



International Workshop on
Security Measurements and Metrics

2011

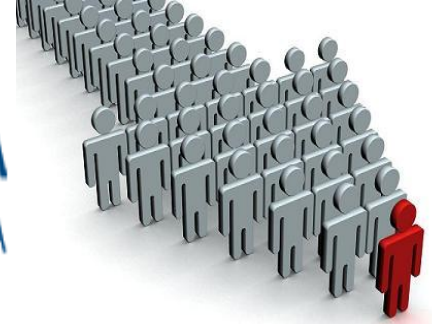
Performance Evaluation of Oracle VM Server Virtualization Software 64-bit Linux Environment

Authors : Ibidokun Emmanuel

Pavol Zavorsky

Dale Lindskog

Ron Ruhl



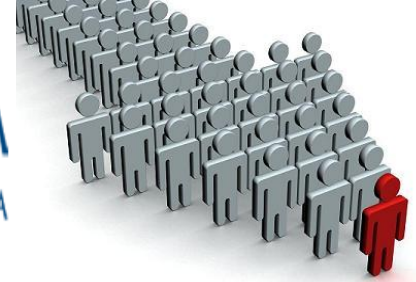
International Workshop on
Security Measurements and Metrics



2011

Introduction

- The art of server virtualization
- Scalability a salient feature of server virtualization
- Oracle VM server virtualization



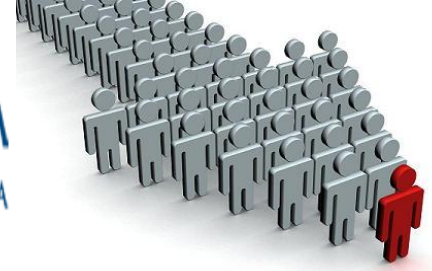
International Workshop on
Security Measurements and Metrics



2011

Objectives

- To evaluate the performance and scalability efficiency of Oracle VM server virtualization software on virtual environment in comparison with bare-metal server
- This work aims at updating the performance metrics and extending the experiments with different hardware, software and configuration using 64-bit architecture system



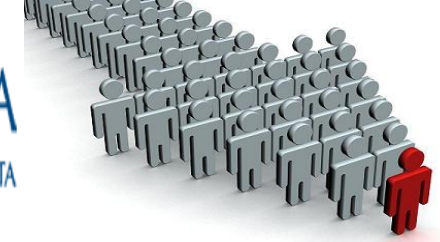
International Workshop on
Security Measurements and Metrics



2011

Motivations

- White paper by the Tolly group
- Different users have different virtualization needs (DRP and BCP)
- Hardware and software versions can make a big difference



International Workshop on Security Measurements and Metrics

2011

Experimental Setup

➤ Hardware

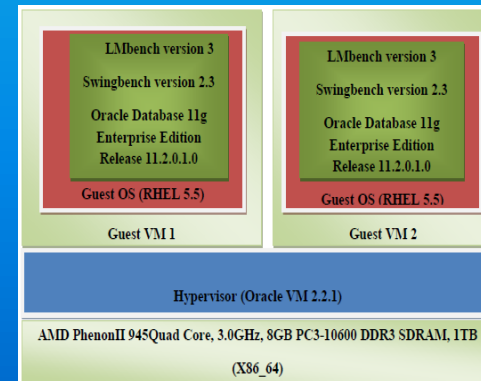
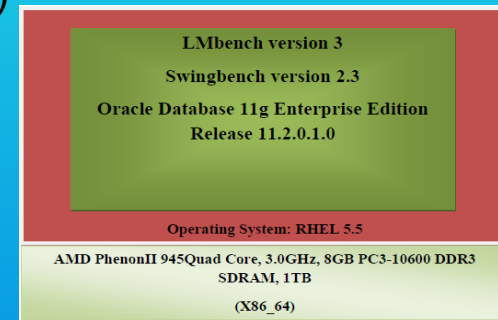
- ❖ 3.0 GHz AMD PhenonII, Quad-core processors 64-bit, 8GB
- ❖ One 64-bit virtual machine, 1CPU core, 3.75GB RAM
- ❖ Two 64-bit virtual machines 2CPU cores, 7.5GB (3.75GB each VM)

