Information Society Technologies

K-WfGrid: Grid Workflows with Knowledge

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Partners

- Fraunhofer FIRST (Berlin, Germany)
- UIBK (Innsbruck, Austria)
- IISAS (Bratislava, Slovak Republic)
- CYFRONET (Cracow, Poland)
- LogicDIS S.A. (Athens, Greece)
- Softeco Sismat SpA (Genoa, Italy)


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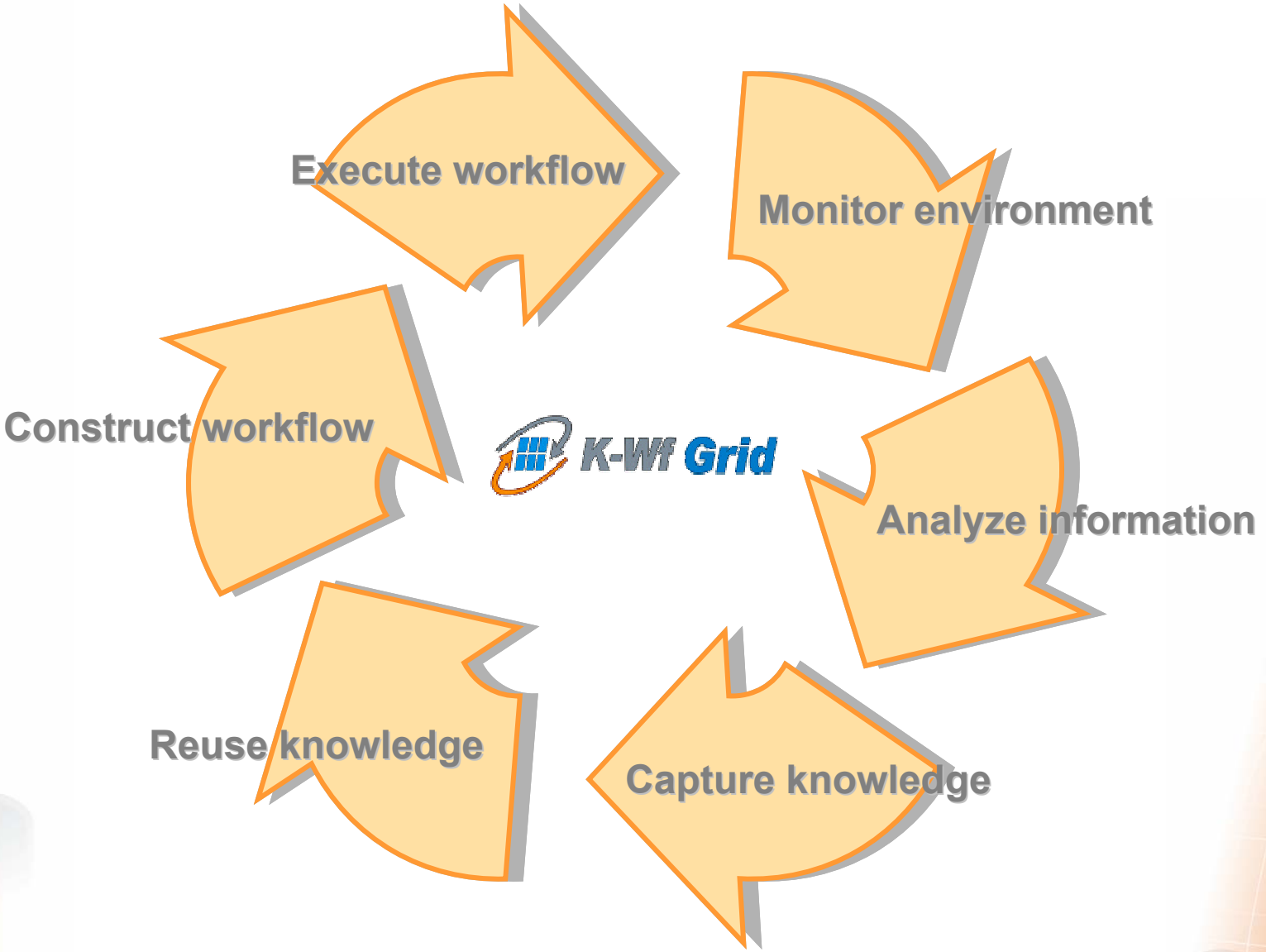
K-Wf Grid Objectives

