Possession as Linear Knowledge

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Epistemic logic analyzes reasoning governing localized knowledge, and is thus fundamental to multiagent systems. Linear logic treats hypotheses as consumable resources, allowing us to model evolution of state. Combining principles from these two separate traditions into a single coherent logic allows us to represent localized consumable resources and their flow in a distributed system. The slogan "*possession is linear knowledge*" summarizes the underlying idea.

We walk through the design of a linear epistemic logic and discuss its basic metatheoretic properties such as cut elimination. We illustrate its expressive power with several examples drawn from an ongoing effort to design and implement a linear epistemic logic programming language for multi-agent distributed systems; see [GBB⁺06, DP09] for preliminary logic design and examples.

Acknowledgments

This talk presents joint work with Michael Ashley-Rollman, Henry DeYoung, and Deepag Garg.

References

- [DP09] Henry DeYoung and Frank Pfenning. Reasoning about the consequences of authorization policies in a linear epistemic logic. In *Workshop on Foundations of Computer Security (FCS'09)*, Los Angeles, California, August 2009.
- [GBB+06] Deepak Garg, Lujo Bauer, Kevin Bowers, Frank Pfenning, and Michael Reiter. A linear logic of affirmation and knowledge. In D. Gollman, J. Meier, and A. Sabelfeld, editors, *Proceedings of the 11th European Symposium on Research in Computer Security (ESORICS'06)*, pages 297–312, Hamburg, Germany, September 2006. Springer LNCS 4189.