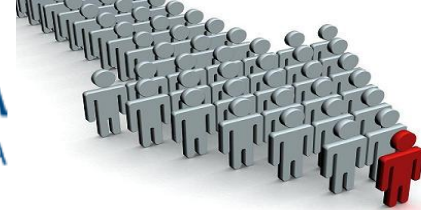
➤ Software

- ❖ Guest Operating System : Redhat 5.5 Linux Enterprise
- ❖ Virtualized environment : Oracle VM server 2.2.1
- ❖ Application :
Oracle database 11g Enterprise Release 2 (11.2.0.1.0)

➤ Tools

- ❖ Swingbench Benchmark version 2.3 .0.422
- ❖ LMBench Benchmark version 3-a9
- ❖ Oratoolkit version 1.0.2.1.5
- ❖ Vmstat (Monitoring tool)





International Workshop on
Security Measurements and Metrics

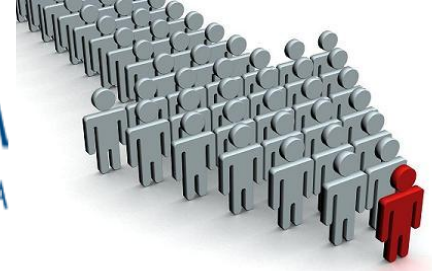
Methodology

➤ Performance efficiency using swingbench

- ❖ Swingbench Benchmark – To measure the maximum transaction per minute delivered by the Oracle VM server and Bare-metal server with the application (Oracle database 11g) load of 30 and 50 concurrent active users
 - ❖ Single Oracle VM server vs. Bare-metal server
 - ❖ Dual Oracle VM server vs. Bare-metal server

➤ Performance scalability using swingbench

- ❖ Swingbench Benchmark – To measure the maximum transaction rate while examining Oracle VM server effectiveness at supporting high volume transactions (30 and 50 concurrent active users as reference points)
- ❖ Single Oracle VM server vs. two virtual machines named OVM1 and OVM2



International Workshop on Security Measurements and Metrics

2011

Methodology contd...

➤ Performance efficiency using LMBench

❖ LMBench Benchmark – To measure Latency and Bandwidth consumption of Oracle VM server vs. Bare-metal server

❖ Latency : simple function latency

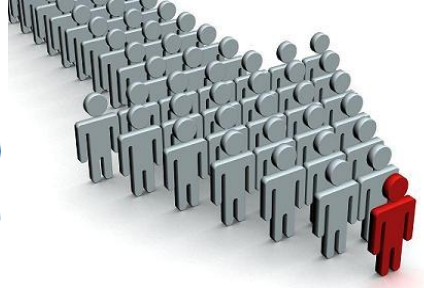
- : File system latency creation
- : File system latency removal

Interprocess communication latency

- : UDP latency
- : TCP/IP connection

❖ Bandwidth : Communication bandwidth

- Memory read
- Memory write



International Workshop on
Security Measurements and Metrics



Overall results

- Swingbench measurement results of performance efficiency
- ❖ Single Oracle VM server - 48% against, Bare-metal server – 52% (30 users) = 4% OVH
46% against Bare-metal server – 54% (50 users) = 8% OVH

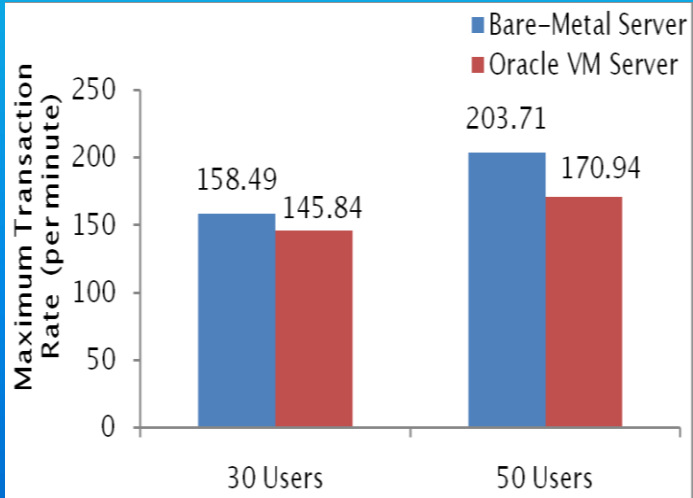


Figure 1. Database Maximum Transaction Rate Comparison of Bare-Metal Server vs. Single Oracle VM Server.

