West African agricultural research data management network

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CERAAS: Centre d'étude régional pour l'amélioration de l'adaptation à la sécheresse

Regional Center of Excellence on dryland cropping systems of the ECOWAS

CEDEAO ECOWAS → CORAF

GOUVERNEMENT RÉPUBLIQUE DU SÉNÉGAL → ISRA

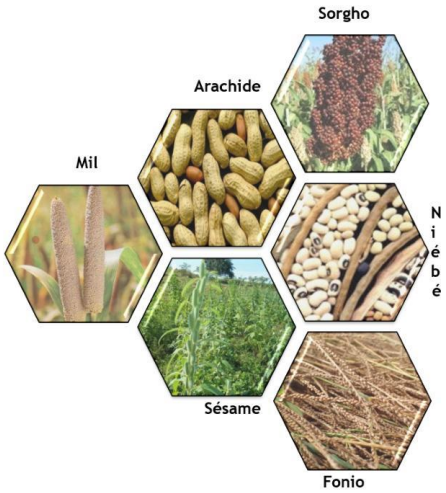
CORAF, ISRA →

- UNIVERSITE DE THIES → ENSA
- CERAAS Centre d'étude régional pour l'amélioration de l'adaptation à la sécheresse
- ISRA CNRA de BAMBEY Au coeur de la recherche dans le bassin agricole
- ISRA BAME Bureau d'analyse macro-économique
- ITA

TRAINING
- Engineering
- Agricultural profession

RESEARCH
- knowledge and innovations dévelopment
- On-hands and on-farm Practices and capacity building

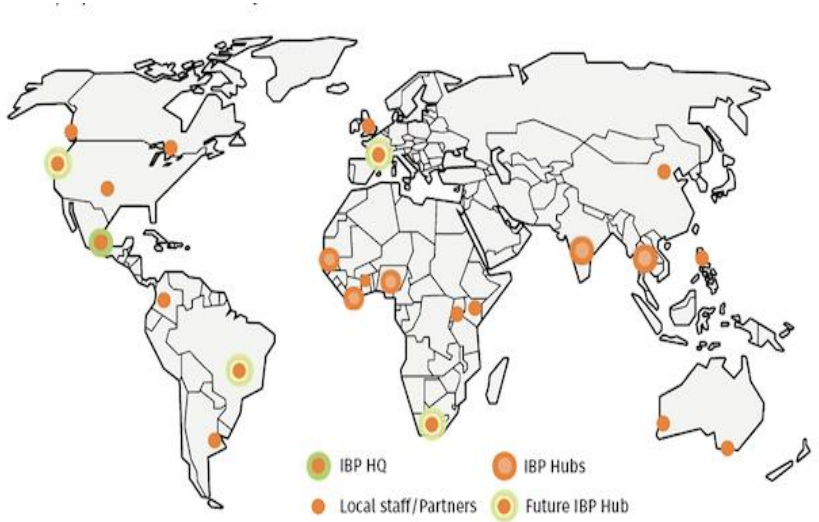
TRANSFER
- Food processing
- Market/comsumption
- Incubator



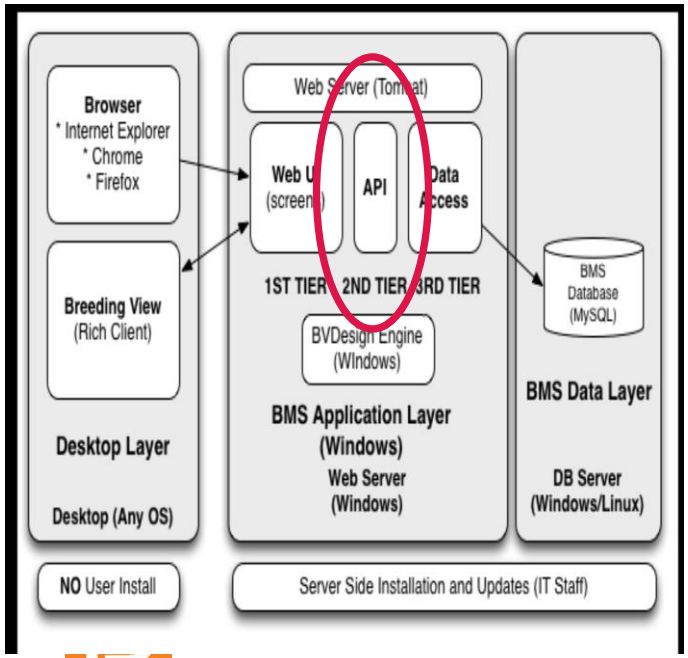
IBP: BMS Development, Deployment and Adoption process

