WORLD METEOROLOGICAL ORGANIZATION

EXECUTIVE COUNCIL WORKING GROUP
ON WIGOS AND WIS

SUBGROUP ON THE WMO INTEGRATED OBSERVING SYSTEM (SG-WIGOS)

Second session

GENEVA, 19 – 23 OCTOBER 2009

EC-WG/SG-WIGOS-2/Doc. 6

(14.X.2009)

ITEM: 6

Original: ENGLISH

WIGOS REQUIREMENTS AND EXPECTATIONS

(Submitted by the WMO Secretariat)

Summary and Purpose of Document

This document contains the background presentation on WIGOS Requirements and Expectations for the discussion on the Item.

ACTION PROPOSED

The session will be invited to review weaknesses and strengths in the management and governance of the current WMO observing systems as well as to identify the priority areas for the period 2011-2015 where the WIGOS development should be targeted and where WIGOS activities should meet requirements and expectations for WIGOS, including WMO co-sponsored systems.

Appendix: WIGOS Requirements and Expectations

WIGOS Expectations and Requirements

J. Lafeuille

Second meeting of the Subgroup on WIGOS
19-23 October 2009

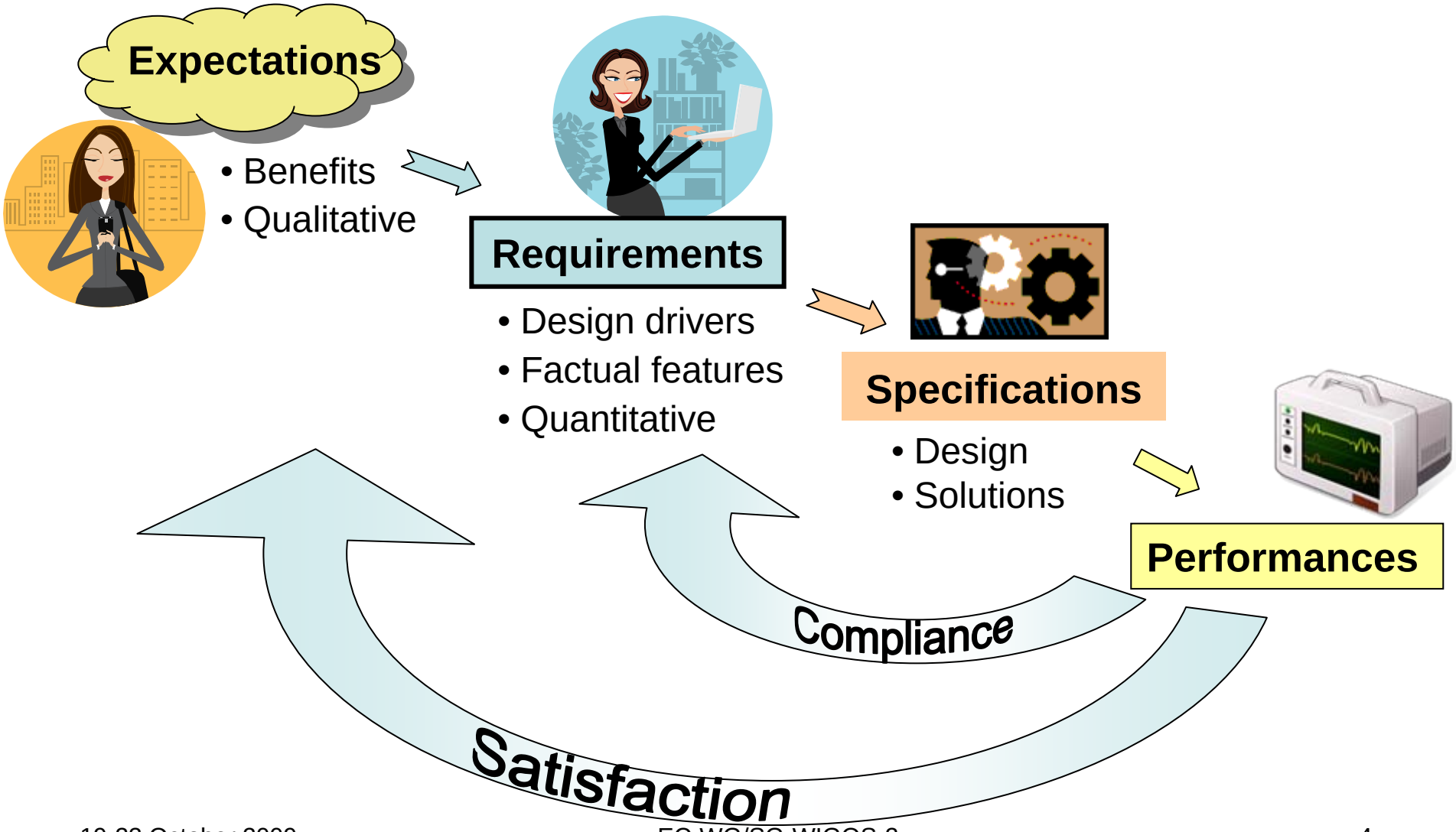
Overview

1. **From expectations to requirements**
2. WIGOS requirements from CONOPS and other sources
3. The GEO/CEOS QA4EO
4. Proposed organization of requirements
5. Conclusions and actions

Different types of requirements

- ***For each observing system***, its user community shall define
  - **Observing requirements** describing what needs to be measured
    - Physical parameters
    - Coverage, resolution (H/V/Temporal), accuracy
      - Threshold, breakthrough, goal
    - Long-term sustainability or not
  - **Service requirements** describing how this information should be available
    - Data, products
    - Timeliness, short-term continuity, priority
    - Format, media of delivery/access
- ***At WIGOS level, WMO defines organizational requirements*** :
  - what is required in order to ensure that these observing systems can be integrated in a framework of observing systems meeting the aims and expectations of the WIGOS concept

Expectations and requirements



WIGOS Expectations from CONOPS (1)

- Need for integration
- Wish for a comprehensive, coordinated, sustained system of observing systems