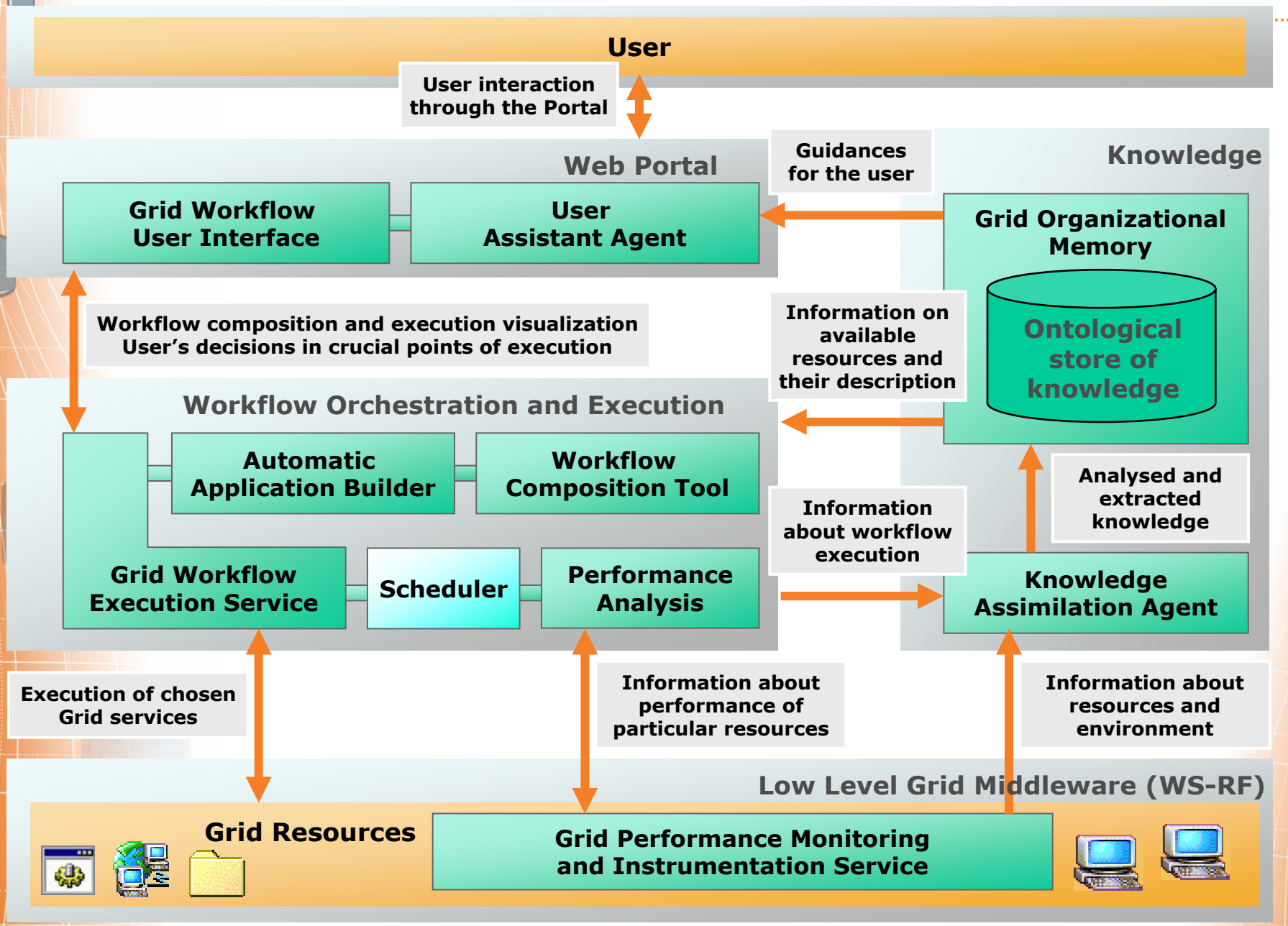
- Integrating services into coherent application scenarios
- Enabling automatic construction and reuse of workflows with knowledge gathered during operation
- Involving monitoring and knowledge acquisition services in order to provide added value for end users

Technologies: service-oriented Grid architecture, workflows in Petri nets, ontologies, dynamic instrumentation

