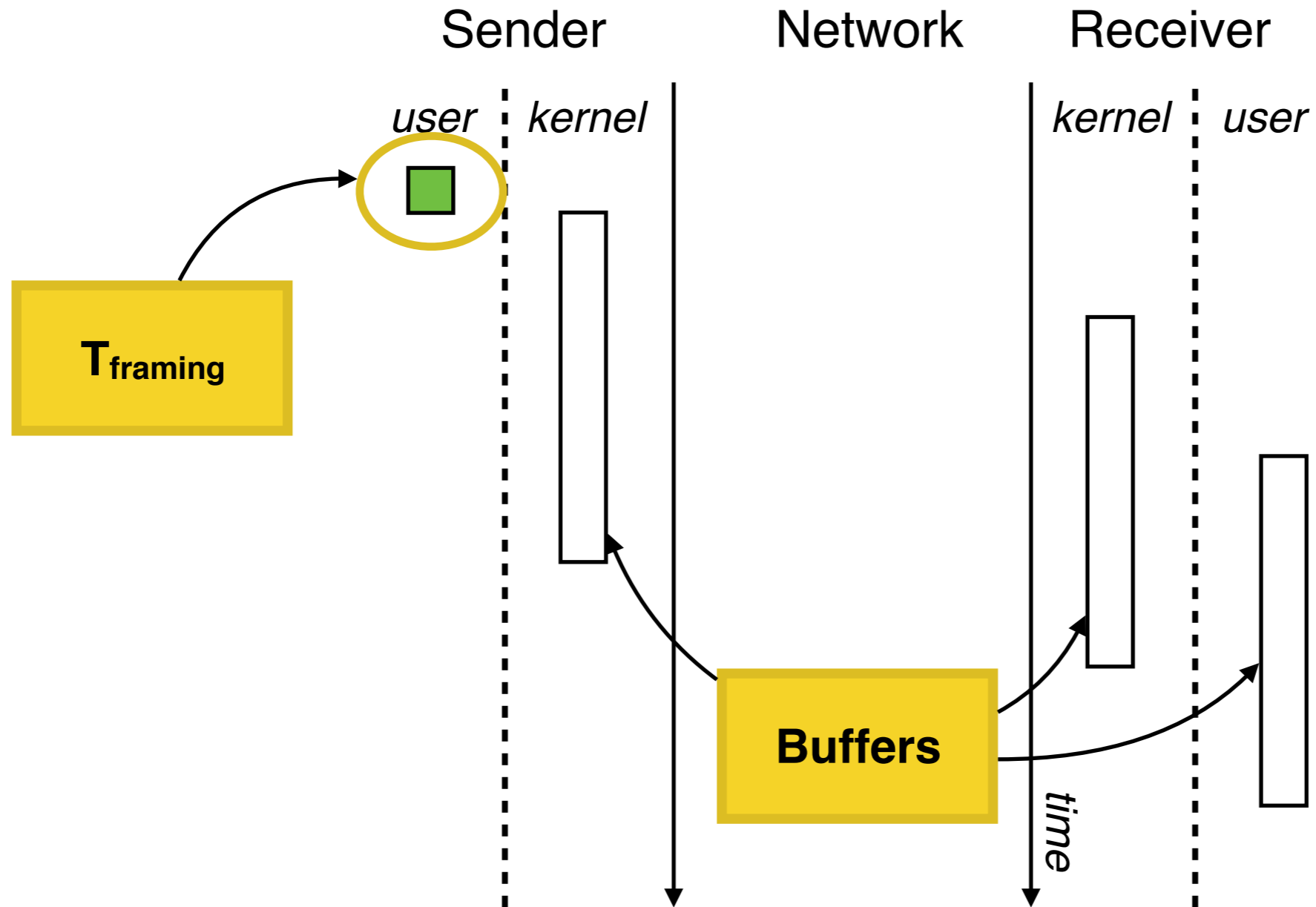
TCP adds latency

- In-order delivery means buffering out-of-order segments, waiting for the delivery of earlier data — head-of-line blocking
- Reliability involves detecting that a segment has been lost, and retransmitting it
- Both of these mechanisms add latency, making TCP a poor choice for real-time multimedia applications

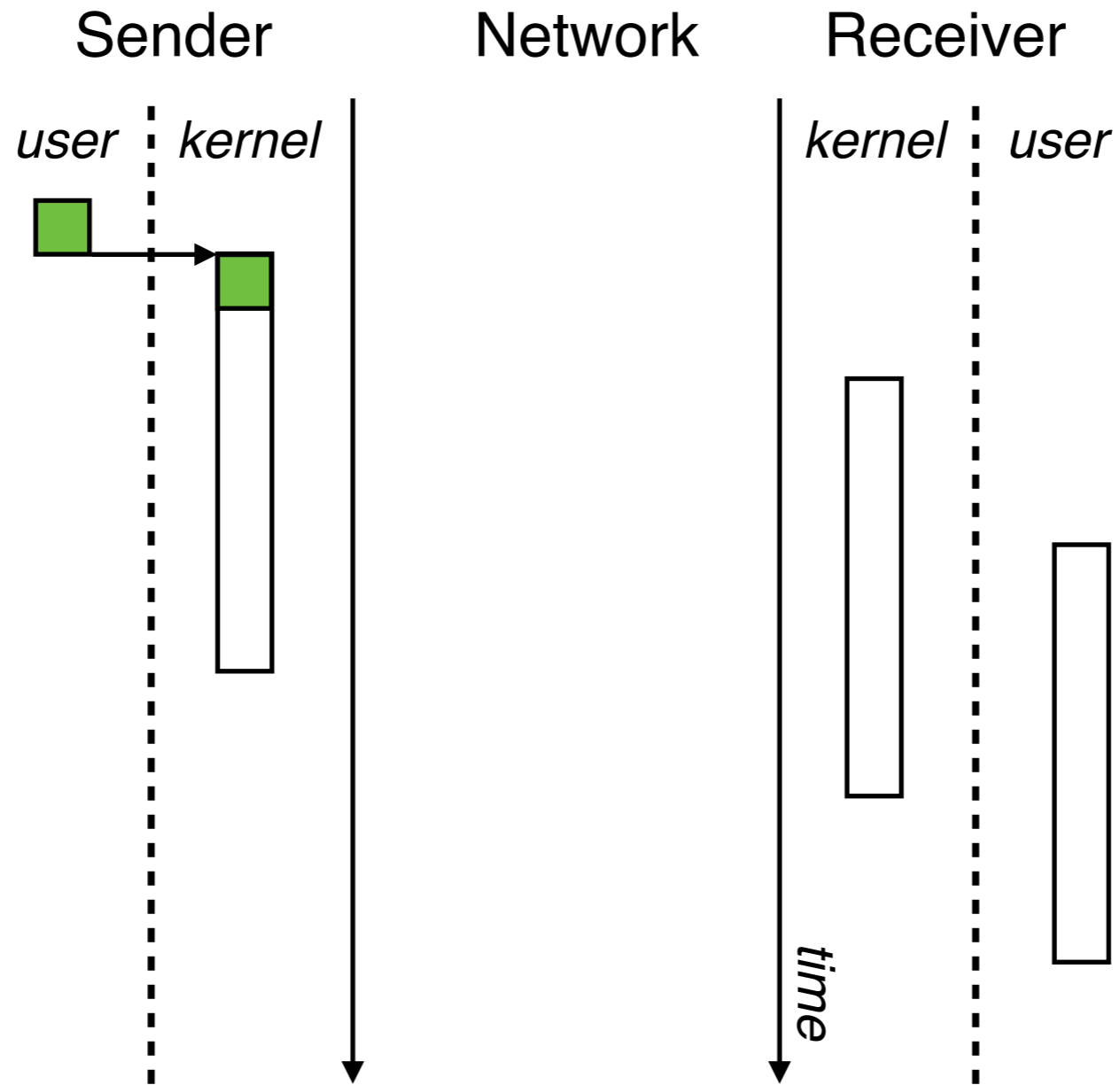
Introducing TCP Hollywood

- Uses TCP as a substrate, to overcome ossification, but modified to reduce latency
- Message-oriented to allow application data units to be sent
- Unordered delivery of messages, given independent utility
- Partially reliable based on time and dependency information