- Satisfy the needs in a cost-effective manner
- Benefit through enhanced availability and integration
- Effective organizational, programmatic, procedural, governance structure
- Improved availability, usefulness, quality, and utilization of data
- Efficiencies and cost savings, better use of existing and emerging capabilities
- Improved availability, higher quality, wider range of observations
- More efficient delivery to users
- Maximum return on investment, optimization, full utilization,
- Facilitated standardization, interoperability, access to good quality data
- Standardization and network optimization, increased interoperability
- Sustained and strengthened governance and relationships with co-sponsors
- Cost-effective approach to address requirements, reduce financial burden
- Maximum efficiencies, ensured availability of all required information
- Facilitated access, improved data management, technological innovation
- Ensure collaboration with manufacturers and scientists, develop appropriate documentation, increased collaboration towards harmonized standards

WIGOS Expectations from CONOPS (2)

- Improved production, use and application of data in a seamless way to satisfy user requirements
- Strengthened ability of all Member countries to access and use data
- Compatibility, connectivity and interoperability..
- Continuing sense of ownership by the various groups…
- Promotion of development, testing and comparison of new capabilities
- Mechanisms to easily integrate them..
- Optimum integration..
- Increased efficiency and effectiveness…
- Reduced redundancies and overlaps..
- Facilitated and more rapid, efficient assimilation of technological advances
- Improved quality, traceability and consistency of observations for better products, improved access,
- Optimization of observing network design and flexibility
- Improved coordination, standardization and evaluation by NMHSs
- Improved data assimilation techniques
- Better exploitation of observations in NWP in an integrated manner
- Clear relationship and intersection between WIGOS and GCOS,GOOS,GTOS, and GEOSS.