Digitizing crops breeding process

Support the digitalization of breeding programs, specifically for national programs, universities and small-to-medium enterprises(SMEs), with an emphasis on developing countries



IBP core product BMS: Architecture



BMS: web application software

BMS is built on Java framework and uses a three-tier architecture. BMS is designed to run on a server and supports multiple users.

API: Application Programming Interface

http://docs.brapi.apiary.io/#introduction/url-structure

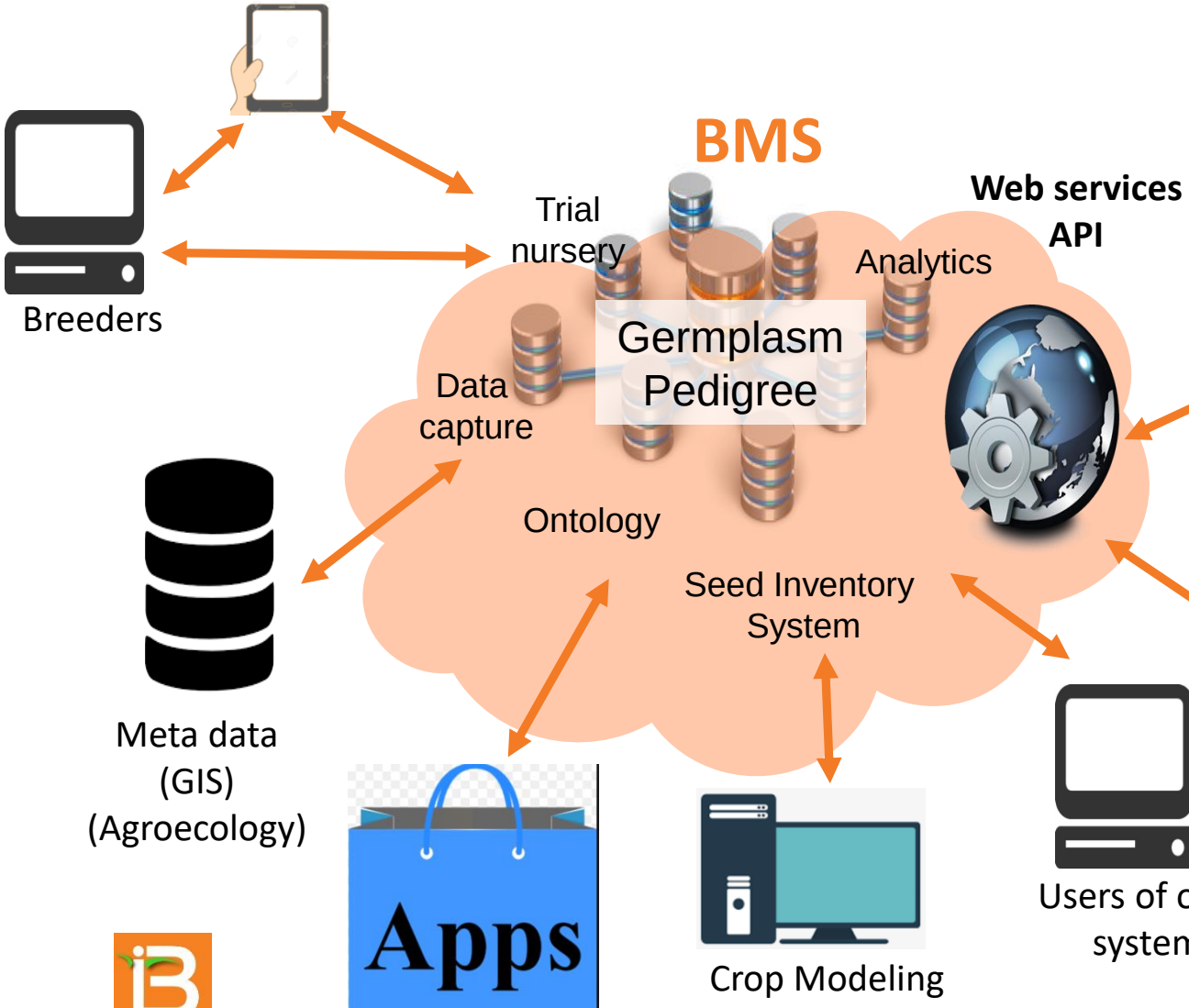
BMS modular approach

- **Breeding Management System(BMS) is designed to help crop scientists manage and store a diverse set of data in a centralized manner.**
