Challenges in real-time virtualization and predictable cloud computing

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Introduction**

- Integration of Real-Time Systems and Cloud Computing

- The shift towards distributed computing driven by affordable and advanced network technologies

- Cloud Computing as a paradigm shift enabling on-demand and distributed services
- Key service models: IaaS, PaaS, SaaS

- Emphasis on the transformative potential of cloud computing for real-time systems

- Mention of challenges and benefits of merging real-time and cloud computing

Benefits of Virtualization:

- Functional execution isolation, enabling privilege separation.
- Testing and debugging capabilities.
- Enhanced reliability through hypervisor-based isolation.

Virtual Machine Architectures:

- Full Virtualizatio : Emulates all hardw are for unmodified guest OS.
- Hardware Assisted Virtualization: Hardware features speed up VM execution.
- Application Level Virtualization: Interprets virtual instruction sets (e.g., Java).
- Network Virtualization: Emulates network topologies for VM communication.

Performance Characteristics:

- Full virtualization can be expensive due to traps and emulation.
- Hardware-assisted virtualization improves VM performance by leveraging hardware capabilities
- Network virtualization emulates network setups, impacting communication latencies.

The excerpt covers various topics such as terminology mapping, control and access to the execution platform, real-time scheduling and resource management, and communication network challenges.

- Terminology Mapping
- Control and Access to the Execution Platform
- Real-time Scheduling and Resource Management
- Communication Network Challenges
- Virtualization of I/O Network Communications

IRMOS

- Developed a deadline-based real-time scheduler for Linux kernel.
- Provided scheduling guarantees for VMs on the same system.

RT-Xen

- Developed real-time VM scheduling framework in Xen hypervisor.
- Utilized fixed-priority server algorithms based on real-time scheduling theory.

Comparison between IRMOS and RT-Xe

- Shared goal: Predictable execution and real-time performance in virtualized environments.
- IRMOS: Focus on multimedia-oriented applications in virtualized cloud, QoS support in core resources.

Network Functions Virtualization

- Emerging technology for decoupling network functions.
- Focus on flexible, software-based deployment of networking services.

Future Directions

- Enhancing virtualization technology for real-time guarantees.
- Addressing challenges of data-intensive and Big-Data workloads

Conclusion

-Integration of Real-time and Cloud
-Challenges and Barriers
-Current Solutions and Limitations
-Future Directions