A Publish/Subscribe Middleware for Dependable and Real-time Monitoring in the Cloud

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Outline of Presentation

- Context & Challenges
 - Monitoring Clouds
 - Related Research and Challenges
- Design of SQRT-C
 - Overview of OMG DDS
 - System Architecture
 - Middleware Communication
 - Auto-scaling Use Case
- Experimental Results
 - Testbed Environment
 - Average Message Latency Comparison
 - Jitter Comparison
- Conclusion





Monitoring Clouds

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Monitoring Clouds

- Providing scalable and QoS-enabled monitoring of resources in the cloud is essential
 - To support application QoS properties
 - To identify security threats
- Existing approaches to resource monitoring in the cloud
 - RESTful APIs, SOAP, AMQP, and XML-RPC
 - Cannot provide monitoring information timely and scalably









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Related Research and Challenges





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Related Research and Challenges

- Related Research
 - Ganglia
 - Nagios
 - Pub/Sub middleware for real-time grid monitoring









Related Research and Challenges

- Related Research
 - Ganglia
 - Nagios
 - Pub/Sub middleware for real-time grid monitoring
- Challenges in Prior Work
 - Not for virtualized resources
 - Lack of scalability and support for QoS (timeliness, availability \ldots)









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Overview of the OMG DDS



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Overview of the OMG DDS

- Object Management Group (OMG) Publish/Subscribe standard that aim to enable scalable and real-time data exchanges between publishers and subscribers
- DDS provides policies for specifying many QoS requirements
- DDS Architectural Elements
 - Data-Centric Publish-Subscribe (DCPS)
 - Data Local Reconstruction Layer (DLRL)





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SQRT-C System Architecture







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SQRT-C Middleware Communication











Auto-scaling Use Case



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Testbed Environment

- A cluster of 56 blades
 - Dual 2.8 GHz Xeon CPUs
 - 1GB of RAM
 - 40GB of HDD
- 7 rack servers
 - 12-core 2.1GHz Opteron CPUs
 - 32GB of RAM
 - 500GB of HDD
- OpenSUSE 11.4 Linux as operating systems
- OpenNebula 3.0 for operating a private cloud
- OpenSplice DDS 5.2 for the middleware implementation
- <u>web.py</u> and mimerenter for the REST implementation



OpenNebula

OpenSplice | DDS





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Average Message Latency Comparison







Response time and Jitter Comparison

• Message Round-trip Time and Jitter of RESTful Service







Response time and Jitter Comparison

• Message Latency of Different Reliability QoS







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- SQRT-C that leverages DDS
 - Experimental results show that the DDS is more appropriate for real-time cloud monitoring







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- SQRT-C resolves the challenges
 - Virtual resource information provided as a service
 - Proper configurations of DDS







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- SQRT-C that leverages DDS
 - Experimental results show that the DDS is more appropriate for real-time cloud monitoring
- SQRT-C resolves the challenges
 - Virtual resource information provided as a service
 - Proper configurations of DDS
- Future Work
 - Experiment with different QoS settings of DDS
 - Fault-tolerant middleware
 - Fine grained auto-scaling middleware













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