Mobidia

Enhancing Wireless Data

January, 2009

Enhancing Wireless Data

By extending the intelligence of the network down to the user equipment, Mobidia provides:

- Increased radio frequency (RF) utilization and conservation of radio access network (RAN), backhaul resources
- Distributed data traffic management solutions
  - Uplink and Downlink
  - Application-awareness
- Enhanced user experiences
  - Performance and consistency of service
- Network intelligence – sourced from the user equipment

Leveraging the power of millions of **smartphones** and **connected laptops**

Mobidia Company Overview

- Vancouver, BC based; venture-funded software company
  - 40 employees
  - $16.4 million raised
  - Successful tier 1 European and North American carrier trials

- Experienced, entrepreneurial team with wireless expertise
  - Derek Spratt, president & ceo
    - Intrinsyc Software, PCS Wireless, Motorola
  - Lawrence Chee, vice president Engineering
    - PMC-Sierra, Seiko Epson
  - Chris Hill, vice president marketing
    - Microsoft, General Electric
  - Al Larmour, vice president business development
    - IP Applications, EXL Information Corp., Data General
  - Chris Welsh, finance
    - Accenture, Ballard Power Systems, Vlinx

- Majority Investors- BDC, Discovery Capital, BC Advantage Fund

Mobile Data Network Dilemma

- Data growth needed for corporate growth
  - But capital and operational costs required to scale to meet customer experience
  - And continued and growing need to manage capital and operational costs for profitability
- Market dynamics starting to stress the network
  - Vodafone sees 58% growth (year over year) in mobile broadband subscribers
  - Aggressive pricing plans available globally
  - USB laptop modems are flying off the shelves
  - Mass market smartphones are here (the $200 iPhone)
- Usage is not even
  - UK Operator: 2% of users drive 90% of data usage
  - German and S. African Operator: 5% of users drive 95% of data usage
  - Laptop traffic, video, peer-to-peer exceedingly dominant consumers
  - Uplink traffic from laptops and smartphones a growing challenge

Wireless Operators' Needs

- Increase 3G access and capacity
  - While decreasing capital and operating costs
- Improve user experiences, sophisticated and "internet quality"
  - Access and connectivity
  - Video, voice-over-internet protocol (VOIP), and other data services
- Obtain deeper understanding of data usage
  - Per user, per app, per service, per network basis
  - Information for every app flow
  - Device status including signal quality, # of users/base station, cell id, etc.
- Proactively manage uplink and downlink traffic per user or groups
  - Bandwidth shaping, quotas, re-direction, caps, throttling, content control
  - Based on protocol-specific, state-based, and user-specific traffic flow analysis
- Deliver differentiated and innovative billing model options

Mobidia's Core Technology

Intelligent laptop and handset software

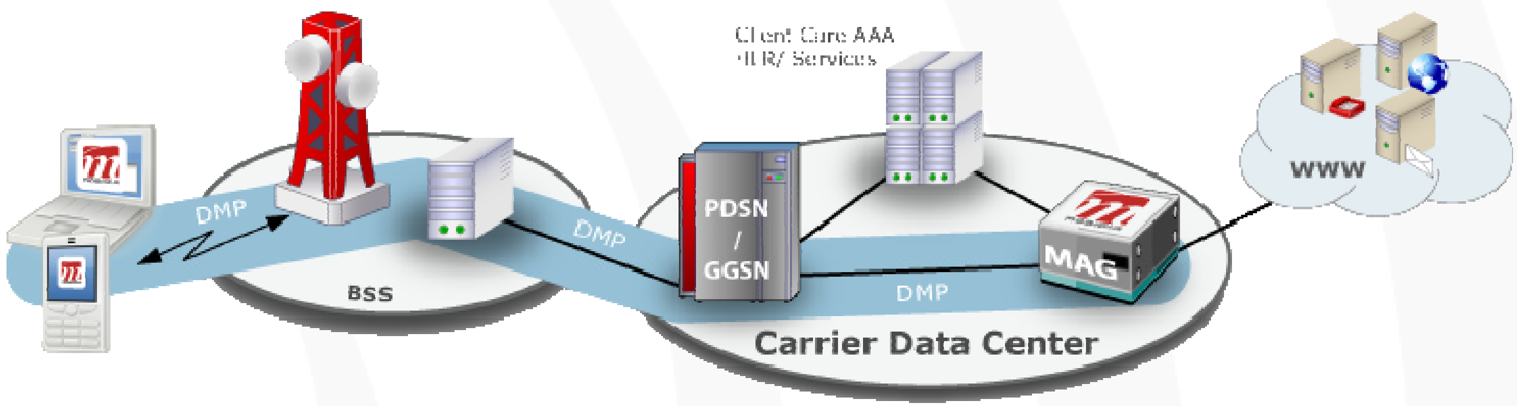
- Extends the intelligence of the network to the user equipment
- Leverages the power of the billions of smartphones and laptops on the wireless networks