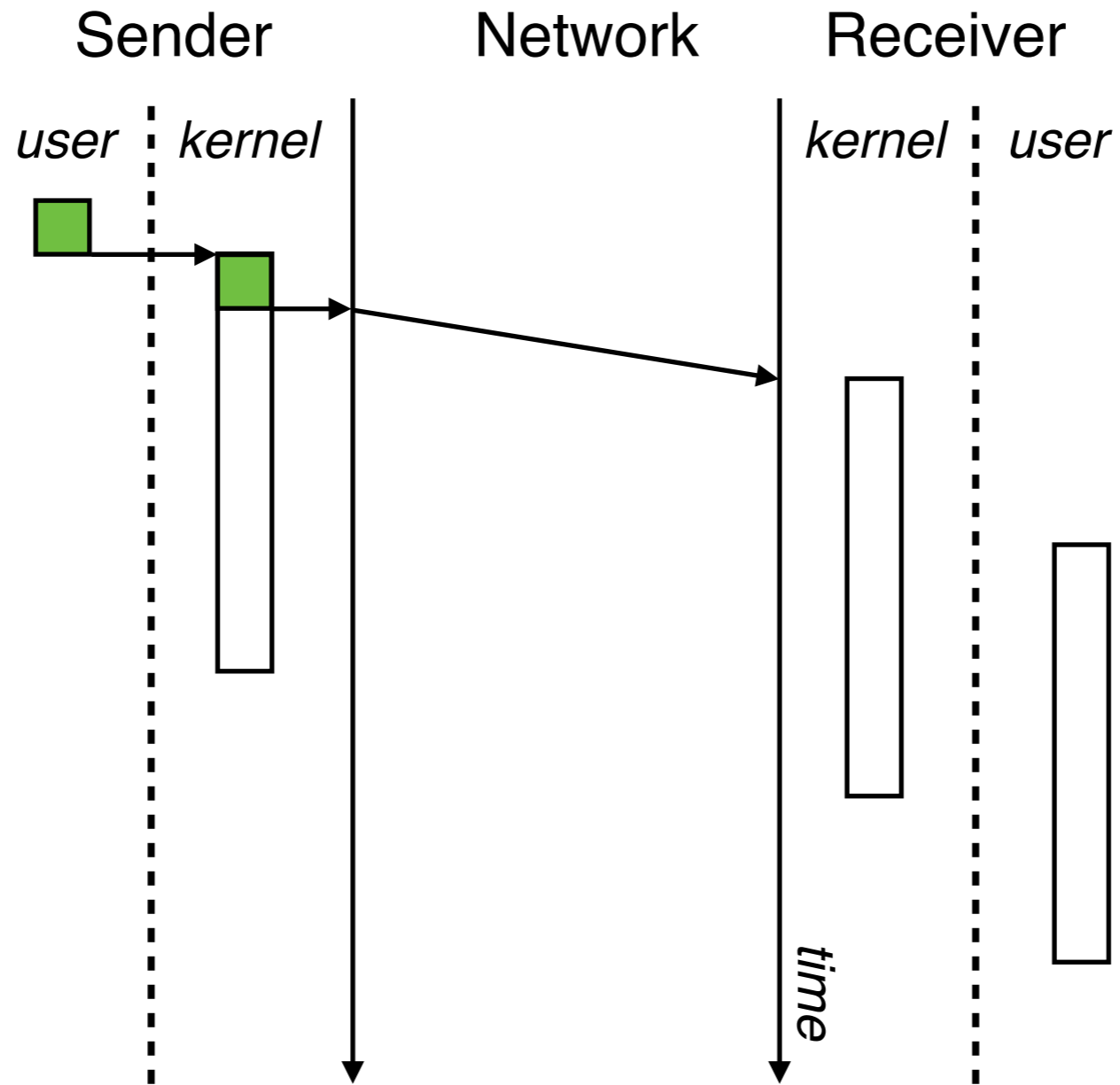
TCP Hollywood in action



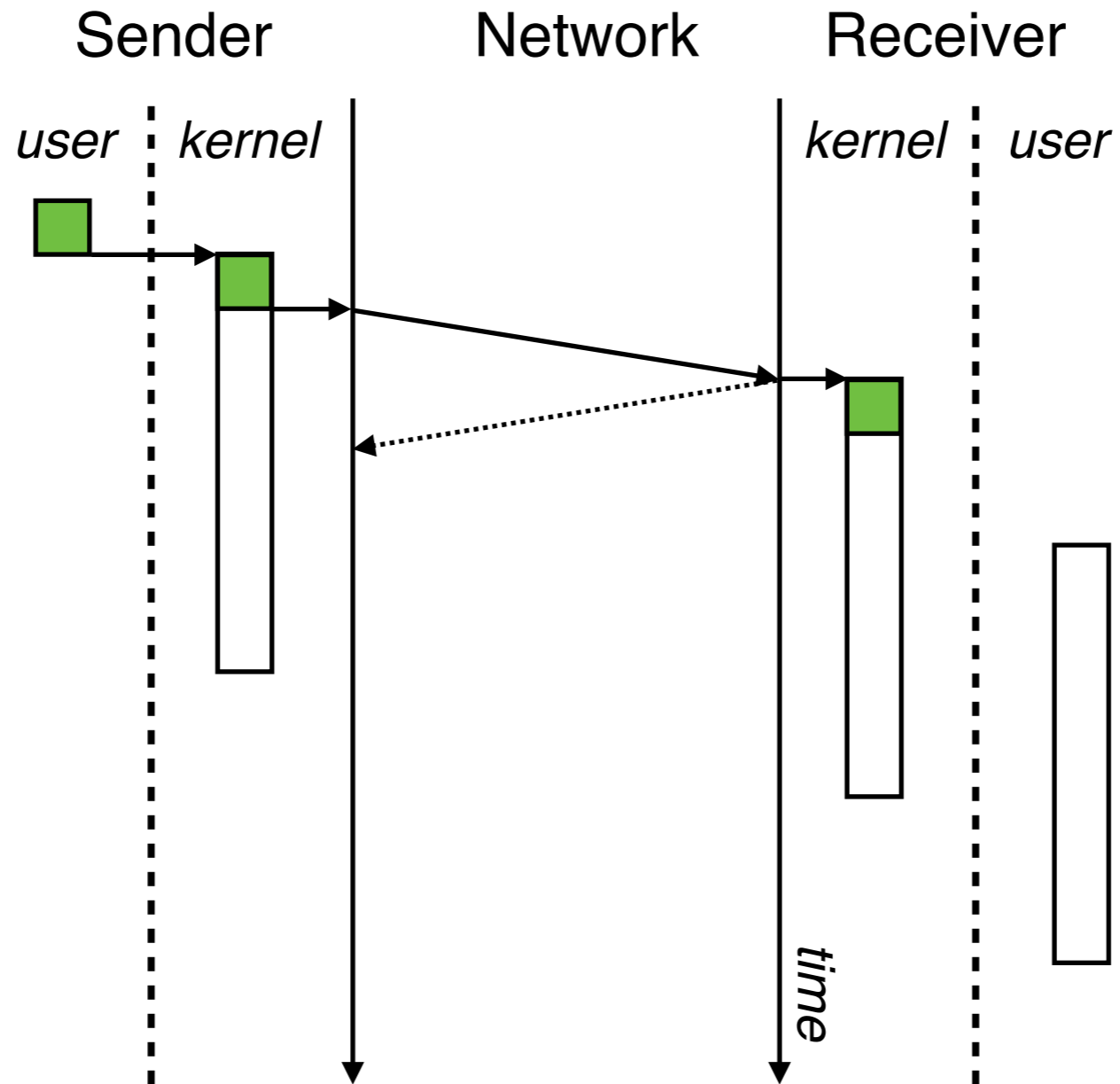
TCP Hollywood in action



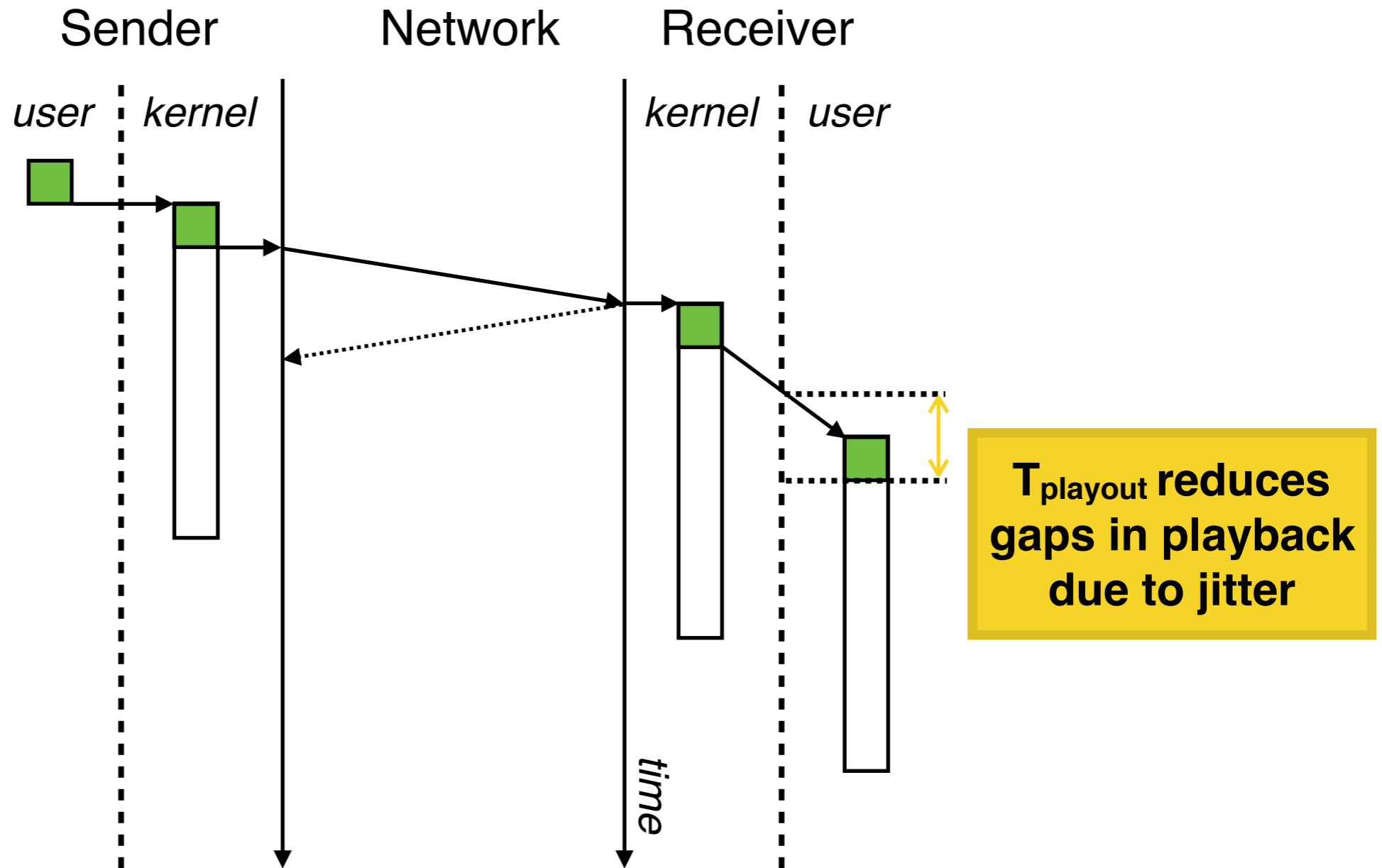
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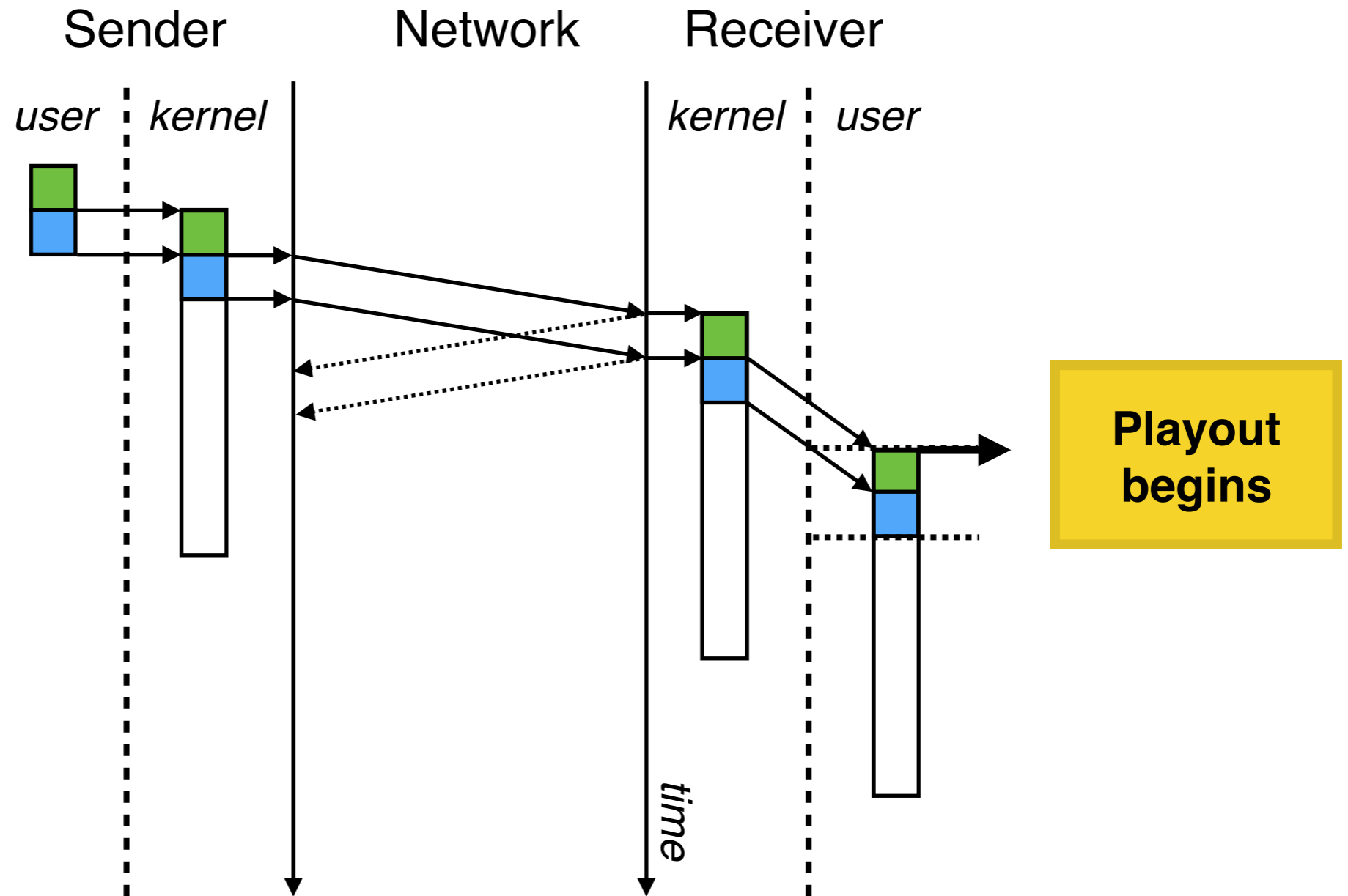
