Information and evaluation models of complex hierarchical network systems

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Our understanding about the world around us is formed on the basis of available information about it.

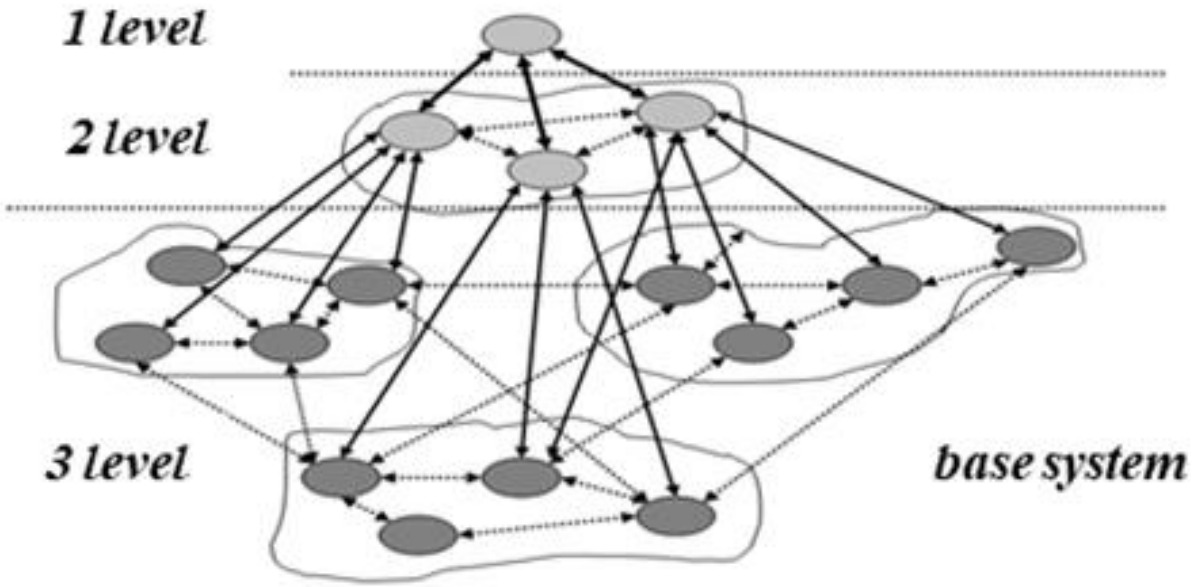
- **2020 > 64.2 x10^{12} GB**
  - **23-35% - useful information;**
  - **1-3% - analized & uzed information**

    Large Andron Collider (Cern) < 0.004% (>4.6 billion euros)
- **Problem of uncertainty:**
  - **the lack of complete data about the system;**
  - **information overload**

    Google Scolar > 100 millions papers

    “complex network” > 5 millions papers

Informational models of complex hierarchical network systems



1. **What information should be included in the information model?**
2. **Structure of priority**
3. **Structure of fullness**
4. **Access rights & information security**

