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

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 share

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?

Our answer:
Usability Issues!

- For end-users and developers

How can middleware help?

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

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.

Converting Guarantees
- 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

Other Functionality
- Determine application requirements
  - Store them
  - Apply them to legacy apps
- GUI
- These are hard!

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)
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...