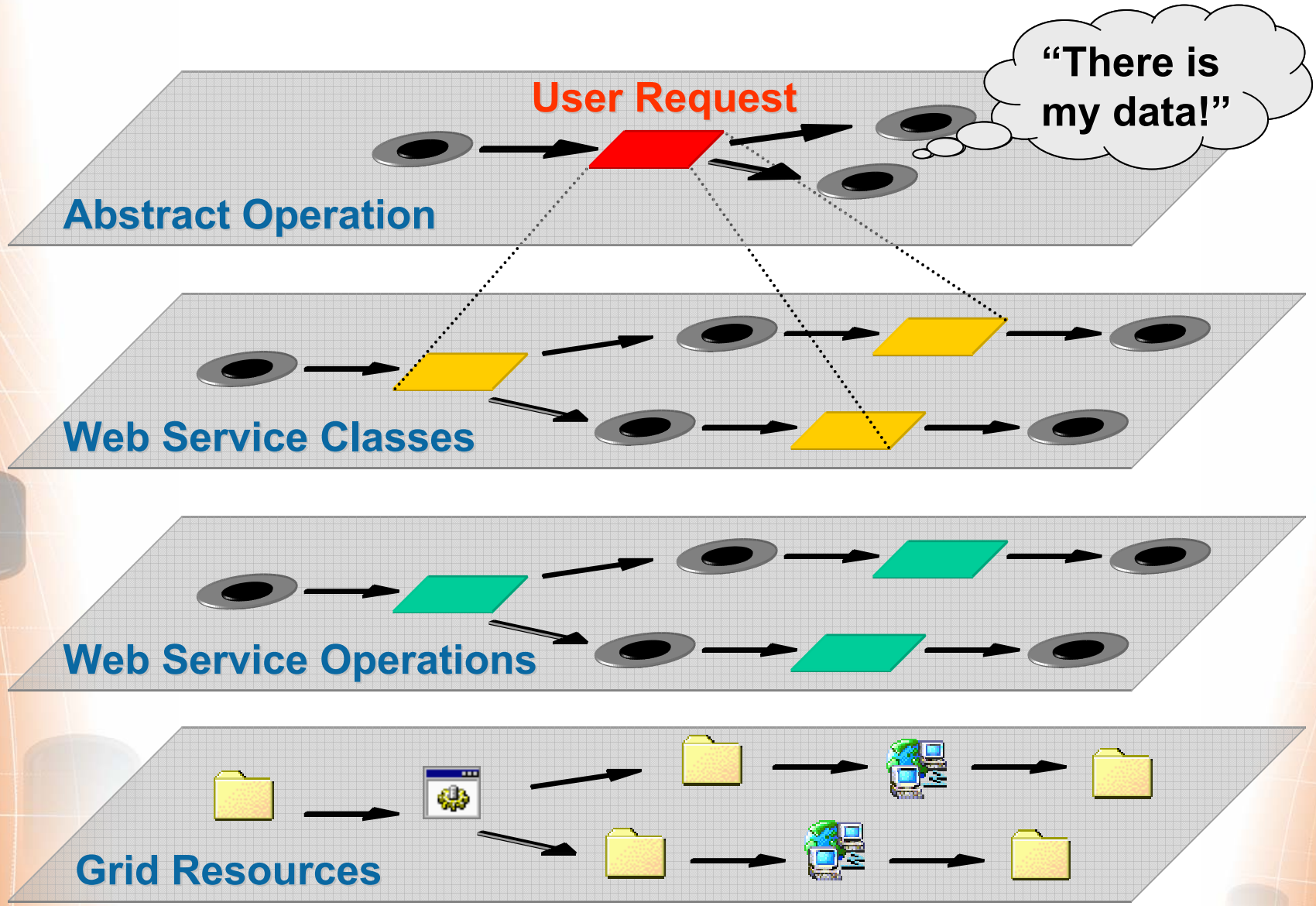
K-Wf Grid concept



Architecture and Flow of Actions



Process of Workflow Refinement

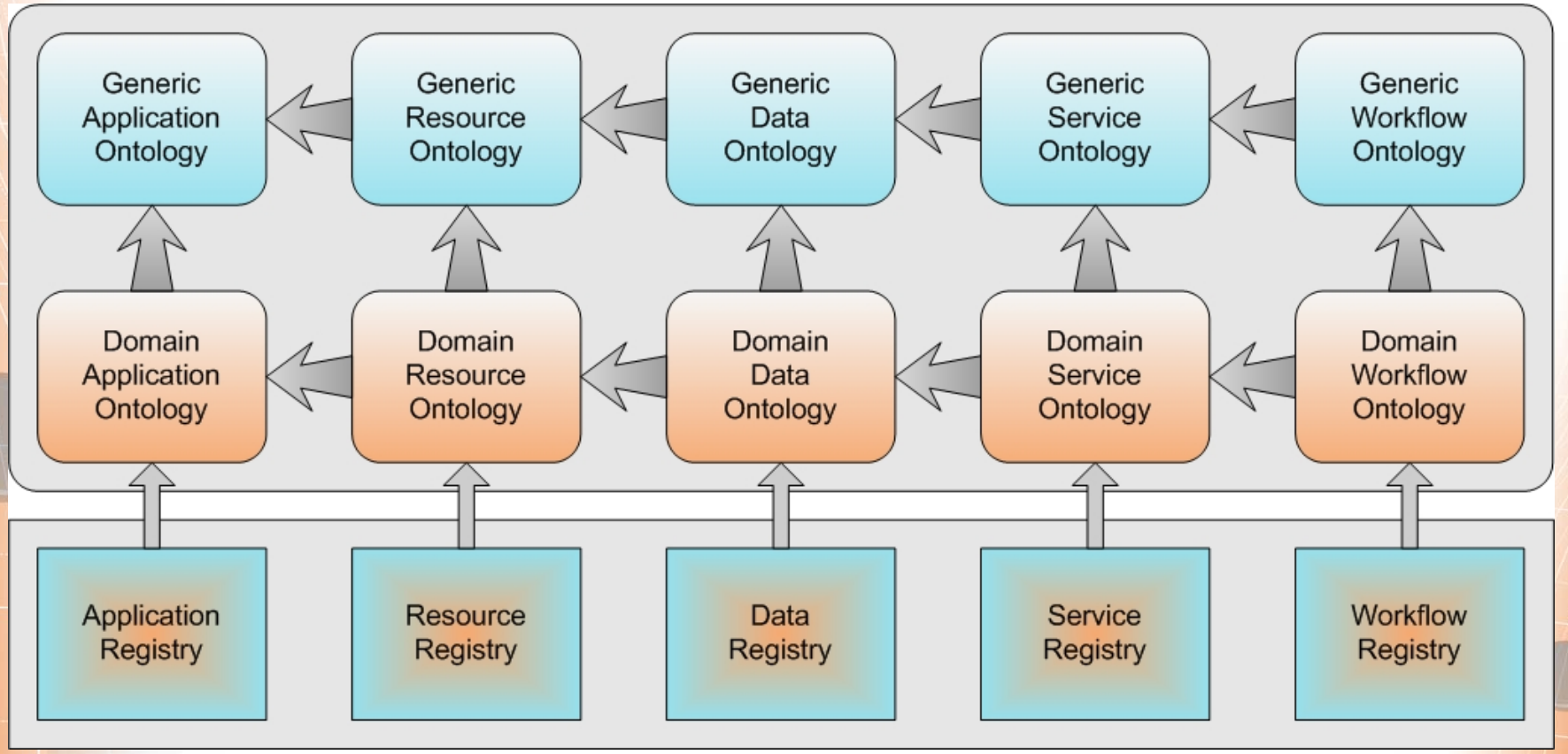


Performance Monitoring and Analysis for Grid Infrastructures and Applications

- **Focus on workflows that are Web/Grid services**
  - Workflow components can be multi-lingual
- **Event infrastructure**
- **Performance and dependability metrics**
  - Define and measure important performance and dependability metrics associated with Grid workflows
- **Monitoring and performance analysis in K-WfGrid**
  - Service-oriented distributed architecture
  - Unified monitoring and performance analysis system covering infrastructure and applications
  - Standardized data representations for monitoring data and events
  - Adaptive and generic sensors, distributed analysis, performance bottleneck search
- **Support for knowledge-based workflow construction and execution**

Ontologies

- **Ontologies are separated into several layers and classes**