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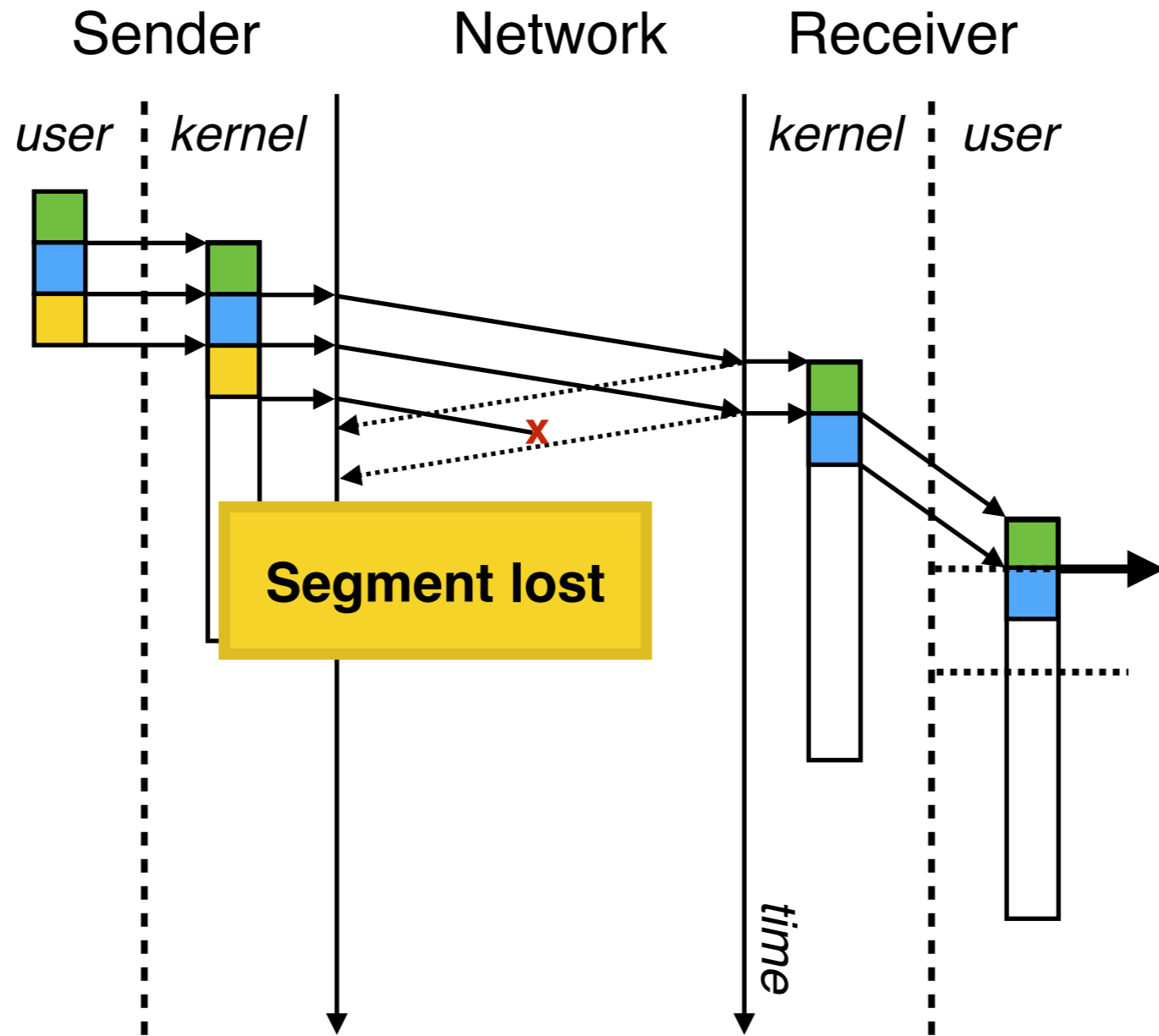
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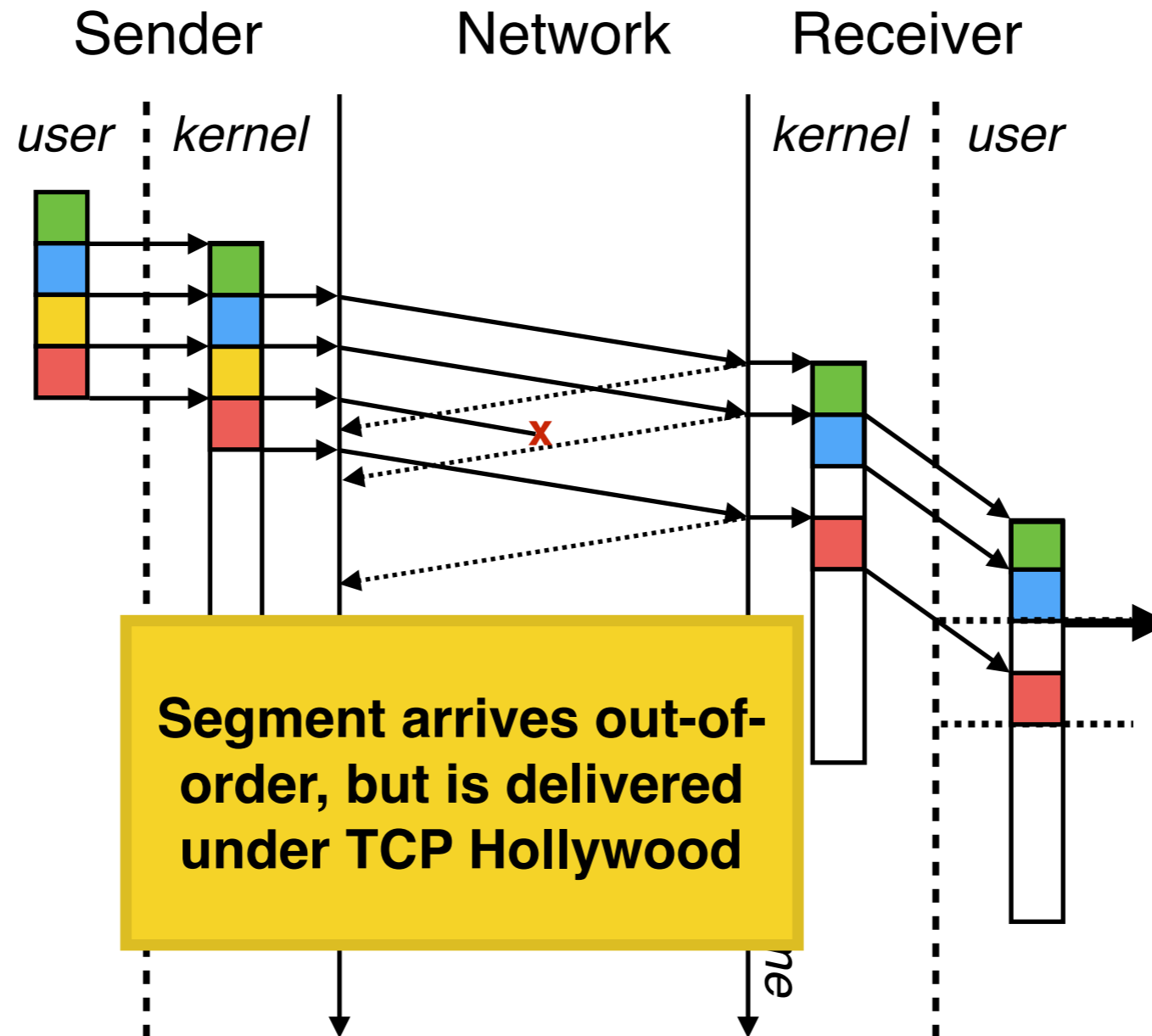
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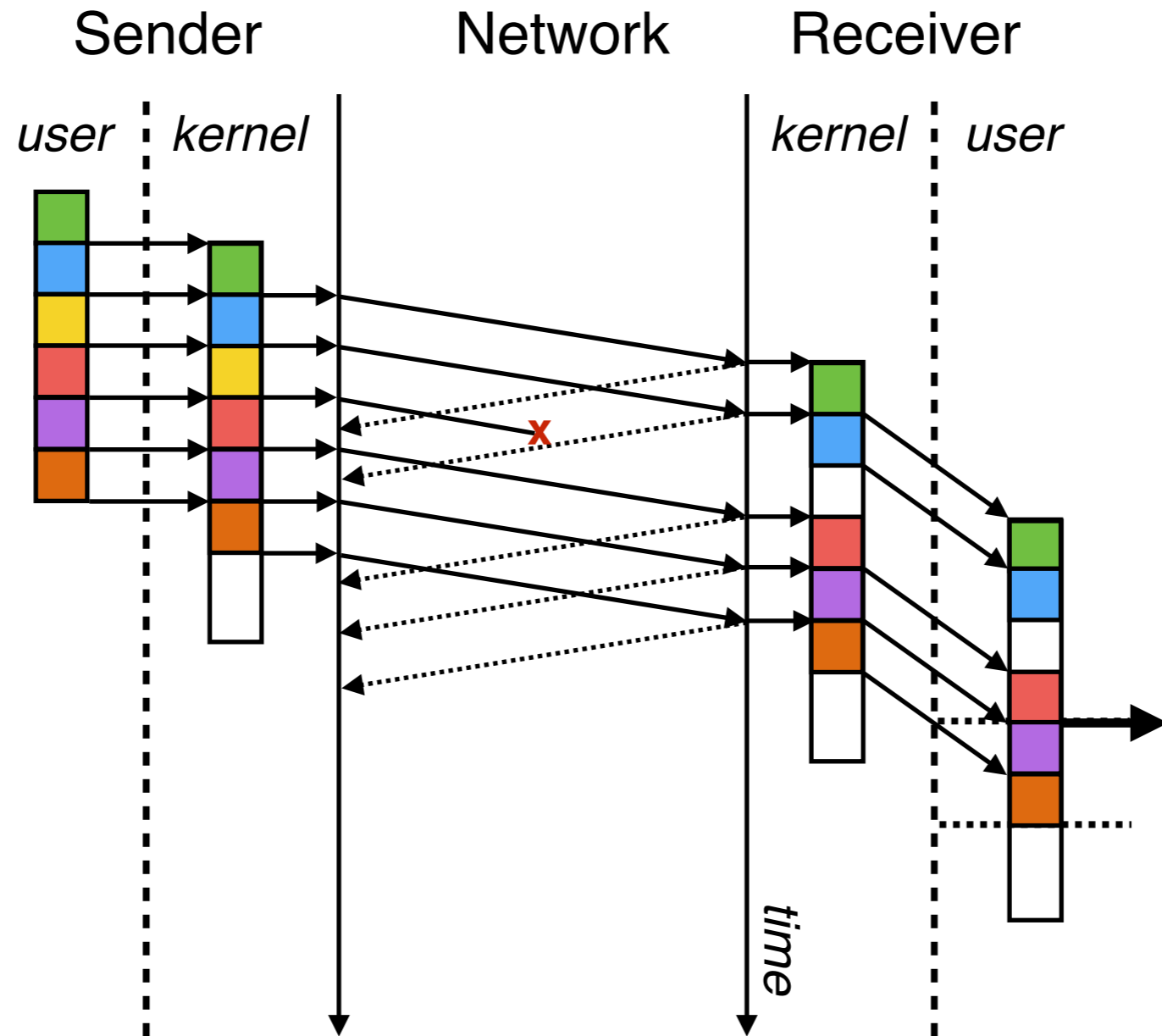
TCP Hollywood in action