Reliable wireless transport

- Transparently proxies transmission control protocol (TCP) over air-link, backhaul and RAN
- Utilizes standard UDP protocol
- Will increase TCP efficiency on equipment not running Mobidia software

Carrier grade server component

- Stand-alone or integrated with existing equipment
- Scalable, available, reliable



Increase Capacity Utilization

- Shapes all traffic to subscribers based on RAN capacity
- Enables faster and smoother bandwidth utilization
- Adapts quickly to bandwidth changes
- Delivers more consistent sessions
  - Manages minor changes in the RAN better
  - Download traffic less susceptible to uplink traffic
- Reduces requirements & cost of backhaul
- Coexists and improves legacy TCP traffic
- Results in increased throughput, speed of all data sessions, and higher utilization of the Node B

Carrier trials have yielded **15%** increases in capacity utilization

Enhanced User Experiences

- Delivers better video streaming and higher performance for multi-media services
- Provides faster file downloads and uploads, web page access, and e-mail synchronizations
  - Especially during busy times
- Reduces frustration from web page time outs
- Improves access and more reliable, consistent connectivity
- Potentially increases battery life
- Provides more choices for billing plans

Recent trialing has yielded **1.3** times faster subscriber experiences

Recent Trial Performance Results

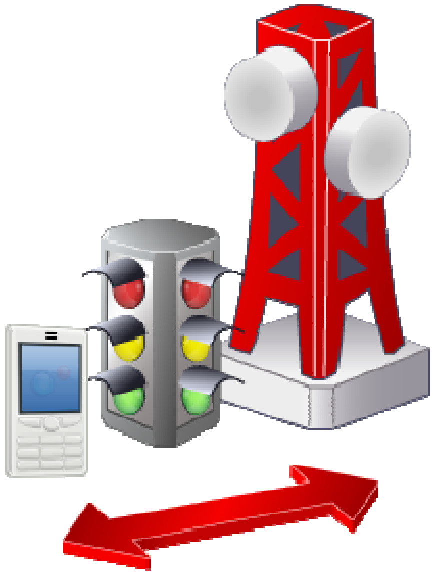
- **15%** better RF Utilization Ratio vs TCP
- **1.3x** better QoE for typical subscriber usage scenarios
- Faster “time to completion” under all profiles
- Higher utilization ratio for RAN under all profiles
- Sustained higher download performance with RAN upload activity
- Improved TCP traffic on devices not running Mobidia’s Dynamic Multimedia Protocol (DMP)

Trialing completed at Tier 1 European Carrier “State of the Art” Facility

MOBIDIA

Note: Trials were completed in low variable controlled lab environment. Additional testing by carriers in real-world condition yielded even higher results

Distributed Traffic Management



- Traffic management on uplink and downlink
  - Protocol-specific, state-based, user-specific traffic flow analysis
  - Encrypted and compressed data management
- Application and service-aware classification
  - More accurate and faster identification of new apps
  - Immediate awareness at the user equipment
  - Prioritization, scheduling, and policy enforcement at the device for bandwidth efficiency
- Innovative billing models
  - Bandwidth-differentiated billing
  - Premium service-based billing

Efficient traffic management to conserve RAN resources

Increased Network Intelligence

- Up-to-Date network intelligence and reporting
- Comprehensive usage data
  - Per subscriber
  - Per application or service
  - Per network
  - Location and Content*
- Real-time and historical data of RAN performance and conditions

Comprehensive understanding of network conditions & subscriber activities

Summary

- Unique, powerful solution for network optimization and traffic management
- Carrier trialing to date has proven 15% better utilization ratio and 1.3x better quality of experience (QoE) advantage over TCP
- Partnering with major infrastructure vendors
- Trials completed in Europe and US