Main Objective: to develop an agent for the maintenance of K-Wf Grid knowledge base, extraction of knowledge from the monitoring results, workflow execution reports, user input and other sources.

- **Used to predict WS instance behavior patterns (**run time prediction**) for scheduling workflow executions and workflow composition**

  based on:

  - Historical (monitored by MIS/PAS) information-WP3 and
  - Semantically described web services and data resources-WP4

Three main components: KAA WS (web interface for predictor**) , WS Behavior Predictor (**Instance based learning and Case-based Reasoning**), Event Store WS** (Cases stored as OWL instances)

User Assistance: Knowledge Sharing Based on Text Notes

(4) Enter Note

↓

(4) Pattern Detection
Annotation Note with Context

↓

(1, 4) Compare Current User Context
And Note Context

↓

(1, 4) Displaying context List

↓

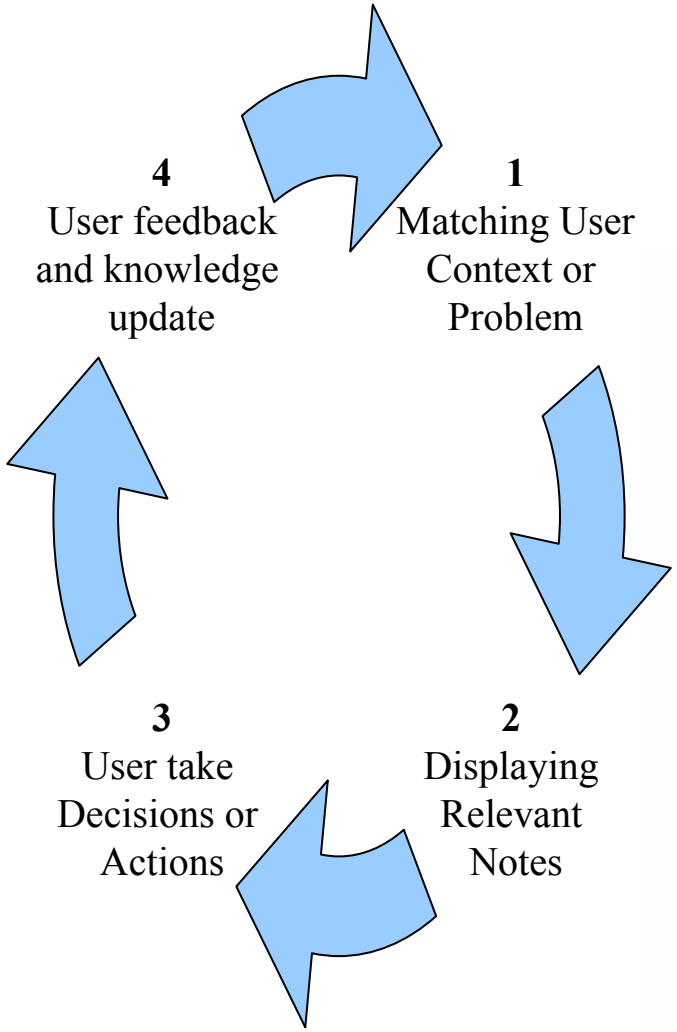
(4) User approve and submit
context of note

