

WiMAX Application Performance Testing Guidelines

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These slides are available at

<http://www.cse.wustl.edu/~jain/wimax/testing.htm>

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- Why Performance Testing?
- Testing Guidelines: Scope
- Goals and Non-Goals

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Why Performance Testing Guidelines?

- ❑ Service providers/users need to be able to compare different vendors equipment/services.
- ❑ For WiMAX to succeed, it is important that performance of user application on WiMAX be better than that on competing technologies.
 - ❑ Confusion caused by differing terminology and differing benchmarks will eventually lead to customer dis-satisfaction
- ❑ Imagine the confusion if the definitions of throughput, response time, fairness, etc. are different by different vendors.
- ❑ Other organizations have standardized performance testing definitions and procedures, e.g., 3GPP, IETF, ATM Forum..
- ❑ Better customer information will contribute to more customer satisfaction and more sales and hence success of WiMAX.

Dictionary Definition

- ❑ **Benchmark** *v. trans.* To subject (a system) to a series of tests in order to obtain prearranged results not available on competitive systems.

From: The Devil's DP Dictionary
S. Kelly-Bootle

Performance: Different Vendors

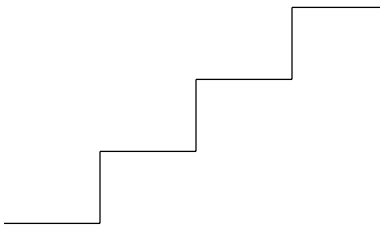
- ❑ Vendor A: Throughput = 55 Mbps
- ❑ Vendor B: Capacity = 100 Voice users
- ❑ Vendor C: Goodput = 200 packets per second 512 B packets
- ❑ Observation:
 - ❑ no standard set of metrics,
 - ❑ no standard definition of metrics
 - ❑ no standard procedure to measure these metrics

Testing Guidelines: Scope

- ❑ Define metrics that help the service providers and users compare various WiMAX equipment and devices.
- ❑ The metrics should be independent of device architectures. They should apply to all architectures.
- ❑ Develop precise methodologies for measuring these metrics. Methodology = Procedure + Configuration + Traffic Pattern
⇒ Anyone (user or vendor) can conduct it and come up with the same result.
- ❑ Any extensions of the above that enhance the marketability of WiMAX can be added to the scope

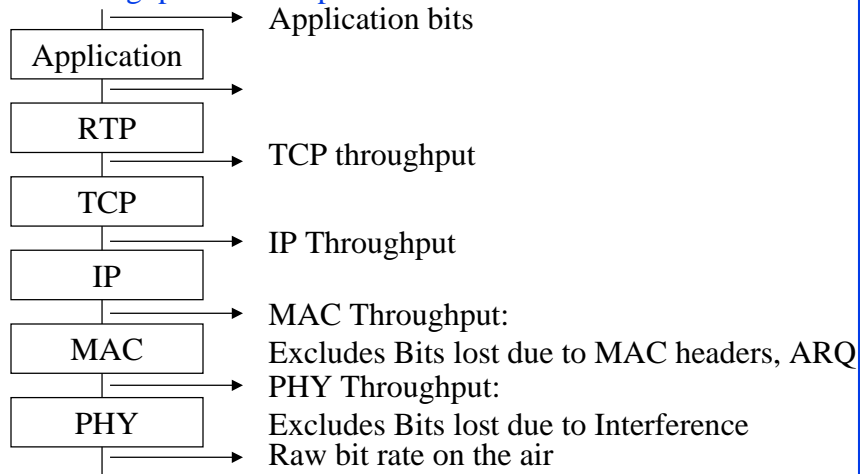
Scope (Cont)

- ❑ Cover as many device types as possible.
Begin with most devices: Base station, user terminals.
- ❑ Should include performance of traffic management, network management, connection setup, along with data transfer.



Performance at Different Layers

- ❑ Throughput = 55 Mbps. What does this mean?



Goals

- ❑ Emphasize end-user/service provider view point where-ever possible.
- ❑ At some levels, the performance should be independent of lower level mechanisms:
 - ❑ Voice over ertPS, rtPS, nrtPS, BE