Enhancing Wireless Data by monitoring, managing & monetizing traffic

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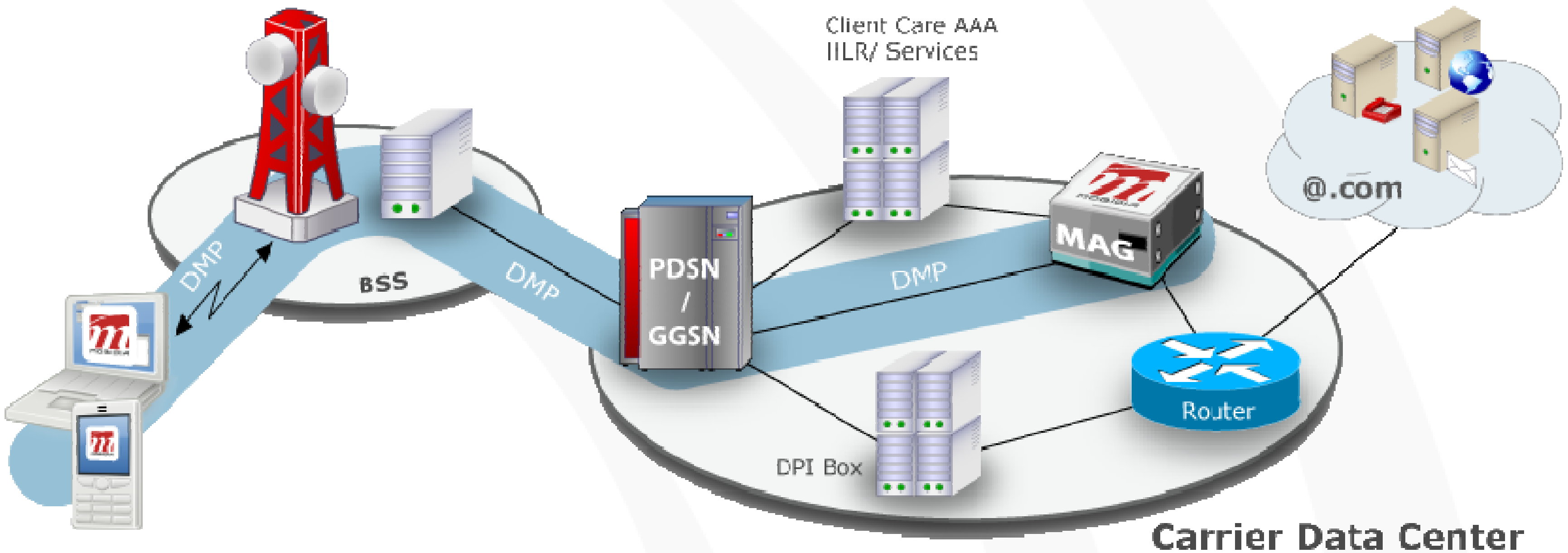
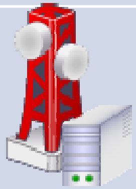
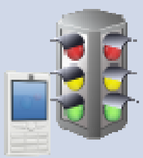
APPENDIX

Mobidia's Deployment Architecture



ROADMAP

Evolving Platform

Now	1H2009	2H2009	2010
 **.wave** RF • Released for		• 10GB • Distributed architecture	• More performance • IPv6 • Operator deployed enterprise services
 **.wave** TM • Released for trialing		• Policy integration • Per application • Real-time policy push	• Content identification • Operator deployed enterprise services • WiFi Hotspot Support (w/session continuity)
 **.wave** NI • Released for trialing		• Location • Per Session	• Radio KPI • MSDB: subscriber database
 **Clients** Windows XP	Windows Mobile Vista Symbian MAC	RIM iPhone	Windows 7

TRIAL PERFORMANCE DETAILS

Increasing Capacity Utilization

- Challenges with TCP over the Wireless Link
  - Often misinterprets wireless network conditions as congestion and throttles back performance
  - Slow initial ramp up time for all data transfers
  - Very slow to respond to changing bandwidth conditions and network types

- Mobidia's DMP Advantage
  - Shapes all traffic to subscribers based on RAN capacity
  - Delivers more consistent sessions
    - Manages minor changes in the RAN better
    - Download traffic less affected by uplink traffic
  - Performs at higher rates due to less sensitivity to latency variations

Trial Conditions & Parameters

- DMP vs TCP Comparison
- Key metric was Time to Completion
- Various "real-world" network loads and usage scenarios
- "State of the Art" testing facility at Tier 1 European carrier
- Automated 3rd party testing Infrastructure (IXIA)
- Tests utilised 6 laptops/users to fully load NodeB

