Initial Post

Agent Communication Languages (ACLs) such as KQML were originally designed to allow autonomous agents to exchange not only data but also requests, goals and commitments. Rooted in speech-act theory, they emphasise communication about intentions and purposes rather than simple procedural execution (Finin et al., 1994). This makes ACLs well suited to multi-agent systems operating in heterogeneous, distributed environments.

Compared with method invocation in Python or Java, ACLs provide a richer, semantically grounded framework. Method calls are efficient but tightly coupled: the caller must know the exact interface, and the interaction is deterministic. By contrast, ACLs enable flexibility and negotiation, allowing agents to collaborate even with partial or evolving knowledge. More recent research shows that this need for interoperability is still critical. For example, a 2025 survey highlights how protocols such as ACP and A2A extend earlier ACL concepts for use in contemporary distributed systems, with decentralised discovery and identity mechanisms (Ehtesham et al., 2025).

At the same time, communication in multi-agent systems is being reimagined. Deep reinforcement learning research has shown how protocols can emerge between agents without predefined languages, raising questions about when structured ACLs are necessary (Zhu et al., 2024). Similarly, recent work on large language model-based agents explores how natural language can itself become a medium of coordination, blurring the line between designed protocols and emergent dialogue (Yan et al., 2025).

The trade-off remains between expressiveness and efficiency. Method invocation provides speed and simplicity, whereas ACLs and modern communication frameworks offer adaptability and autonomy. The challenge for researchers and practitioners is to decide when the additional complexity of rich communication yields genuine value over conventional programming techniques.

References:

Chen, Z., Li, B. and Zhang, H. (2025) *Beyond self-talk: a communication-centric survey of LLM-based multi-agent systems*. arXiv preprint. Available at: https://arxiv.org/abs/2502.14321

Finin, T., Fritzson, R., McKay, D. and McEntire, R. (1994) *KQML as an agent communication language*. Proceedings of the 3rd International Conference on Information and Knowledge Management. ACM. Available at: https://cdn.aaai.org/Workshops/1994/WS-94-02/WS94-02-007.pdf

Xu, K., Zhang, Y. and Zhou, X. (2025) *A survey of agent interoperability protocols: Model Context Protocol, ACP, A2A, ANP*. arXiv preprint. Available at: https://arxiv.org/html/2505.02279v1

Zhang, S., Yang, Y. and Yu, C. (2024) *A survey of multi-agent deep reinforcement learning with communication*. Autonomous Agents and Multi-Agent Systems, 38(1), pp. 1–34. Available at: https://link.springer.com/article/10.1007/s10458-023-09633-6