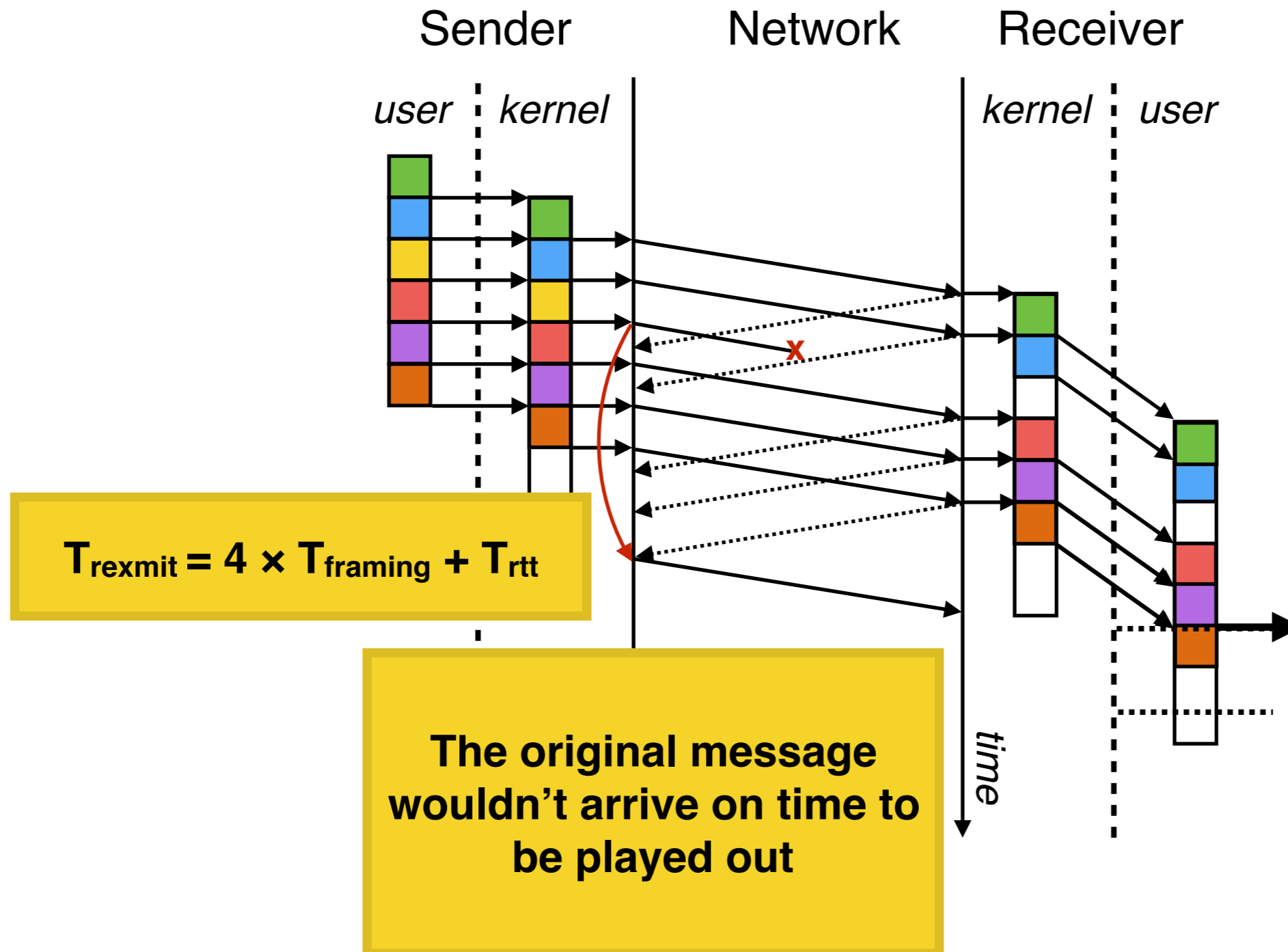
TCP Hollywood in action



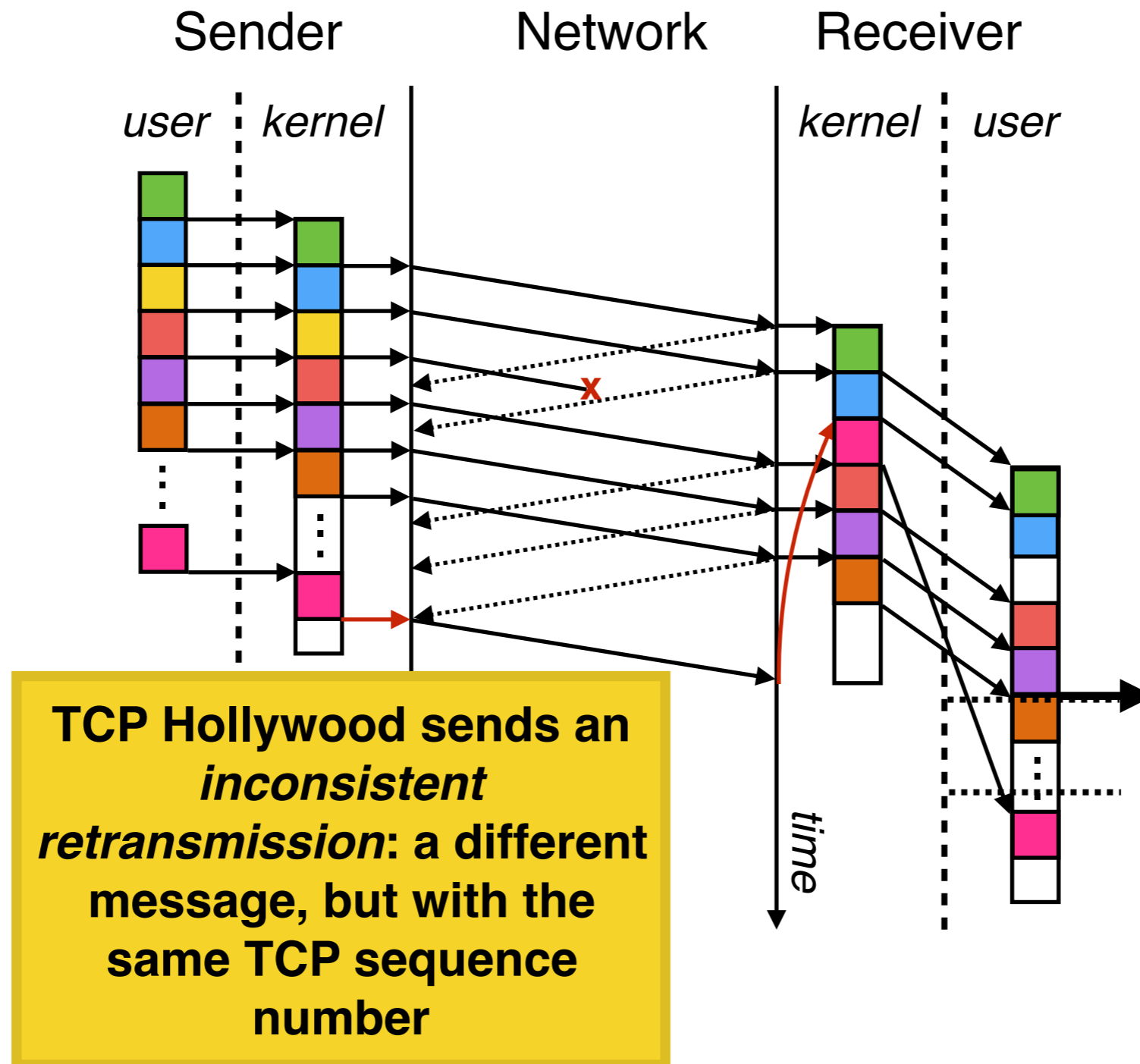
TCP Hollywood in action



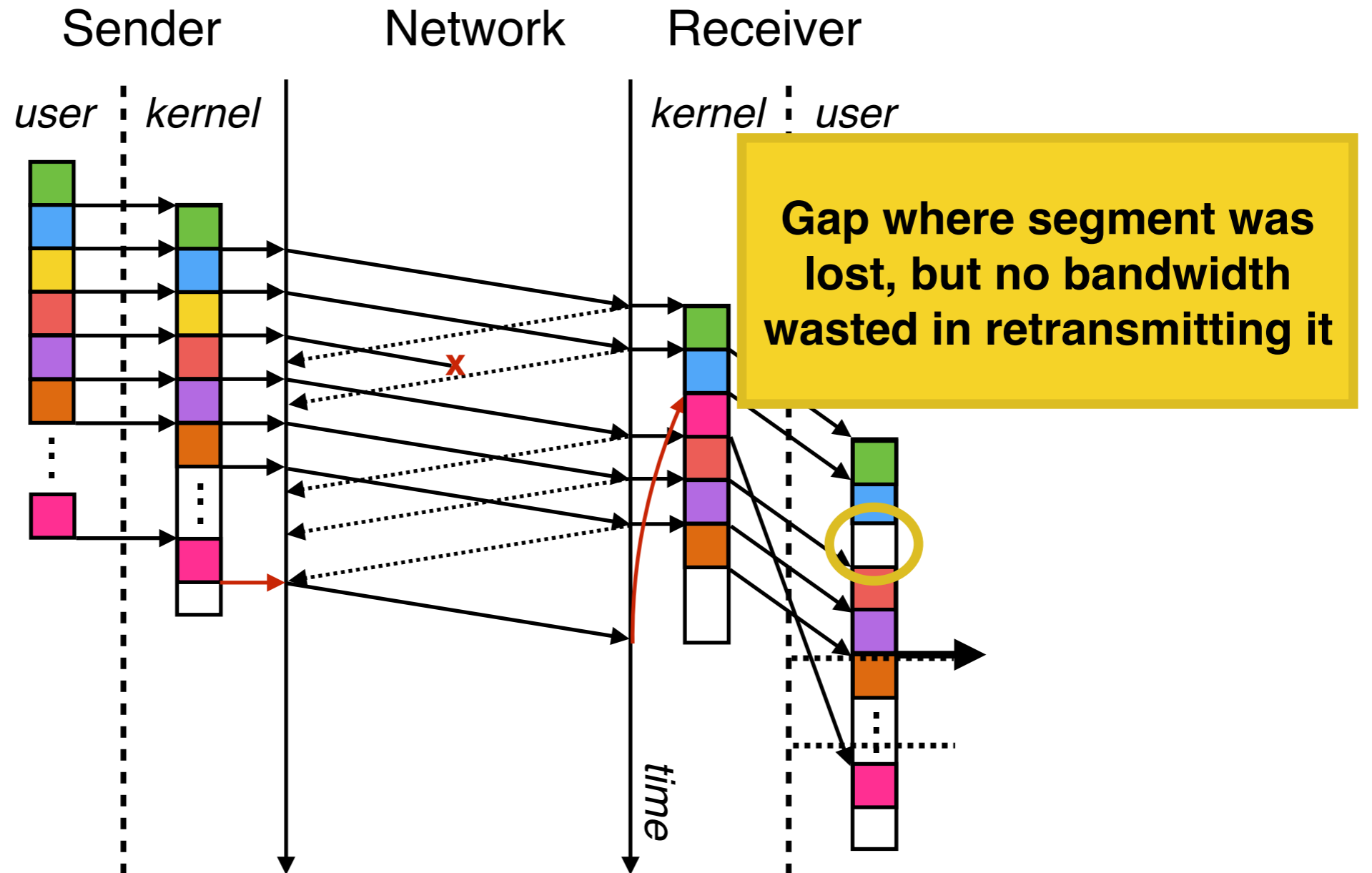
TCP Hollywood in action



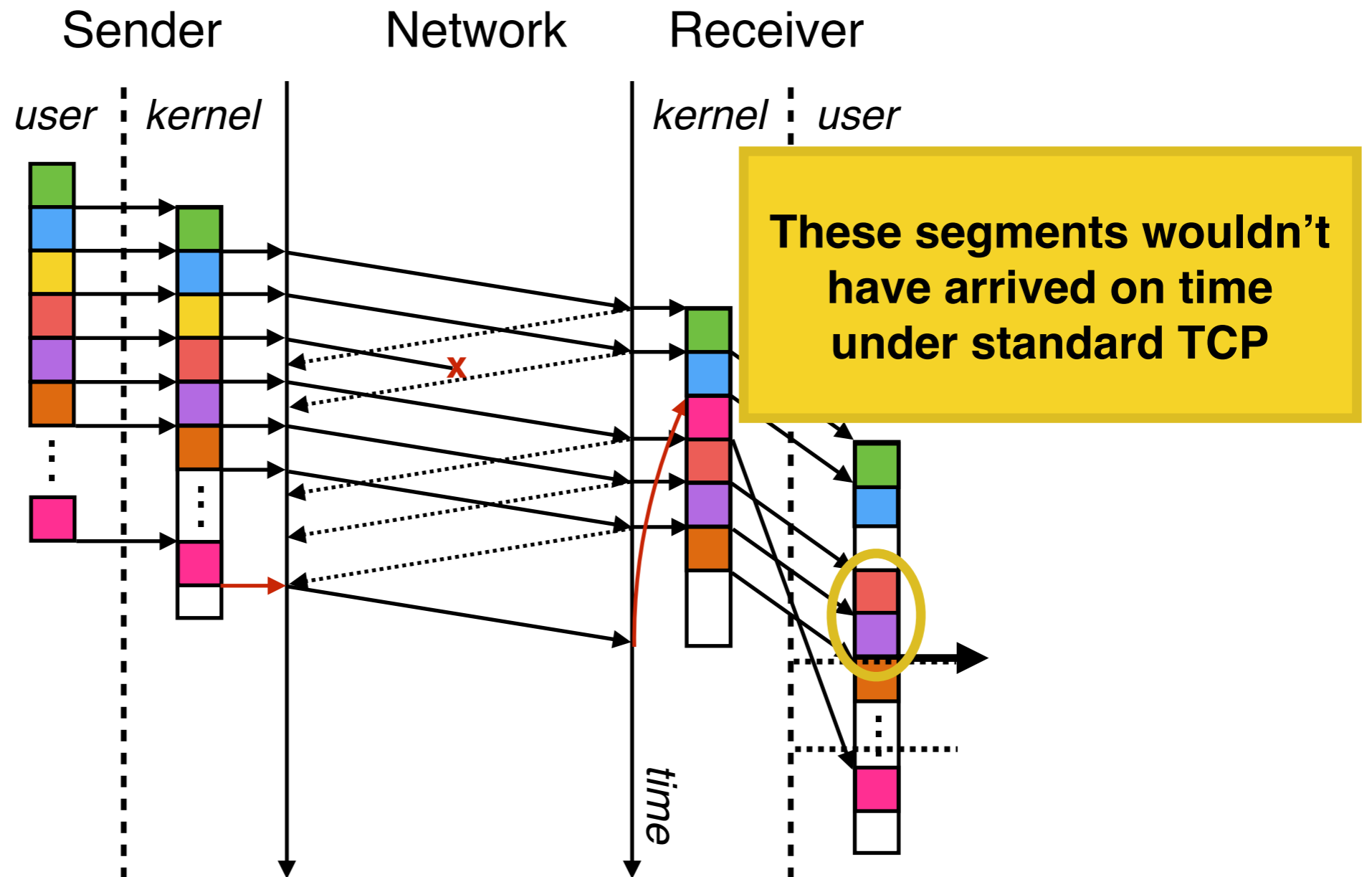
TCP Hollywood in action



TCP Hollywood in action