WMO Integrated Global Observing Systems

Top level goal

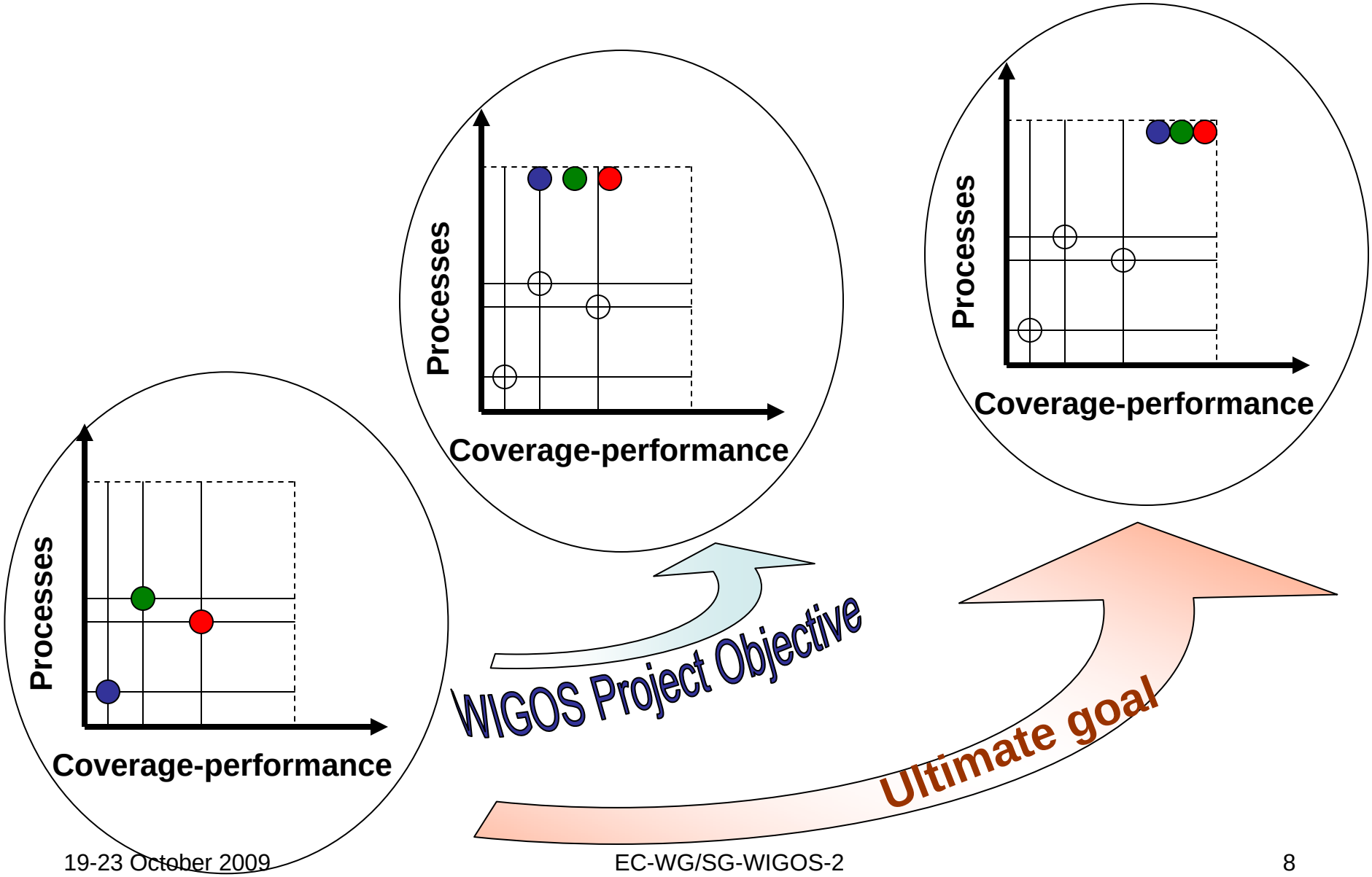
"A comprehensive observing system satisfying the evolving observing requirements of WMO Members in a cost-effective and sustained manner"

Objective: **Integration of WMO observing systems and enhanced coordination with observing systems of partner organizations**

Key requirements

- Governance and collaboration (partnership, data policy/ownership..)
- Quality management (User focus, quality assurance, traceability, documentation, capacity building, evaluation/improvement…)
- Interoperability through data sharing and standardization
- Optimization (Coordinated planning, platform opportunities, innovation)

When will WIGOS be completed ?



