mobidia

Layer 4 Optimization Solution

mobidia

TELECOM COUNCIL 2010 SPIFFY AWARD NOMINEE

RED HERRING CANADA WINNER 50

TECHNOLOGY IMPACT AWARDS WINNER

Unplanned Growth Crushing Mobile Networks

Mobile Broadband

Smartphones & OpenOS

Massive Growth*

- 3900% increase 2009-2014
- 66% Video by 2013

Network Stress

- "Brown-Outs":
  - Bottlenecks
  - Latency
  - Lost connections
  - Upset subscribers

* Cisco VNI 2010

Compelling Apps & Services

YouTube, sling MEDIA, Google Video, hulu, fring, facebook, BitTorrent, skype

Attractive Pricing

The Challenging State of Mobile Networks

- ARPU is not keeping up with costs
- Device consumption growing
  - 2GB/mo on laptops
  - 250MB/mo on smartphones
- Managing networks is tough
  - Varied users and service models
  - Very uneven subscriber usage
  - Increased uplink traffic
  - Dropped connections, slow response

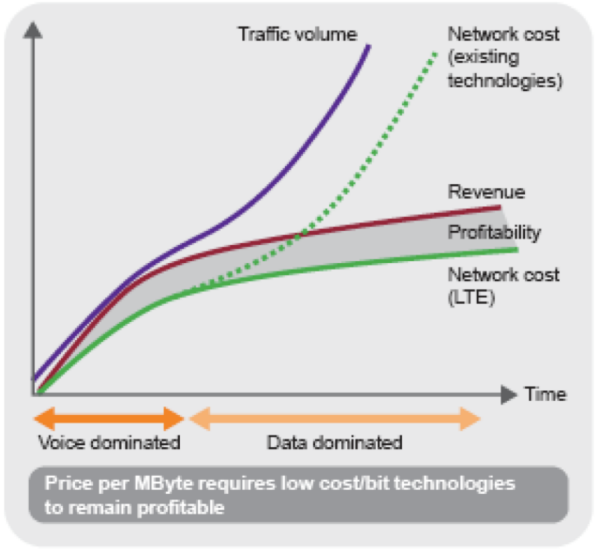


Figure 4. Revenue trends do not correspond with traffic growth.

Cost and revenue misalignment demands optimization strategies

General Solutions

- Spectrum & cell site enhancements
  - Expensive and slow to deploy
- HSPA, LTE, WiFi offload
  - TCP inefficiencies exist
- DPI\Policy (caps &tiers)
  - Decisions made after data is consumed
- Compression, transcoding, video shaping
  - CPU intensive, hard to scale, increases latency
  - Decreasing value as content providers implement at the source
- Server-based transport optimization
  - Limited impact

- Mobidia Complements
  - Client\Server UDP approach
  - 15-30% efficiency gains
  - Incremental to other solutions
  - Scalable
  - Hosted solution deploys quickly
  - Performance on 3G, 4G
  - Enhanced policy, DPI, offload

No Single Solution Exists

Better Networks with Intelligence at the Edge

Client-Based Transport Layer Technology Platform **Benefits**

Network Efficiency

- Maximize radio capacity
- Minimize network congestion

Increase efficiency **15-30%**
1.5x faster subscriber experience

End to End Service Delivery

- Policy enforcement point at the end of the network
- Precise application ID by user equipment
- Congestion-sensitive service capping
- Intelligent Off-Load capability

Uplink management
Differentiated billing
Subscriber fairness
Network Off-Load

Services and Network Analytics

- More accurate and real –time intelligence to the core
- Who is generating what data with what applications on which segments of the network
- Subscriber and service intelligence