Dual Oracle VM server –75 % (30 users) and 87% (50 users)
Bare-metal Server – 52% (30 users) and 54% (50 users)

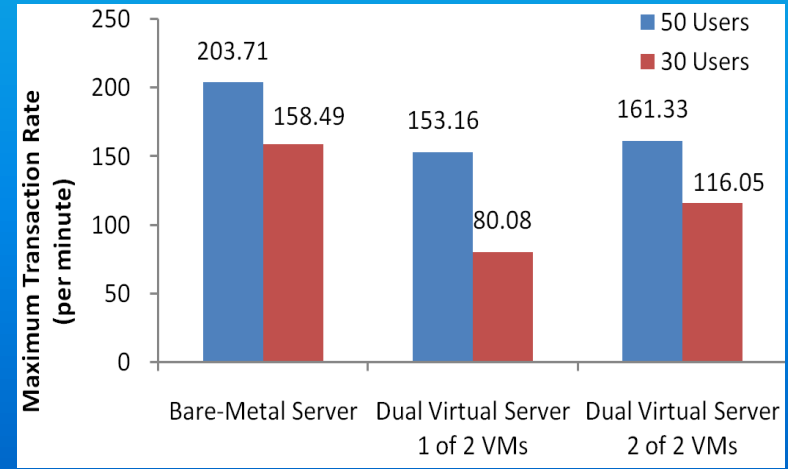
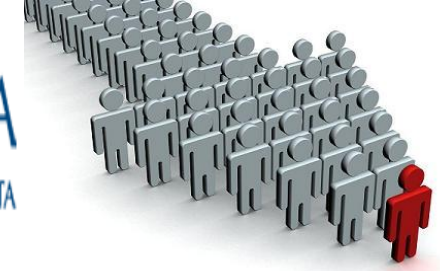


Figure 2. Database Maximum Transaction Rate Comparison of Bare-Metal Server vs. Dual Oracle VM Server.



International Workshop on Security Measurements and Metrics

2011

Overall results contd...

➤ swingbench measurement results of performance scalability

- ❖ Two virtual machines named OVM1 and OVM2

Maximum transaction load processed by OVM1 and OVM2 : 50% and 49%, (30 users)

Maximum transaction load processed by OVM1 and OVM2 : 44.89%. 44.63% (50 users)

- ❖ = A slight flexibility of less than 10% OVH in performance produced in 30 and 50 active users

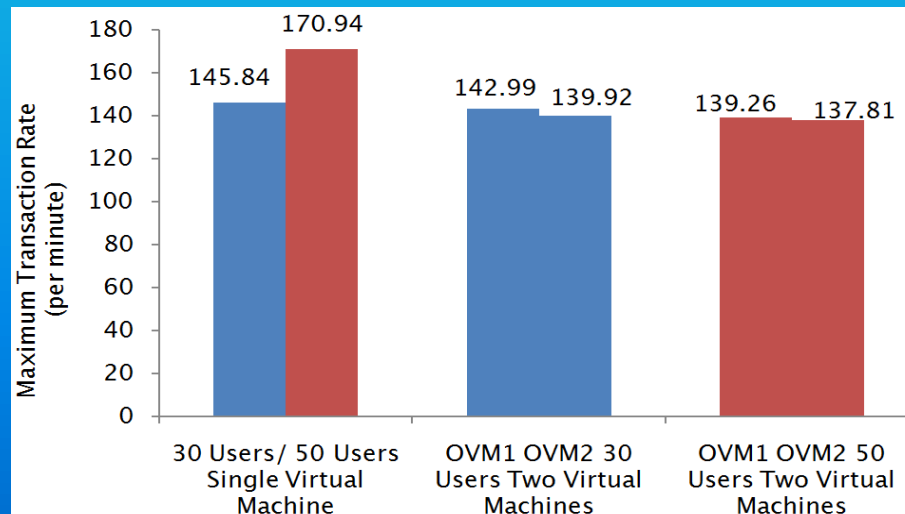
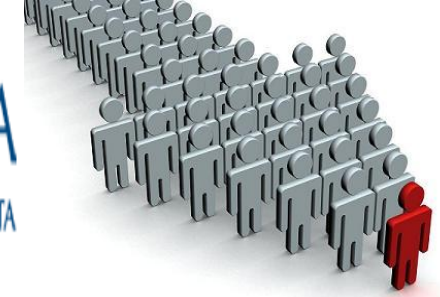


Figure 3. Database Maximum Transaction Rate Comparison of a Single VM Server vs. Two Virtual Machines using 30 and 50 Concurrent Active Users.