WIGOS Project Implementation and System Operation

Expectations

Outcome of WIGOS Operation

- **Improved observations and services**

WIGOS Requirements

WIGOS Project Deliverables

Continuous improvement of observations and service delivery

- Management processes (QMF)
- Common data management standards
- Common set of observation standards (different levels/scope)

- Processes implemented & controlled
- Standards applied

Compliance

Satisfaction

Overview

1. From expectations to requirements
2. **WIGOS requirements from CONOPS**
   (version approved by EC-LXI; see: http://www.wmo.int/pages/prog/www/wigos/index_en.html)

   and other sources
1. The GEO/CEOS QA4EO
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Requirements contained in CONOPS (1)

Collaboration and governance

- Respect the data policy of partner organizations (6.1)
- Adhere to Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII).. (6.1)
- Ensure that conditions placed on additional data are respected (6.2)
- Ensure policy and technical coordination with co-sponsors through cross-representation at sessions of (…) committees and ICPC. (5.4.4)
- Resolve potential conflicts (on governance issues) through a mechanism as defined by the WMO-UNESCO-IOC-UNEP-FAO-ICSU MOU (5.4.5)
- Complement these mechanisms by national arrangements (5.4.6)
- Involve the groups (that have initiated and developed the individual observing system components) in the planning and implementation (5.3)
- Involve the various scientific communities in setting requirements, monitoring and assessing the performances. (5.3)
- Coordinate planning and implementation with WIS through the EC WG, subgroup, RAs, TCs, Secretariat (5.4.6)
- Be clearly related with GEOSS (8)

Requirements contained in CONOPS (2)

Quality management

- The owner of an observing system *must* …implement a quality management system that shall operate continuously at all points of the whole system (planning and installation, operations, maintenance and inspection, test and calibration, quality and performance monitoring, evaluation and remedial procedures, training, data pre-processing, dissemination, processing, management and archiving, performance monitoring and evaluation, feedback and follow-up actions…) (2.2.2)
- Embrace a QMF and updated technical regulations to ensure the best possible products to be delivered based on agreed QA/QC standards (3.2.3)
- Specify relevant processes, procedures, relationships (8)
- Document and validate observation requirements building on RRR (8)
- Satisfy observational requirements (…) through the RRR process (2.2.3)
- Allow for continuous review of requirements (5.3)
- Have the capability to adjust and respond to changing requirements (5.3)
- Coordinate the response to requirements with all TCs, RAs, Progs. (2.2.3)
- Systematic performance monitoring and evaluation of WIGOS capabilities (8)

Requirements contained in CONOPS (3)

Standardization

- WIGOS general standards and recommended practices will apply to all WMO and co-sponsored observing systems (2.2.1)
- Guarantee interoperability (by) documented quality standards (2.2.3)
- Be designed to accommodate the diversity among Member countries.. (5.3)
- Encompass homogeneity, interoperability, compatibility and traceability of observations (..) through implementation of recommendations by IMOP and related programmes (3.2.1)
- Use a comprehensive standardized data representation in compliance with WIS information exchange requirements (3.2.2.2)
- Production, editing and management of metadata (2.2.3)
- Exchange data / metadata via WIS using agreed forms and formats (2.2.3)
- Use compatible hardware / software for data, metadata and products (2.2.3)
- Archive data in approved form / resolution at agreed archival centres (2.2.3)

Requirements contained in CONOPS (4)

Optimization

- Evaluate existing and emerging capabilities before developing, acquiring and/or deploying new observing systems and in the design of composite observing systems (2.2.3)
- Exploit existing platforms and employ multi-sensor platform concept (2.2.3)
- Foster collocation of observing sites (5.3)
- Build on existing systems and provide framework for new systems (2.2.3)