↓

(2) Notes are displayed to user
in detected user context

↓

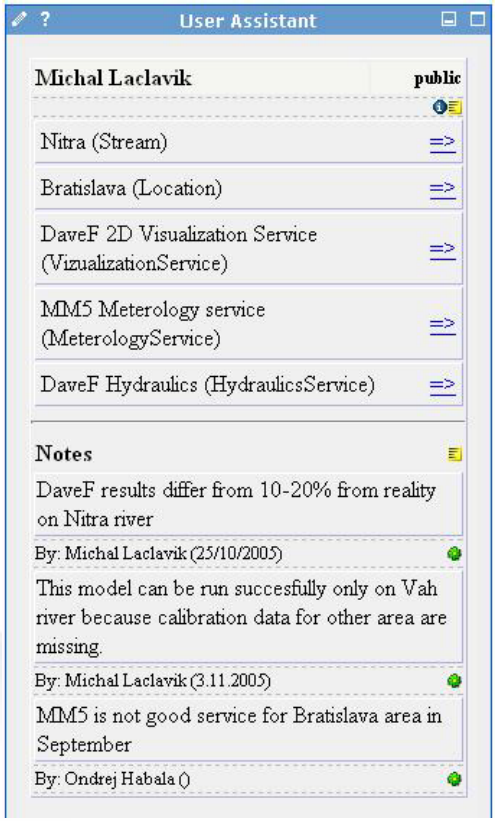
(4) Vote on note,
Updating relevance

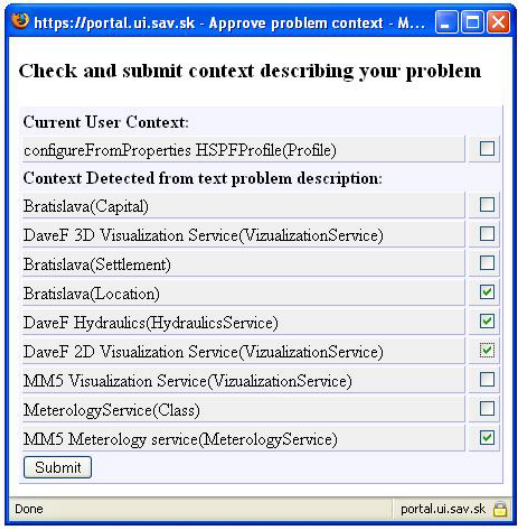


User Assistant Agent

- Collaboration among users
- Knowledge Sharing and Recommendation
- User Problem specification

- Representation of Experience or Knowledge
  - Text Notes





- Proactive knowledge provision
- Works with any domain ontology

Current Research:

- Experience (Knowledge) Management
- Knowledge, Semantic, Ontologies
- Text Processing & Semantic Annotation
- User Interaction
- Knowledge Relevance, Problem detection

Pilot applications (PAs)

- **PAs as domain-related instances of a typical K-Wf Grid-based application system**
  - Common horizontal features / Specific vertical customization
    - Flood Forecasting Simulation Cascade (FFSC, PA1)
    - Enterprise Resource Planning (ERP, PA2)
    - Coordinated Traffic Management (CTM, PA3)

