Art of Using Xen at Scale

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Agenda

• Amazon Web Services - Intro
• Virtualization in the Cloud
• Scale Impact on Virtualization
• Xen Enhancements..
• Future Features – Some Thoughts
AMAZON WEB SERVICES - INTRO
Amazon Web Services

“..delivers a highly scalable cloud computing platform with high availability and dependability, and the flexibility to enable customers to build a wide range of applications.”
Amazon Web Services

• Includes more than 20 Services
  – Compute Services
    • EC2
  – Storage Services
    • S3
    • EBS
  – Database Services
  – Content Delivery Services
  – Messaging Services
  – And many more..

• More Details: aws.amazon.com
EC2 Instance Types

- Standard Instances
- Micro Instances
- High Memory Instances
- High Compute Instances
- Cluster Compute Instances
VIRTUALIZATION IN THE CLOUD
Virtualization and Cloud

• Virtualization a key enabler for Cloud Computing

• Virtualization Provides:
  – Secure Control Plane
  – Fine grained resource allocation
  – Cloud Specific Business Logic in Dom-0
Virtualization in the Cloud

• Guest OS(Kernel) chosen by customer
  – Large and ever changing set
• Aggressive ingestion of Security fixes
  – Security is paramount
• Unique Challenges at Scale..
SCALE IMPACT ON VIRTUALIZATION
Scale Matters..
Intra Host ‘Scaling’
Multi-tenancy
Multi-tenancy

• Scaling Challenges
  – Performance Scaling: I/O performance etc
  – Tools Scaling: XM etc

• Isolation Challenges
  – Performance Isolation
  – VM Fault Isolation
Fault Isolation
VM-level Fault Isolation

• Failure related to one VM isolated from Peer VMs
• Good Hypervisor Level Fault Isolation in Xen
• End-to-End Fault Isolation Important
  – Including Dom-0 I/O Stack
  – Including Control Plane (e.g. Xenwatch)
Performance
Consistency of Performance

Performance Isolation
Performance Scaling

- Critical for Multi-tenancy
- Particularly I/O Performance
- Good in Xen
- Deserves continued Focus..
I/O Performance

Direct Attached Device Performance Good But..

Loss of Control and Flexibility Not Great
Para-virtualized I/O Performance Important
Reduce Cost
Hardware Enablement

• Xen Enablement bit ‘Slow’ for some hardware

• Faster ‘Production’ quality enablement in Xen
  – Help Cloud adopt new hardware faster
Upstream Linux Integration GREAT !!
Interface Compatibility
Interface Compatibility

- Applies to Many Types of Interfaces
  - Paravirtualized Driver Interface
    - Blkfront – Blkback
    - Netfront – Netbk
  - Hypercall Interface
  - Control Plane Interface (XM vs XL)
- Has Been Good in Xen
  - Deserves continued focus
XEN ENHANCEMENTS..
Serve Spiky Workloads For Less
Micro instance in EC2

- **t1.micro**: Max CPU Level
- **m1.small**: Fixed CPU Level
- **t1.micro**: Background CPU Level
Micro Instance and CPU Hogs

CPU Usage

Max CPU Level

Background Level

CPU Level Limited

Time
Large ‘CPU Time’ Bucket

10s of milliseconds

Bigger than 10s of millisecs
Some Thoughts on

FUTURE FEATURES
Multi-tier Scheduling?

• Lots of use cases in the Cloud
• Classes with prioritization
  – Beyond ‘CPU Pools’
  – Similar to Linux Scheduler?
  – Real Time Scheduling/Advanced Functionality
• Preserve existing Scheduler Semantics to the extent possible
Dom-0 Resource Accounting

• CPU consumed in Dom-0 for each VM
  – Isn’t accounted against the VM per se
  – Fairness Issues
  – Prioritization Issues
Dom-0 Resource Accounting

• Possible Solutions
  – Group Scheduling in Dom-0 – Partial Solution
  – Xen and Dom-0 Scheduler Cooperation ??
    • Hypervisor – Dom-0 Interface Blurred..
  – Something else ??

• Scheduler deals with Threads..
  – One Thread serving Multiple VMs not great
  – ‘Thread Aligned’ VM Resource Consumption Good
Key Takeaways

• Virtualization Key For Cloud
• End-to-End Fault Isolation Important
• Performance Isolation And Performance Consistency Important
• Para-virtualized I/O Performance Important
• Faster ‘Production’ Quality Hardware Enablement
• Interface Compatibility Critical
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