CONOPS Requirements for WIGOS

- Are these requirements reflecting the expectations ?
- Are they complete ? What other potential sources of requirements ?
  - SWOT analysis foreseen in WIGOS work plan (in progress)
  - Technical Regulations (CIMO, CBS, CCl,..)
  - QMF
  - External standards agreed by WMO (ISO)
  - Emerging GEO principles
    - **Quality Assurance Framework for Earth Observation (QA4EO)**
- Are these requirements homogeneous ?
  - Implementing a QMS for each observing system is a far-reaching requirement.
  - Suggest to break it down at the process level
- How should the requirements be best organized to facilitate systematic review
  - Align with the key elements of the Quality Management System
  - Identify the key processes

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Quality Assurance Framework for Earth Observation (QA4EO)

- Developed by the CEOS Working Group on Cal/Val (WGCV)
- Part of GEO Task DA-09-01: Data Management (a) GEOSS Quality Assurance Strategy

- It is proposed by GEO that *GEOSS data set registration include associated quality assurance information to enable interoperability and harmonization, which could be (..) a declaration of compliance with respect to QA4EO and/or its underlying principles.*

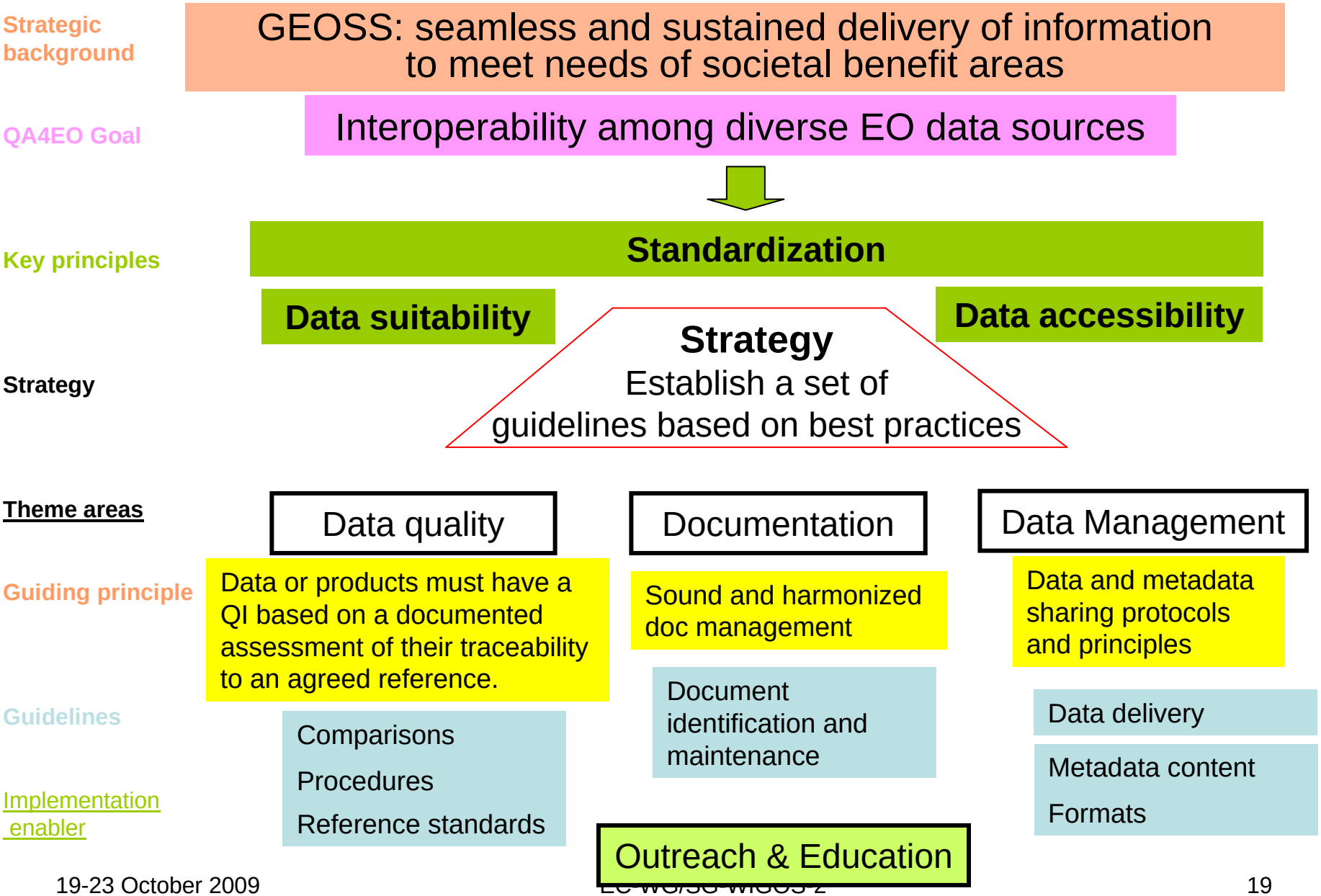
- Version 1 « endorsed » by CEOS plenary in 2008
  Version 2 reviewed by GSICS Chairman (May 2009)
  Version 3 available now http://qa4eo.org/documentation.html

