A DATA CO-PILOT FOR ELECTRIC DISTRIBUTION UTILITIES TO SUPPORT GRID SITUATIONAL AWARENESS

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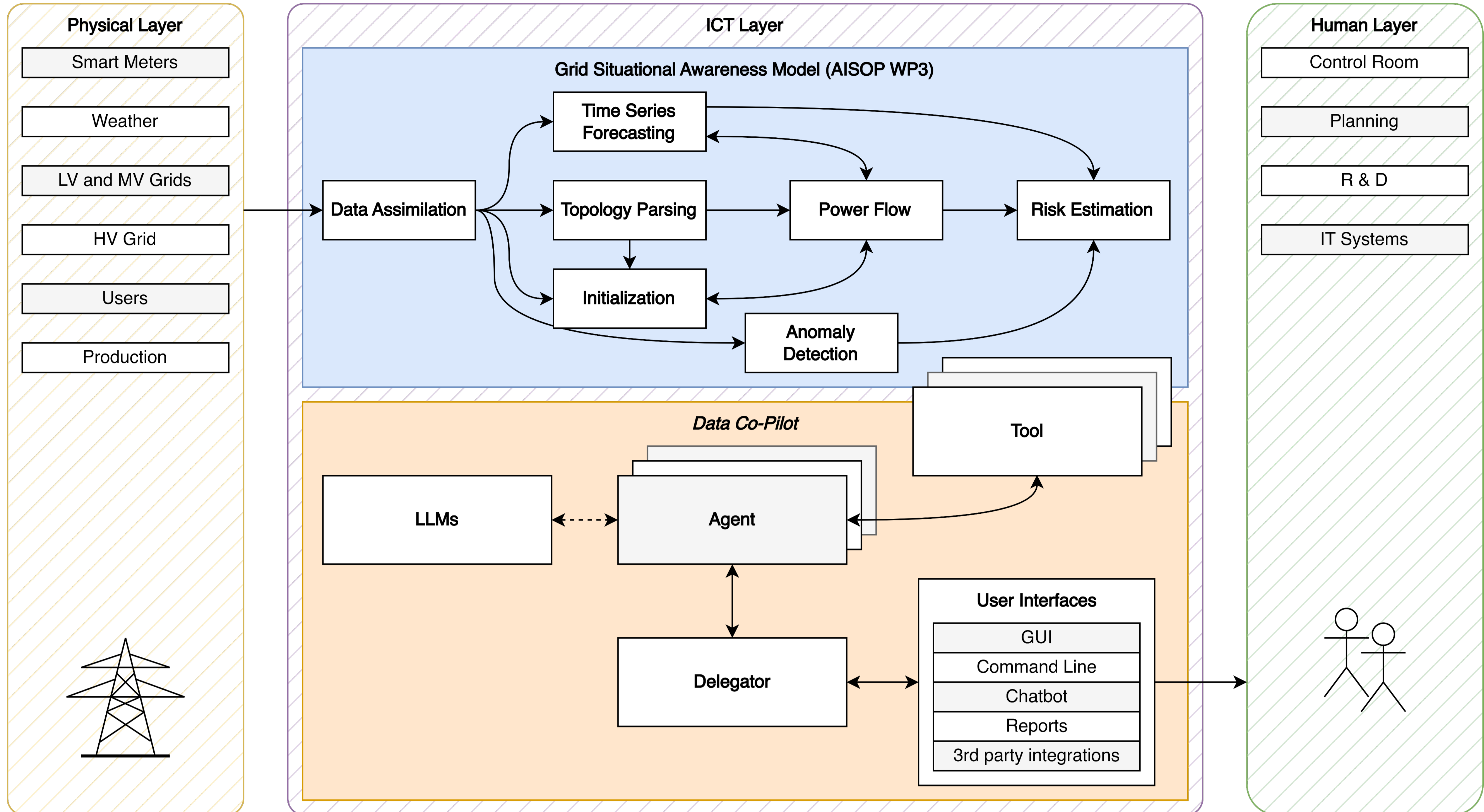
Summary

The integration of sensors and smart meters into distribution grids can enable distribution system operators (DSOs) to gain a deeper understanding of the grid state. However, the massive influx of data poses a challenge to assimilate information to support operational decisions. Automation and AI offer powerful solutions to this data deluge.

The AISOP project models as a whole aim to provide forecasts and scenarios of grid conditions, detect anomalies, estimate risk, and design dynamic tariffs for consumers and producers.

The tool described here will serve as a user interface to various data sources, enabling DSOs to effectively manage their grids.