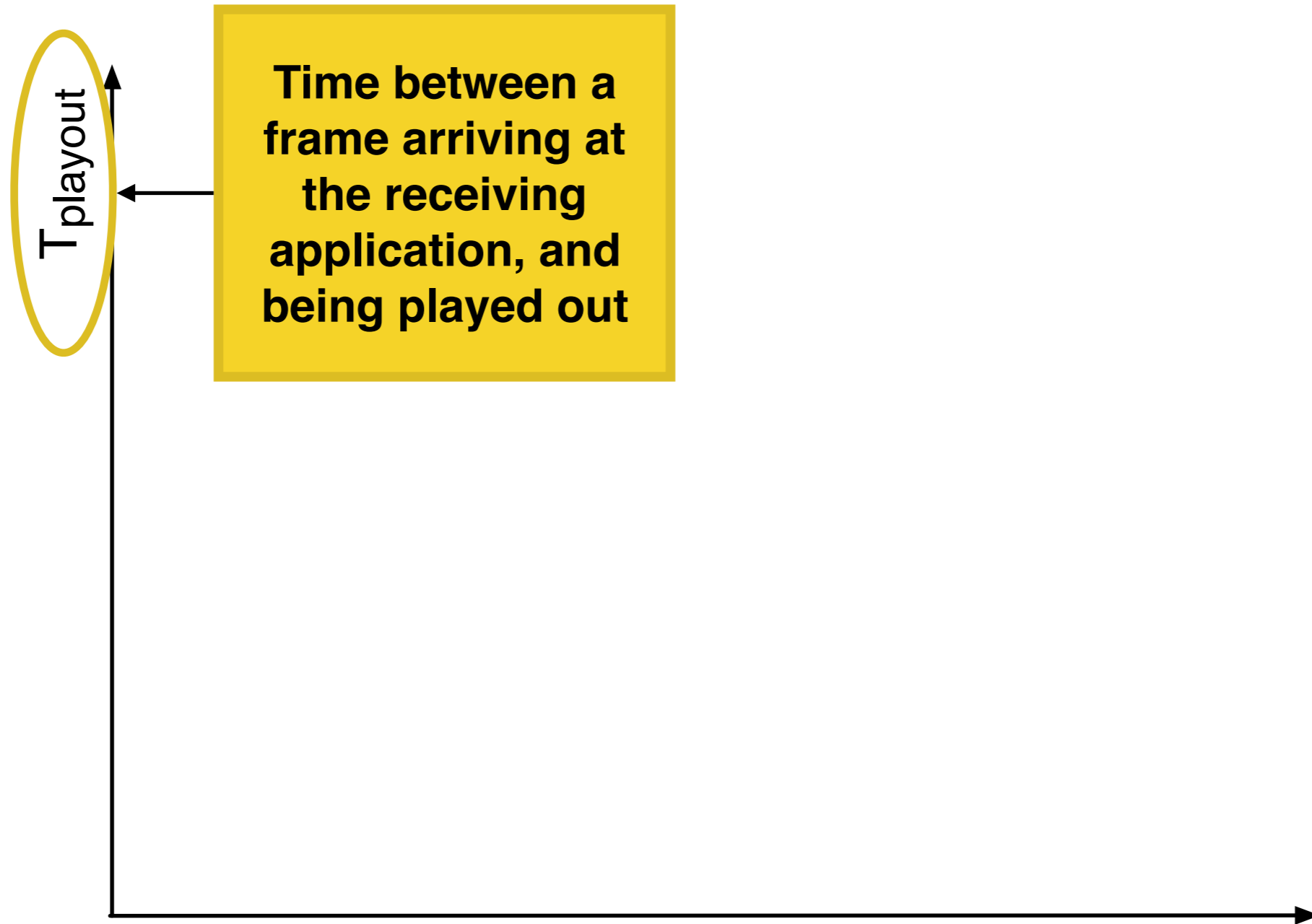
TCP Hollywood in action



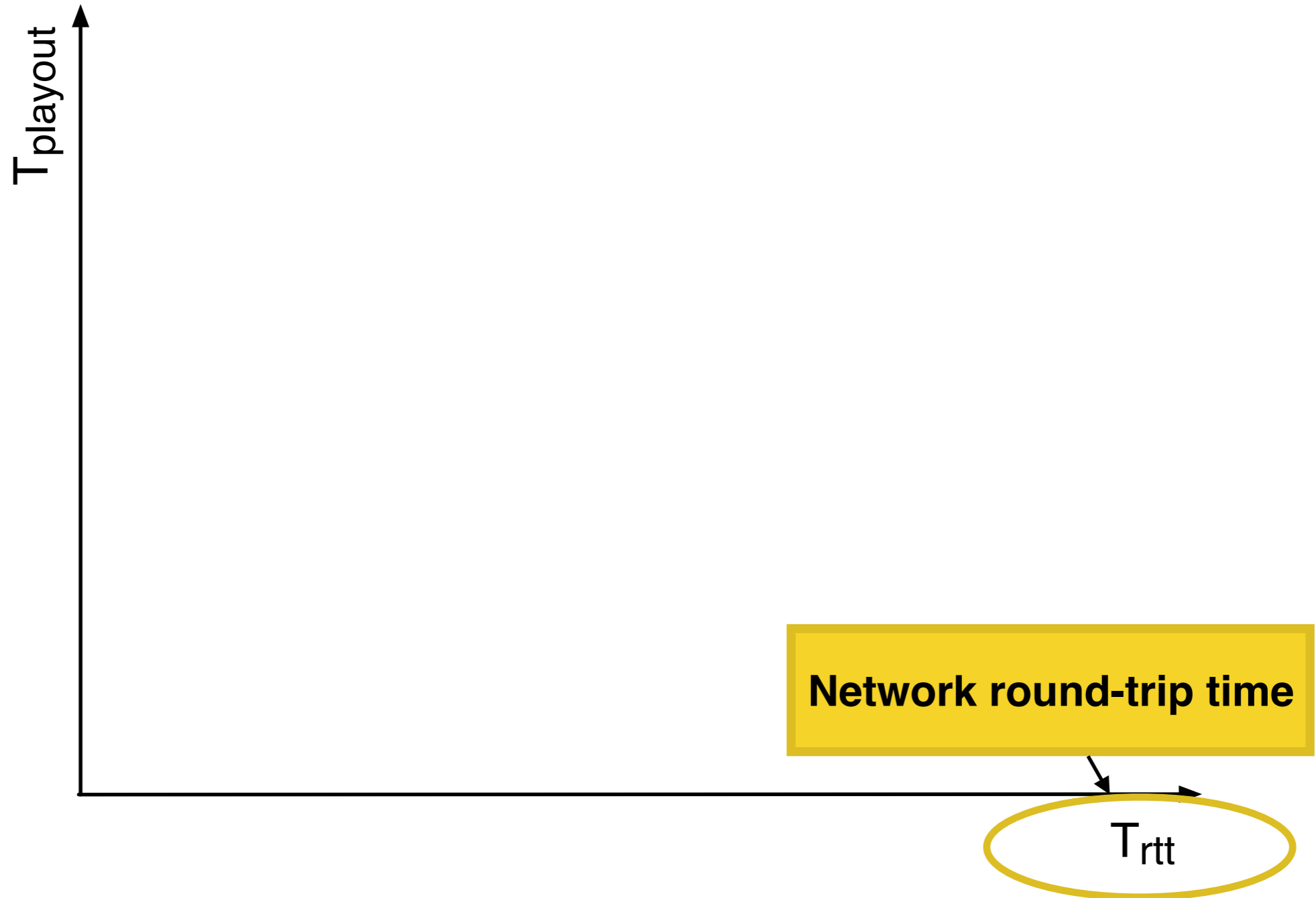
Feasibility Region



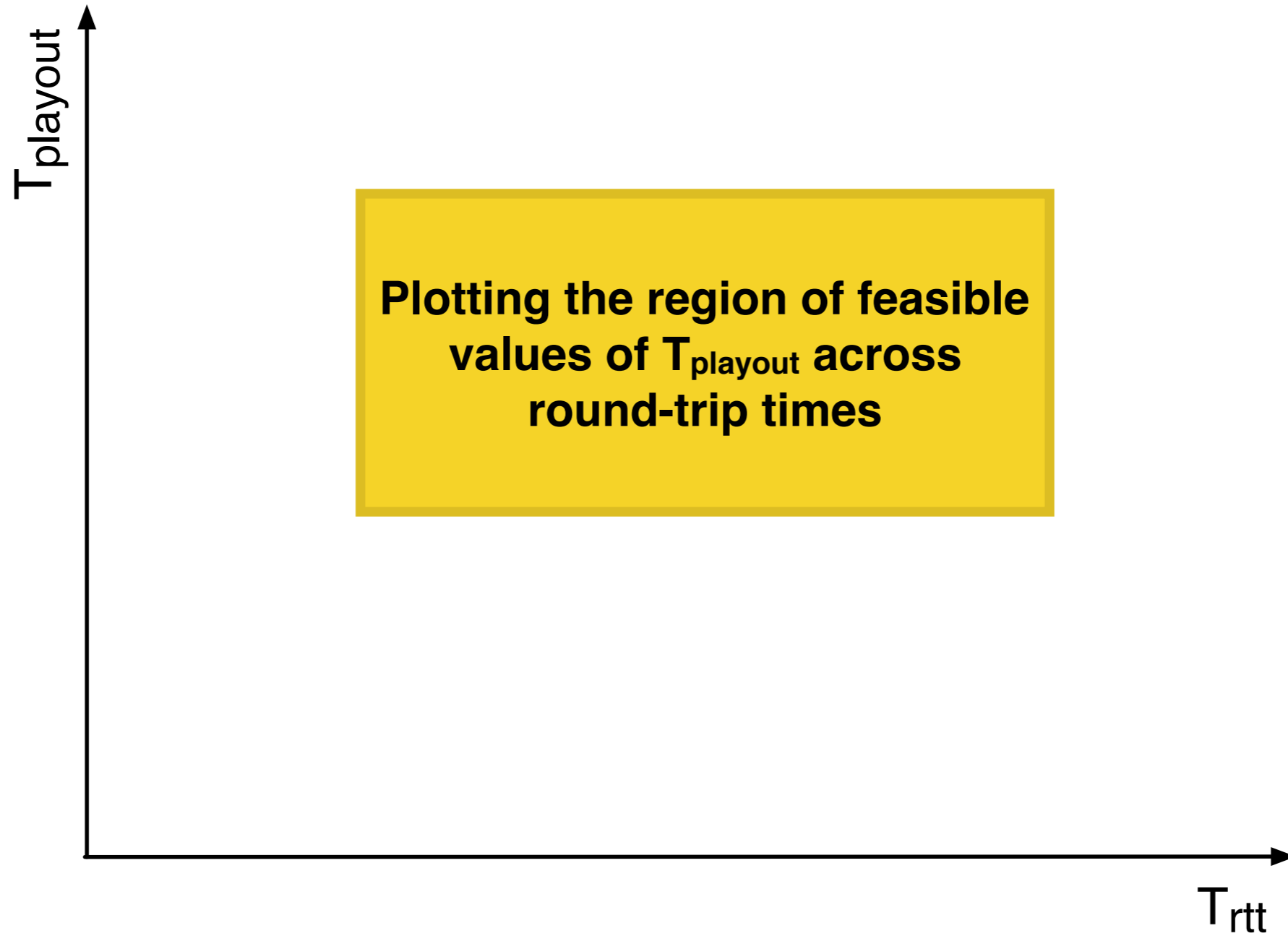
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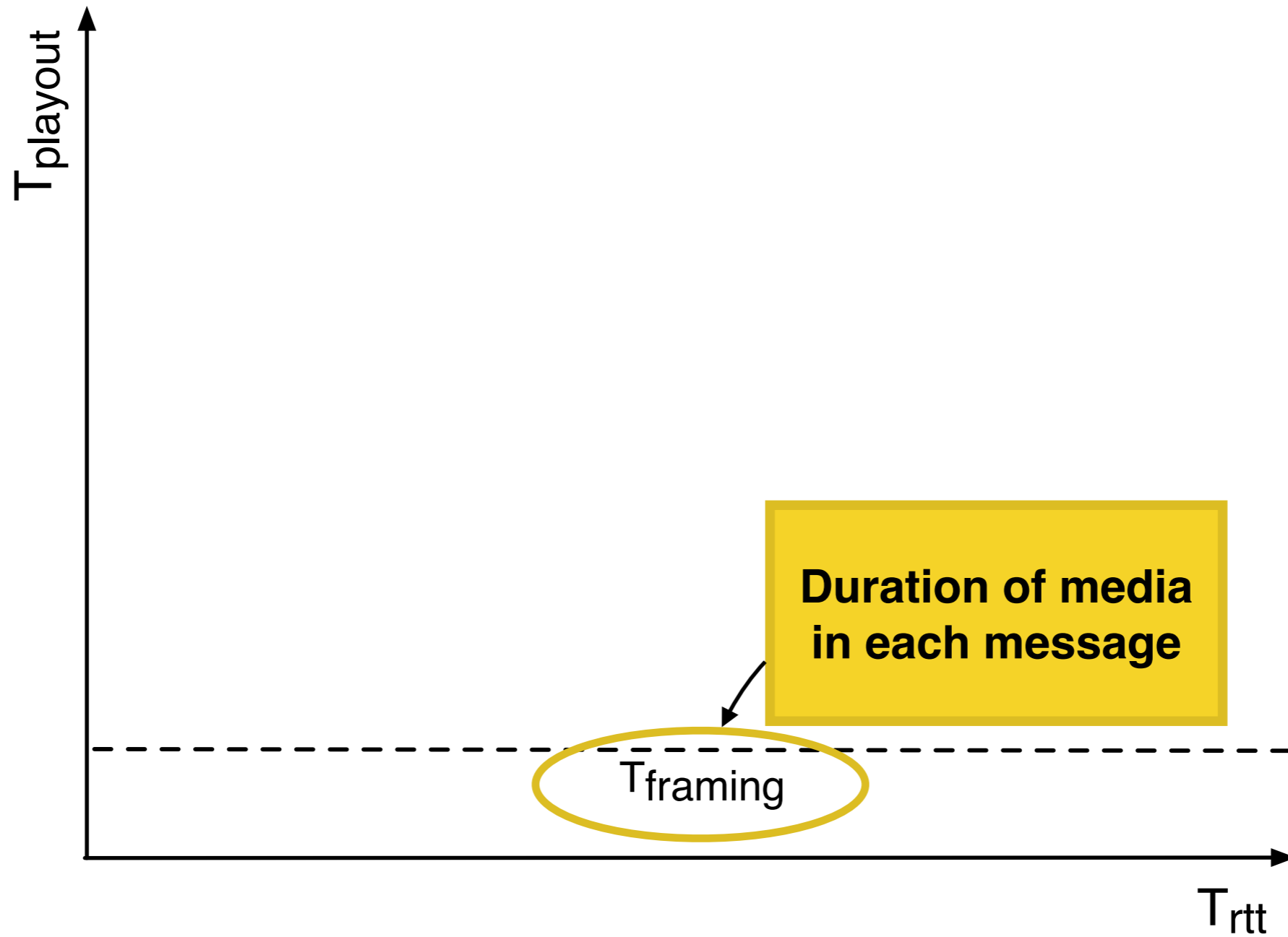