Network planning

Informed decision making

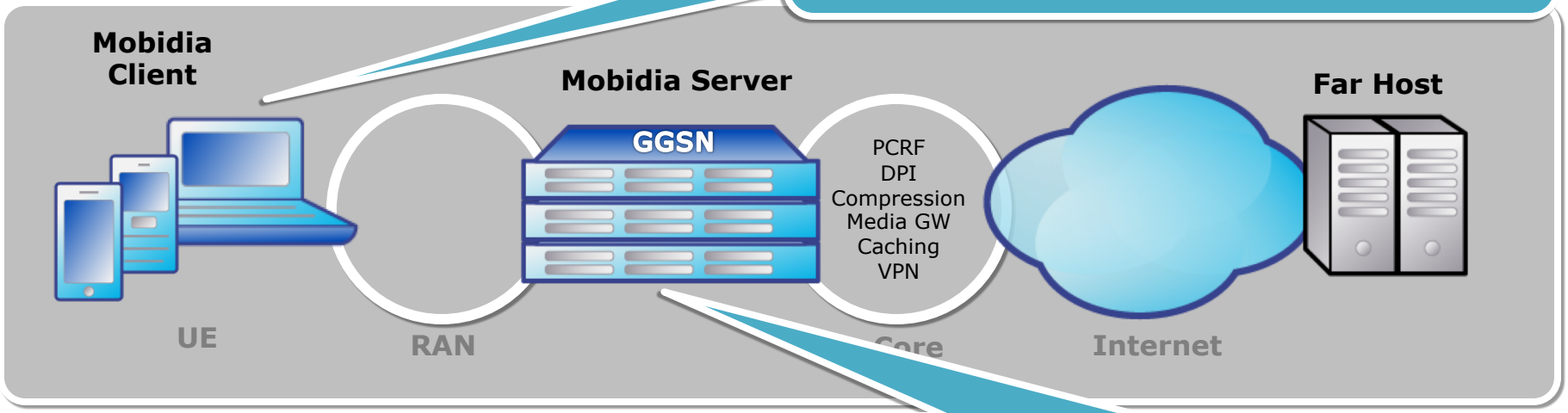
Transparent - Complementary - Additive

Overall System Software Components

1. Enhanced Network Stack

- Works on laptops, smartphone, tablets
- No user interface or configuration

Client architecture enables optimization and enhanced policy, DPI, off-load



2. Server Software

- Limited processing, power, and memory requirements
- Flexible Deployment Options
  - Hosted
  - Stand-alone in-network
  - Integrated (GGSN, gateway, optimization)

Flexible server, single-blade architecture enables flexible deployment options.

Server can live in RAN, core network, or hosted co-location

Mobidia's Differentiated Benefits

- Mobidia's solution is scalable, complimentary
  - Significant efficiency gains
  - Fundamental base to compliment other optimization
- Improves existing networks and 21\42Mbps, HSPA & LTE
- Limited processing requirements ease integration and scalability
  - Integrates with GGSN, gateways, compression without impact or latency
  - Hosted solution deploys quickly
- Client-based architecture evolves to increase ROI
  - Better policy enforcement and differentiated services
  - Enhanced DPI
  - Enhanced Off-load
  - More comprehensive understanding & management of the network

Mobidia's Technology has been Trialed World Wide

- Repeatable performance on 20+ networks

EMEA

- R&D Vodafone Global
- Vodafone Germany (D2)
- T-Mobile International
- Orange UK
- O2/Telefonica
- Three UK
- Vodacom

North America

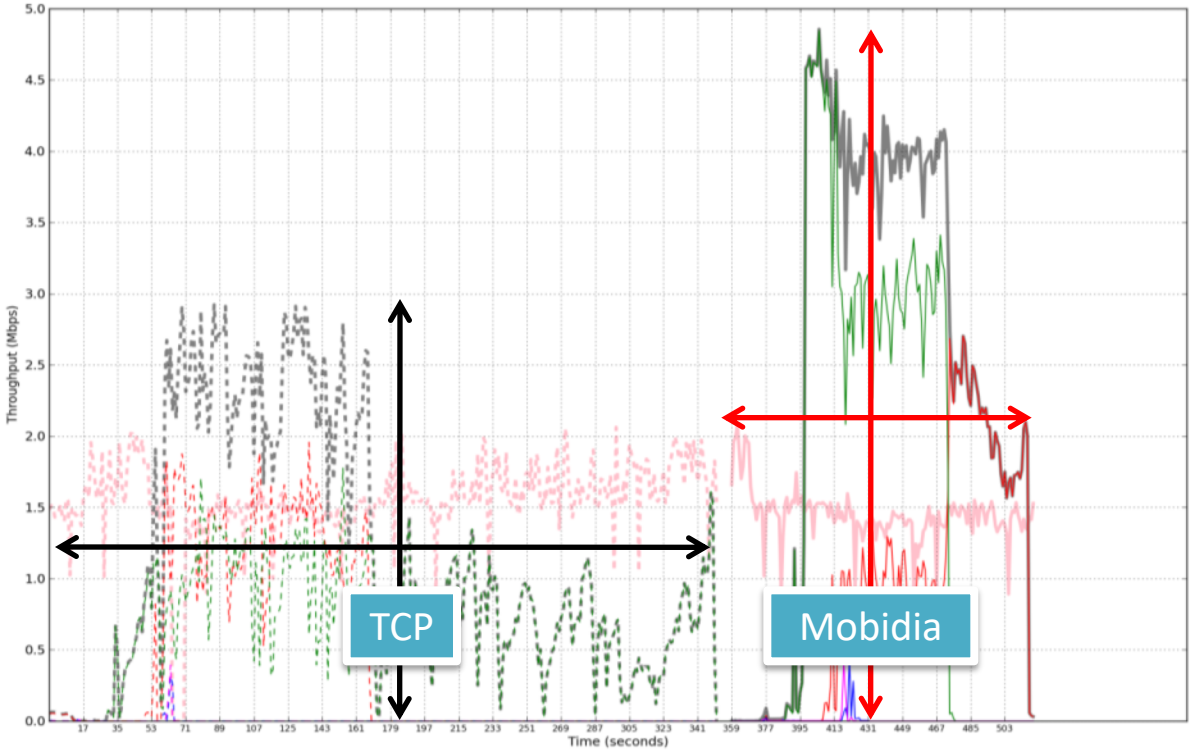
- T-Mobile
- Verizon
- Rogers
- Sprint
- AT&T