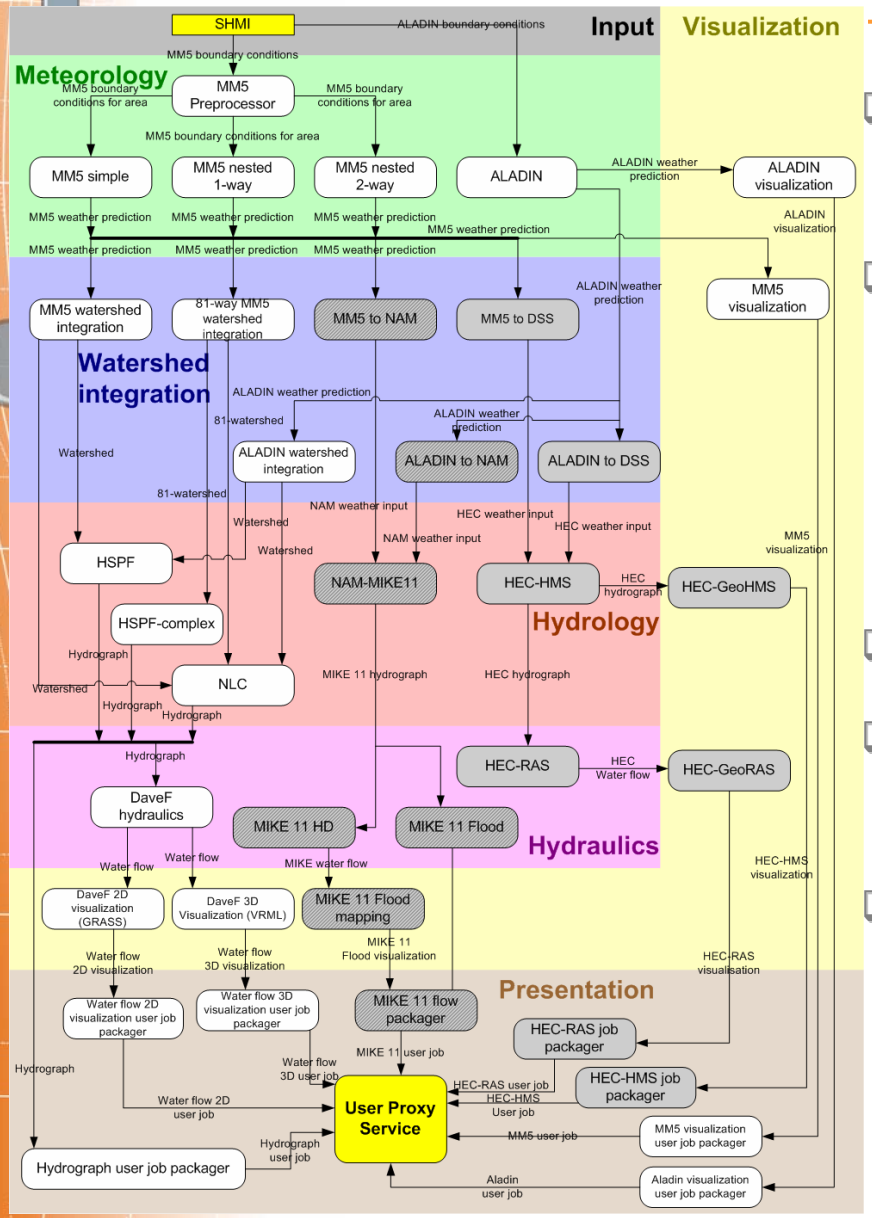
- **Focus on specific aspects**
  - demonstration of K-Wf Grid solutions and value added
  - enhancement of functionalities
  - system testing & validation
  - real end users' active involvement and contribution
    - production of dissemination material

Flood Forecasting Simulation Cascade

- a cascade of simulation models for weather forecasting, hydrological and hydraulic simulations, able to produce predictions of possible floods in target areas

  - **Input**
    - map of area, precipitation, river water level etc.
  - **Output**
    - water flow in target area
  - **Suggestions / user support**
    - applicability of different models to specific scenarios (QoS)
    - comparison between stored predictions and real data
    - future dispersion forecasting

Flood Forecasting Application
(PA1-FFSC)



- Flood forecasting based on a series of simulations
- Several simulation models for
  - Meteorology
  - Hydrology
  - Hydraulics
- 2D/3D visualization
- Implementation using GT4 WSRF
- Being extended
  - More models
  - More services – towards risk management

PA1 – FFSC + K-Wf Grid

- **Improvement of application reliability**
  - Creation of a Grid of modular (scalable) dedicated Web Services
- **General improvement of performances**
  - CPU time-demanding meteorological and hydraulic simulation models
  - gigabytes/month transferred and stored datasets
- **Knowledge management support**
  - multi-user, extensible multi-module system (with potentially tens of thousands of existing datasets) needing sophisticated collaboration tools to enable cooperation in a multidisciplinary context