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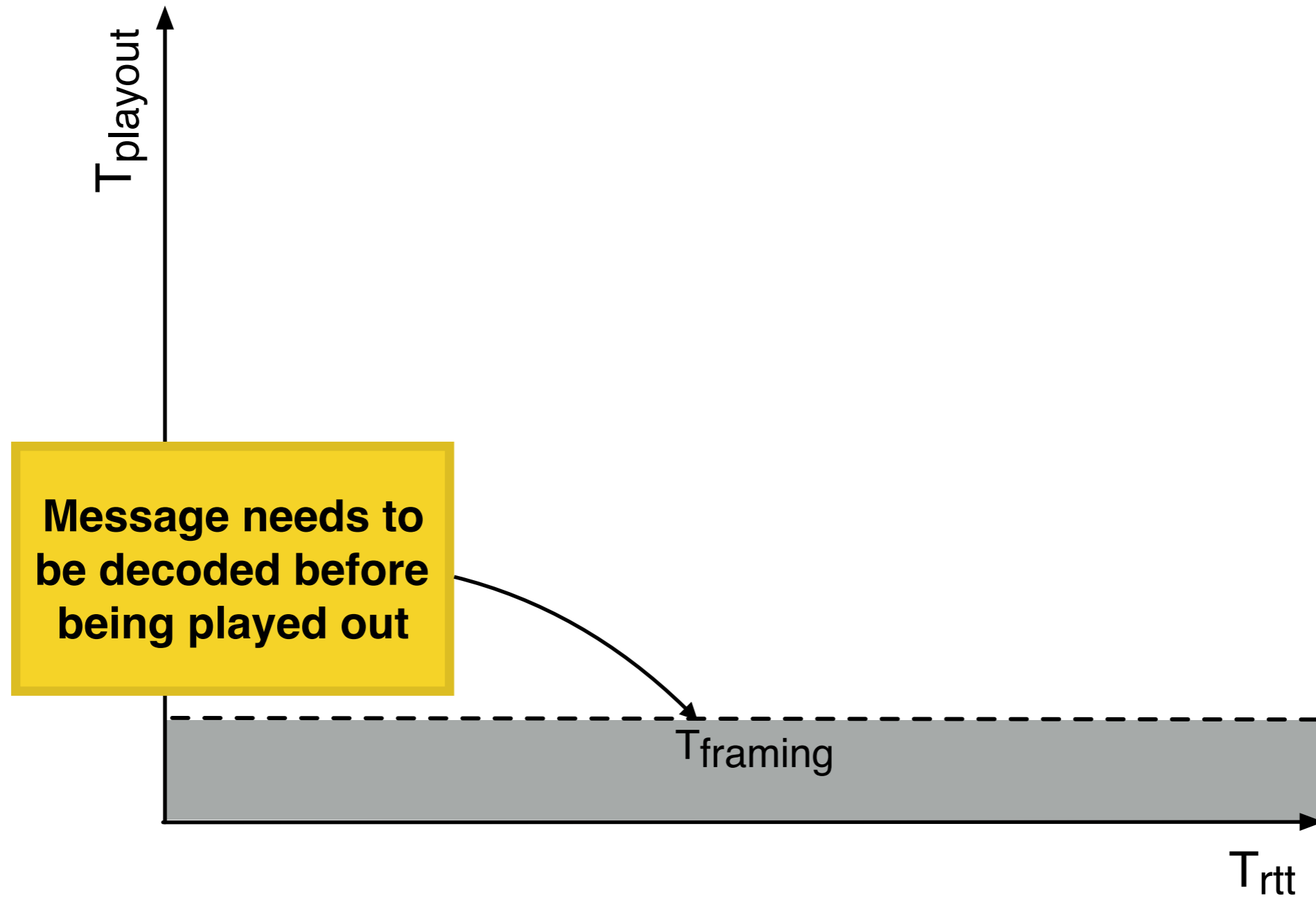
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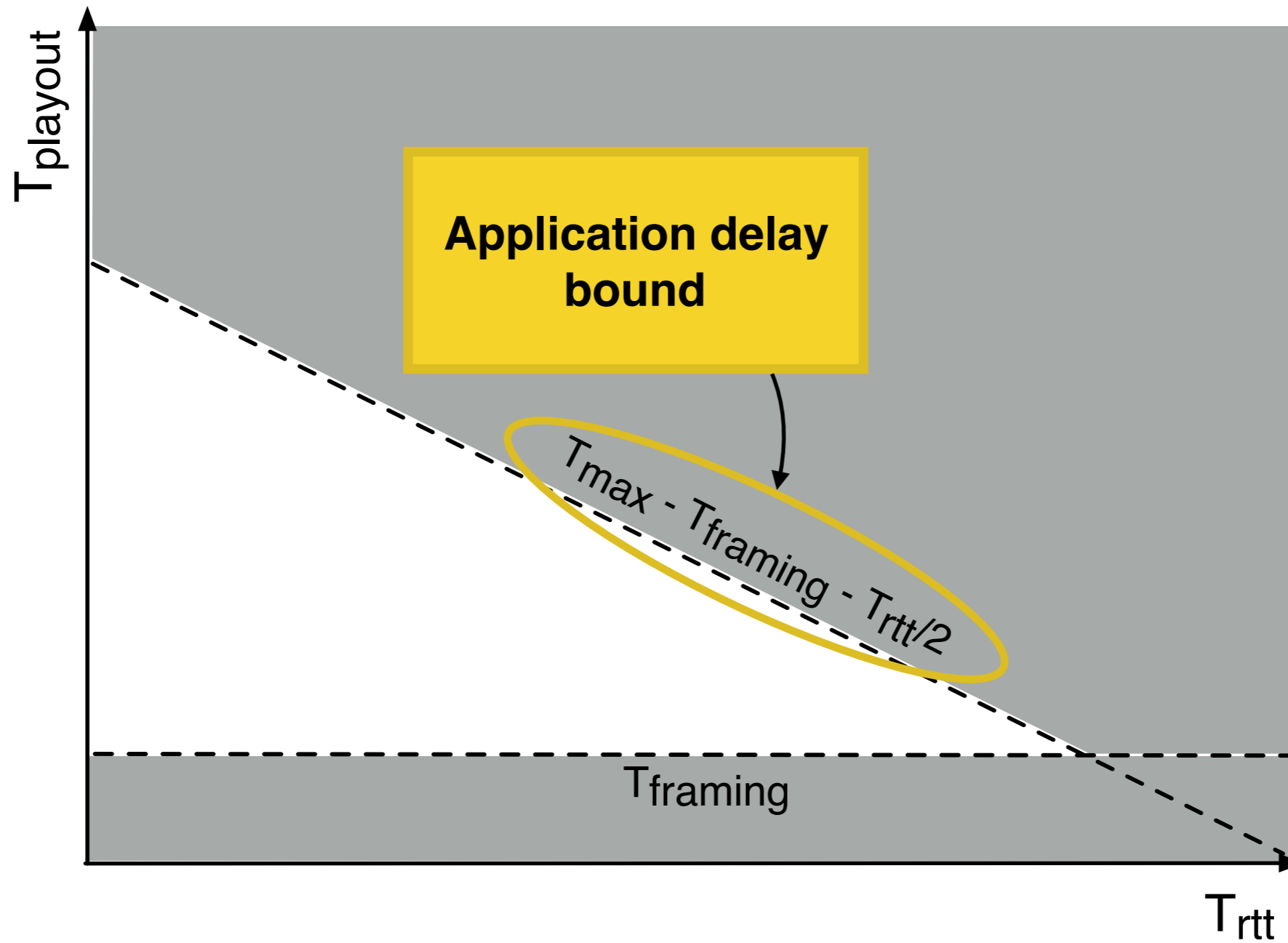
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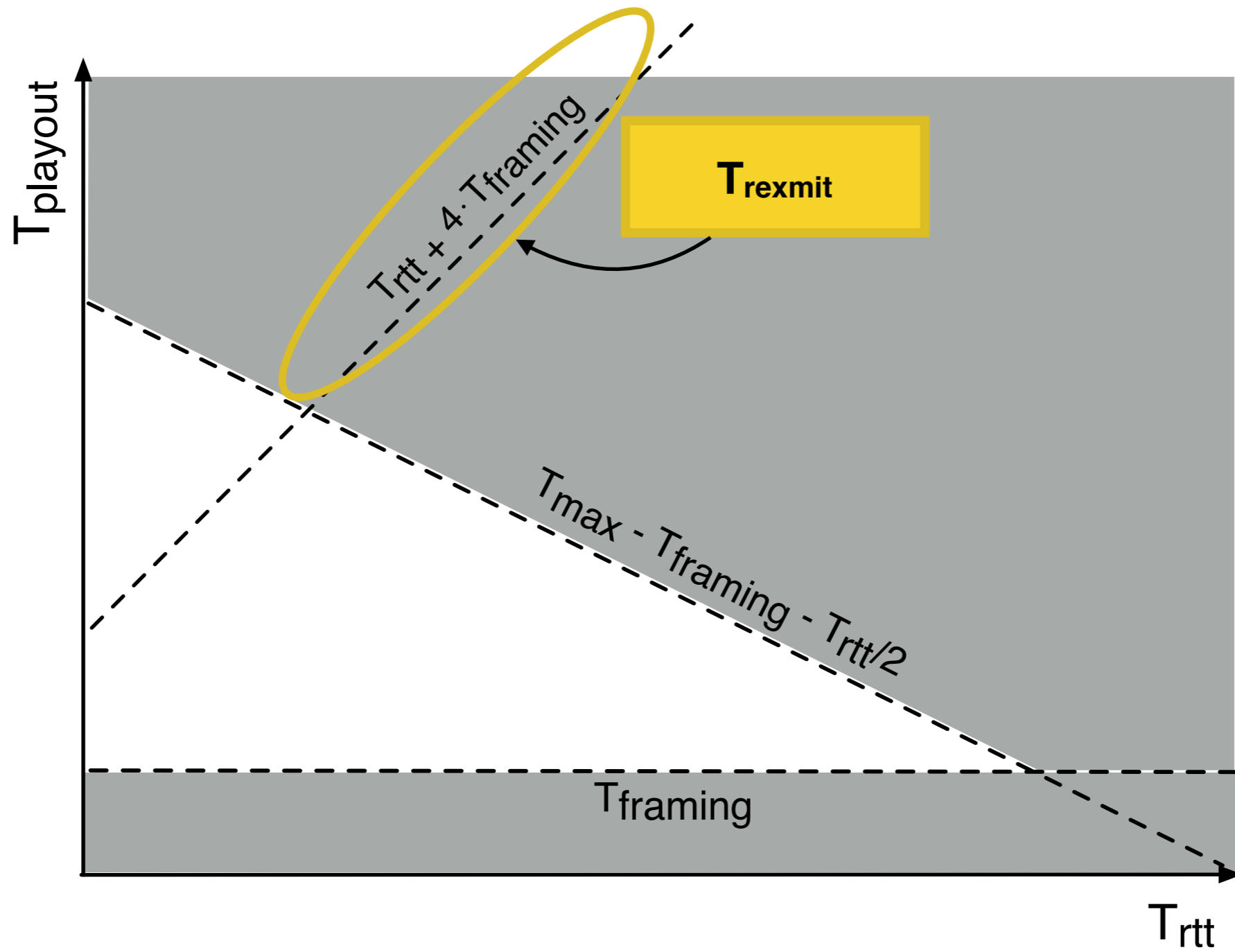
