Reference architecture for wind power forecasting systems

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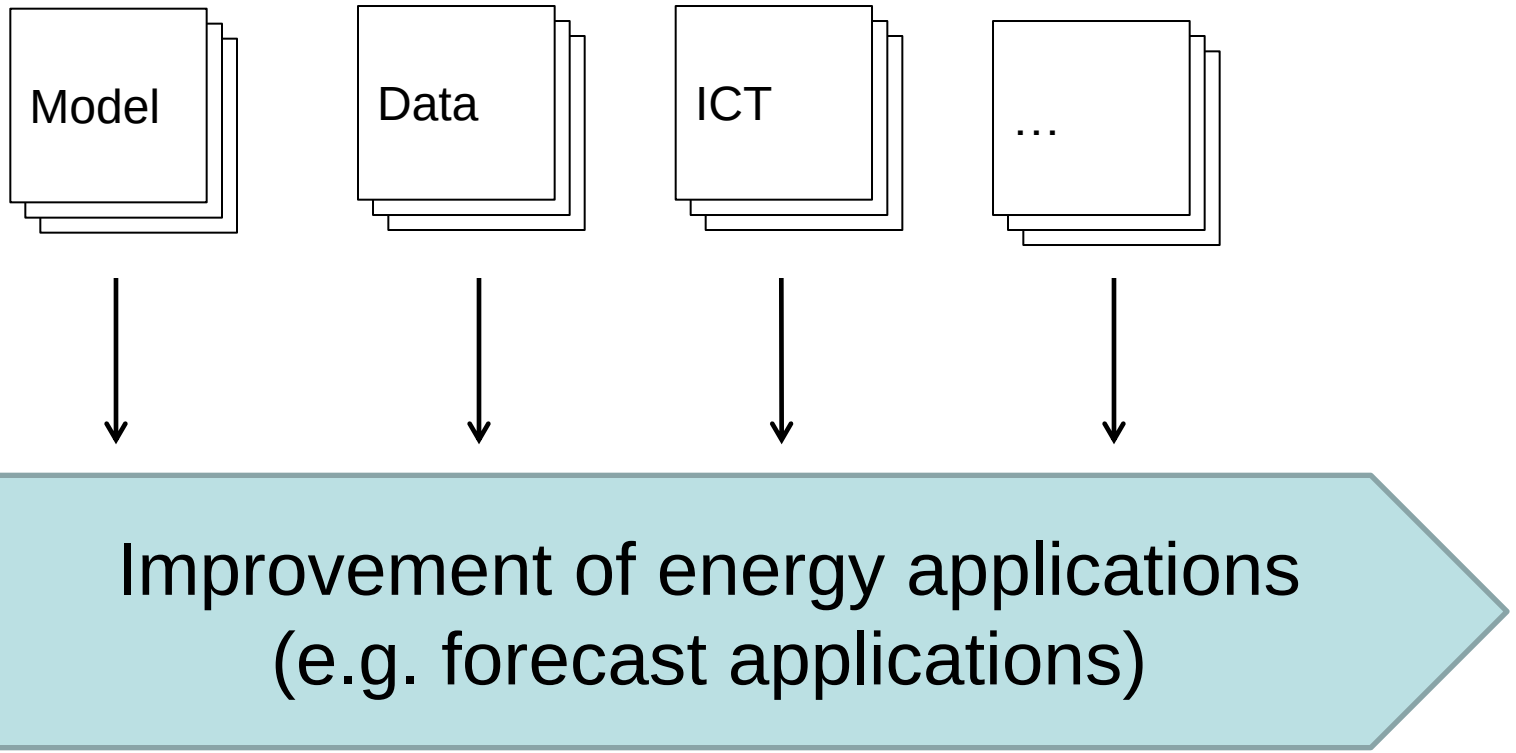
EWeLiNE

– Cooperation of
  - IWES
  - DWD
  - TenneT
  - Amprion
  - 50 Hertz Transmission

EWeLiNE

– Key research areas
  - Integration of new types of data (power production) into meteorological prediction system
  - Optimization of the model system towards **energy applications**
  - Development of forecast products in close communication with the users

EWeLiNE


Model
Data
ICT
...
Improvement of energy applications
(e.g. forecast applications)