International Workshop on Security Measurements and Metrics

2011

Overall results

➤ The LMBench measurement results of performance efficiency

❖ Latency : simple function latency

File system latency creation : Oracle VM Server significantly low by 63%

File system latency removal : Oracle VM Server was 13% better in performance

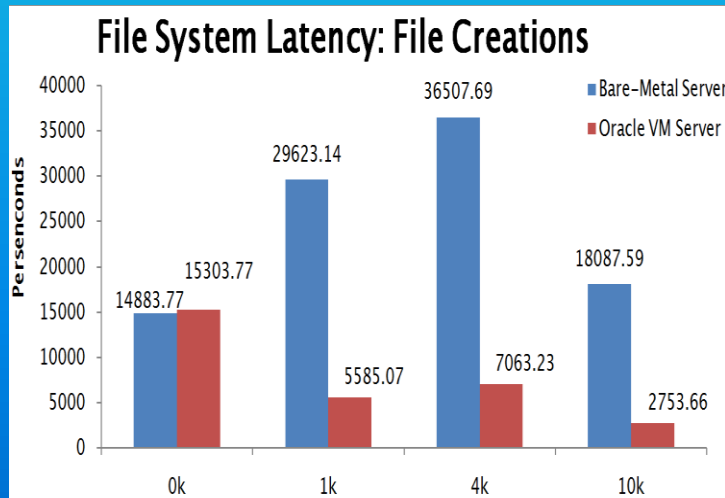


Figure 4 File System Latency: creations comparison of a Bare-Metal server vs. Oracle VM server

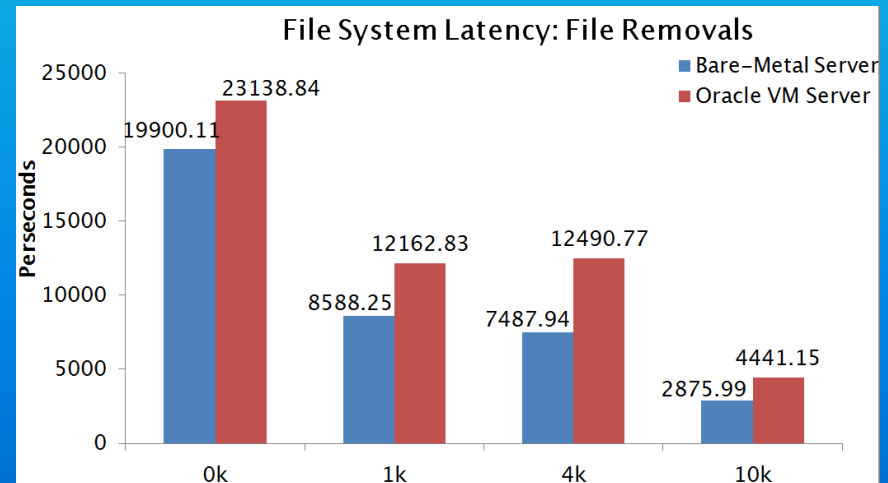
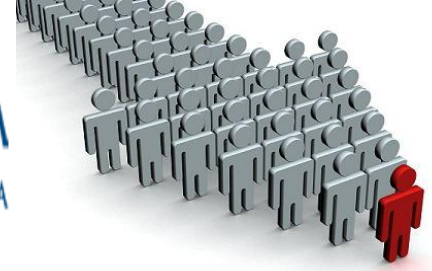


Figure 5 . File System Latency: Removal comparison of a Bare-Metal server vs. Oracle VM server.



International Workshop on Security Measurements and Metrics

2011

Overall results contd...