Mathematical models of complex hierarchical network system

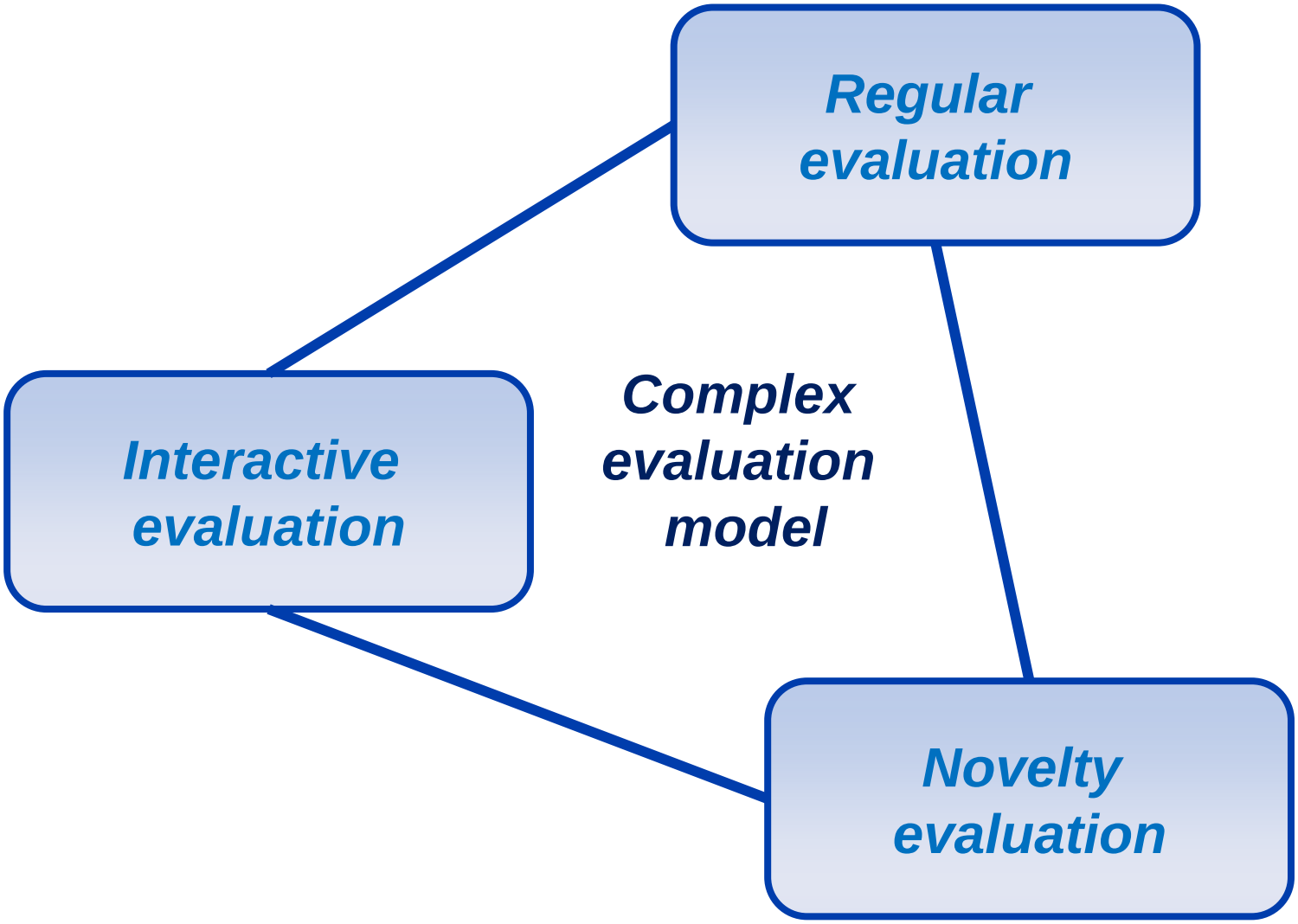
- **macroeconomic models of the world economy**
- **models of social processes**
- **climate models**
- **transport models of megacities**
- **models of epidemics**
- **…**