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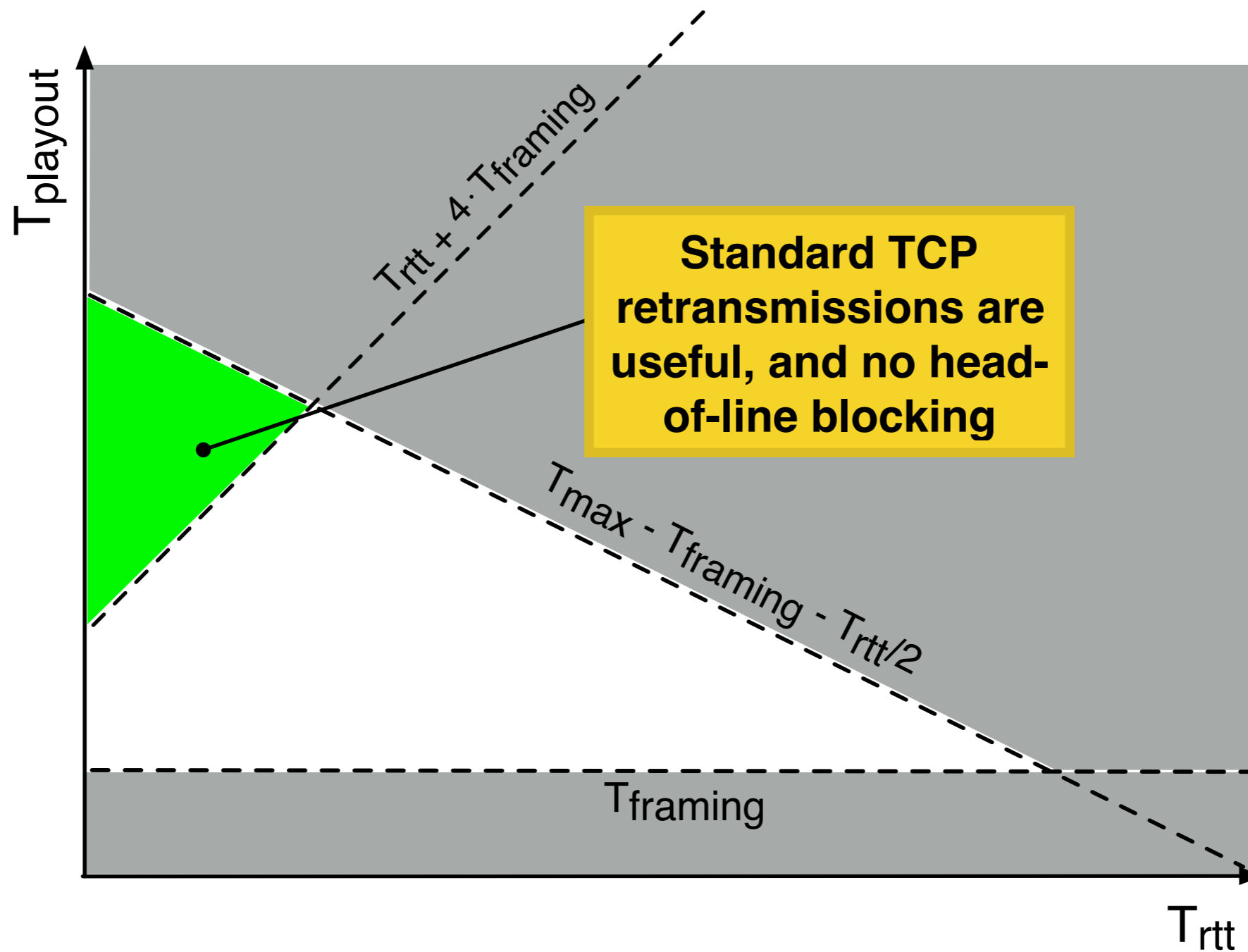
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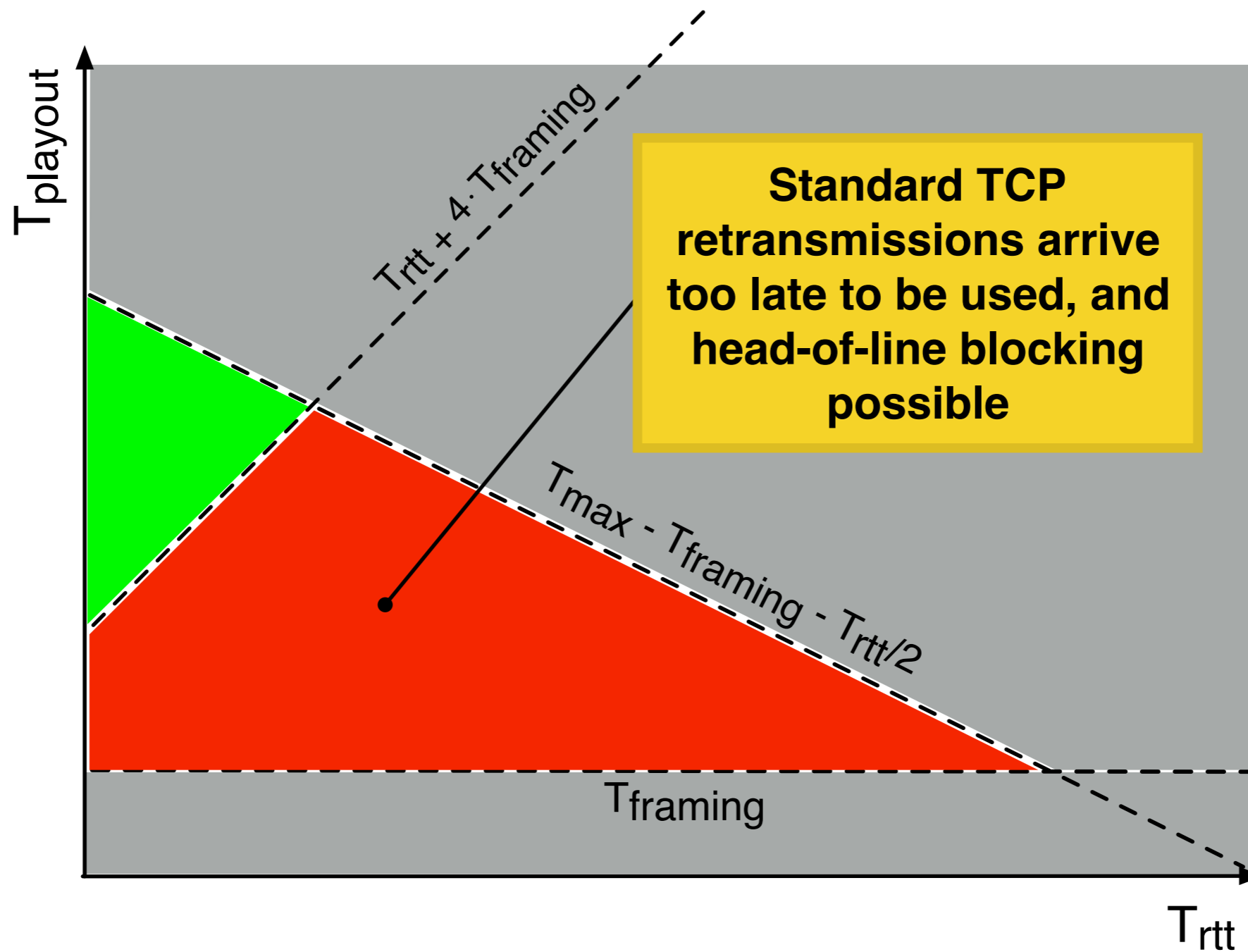
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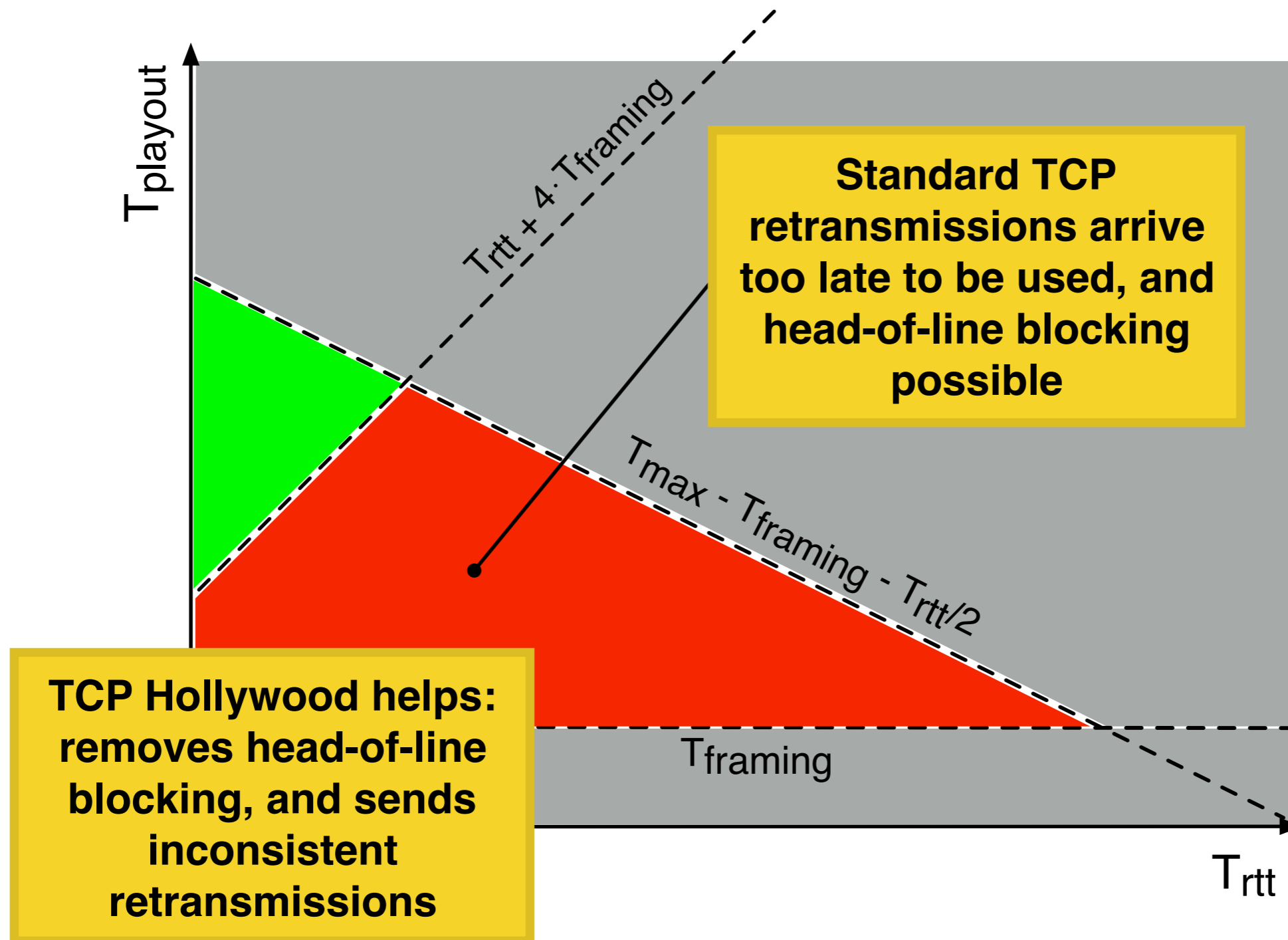
Feasibility Region



