CRM: Middleware for Managing CPU Time

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Outline of Talk

- **♦** Context
- Motivation
- ♦ CRM
 - > Structure
 - > Converting Guarantees
 - > Enforcing Rules
 - > Other Functionality
- ♦ Related work
- Conclusions

2

Context

- ♦ Focus on
 - > Single-node
 - > CPU time as critical resource
- ♦ Open system model
 - > Independently developed apps running concurrently
 - > Requires enforcement
 - > e.g. CPU reservations or proportional

3

Motivation

- ♦ OS support for multimedia not used much in practice
- ♦ Why?
 - > Users would rather run just one app at a time?
 - > Field is immature?
 - Bill Gates, Linus Torvalds, and Steve Jobs don't care?
 - Usability issues?

4

Our answer: Usability Issues!

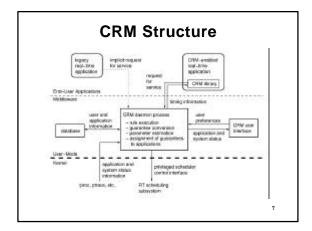
♦ For end-users and developers

5

How can middleware help?

- ♦ Store user preferences
- ♦ Interact with user (minimally)
- ◆ Determine app. requirements
- ♦ Support legacy apps.
- Hide differences between schedulers

6



Converting Guarantees

tasic, hard tasic, soft proportional share reservation with bounded arror continuous, continuous, proportional share hard res. self res. with air bounded error with air bounded error.

- **◆** Example:
 - > Basic CPU Res. of x, y can be converted to PS with share x/y and error bound 2(x/y)(y-x)
- ♦ More conversions in RTSS '01 paper
- ◆ The point: Enforcement of guarantees is what matters

8

Enforcing Rules

- Entities are: resource principals, guarantees, requests, rules and events
- ♦ Events cause rules to be evaluated
- **♦** Examples:
 - > Enforcing fairness between users
 - > Running feasible set of apps. with highest value
 - > Selecting mode for adaptive app.

9

Other Functionality

- ◆ Determine application requirements
 - > Store them
 - > Apply them to legacy apps
- ♦ GUI
- ♦ These are hard!

10

Related Work

- ◆ QoS Broker (Nahrstedt and Smith '95)
- Rialto resource manager (Jones et al. '95)
- Adaptive resource manager (Oparah '99)
- ♦ RT-CORBA

Status

- ♦ Not implemented (yet)
- ♦ Targets:
 - > Linux/RT (TimeSys)
 - > QLinux (UMass)
 - > Linux-SRT (AT&T Research)
 - > Linux + HLS (Utah)

12

Conclusions

- ♦ Hacking the scheduler is not enough
- Middleware can help solve remaining problems

The End

- ◆ More info and papers here: http://www.cs.utah.edu/~regehr
- ♦ Let's talk...

14