Trial Metric

- Key metric is Time To Completion (TTC) of a test:
  - Neither bandwidth nor throughput metrics take into account
    - inefficiencies of the underlying transport protocols (e.g. retransmissions, packet overhead)
    - transient nature of the mobile network or traffic patterns
  - Enables common metric to be applied across a variety of test cases.
    - Complex test cases such as P2P or Web and combinations thereof have many sessions with inter-session dependencies and time gaps

Trial Metric (Cont'd)

- Utilization Ratio (UR): Indication of NodeB utilization for a given test case.
- Formulas used for calculating UR of TCP and DMP:

UR[TCP] = TUD / (MaxPeakRate * TTC[TCP])

UR[DMP] = TUD / (MaxPeakRate * TTC[DMP])

TUD: Total User Data

TTC: Time To Completion

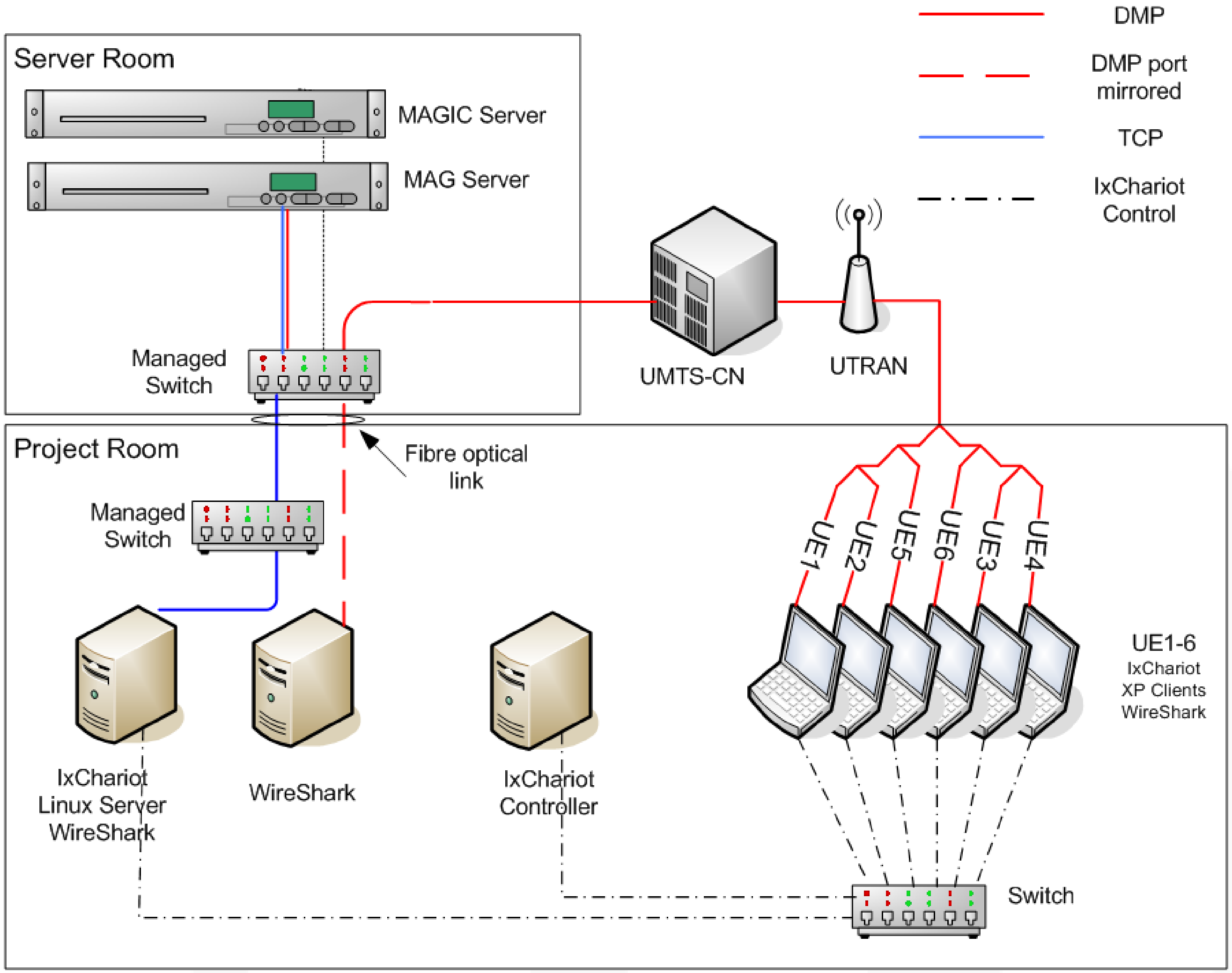
Trial Metric (Cont'd)