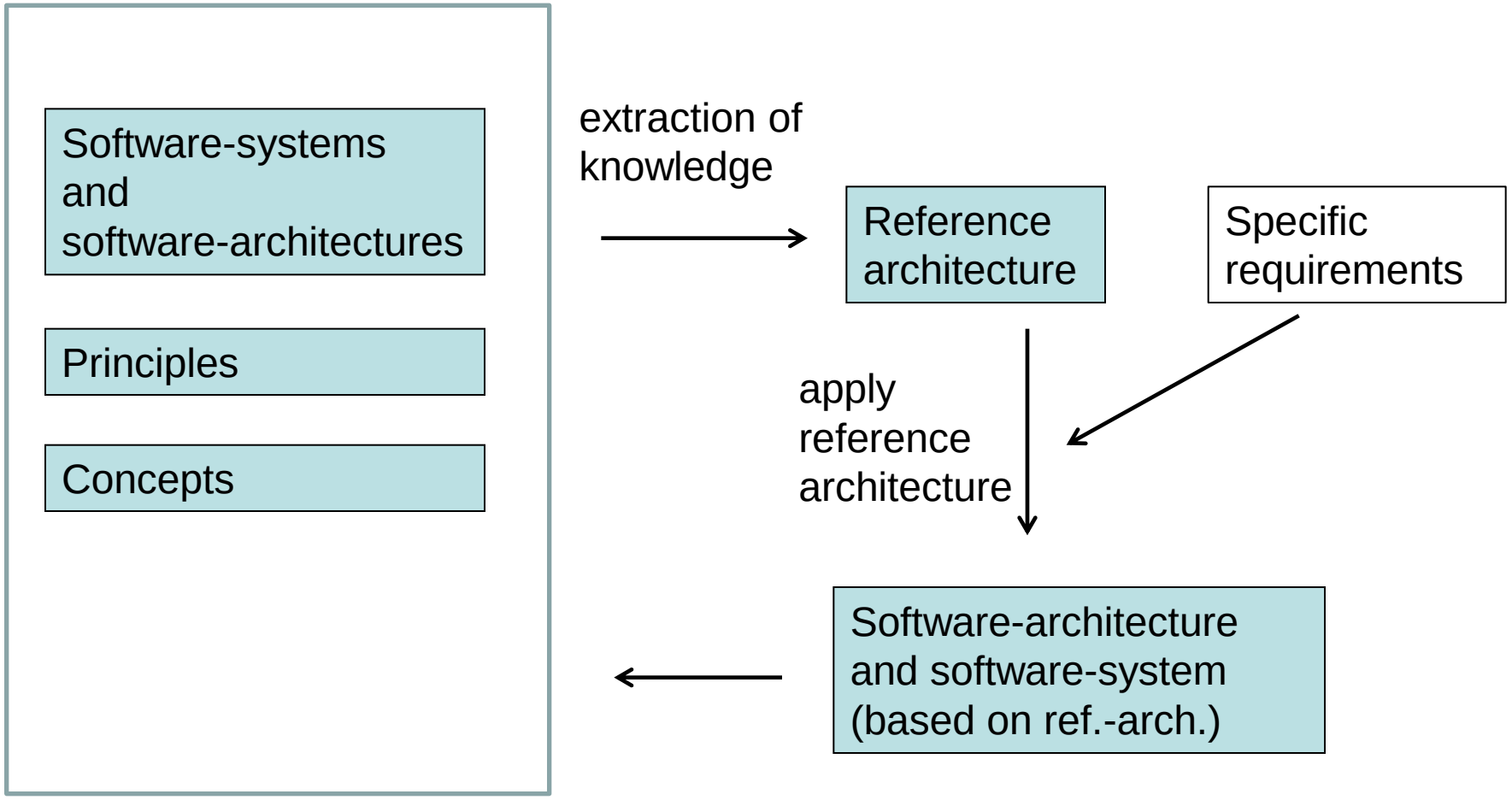
Reference architecture

- Template solution for software architectures for a particular domain
- High level of abstraction

