

# VFER

## High Performance Transport in User Space

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## Problem Space

- TCP is difficult to tune for high performance
- Today's alternatives to Reno **require** kernel modifications
  - Require root access
  - Can bring down the system
  - Difficult to install and difficult to experiment with
  - Most users stay with default transport
- Loss-based congestion control ignores information

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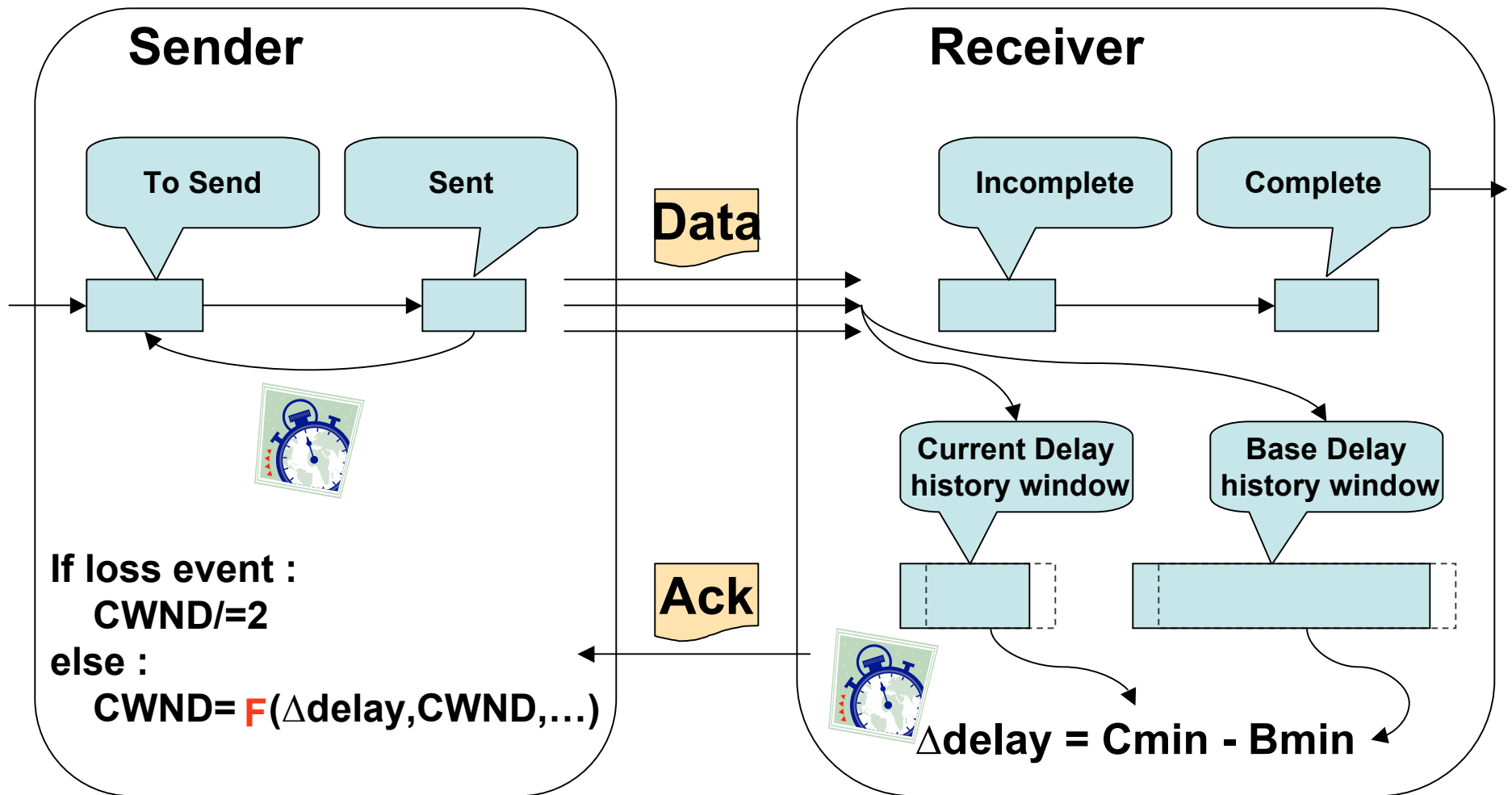
## Goals

- Open-source user-space transport tool
  - Easy to install and configure
  - No kernel modifications nor root access
  - Portable
- Two ways to use
  - Library with a socket-like API
  - File transfer tool
- Advanced congestion control
  - Performs better than TCP out of the box
  - Delay-based and TCP-friendly
- Security layer – if necessary