Asia Pacific

- Vodafone Australia
- Maxis & Celcom
- Indosat & Telkomsel
- Starhub, PCCW, CSL

HSPA Network Results

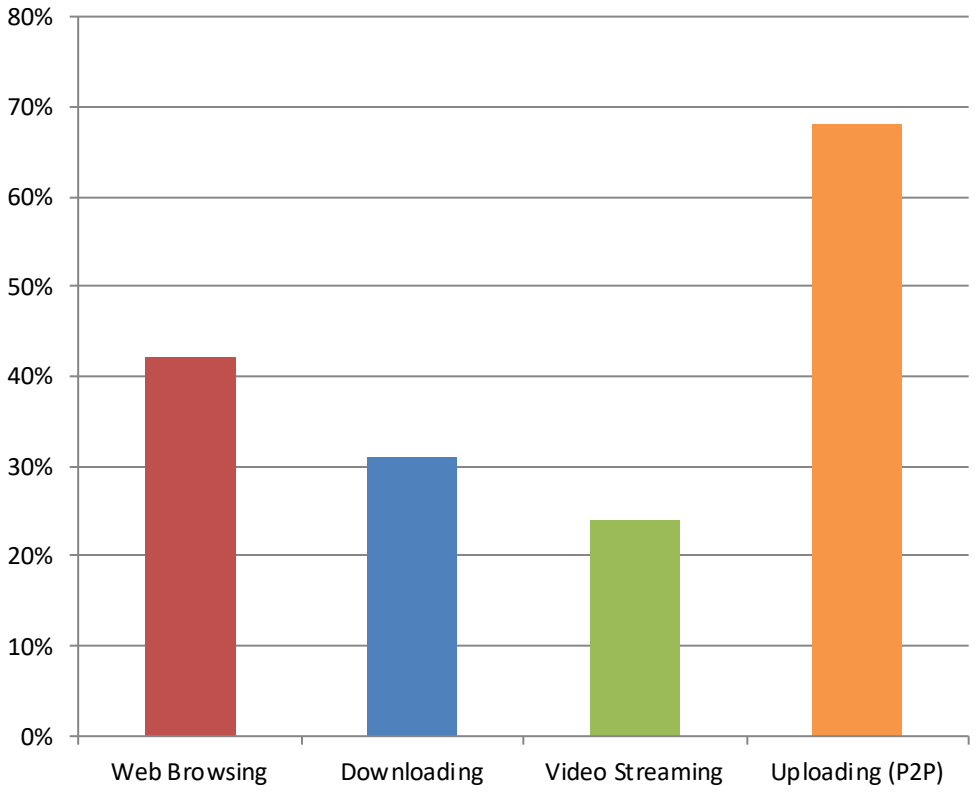
- Repeatedly outperformed TCP
- 20+% capacity recovery
- Data sessions completed faster
- Bandwidth rates significantly increase user experience



Example of an "A/B" comparison of TCP and Mobidia (multiple test profiles run consecutively)