Reference architecture importance

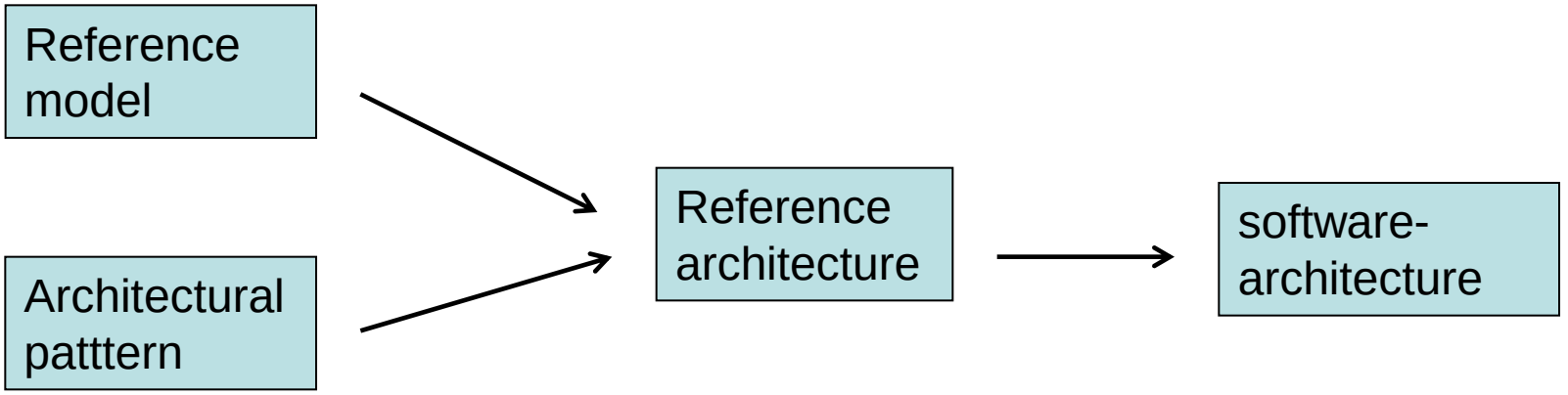
- Early and important design decisions
- Proven solution
- Transferable abstraction of a system
- Communication among stakeholders

Reference architecture development



Following: [Appel2012], [Reuss2009]

Reference architecture



: More design elements

[Bass200]

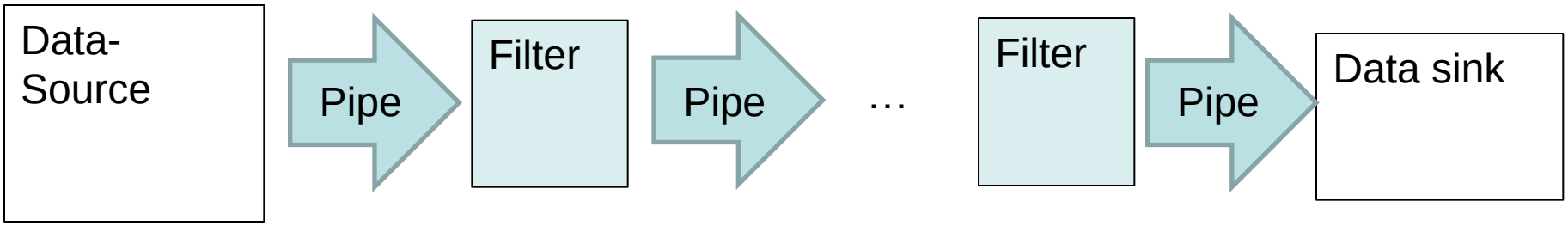
Reference model

– Model chain
  - Key concept
  - Focused on core forecasting systems

Example:

Architectural pattern

- Pipes and Filters
  - Processing data streams
  - Chain of processing elements
  - Each processing step is encapsulated in a filter
  - Data is passed through pipes
  - Datasource, pipe, filter, data sink