- DMP advantage (DMPa): Comparative metric between DMP and TCP
- Formula used for calculating DMPa:

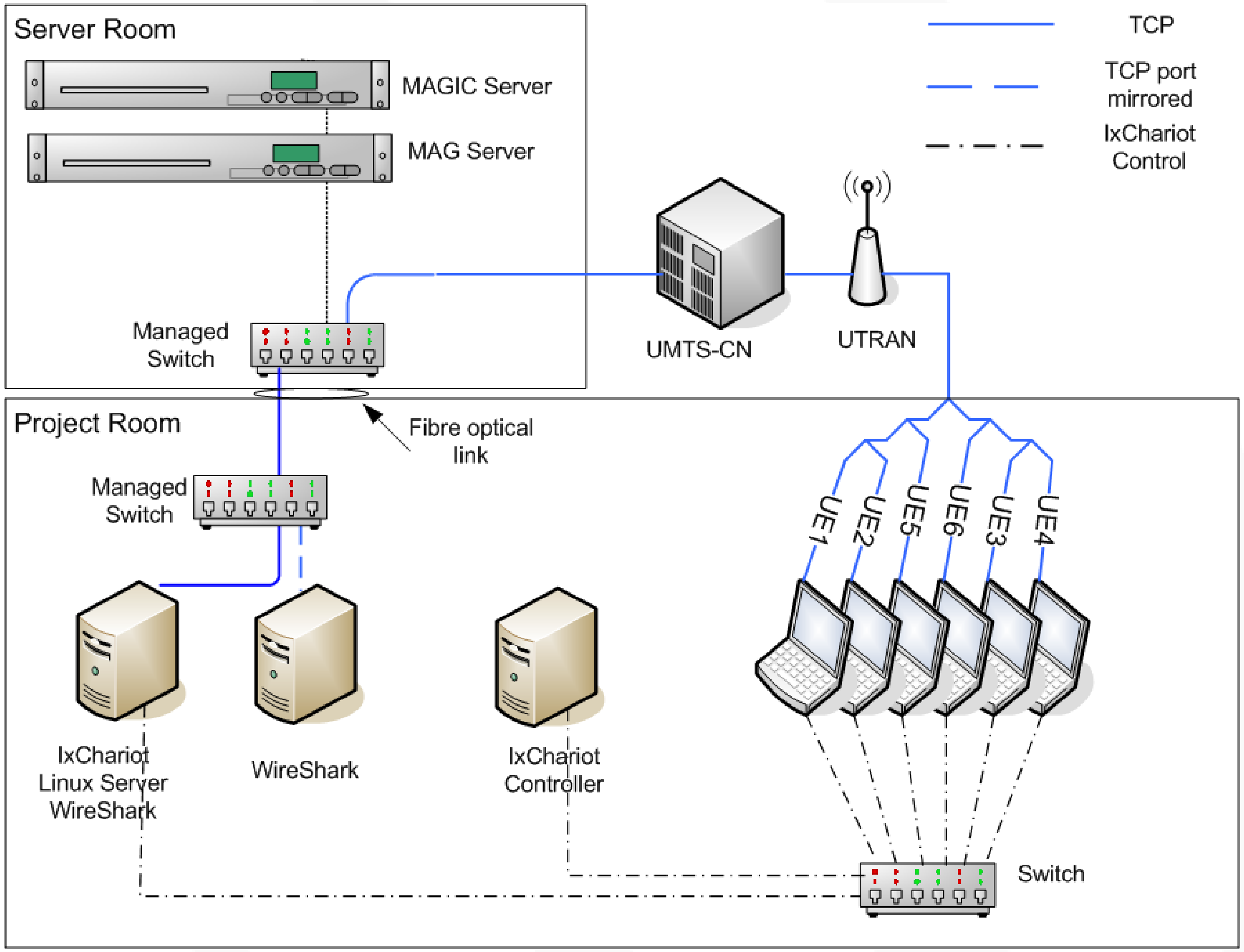
$$DMPa = 1 - (TTC[DMP] / TTC[TCP])$$

TTC: Time To Completion

Lab Physical Network Diagram (DMP)