Enterprise Resource Planning

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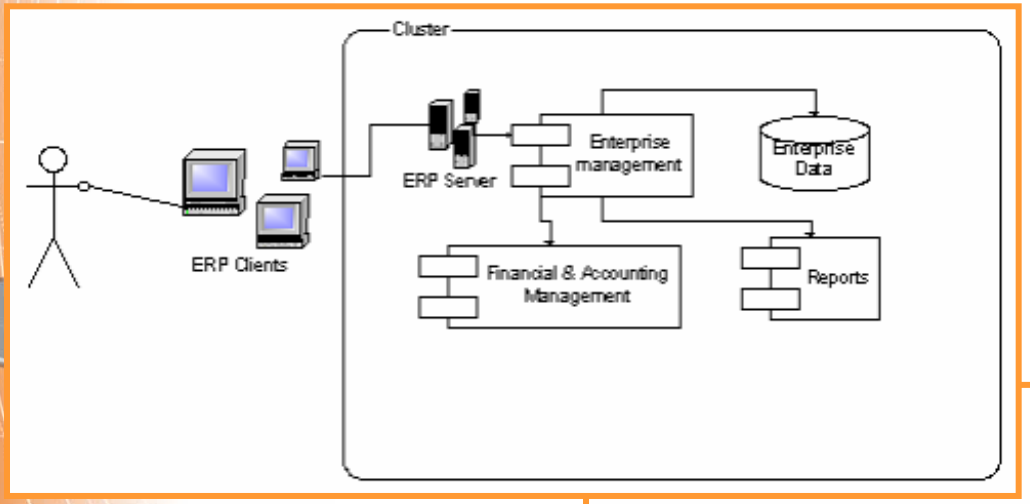
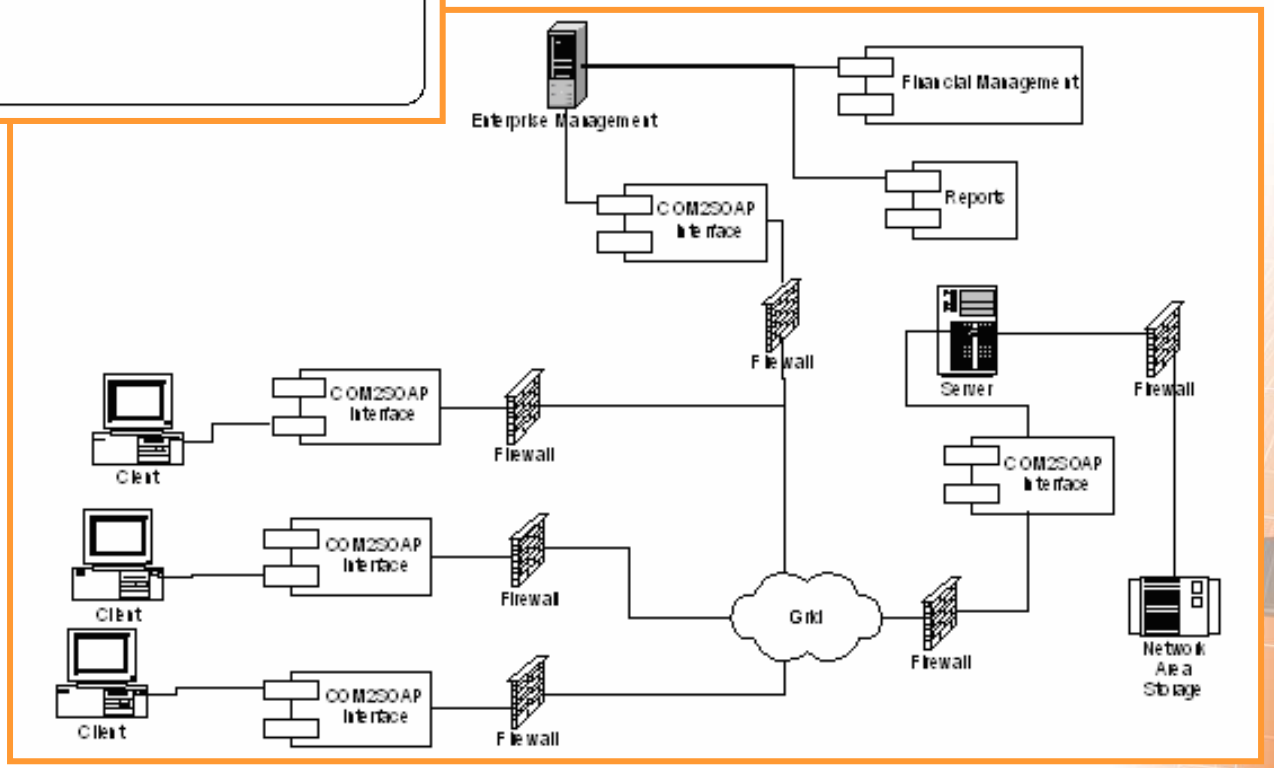
- product line management for different targeted market segments
  - enterprise financial & accounting systems,
  - manufacturing systems
  - supply chain management
  - electronic commerce support
  - multi-level parametrical system setup based on simple or complex business processes to post or extract data and information

PA2 – ERP


Cluster
ERP Clients
ERP Server
Enterprise management
Enterprise Data
Financial & Accounting Management
Reports


Enterprise Management
Financial Management
COM2SOAP Interface
Reports
Firewall
Server
Firewall
Client
COM2SOAP Interface
Firewall
COM2SOAP Interface
Client
COM2SOAP Interface
Firewall
Grid
Firewall
Network Area Storage
Client
COM2SOAP Interface
Firewall

PA2 – ERP + K-Wf Grid

- **Grid-enabled big corporate resource management**
  - transparent access to corporate resources and financial services throughout a VO composed by e.g. all affiliated companies
  - location-independent analysis and data mining possibilities
- **General improvement of performances**