  - ✓ Germplasm, Crosses, Nurseries & Field trials, Seed Inventory, Marker Information, Decision making tools-data queries, Statistical Analysis

Data capture
KSU App

BMS is developed with a modular approach driven by API calls

- **Allow interoperability with other modules (KSU Field App, Data queries)**

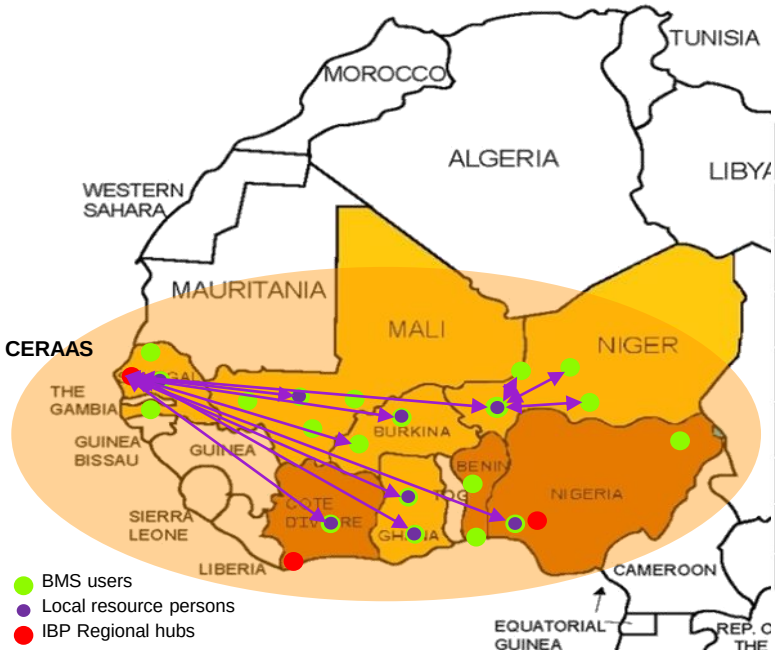


Data Flow in Breeding Pipeline adopted at CRE CERAAS

BMS workflow

- Breeding Program Objectives (Breeders and team)
- Data Design (BMS and each NARS DM FC)
- Design of Experiment (Validated by Biometry unit)
- Data Capture Protocols / Crop Ontologies / Scales (BMS)
- Barcodes & Electronic Field Books (BMS)
- Data Captured and Stored Centrally
- Data Curation Process
- Statistical Modelling & Data Analysis
- Valid Interpretation & Publication of Results
- Data Archiving & Sharing