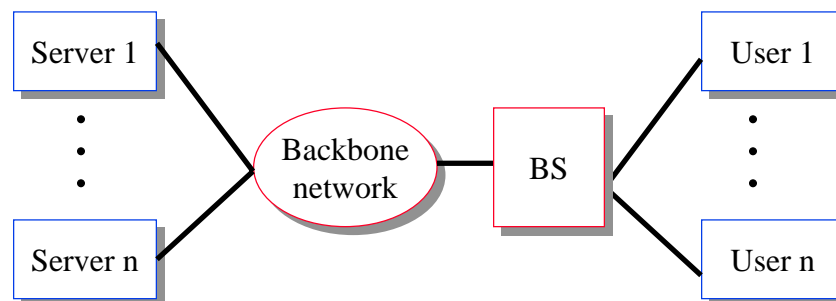
Non-Goals

- ❑ WiMAX Forum will not do any measurements.
- ❑ Independent labs may use the WiMAX forum specified methodology to perform these measurements, e.g.,
 - ❑ Harvard Network Device Test Lab
 - ❑ University of New Hampshire Interoperability Lab
- ❑ Labs generally work with the vendor to prevent premature disclosure of information
- ❑ WiMAX Forum will not set any performance thresholds
 - ❑ Setting thresholds can kill the performance-cost tradeoffs
 - ❑ Example 1: Frame loss rate should be no more than 1%
 - ❑ Example 2: BS delay should be less than 1 ms.

Performance Metrics

- ❑ General Metrics
- ❑ Traffic management metrics
- ❑ Protocol specific metrics
- ❑ Network management metrics

Reference Configuration

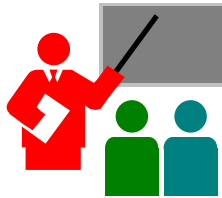


- ❑ Exact scope and configuration to be discussed

Example Performance Metrics

- ❑ Throughput
- ❑ Frame loss rate
- ❑ Back-to-back burst size
- ❑ Latency
- ❑ Call establishment time

Summary



- ❑ Performance testing guidelines will help service providers use the same terminology and procedures for performance
- ❑ Service providers and users will be able to compare results from different vendors/sources
- ❑ Other telecom technologies including 3GPP, IETF, have similar documents

IP Performance Metrics: RFCs

- ❑ RFC 2330 "Framework for IP Performance Metrics," May 1998.
- ❑ RFC 2501 "Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations," January 1999.
- ❑ RFC 2647 "Benchmarking Terminology for Firewall Performance," August 1999.
- ❑ RFC 3222 "Terminology for Forwarding Information Base (FIB) based Router Performance," December 2001.
- ❑ RFC 3393 "IP Packet Delay Variation Metric for IP Performance Metrics (IPPM)," November 2002.
- ❑ RFC 3432 "Network performance measurement with periodic streams," November 2002.

RFCs (Cont)

- ❑ RFC 3511 "Benchmarking Methodology for Firewall Performance," April 2003.
- ❑ RFC 3729 "Application Performance Measurement MIB," March 2004.
- ❑ RFC 4148 "IP Performance Metrics (IPPM) Metrics Registry," August 2005.
- ❑ RFC 4149 "Definition of Managed Objects for Synthetic Sources for Performance Monitoring Algorithms," August 2005.
- ❑ RFC 4150 "Transport Performance Metrics MIB," August 2005.

IP Benchmarking: RFCs

- ❑ RFC 1242 "Benchmarking Terminology for Network Interconnection Devices," July 1991.
- ❑ RFC 2285 "Benchmarking Terminology for LAN Switching Devices," February 1998.
- ❑ RFC 2432 "Terminology for IP Multicast Benchmarking," October 1998.
- ❑ RFC 2544 "Benchmarking Methodology for Network Interconnect Devices," March 1999.
- ❑ RFC 2647 "Benchmarking Terminology for Firewall Performance," August 1999.
- ❑ RFC 2761 "Terminology for ATM Benchmarking," February 2000.

Benchmarking RFCs (Cont)

- ❑ RFC 2889 "Benchmarking Methodology for LAN Switching Devices," August 2000.
- ❑ RFC 3116 "Methodology for ATM Benchmarking," June 2001.
- ❑ RFC 3133 "Terminology for Frame Relay Benchmarking," June 2001.
- ❑ RFC 3134 "Terminology for ATM ABR Benchmarking," June 2001.
- ❑ RFC 3511 "Benchmarking Methodology for Firewall Performance," April 2003.
- ❑ RFC 3918 "Methodology for IP Multicast Benchmarking," October 2004.

Benchmarking RFCs (Cont)

- ❑ RFC 4061 "Benchmarking Basic OSPF Single Router Control Plane Convergence," April 2005.
- ❑ RFC 4062 "OSPF Benchmarking Terminology and Concepts," April 2005.
- ❑ RFC 4063 "Considerations When Using Basic OSPF Convergence Benchmarks," April 2005.
- ❑ RFC 4098 "Terminology for Benchmarking BGP Device Convergence in the Control Plane," June 2005.
- ❑ RFC 4689 "Terminology for Benchmarking Network-layer Traffic Control Mechanisms," October 2006.
- ❑ RFC 4814 "Hash and Stuffing: Overlooked Factors in Network Device Benchmarking," March 2007.
- ❑ RFC 4883 "Benchmarking Terminology for Resource Reservation Capable Routers," July 2007.