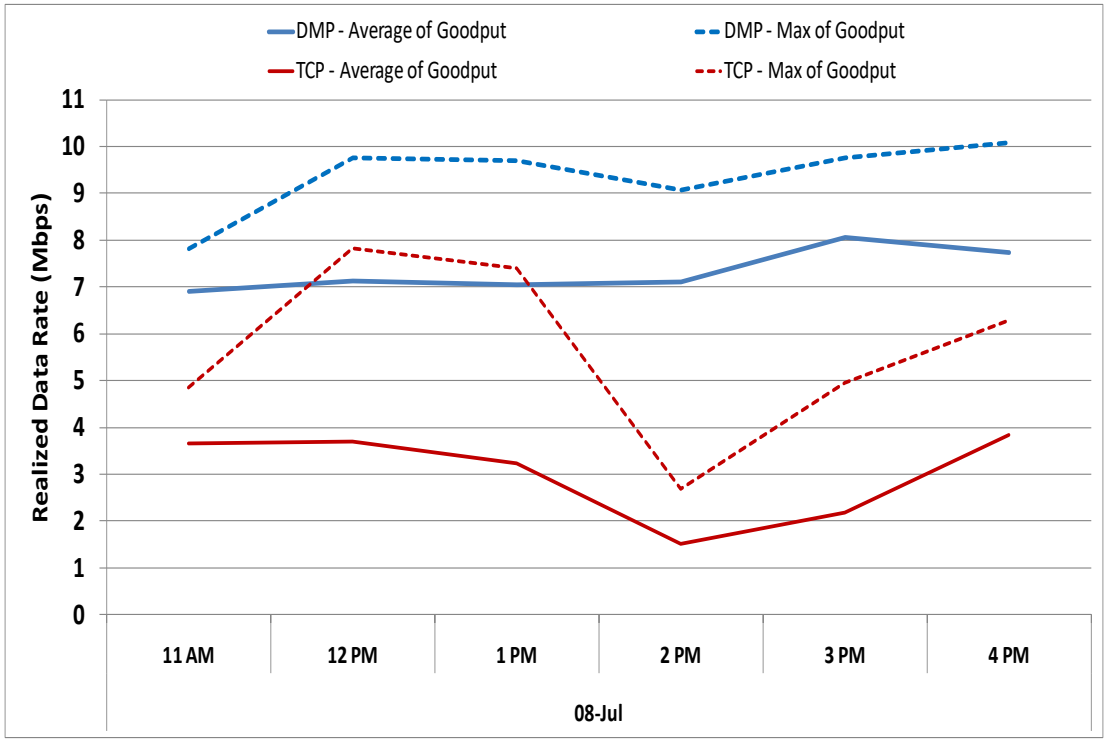
EVDO RevA Network Results

- Download connection rates **increased by 24 to 42%**
- Upload rate increased by 68%
- Capacity recovery of over 20%



New HSPA+ Network Results

- Mobidia demonstrated **2X rate increase** over TCP
- TCP fails to fully utilize mobile resources
  - Poorly reacts to RTT variability & packet discards
- Decreased resource demands
  - Retransmission -35%
  - Spurious -90%
  - ACK bytes -50%

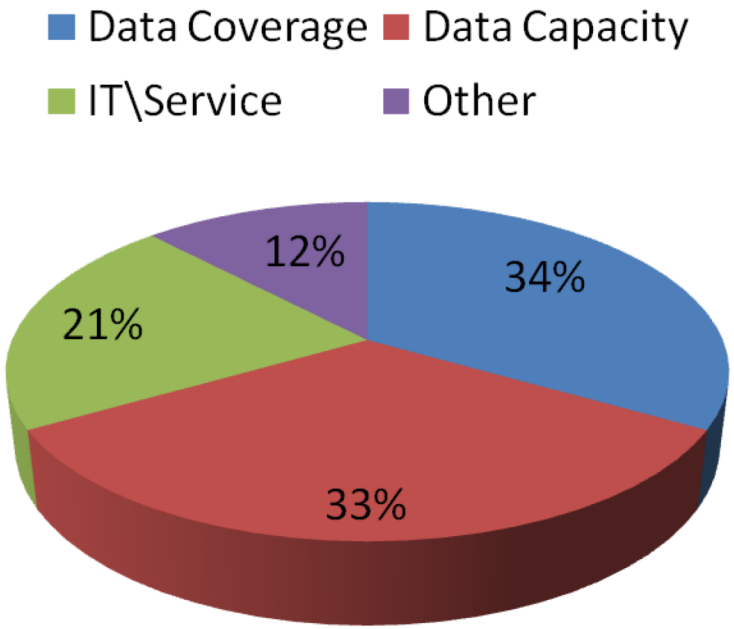


Each hour represents a number of runs and variety of traffic profiles.