- WMO has provided comments (August 2009, SAT) and contribution to a QA4EO workshop in September 09 (CIMO, WIS, GAW, SAT)

Quality Assurance Framework for Earth Observation (QA4EO)

- Reduced set of common overarching principles focusing on need for calibration, traceability, quality indicator, metadata
- Guidelines for implementation of these key principles in specific application domains.
- Identifies 3 topics for « key guidelines »
  - Data quality/suitability
    - Quality indicator
    - Calibration and validation (mainly relevant for space-based observation)
  - Data accessibility/availability
    - Data policy
    - Metadata
  - Documentation/communication
    - Documentation management
    - (Communication and outreach)

QA4EO Concept Summary. Fig.1- amended by WMO/SAT



QA4EO: discussion

- WIGOS and GEOSS have similar objectives
  « Coordinated, interoperable, sustained observing systems »
- WIGOS « QMF » and GEOSS QA4EO have similar objectives
  « Standardization, traceability, quality, availability… »
- WMO involvement in QA4EO aims at consistency with WIGOS QMF
  - Ensure that QA4EO guidelines are acceptable
  - Or that their domain of application is properly qualified
  - Or that their implementation is optional rather than mandatory
- QA4EO Workshop provided an opportunity to share WMO's experience (CIMO, WIS, GAW, GSICS) and contribute to QA4EO review