❖ Interprocess communication latency

UDP latency : Oracle VM server was 38% lower in performance

TCP/IP connection : Oracle VM server was 40% better in performance

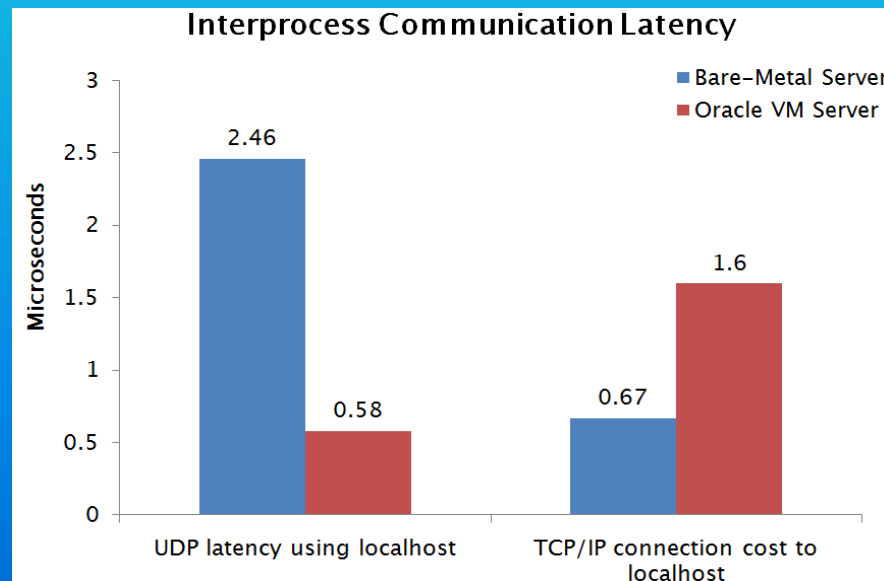
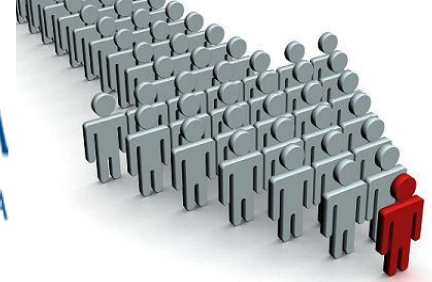


Figure 6. Interprocess Communication latency comparison of a Bare-Metal server vs. Oracle VM server



International Workshop on Security Measurements and Metrics

2011

Overall results contd...

❖ Bandwidth : Communication bandwidth

Memory read : Oracle VM server was 12% better in performance

Memory write : Oracle VM server was 14% lower in performance

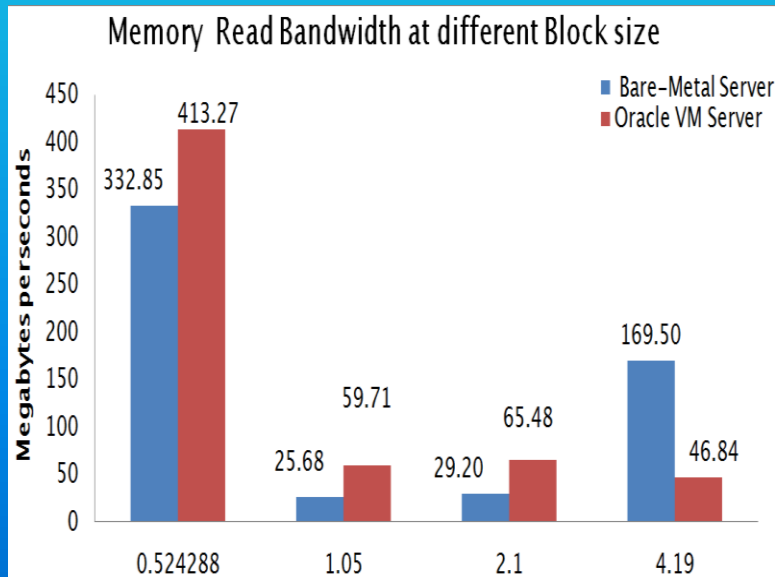


Figure 7. Memory Read Bandwidth Comparison of a Bare-Metal server vs. Oracle VM server