Vodafone D2 Case Study

36M Subscribers

2010: €815M Capital Expenses*



- 33% of network spending is for capacity
- €273M addressable CAPEX to Mobidia

* Amount represents 7.2% of revenue. Most operators spend at 10% levels

Annual CAPEX Savings Delivered

60%

- Conservative estimate of percentage of laptops running Mobidia software
- Operator expect 80%+ when integrated with modems

25.4%

- Capacity recovery provided by Mobidia
- Proven and validated at MVTC Vodafone D2 test center

€31M

- Annual savings to operators from addressing laptop users only
- 3yr NPV of €70M
- 11% savings of annual capacity CAPEX

Optimizing Laptop traffic alone will add over $100M USD to an operator's bottom line over 3 years

Smartphones doubles this number

Summary

- Unique client-based solution offers immediate, fundamental value today
  - Recovers capacity thru increased efficiency
    - Lowers congestion contributions of users
    - Increases mobile data throughput performance by over 20%
  - Scalable and integration-friendly
    - Transparent to other optimization solutions
    - Transparent to applications and servers
    - Low processor requirements
- Evolves to deliver more value after architecture implemented
- Flexible deployment options enable quick, scalable usage

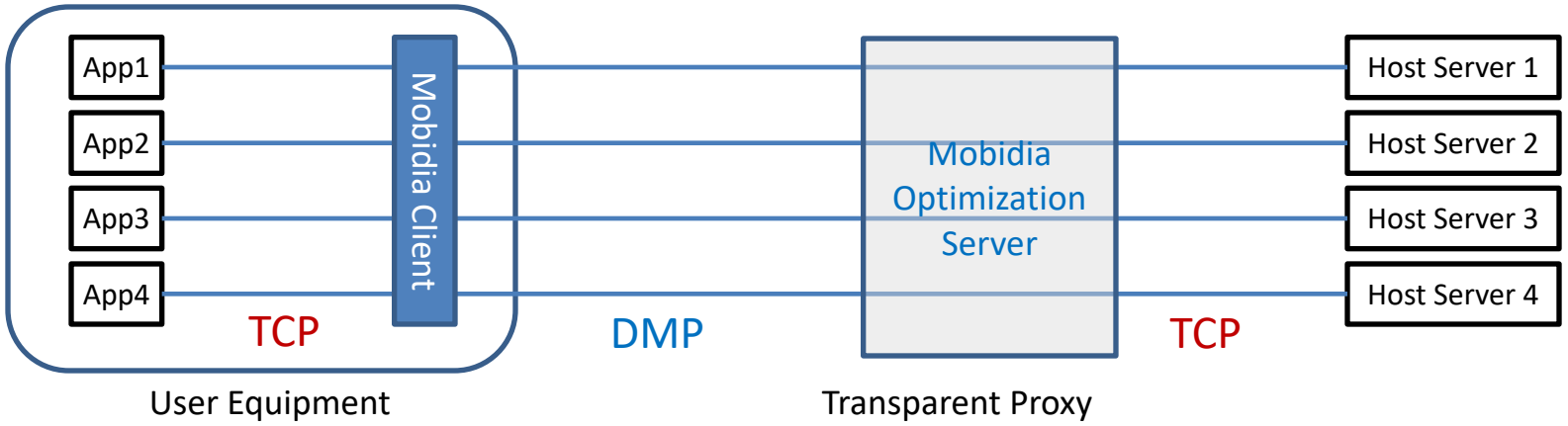
APPENDIX

TCP vs Mobidia's DMP

- TCP has inherent weaknesses on radio links
  - High RTT variation is often misinterpreted as congestion
    - Window collapse that reduces radio-link efficiency
  - No awareness of connection rate
  - No awareness of competition for limited connection resources
  - Over-contributes data into the network
    - especially for multi-sessions from single user
  - Spikes of in-flight data drive congestion