- **Anomalies**: detecting anomalies and trends → monitor the grid and identify potential issues that may not be immediately apparent from raw data alone.

- **Grid simulation**: forecasts and scenarios of grid conditions → plan against grid overloading

- **Risk estimation**: analysing historical data and future scenarios to quantify risk of operating in states with too high or too low voltage or load → summarises the state of operation and gives input to the design of dynamic tariffs

In a future step, the combination of O&M data with operational data would also offer the potential to ensure that critical equipment receives timely attention to prevent failures.
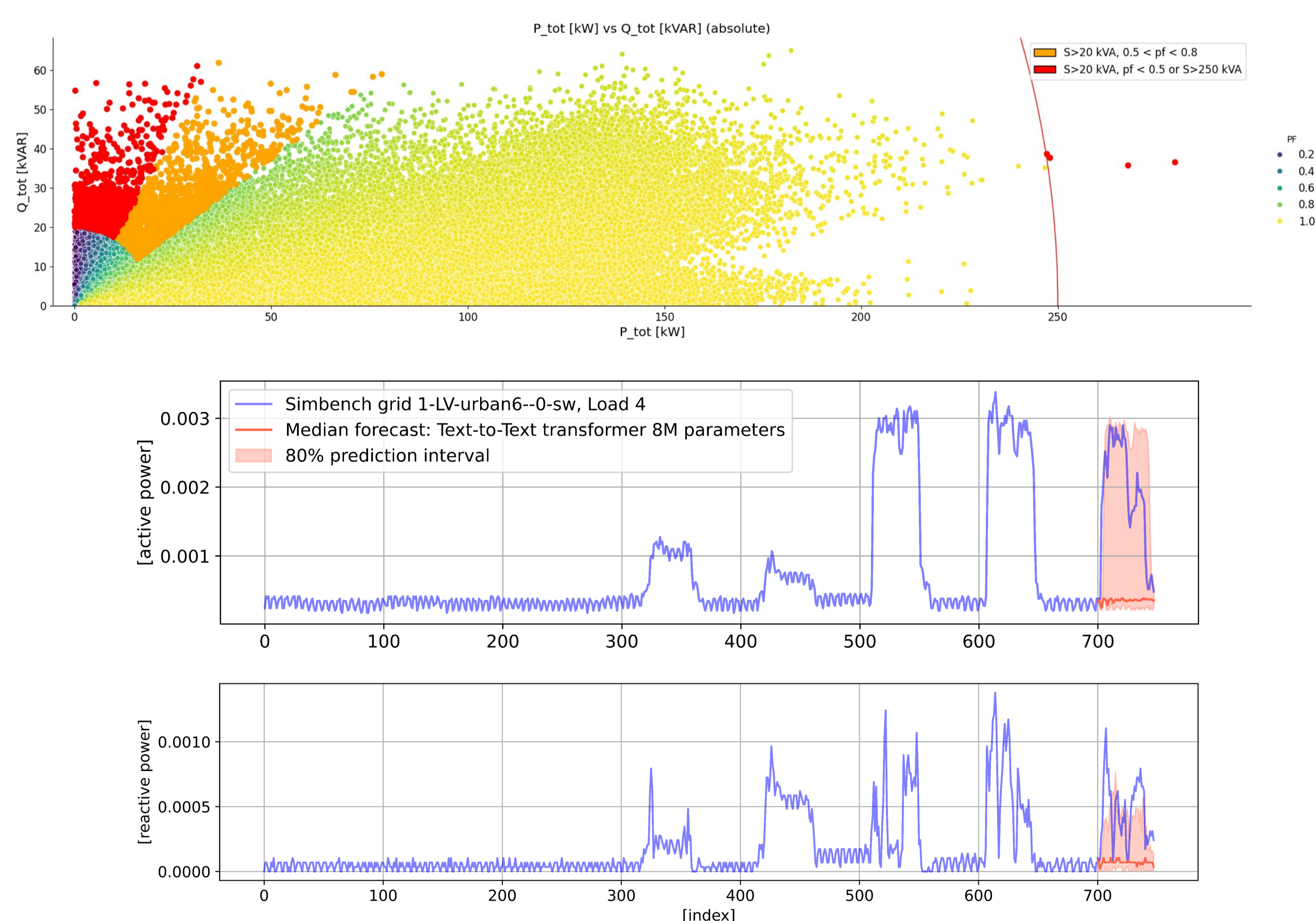
Conceptual flow diagram
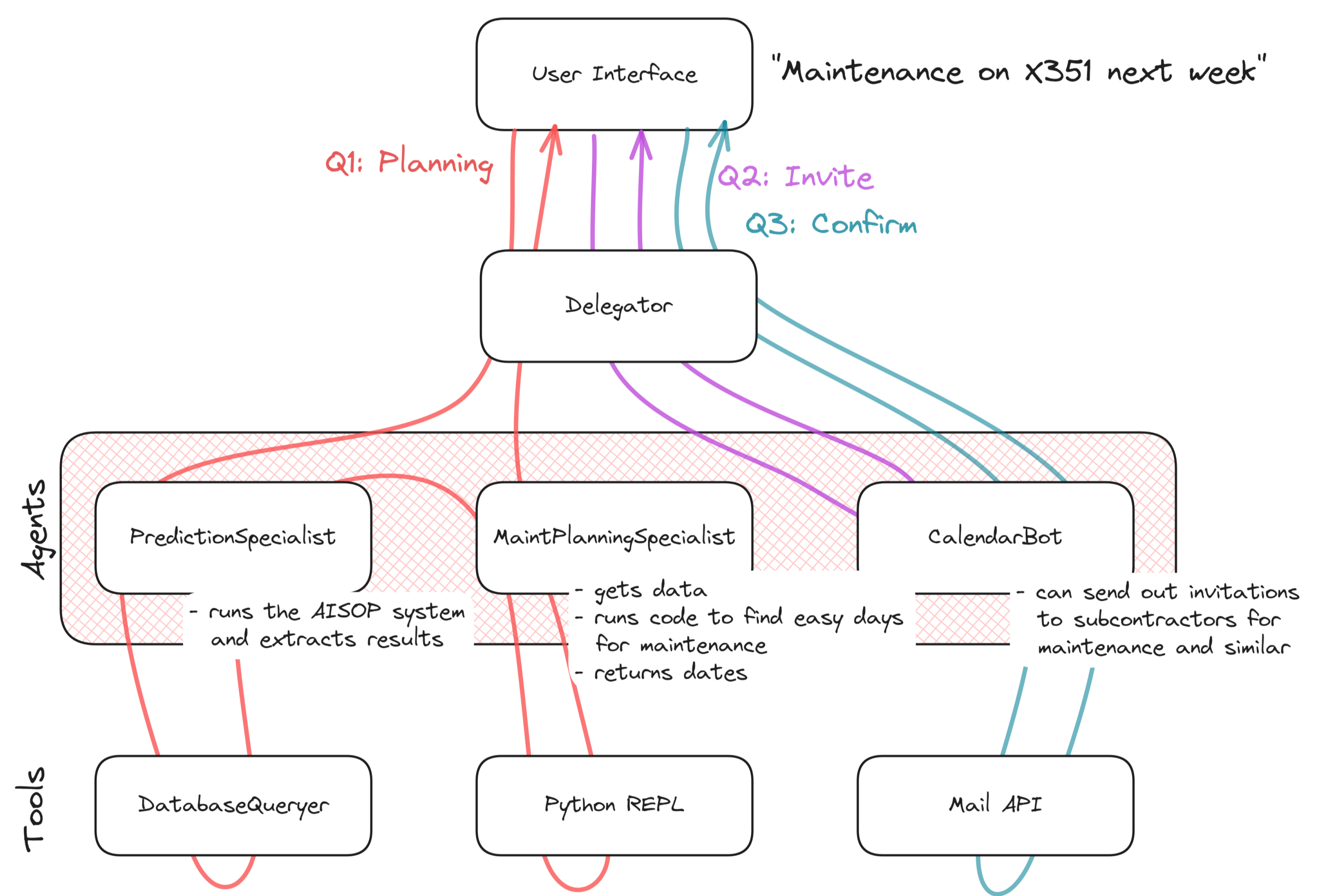
Outlook to implementation

We are developing grid situational awareness tools to facilitate monitoring and support decisions that operators take for grid congestion, or voltage management in a time scale of hours to days ahead.

- Feedback from technicians and operators involved in operational planning, as well as relevant IT-personnel is key to the design of workflows and interfaces.

- Expert systems approaches in combination with consolidated, machine-readable data could take us a long way to automate pre-defined workflows.

- Data privacy, information security, and cybersecurity all play an important role in defining tools, architecture, and requirements.

- To reduce expenses, using models 'just big enough' for the problem can drive price and computational requirements down. Example: GPT4 call costs for Input/output per MToken in the order of 60/120$. Where as Mistral 7B is in the order of 0.2/0.2$

- From an environmental sustainability perspective, the LLMs energy consumption and its footprint should be considered.

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