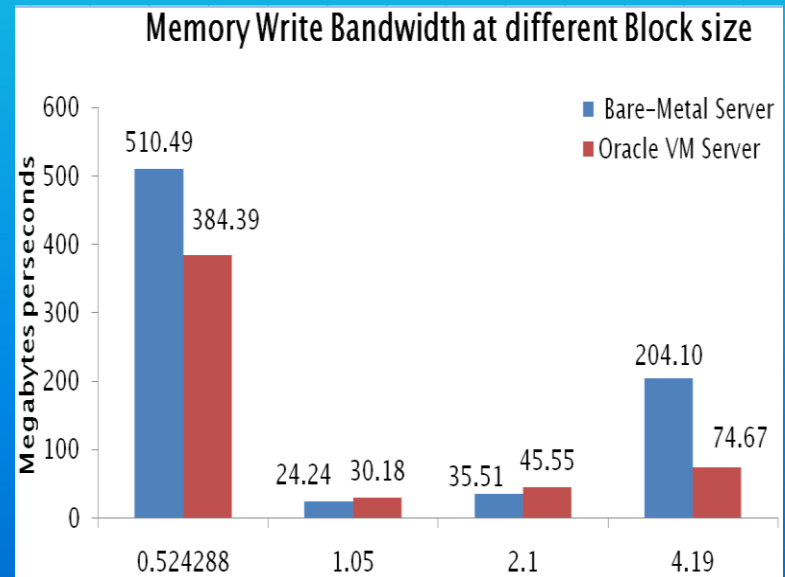
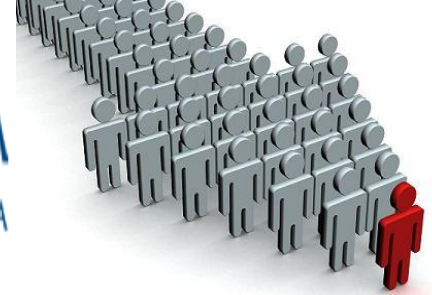


Figure 8. Memory Write Bandwidth Comparison of a Bare-Metal server vs. Oracle VM server.



International Workshop on Security Measurements and Metrics

2011

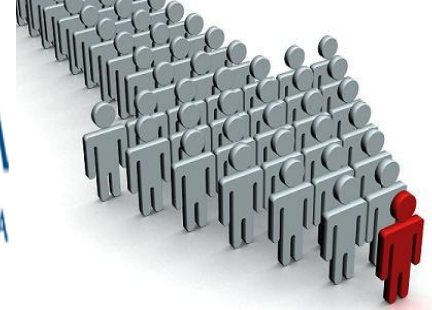
Conclusions

- ❖ It can be concluded that the performance of Oracle VM server achieved significant percentages in latency and bandwidth
- ❖ Oracle VM server can support a variety of work load efficiently in a virtualized environment as justified by 4% overhead obtained using 30 concurrent active users and 8% overhead obtained using 50 concurrent active users
- ❖ The throughput of 75% and 87% with 30 concurrent active users and 50 concurrent active users in dual Oracle VM server indicated that there is performance scalability improvement with two virtual machines compared to a single virtual machine
- ❖ This is also an indication that Oracle VM server utilized its hardware resources effectively
- ❖ These results provide a premonition knowledge that will help the small scale enterprise to evaluate the Oracle VM server's performance compared to the bare-metal server

International Workshop on
Security Measurements and Metrics

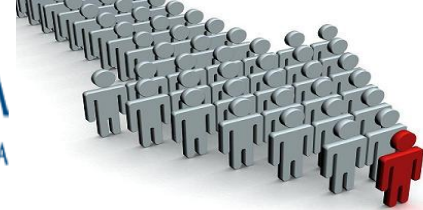


2011



Future Work

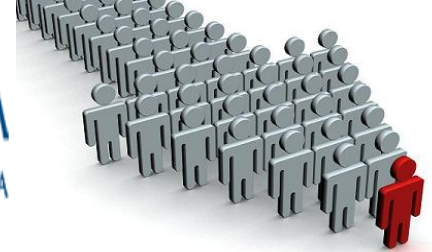
- Researchers can further scale the number of virtual machines and test for the performance scalability
- Performance analysis of Oracle database in virtual environments



Special

Thanks

- ❖ Security Measurements and Metrics 2011 Program chairs : James Walden (Northern Kentucky University (US)) and Laurie Williams (North Carolina State University (US))
- ❖ Steering Committee and Program Committee Security Measurements and Metrics 2011
- ❖ Concordia Faculty of Professional Education and Faculty of Graduate Studies
- ❖ Pavol Zavarsky: Director of Research, Information Systems Security Management Department, Concordia University College of Alberta
- ❖ Dale Lindskog: Assistant Professor, Information Systems Security Management Department, Concordia University College of Alberta
- ❖ Ron Ruhl : Director and Assistant Professor Information Systems Security Management Program Concordia University College of Alberta
- ❖ Marco LoVerso, PhD : Dean of Research and Graduate Studies, Concordia University College of Alberta
- ❖ Dominic Giles at Oracle UK (Swingbench)
- ❖ Dr. Carl Staelin at HP Labs Israel (LMbench)
- ❖ Tridon Communications Fort McMurray Canada



International Workshop on
Security Measurements and Metrics

2011

**IS YOUR TURN TO
ASK QUESTION.....?**