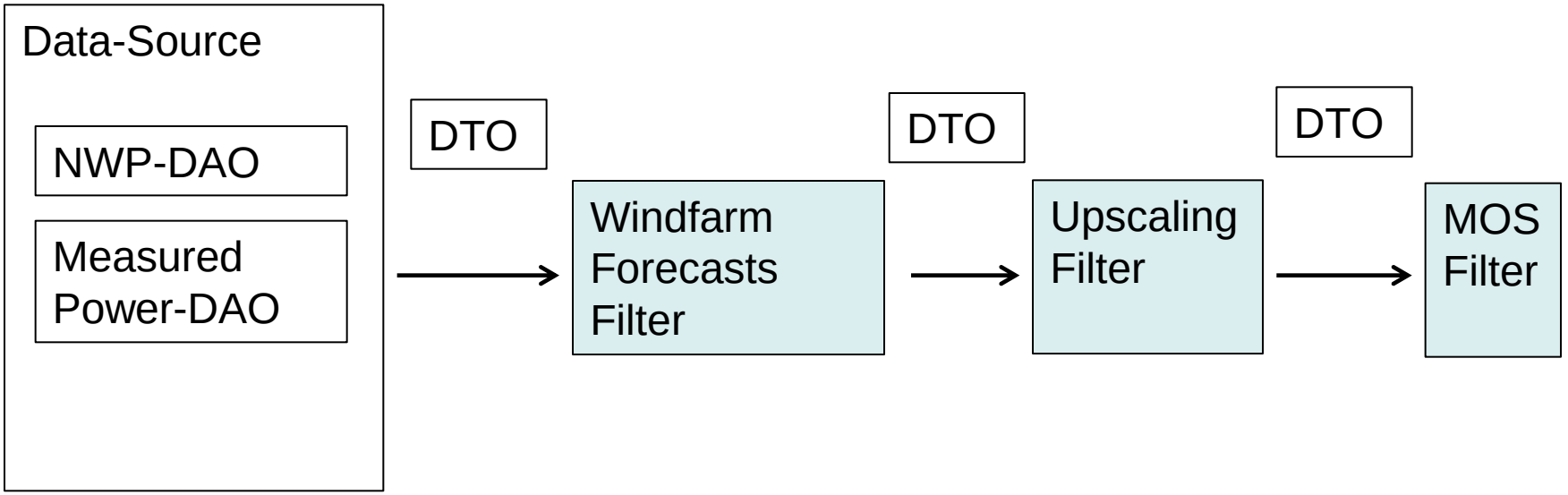
see: [Busch1969], [Hohpe2011]

Mapping of reference modell and architectural pattern

– Model chain and pipes and filters
  - Process a stream of data
  - Flexibility (reorder, exchange)
  - Non-adjacent steps do not share information

Apply reference architecture

- Software architecture (based on ref. arch.)
  - Simple stand alone forecasting system
  - Added design pattern : DAO, DTO



Thank you

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Appendix

EWeLiNE

Eweline contact

http://projekt-eweline.de

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EWeLiNE

EWeLiNE

„ ***E***rstellung innovativer ***We***tter- und ***L***e***i***stungsprognosemodelle für die ***N***etzintegration wetterabhängiger ***E***nergieträger”


EWeLiNE

IFP (Forecasting discussion forum)

- plattform for industry and applied science
- meets twice a year
- open to the public
- registration : http://projekt-eweline.de/en/ifp.html


Reference model and model chain

– Giebel,G.; a.o.

“State-of-the-Art on Methods and Software Tools for Short-Term Prediction of Wind Energy Production”

– Monteiro, C.; a.o

„ Wind Power Forecasting: State-of-the-Art 2009“

– Giebel; a.o.

“The State of the Art in Short-Term Prediction of Wind Power”

Definitions

Reference model

„ A reference model is a division of functionality togehter with data flow between the pieces.” [Bass2006]

Definitions

Reference architecture

„A reference architecture is a reference model mapped onto software elements

(that cooperatively implement the functionality defined in the reference model) and the data flows between them.”

[Bass2006]

Definitions

Architectural pattern

„ An architectural pattern is a description of element and relation types together with a set of constraints on how they may be used.” [Bass2006]

Literature

[Bass2006]

Bass, Len; Clements, Paul; Kazman, Rick

„Software architecture in practice“

[Reuss2009]

Reussner, Ralf; Hasselbring, Wilhelm

“Handbuch der Software-Architektur”

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[Appel2012]

Appelrath, Hans-Jürgen

„IT-Architekturentwicklung im Smart Grid “

[Clem2009]

Clements, Paul

“Documenting software architectures. Views and beyond”

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[Mon2009]

Monteiro, C.; Bessa, R.; Miranda, V.; Conzelmann, G.

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[Giebel2003]

Giebel,G.; a.o.

“State-of-the-Art on Methods and Software Tools for Short-Term Prediction of Wind Energy Production”

[Busch1996]

Buschmann, Frank

„Pattern-oriented software architecture“ Vol. 1

Literature

[Hohpe2011]

Hohpe, Gregor; Woolf, Bobby; Brown, Kyle“

Enterprise integration patterns”