Feasibility Region



Feasibility Region



Deployability

- Inconsistent retransmissions are the only wire-visible modification vs. standard TCP — same TCP sequence number, different payload
- Middleboxes performing payload inspection may interpret the behaviour as an attack — man on the side
- Experiments between TCP Hollywood server, and 14 UK clients
- 8 fixed-line ISPs, 4 cellular operators - all major UK ISPs

TCP Hollywood is deployable

- **I** inconsistent retransmissions delivered successfully
- **O** segments cached by middlebox, so original delivered instead — performance no worse than standard TCP
- Safe failure mode for TCP Hollywood

ISP	Port	
	80	4001
Fixed-line		
Andrews & Arnold	I	I
BT	I	I
Demon	I	I
EE	I	I
Eclipse	I	I
Sky	I	I
TalkTalk	I	I
Virgin Media	I	I
Mobile		
EE	O	O
O2	O	O
Three	I	I
Vodafone	O	I

TCP Hollywood

- Unordered, partially reliable message-oriented transport protocol
- Wire-compatible with TCP
- Analysis shows when TCP Hollywood helps applications
- Deployable across all major UK fixed-line and cellular ISPs



“Hollywood Sign”, Gnaphron - CC BY-SA 2.0
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TCP Hollywood

- “TCP Goes to Hollywood”
NOSSDAV 2016
- “TCP Hollywood: An Unordered, Time-Lined, TCP for Networked Multimedia Applications”
IFIP Networking 2016
- “Implementing Real-Time Transport Services over an Ossified Network”
Applied Networking Research Workshop 2016