description of the current situation // forecasting & control

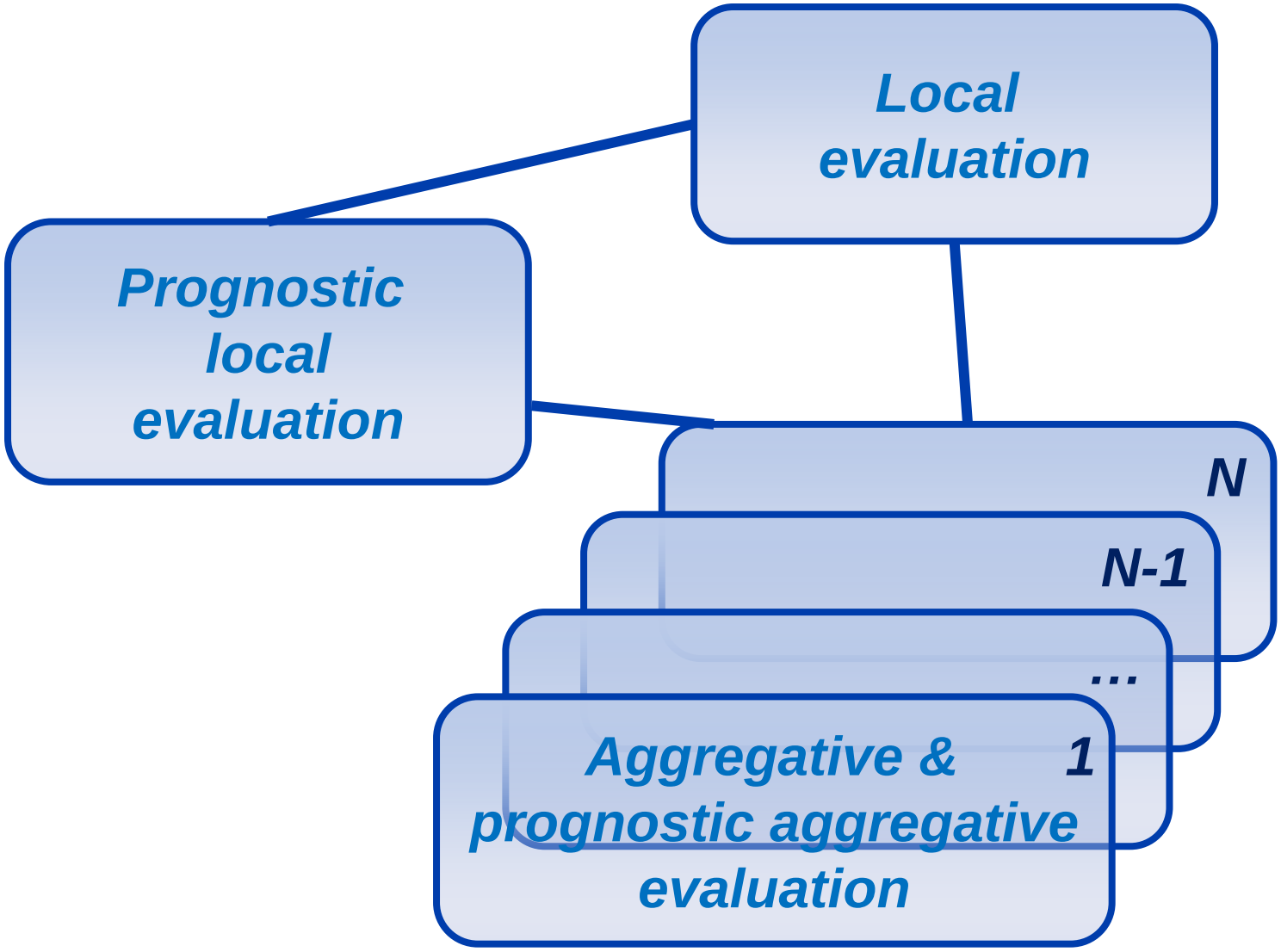
"Simple systems" → complex models

Complex systems → simple models

Model of complex evaluation of hierarchical network system

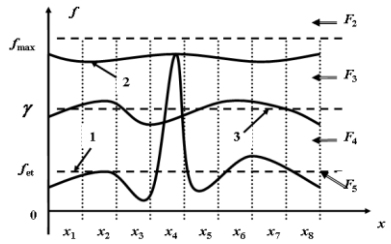


Evaluation models of complex hierarchical network system

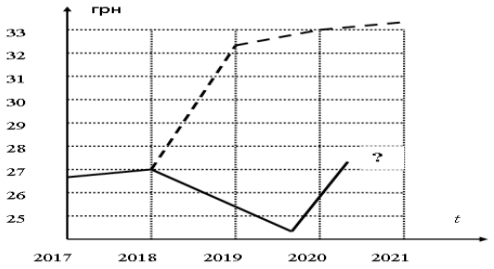


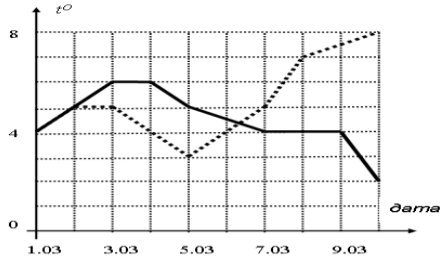
Components of evaluation models

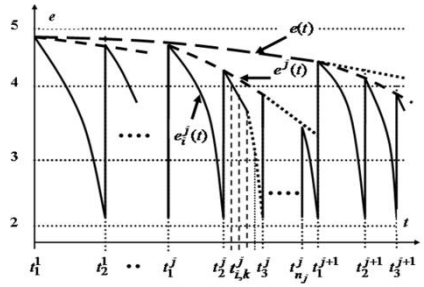
- **Local evaluation**
  (precized evaluation scale)



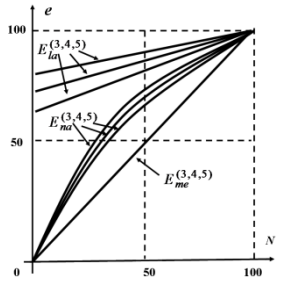
- **Prognostic evaluation**
  (short-term forecasting)

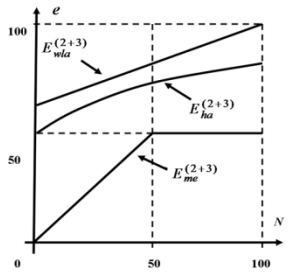




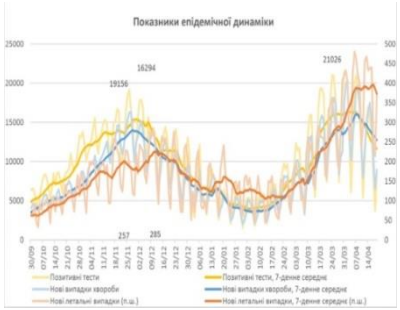


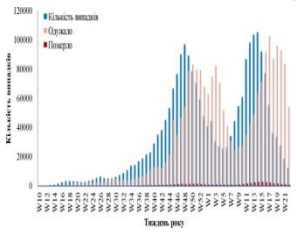
- **Aggregative evaluation**
  - **the weakest element method;**
  - **linear aggregation method;**
  - **weighed linear aggregation method;**
  - **nonlinear aggregation method;**
  - **hibrid aggregation method.**

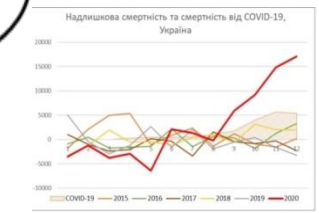




Model of complex evaluation of Covid-19 spreading







Optimization of data processing in information models of complex systems

The complex methodology:

- large amounts of input data;
- involves a number of parameters and evaluation criteria;
- different operation modes.

Input data processing:

- the optimal parallel-pipeline algorithms of filtering;
- highly parallel digital filtering algorithms, computers with a multi-core processors and clusters;

Optimization of data processing in information models of complex systems

A general approach to the large-blocks parallelization:

- a parallel-sequential approach to optimize calculations in the case of local evaluation of the CHNS element characteristic according to the given parameters;

- efficient algorithmic constructions for parallelization of computations during obtaining generalized conclusions (aggregated evaluation) for different components of system;

- the parallelization of procedure of interactive evaluation;

- original approaches to visualization of evaluation results.

Many thanks
for your attention!