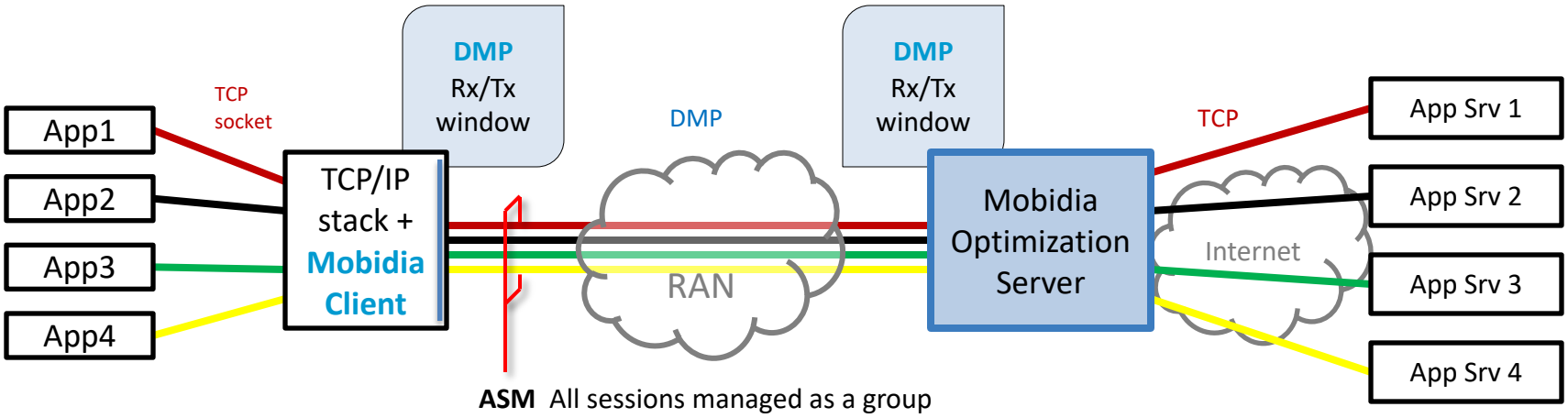
- Mobidia's DMP is optimized for mobile data networks
  - Increase peak hour data throughput (15-30% increases)
  - Lower congestion (maintains minimal amount of data in flight)
  - Improved user experience across all users (eliminates congestion spikes)
  - Heavy and Light users consume same network resource
  - Users with multiple sessions contribute identically to those with single sessions

Mobidia's DMP Topology and Basics



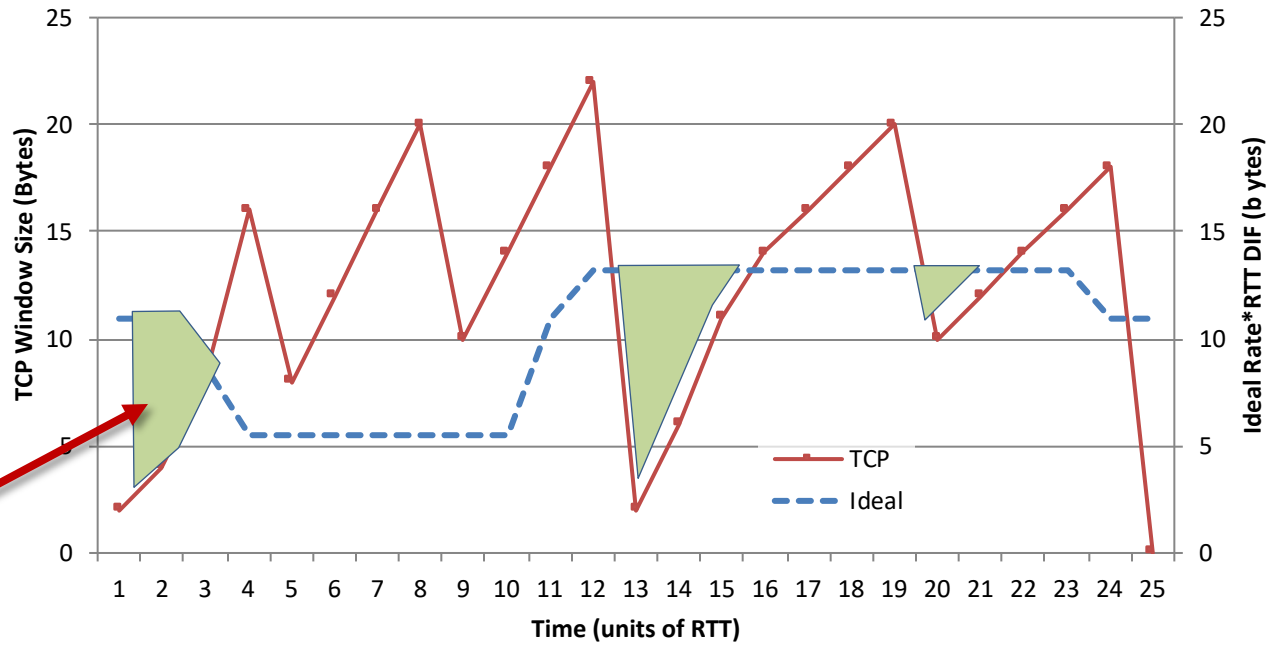
- A client/server layer 4 solution
- TCP sessions eliminated from the radio core
- Mobidia's DMP uses UDP protocol to transport TCP payload
  - A reliable transport with no payload modification
- 1:1 DMP to TCP session mapping enables full QoS in the radio core
- Multiple addressing options
  - Host server either "sees" UE address or server address
    - UE address useful for transparency
    - Server address useful for session continuity
  - UE directs DMP traffic to server