Lab Physical Network Diagram (TCP)

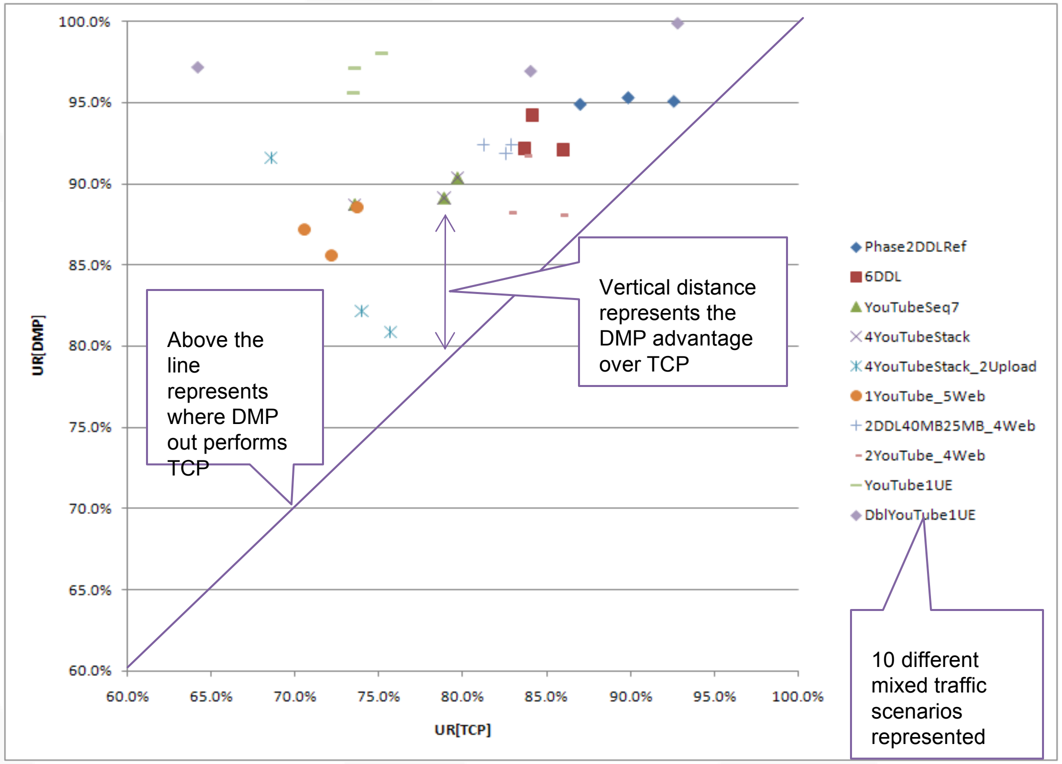


Test Cases

- All cases developed and validated in collaboration with tier1, European operator and aligned with their current and future data traffic
- Test cases developed to reflect dynamic, ‘real world’ environment
  - Fully loaded NodeB
  - Subscribers dynamically connecting and disconnecting
  - Multiple sessions, smaller files
  - Multiple test runs to account for variability of TCP and RAN
- 10 cases to reflect different but common usage scenarios
  - Most cases included mixed traffic representing users with different usage habits
  - Web browsing
  - Video streaming
  - File transfer (e-mail sync, file sharing, download)

Utilization Ratio: DMP vs TCP

- 10 different test cases run 3 times each
- Measurements taken for utilization ratio (UR) for both DMP and TCP
- DMP’s UR is consistently higher for every test case and test pass
- DMP’s UR is more consistent for each of the different test cases