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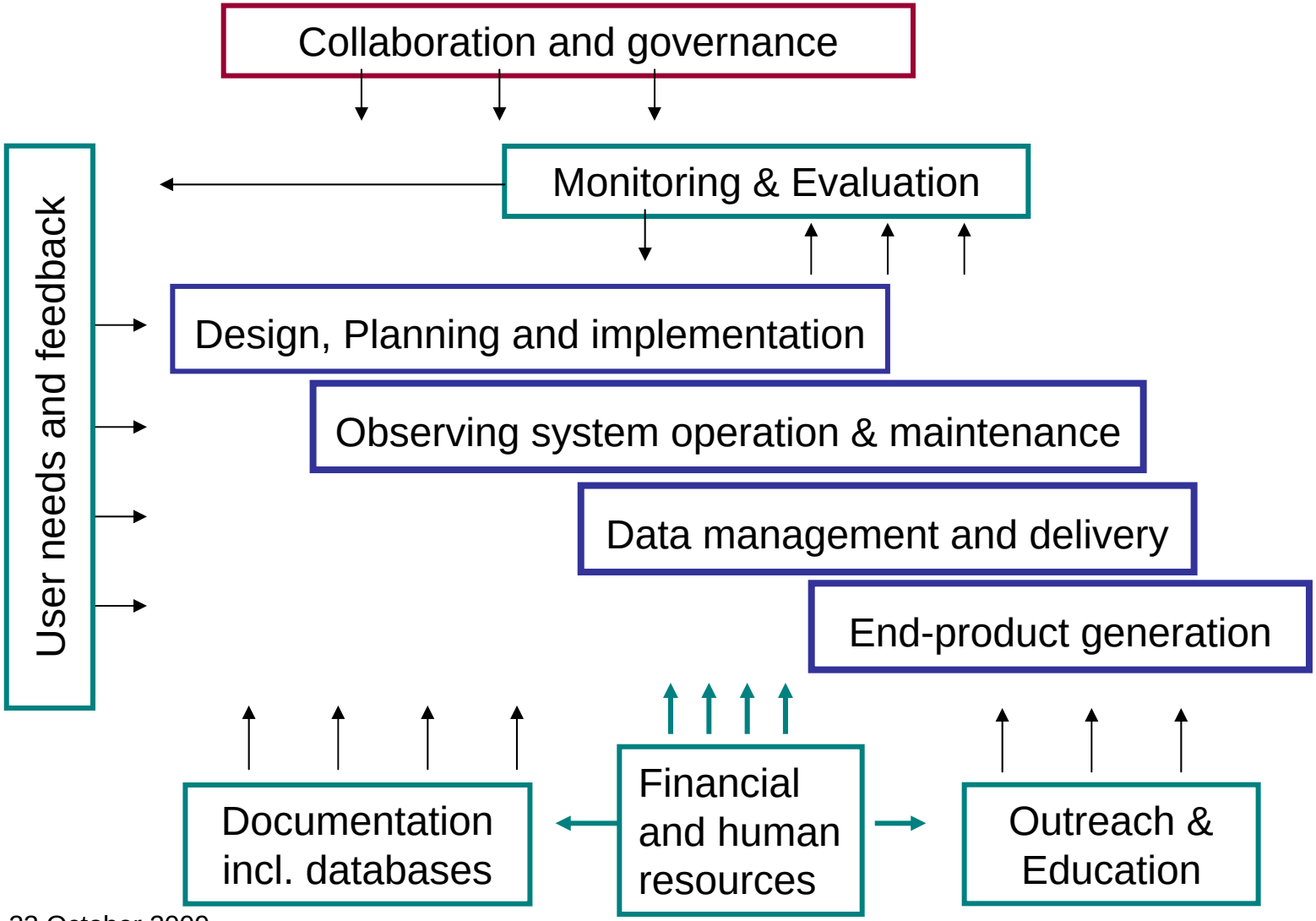
Structuring the WIGOS Requirements

Major WIGOS processes



RC- Requirements on Collaboration and Governance

- Governance
- Ownership
- Data policy
- Global co-sponsoring arrangements
- National co-sponsoring arrangements
- Linkage with GEO including QA4EO
- Involvement of science and user communities
- Planning constraints (see WIDP)
- Expectations from applications programmes
- …

RU- Requirements on User Needs & Feedback

- Rolling Review of Requirements (RRR): each component observing system shall:
  - Identify target users and representatives
  - Identify and update observation requirements
  - Identify and update data/service requirements
  - Develop Statements of Guidance per application areas
  - Develop guidelines for regional aspects

- WIGOS RRR database
  - Maintain and make available a RRR database consolidating all requirements
  - Ensure consistency of the requirements contained in the RRR database

- User feedback
  - Seek user feedback
  - Respond to feedback

RP- Requirements on Planning and Implementation

- Identify existing/emerging capabilities
- Maintain capabilities database for each observing system
- Ensure interoperability of the databases
- Perform synthesis across applications and systems
- Evaluate planned performance (end-products uncertainty)
- Take into account projected Vision of WIGOS
- Investigate opportunities for optimization
  - Complementary ground-ground, space-space, ground-space systems
  - Sharing /collocating platforms
  - Coordinated operation (e.g. satellite constellations)
- Issue recommendations for implementation and optimization
- Coordinate response to requirements with all TCs, RSs and Programmes
- Adjust to changing requirements
- Implement…