DMP Mechanisms



- Aggregated session management (ASM) across RAN segment
  - Replaces independently maintained Tx windows of TCP
  - Optimal congestion contribution and throughput are balanced
- Per UE managed data-in-flight (DIF)
  - DIF is dynamic to connection and conditions
  - Downstream and upstream shaped to realized connection rate
- Tightly managed resource allocation across active sessions of a UE
  - Conversely, enforcement is tightly coupled to congestion management/available connection rate in real time

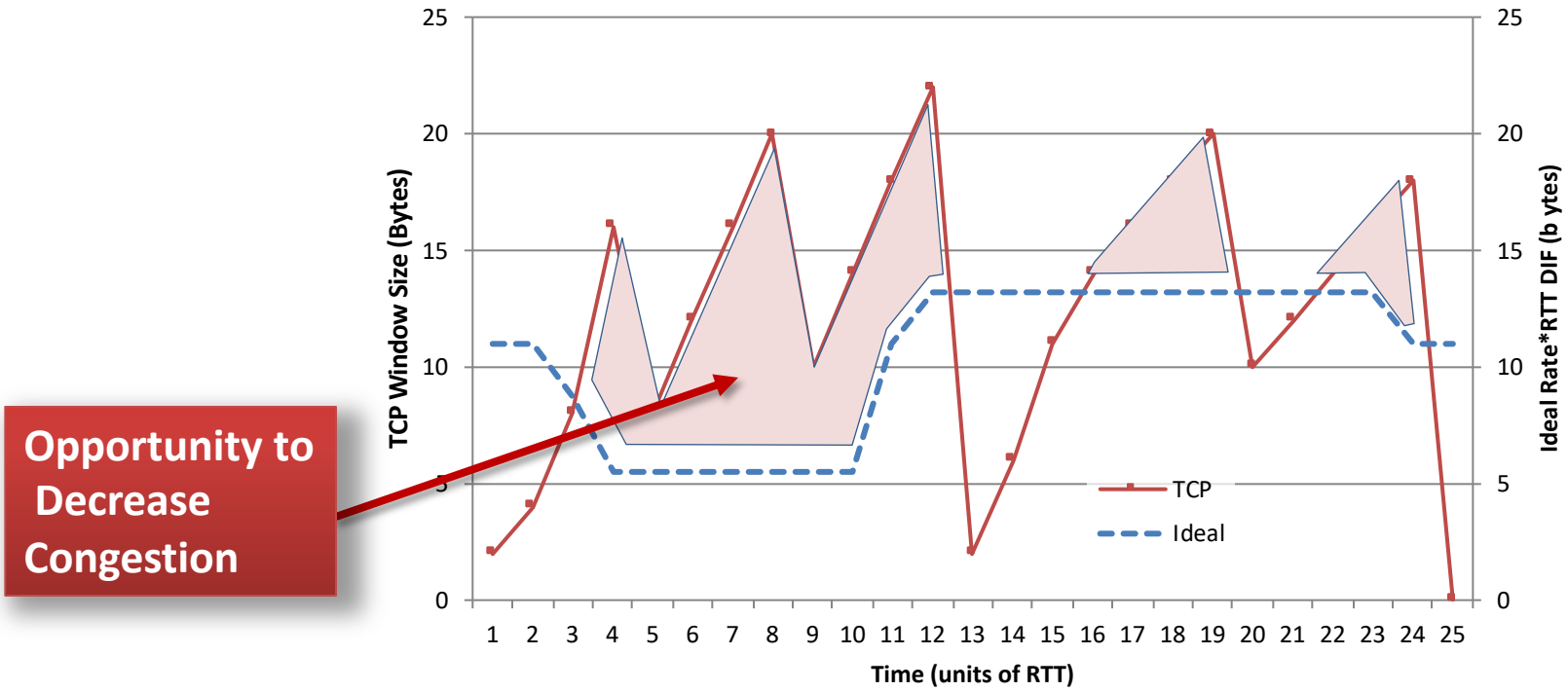
Opportunity to Improve on TCP Throughput on Wireless Network Connections