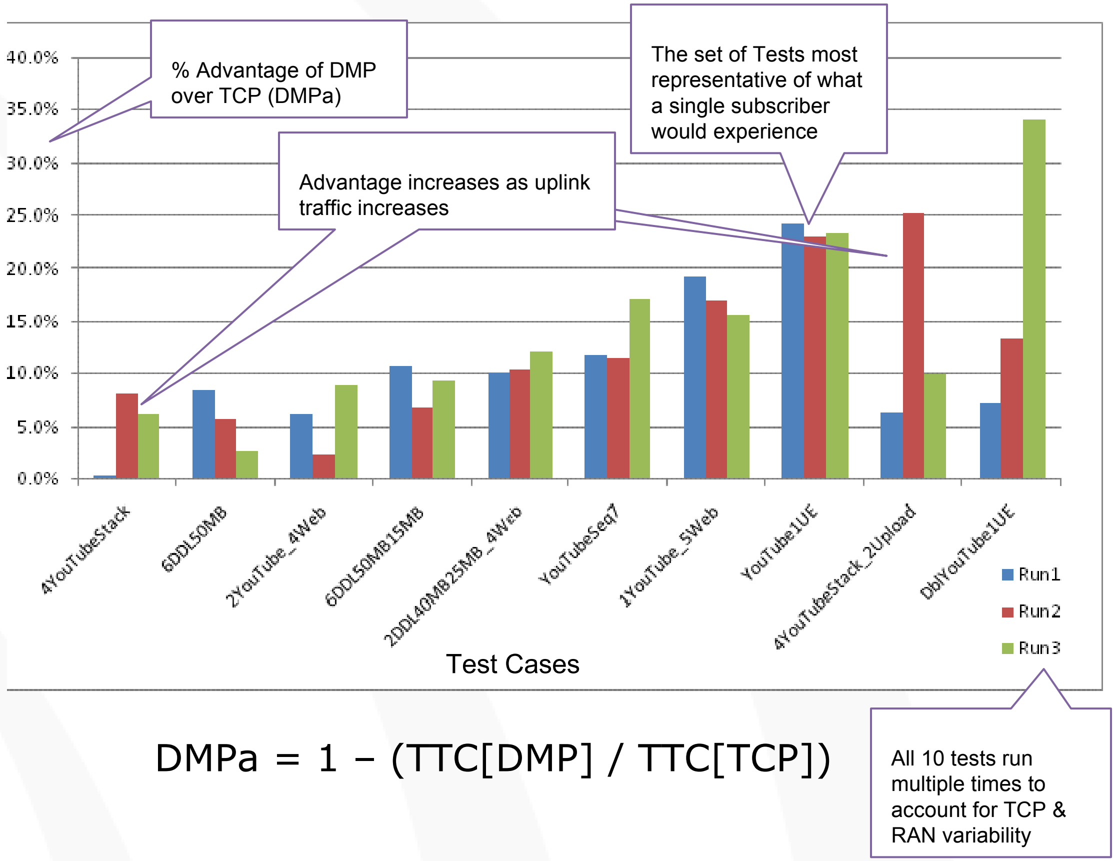


UR [TCP] = TUD / (MaxPeakRate * TTC [TCP})
UR[DMP] = TUD / (MaxPeakRate * TTC [DMP])

A higher utilization ratio represents more efficient use of RF resources

Significant Increases in Quality of Experience

- 10 different test cases run 3 times each
- DMP was faster in all runs - representing a faster experience for subscribers
- Test cases where users were dynamically connecting and disconnecting to the network yielded the best performance from DMP
  - Which is more aligned with actual behavior
- The most representative case yielded an average of 30% gain
- DMP's advantage increases as more uplink traffic is introduced