## Protocol

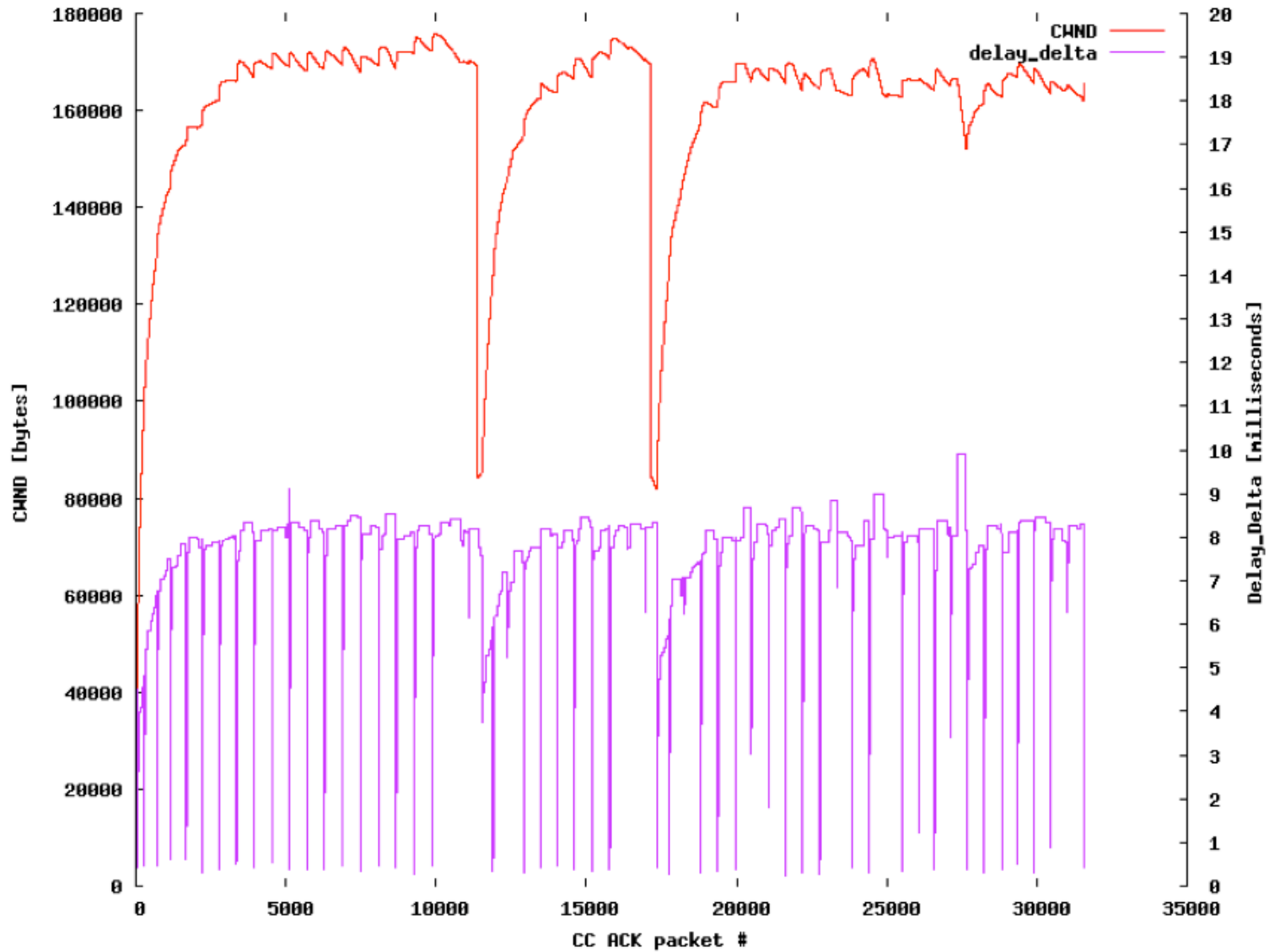
- In-order reliable delivery of variable-sized objects
- Connection-oriented
- Congestion control uses delay and loss
- Path MTU discovery

## Congestion Control



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## Sample WAN transfer with VFER



## Implementation Details

- Written in C, runs in user-space
  - Linux, BSD, OSX support
  - Familiar socket-like API
- Over UDP
- Time stamping with TSC-I2 library
- Uses existing SSH credentials

## Results

- Coming into use by
  - The electronic-Very Long Baseline Interferometry (e-VLBI) community
  - The Visible Human Project (VHP)



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## Summary

- Advanced congestion control
- User-space implementation
  - Library with a familiar API
  - File transfer tool

Try VFER!

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