Opportunity to Increase Radio Throughput

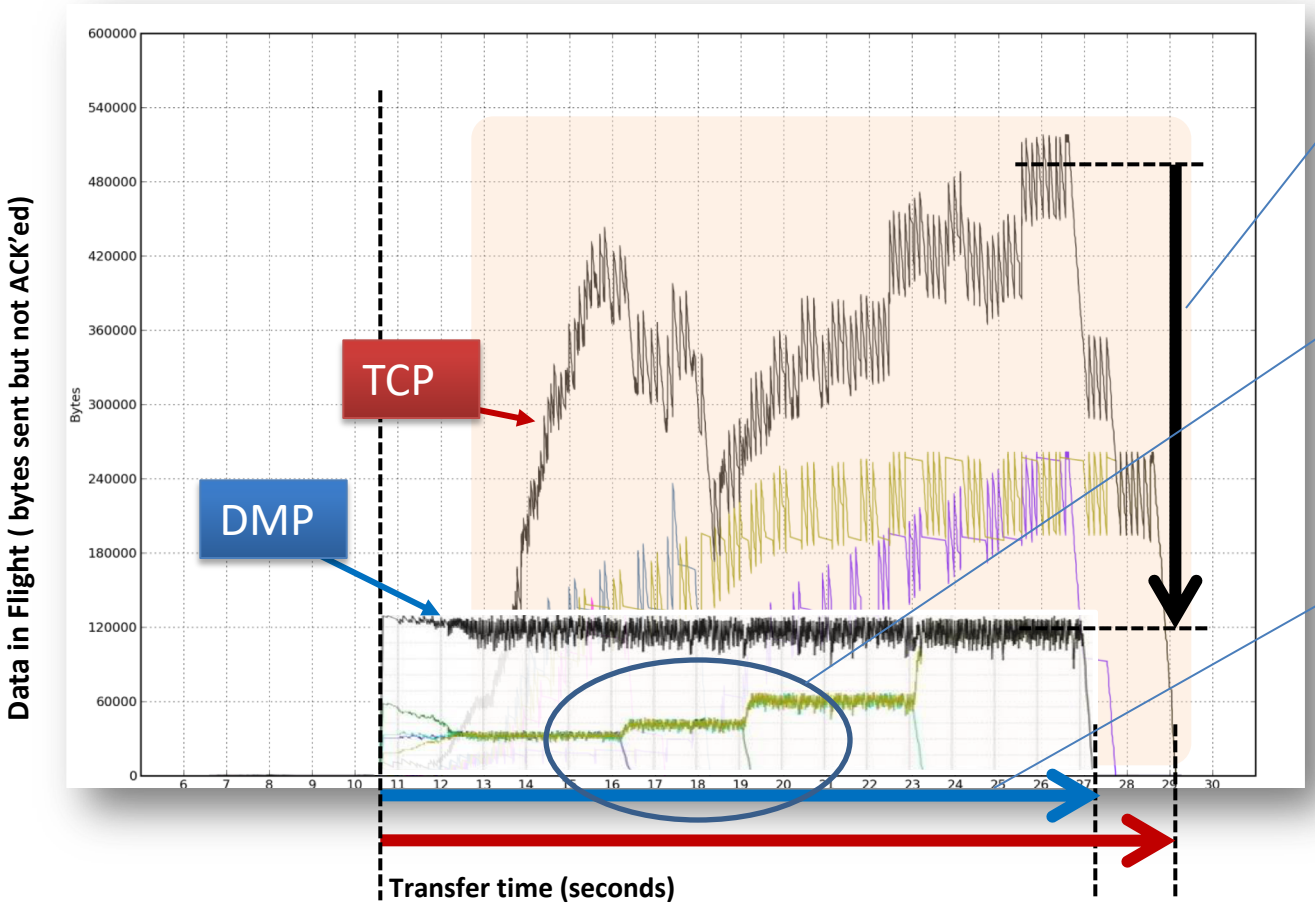
- Ideal DIF equals Realized data rate * Real-time RTT
- Unnecessary window collapse as the result of variability in transmission delay (RTT)
  - RTO expiry also generates a spurious retransmission.
- DMP appropriately responds to transmission delay variability characteristics of wireless networks

Opportunity to Improve on TCP Congestion Contribution and Fairness



- Data-in-flight congests queues in backhaul
- TCP DIF increases with multiple sessions as each session acts independently
- TCP increases window size (data in flight) until there is a loss event
- TCP hunting translates to inefficient use of limited radio resource
- DMP follows ideal DIF defined by **Real-Time BDP** of radio connection

ASM & DIF Plots for Back to Back TCP/DMP Test*



- Lower DIF == better latency management
- Precise distribution of resources across sessions
- Faster completion time

Plot starts are aligned

Measurement using Win7 laptop with 4 simultaneous sessions on HSPA network