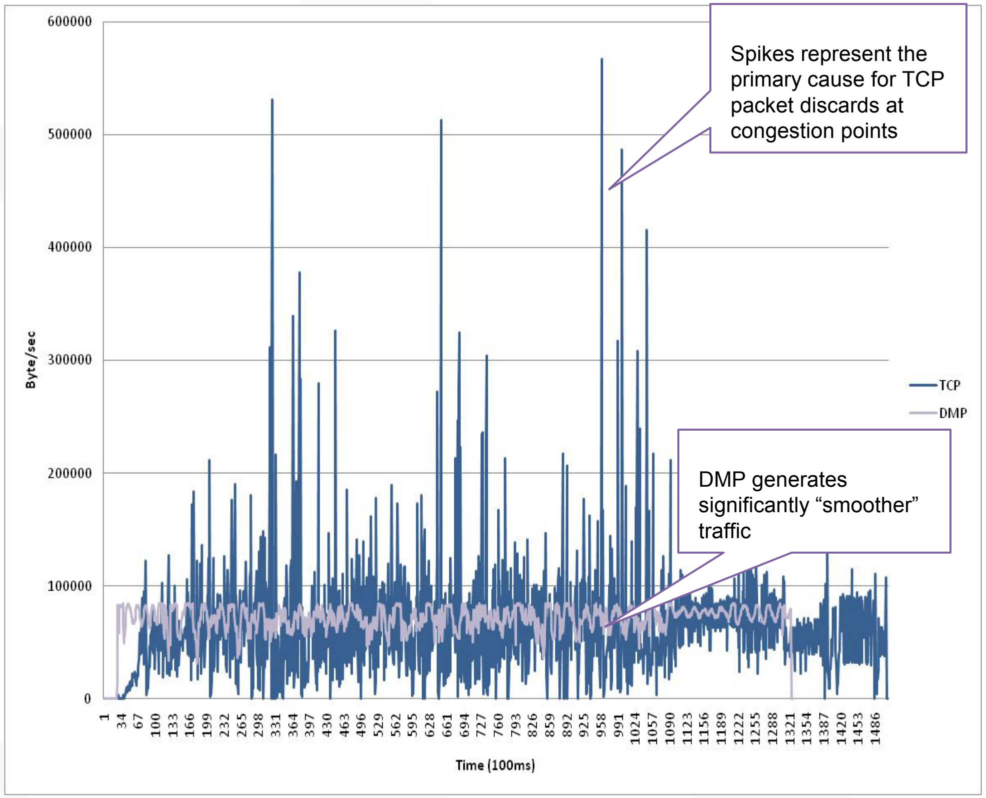


DMPa = 1 – (TTC[DMP] / TTC[TCP])

DMP delivers web pages, downloads, and videos faster to subscribers

Significant Increases in Quality of Experience

- Graph represents a single snapshot of one of the test passes comparing DMP & TCP
  - But differences in variability were consistently observed in all test cases and passes
- DMP consistently finishes faster than TCP
  - Which increases efficiency
- DMP's traffic is consistently much less variable than TCP traffic
  - Potential savings in backhaul
  - Reduces packet discards in the core network



DMP provides traffic shaping and a much more consistent user experience

More Details on the Test Cases

PLOT / Test Cases	Description
1YouTube_5Web	UE6 is watching a big YouTube video of 50 million bytes whilst the remaining 5 UEs are surfing the web. UE1 and UE6 starts off followed sequentially by UE 2->5 with start times of 10, 20, 30, 40 seconds respectively.
YouTube1UE	Single UE performing a 50 million byte download. This is equivalent to a downlink speed test profile a consumer would execute.
6DDL50MB	All 6 UEs performing identical DDL (Direct Download) of 50MB file. UE1 starts off the test, followed sequentially by UE 2->6 with start times of 25, 45, 65, 100 and 100 seconds respectively.
6DDL50MB15MB	All 6 UEs performing DDL, with UE1 transferring 50MB and the remaining UEs transferring 15MB. UE1 starts off the test, followed sequentially by UE 2->6 with start times of 25, 50, 50, 55, 55 seconds respectively.
YouTubeSeq7	All 6 UEs "watching" an HTTP file of 5 million bytes (typical size of a 2.5 minute music video). UE1 starts off the test, followed sequentially by UE 2->6 with start times of 7, 14, 21, 28, 35 seconds respectively.

More Details on the Test Cases (Cont'd)

PLOT / Test Cases	Description
4YouTubeStack	4 UEs "watching" an HTTP file of 5 million bytes. UE2->5 are participating, all starting off at the same time. This is considered to be the most ideal multi-user test case for TCP.
4YouTubeStack_2Upload	4 UEs "watching" an HTTP file of 5 million bytes. UE2->5 are participating, all starting off at the same time. UE1 & 6 are performing an upload of 3.5 million bytes. UE1 & 6 starts off first to secure the uplink channels, and UE2->5 start 2 seconds later. This test was to study the efficacy of the download when the upstream channel is near capacity. TTC is measured between UE2->5 to enable comparison to the non upload test case.
2DDL40MB25MB_4Web	UE1 & 2 performing large DDL of 40MB and 25MB respectively, and the remaining UE 3->6 are surfing the web. UE1 starts off the test, with UE 2->6 having start times of 10, 10, 10, 15, 15 seconds respectively.
2YouTube_4Web	UE 5 & 6 "watching" 25 million byte, and the remaining UE 1->4 are surfing the web. UE5 & 6 start off the test, with UE 1->4 having start times of 0, 10, 20, 30 seconds respectively.
DblYouTube1UE	Single UE performing two simultaneous 25 million byte downloads.