Coordinated Traffic Management

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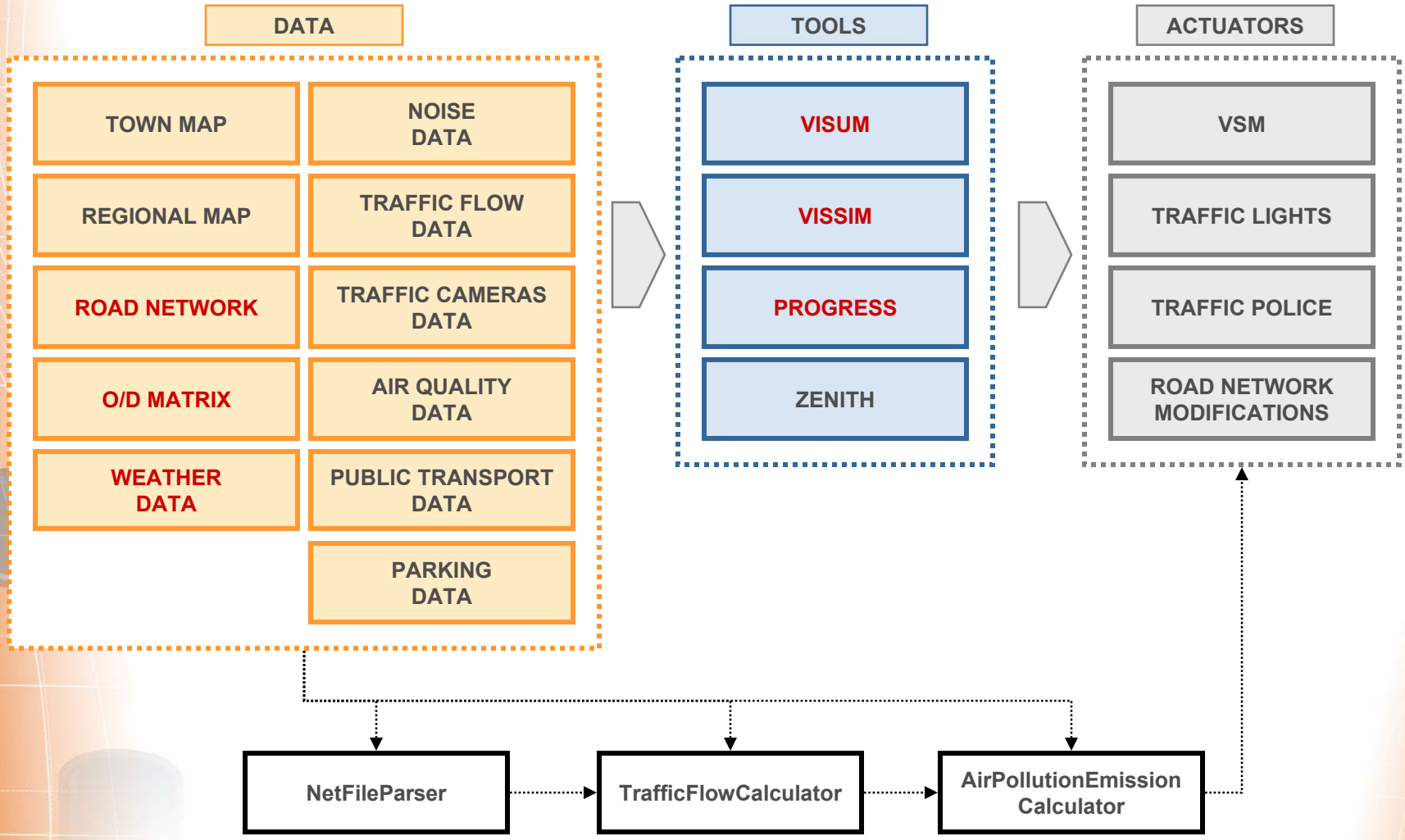
- workflow creation and management in handling complex traffic planning and management tasks
  - management of different traffic situations
    - by composing and operating suitable simulation chains involving distributed resources, data and services
  - three classes of scenarios
    - air pollution emission forecasting / calculation
    - mid / long term planning
    - immediate emergency reaction
  - scenarios analysis and description
    - resource (services + data) availability
    - performance requirements
      - » priority to accuracy and to speed

PA3 – CTM


DATA
TOWN MAP
NOISE DATA
REGIONAL MAP
TRAFFIC FLOW DATA
ROAD NETWORK
TRAFFIC CAMERAS DATA
O/D MATRIX
AIR QUALITY DATA
WEATHER DATA
PUBLIC TRANSPORT DATA
PARKING DATA
TOOLS
VISUM
VISSIM
PROGRESS
ZENITH
ACTUATORS
VSM
TRAFFIC LIGHTS
TRAFFIC POLICE
ROAD NETWORK MODIFICATIONS
NetFileParser
TrafficFlowCalculator
AirPollutionEmission Calculator

PA3 – CTM + K-Wf Grid

- **From a fragmented "manually-integrated" system to a truly coordinated & distributed Grid-enabled environment**
  - transparent access to data repository, simulations and calculations tools, within a VO composed by all "traffic management-related" authorities
- **Alternatives scenarios analysis**
  - possibility to configure parallel simulations and forecasting tests with different boundary conditions, composing workflows and exploiting resources accordingly
- **General improvement of performances**


Berlin
GWES
Scheduler
AAB
WCT
Cracow
GOM
FFSC Application
Monitoring service
GWES
Scheduler
AAB
WCT
Innsbruck
FFSC Application
Monitoring service
Analysis service
Portal
Genoa
CTM application
Bratislava
FFSC Application
UAA
KAA
Portal
RLS
MDS
myProxy
Athens
ERP Application
Germany
Poland
Czech Republic
Slovakia
Austria
Switzerland
Croatia
Romania
Bosnia and Herzegovina
Serbia and Montenegro
Bulgaria
Macedonia
Albania
Greece
Italy
Monaco

K-Wf Grid

Thank you!

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