RO-Requirements on Observing system operation and maintenance

- Refer to IMOP recommendations (+GSICS, WGCV for space-based systems) including:
  - Characterization of instrument performance
  - Testing
  - Acceptance
  - Observing site location
  - Observation methods
  - Instrument maintenance
  - Routine calibration
  - Calibration campaigns

(Distinguish space, surface remote sensing, surface in-situ, altitude)

- Ensure full traceability
- Accommodate diversity of Member country environment

RI- Requirement on Data management

- See WIS recommendations/standards
  - Agreed data representation, formats
  - Metadata production and management
  - Compatible catalogue search functions
- Delivery through appropriate media
- Timeliness of delivery
- Data discovery and access capability
- Archiving
- Compatible hardware and software
- Robustness
- Monitoring:
  - Availability, correctness, completeness, timeliness, format compliance

RQ-Requirements on End-product Quality

- Ensure traceability of pre-processing
  - Definition, usage, algorithm
- Ensure sustainability of processing tools and software quality
- Ensure and document validation
- Evaluate end-to-end uncertainty budgets
- Perform routine Quality Control
- Provide monitoring reports
- Can focus on key representative parameters
  (e.g. wind, pressure, precipitation, temp sounding…)

RM- Requirements on Monitoring & Evaluation

- Monitoring and evaluation should apply to all other processes but particular focus on the outcome of:
  - Planning/implementation
  - Observation
  - Data Management
  - End-product generation
- Shall review systematically:
  - needs
  - performances
  - user feedback
  - gaps and opportunities
- Initiate corrective actions

- Report

RD-Requirements on Documentation

- Establish a documentation management system
  - Doc identification, review, approval, versioning,
- Procedures
- Technical Regulations
- Operational documentation
- Results and records
- Reports
- Training/explanatory material

- Review and update on a regular basis

RE-Requirements on Education and outreach

- Provide explanatory documentation
- Provide training opportunities on critical aspects
- Publicize benefits of WIGOS to target audiences
- Review and update on a regular basis

RR- Requirements on Resources

- Ensure viable WIGOS project/coordination office
- Ensure WIGOS focal points for WMO Members
- Identify funding issues and funding opportunities for WIGOS components in Regions and at the global level
- Review and update on a regular basis

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Conclusions

Focusing on WIGOS-level requirements (related to WIGOS processes) rather than individual observing system requirements (related to observation needs and data service needs)

- CONOPS provides a basis for key WIGOS requirements
- Need to be complemented and refined
- A schematic description of WIGOS processes has been proposed, necessary step for a WIGOS QMF
- Similar structure could be used to organize WIGOS requirements
- Convergence among QA4EO and WIGOS/WIS is being pursued

Implementation actions

Collabor./Governance	Define mechanisms (ET, MOA, regional structures,…) Data policy principles
Design/planning	Define optimization principles/methods
Observation	Determine common/specific standards Implement/migrate
Data management	Implement WIS standards
Obs. end products	Document end product quality
User needs	Reactivate RRR in needed areas
Monitoring/evaluation	Define methods, tools, priorities
Documentation	Update/complement doc, implement database
Resources	Secretariat, Members, TCs, RAs, Partners
Outreach/education	Document/communicate benefits Initiate training and capacity building scheme


Thank you !

The GOS evolution process

Requirements

Requirements

Requirements

Long-term vision of the GOS

Critical Review

Statements of guidance *per application*

Implementation Plan for Evolution of the GOS
All applications synthesis
Recommendations for the observing system

WMO Members' Space Agencies and partner organizations' Programmes

Monitoring surface/space observing capabilities and plans

User Requirements

- Expressed for >120 geophysical parameters
- Different domains (horiz. layers, sea/land, …)
- For each requirement: 5 criteria (H/Vresol, accuracy, obs cycle, timeliness) x 3 values (ideal “goal”/ optimal “breakthrough”/ minimum “threshold”) + 3 attributes (confidence, approval date & authority)
- 23 application areas (WMO, or co-sponsored , or other)
- **Total:** 632 requirements recorded (parameter x domain x application)

➢ 11376 fields recorded