Possession as Linear Knowledge

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Epistemic logic analyzes reasoning governing localized knowledge, and is thus fundamental to multi-agent 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

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.