CERAAS-CRE: BMS Instances and DM network



BMS: mature and largely adopted

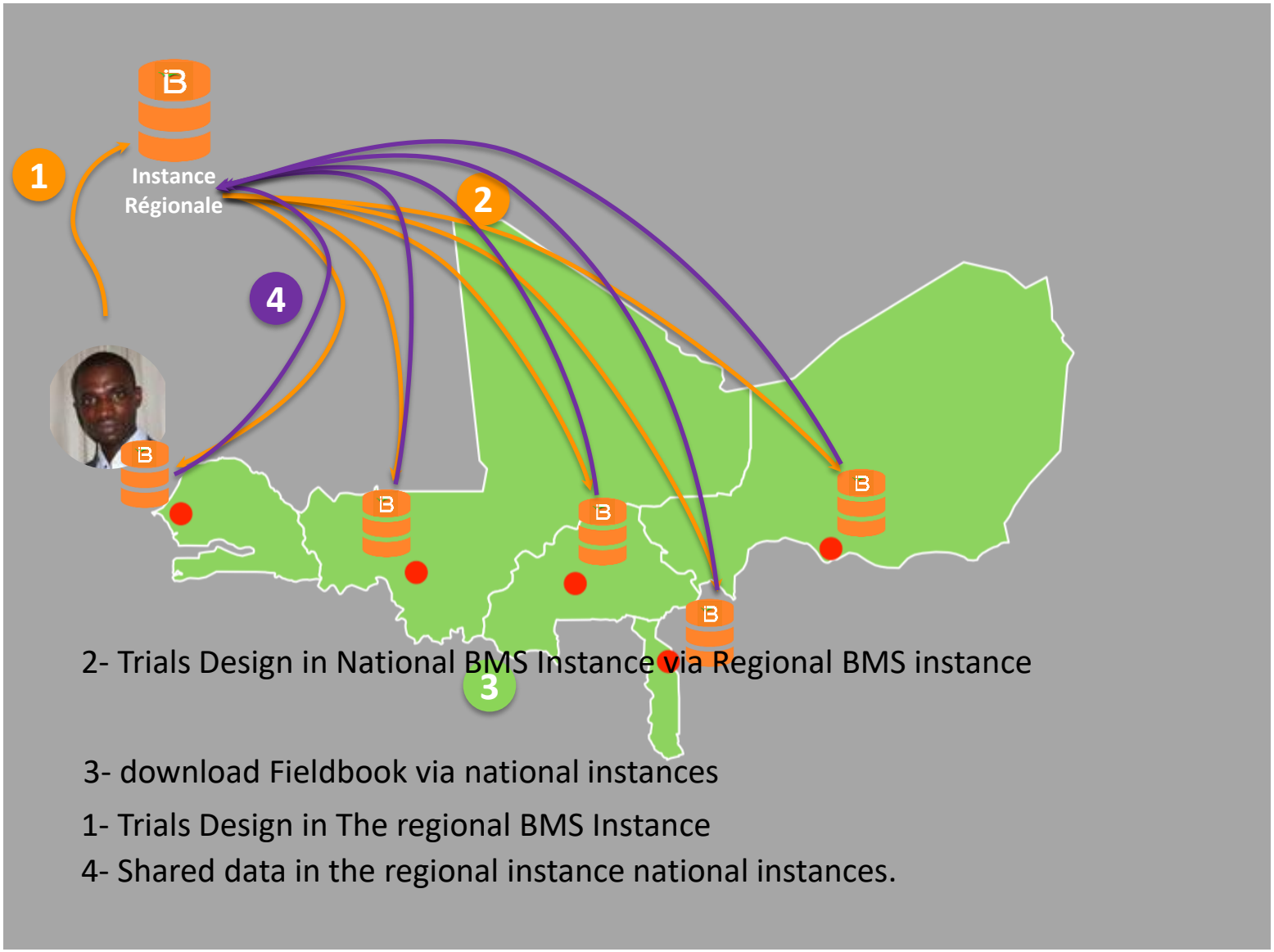
COUNTRY	NARS/Institute	Started	Status	Number Crops	Users/Trainers
Senegal	ISRA/CERAAS	2015	Server (Cloud)	10	70
Burkina Faso	INERA	2016	Server (Cloud)	12	92
Ghana	CRI	2016	Server (Cloud)	7	37
Ghana	SARI	2016	Server (Cloud)	12	52
Mali	IER	2016	Server (Cloud)	6	37
Niger	INRAN	2017	Server (Cloud)	8	34
Togo	ITRA	2020	Server (Cloud)	9	16
Regional	IAVAO	2018	Server (Cloud)	6	50

NARS in WA used BMS

>300 scientific staff trained

- ✓ IAVAO and The BMS BrAPI sync is unique and can implement a federation approach of BMS instances
  - Perfect for a network with regional trials and individual institutional instances

BMS-IAVAO network: Link with national BMS



2- Trials Design in National BMS Instance via Regional BMS instance

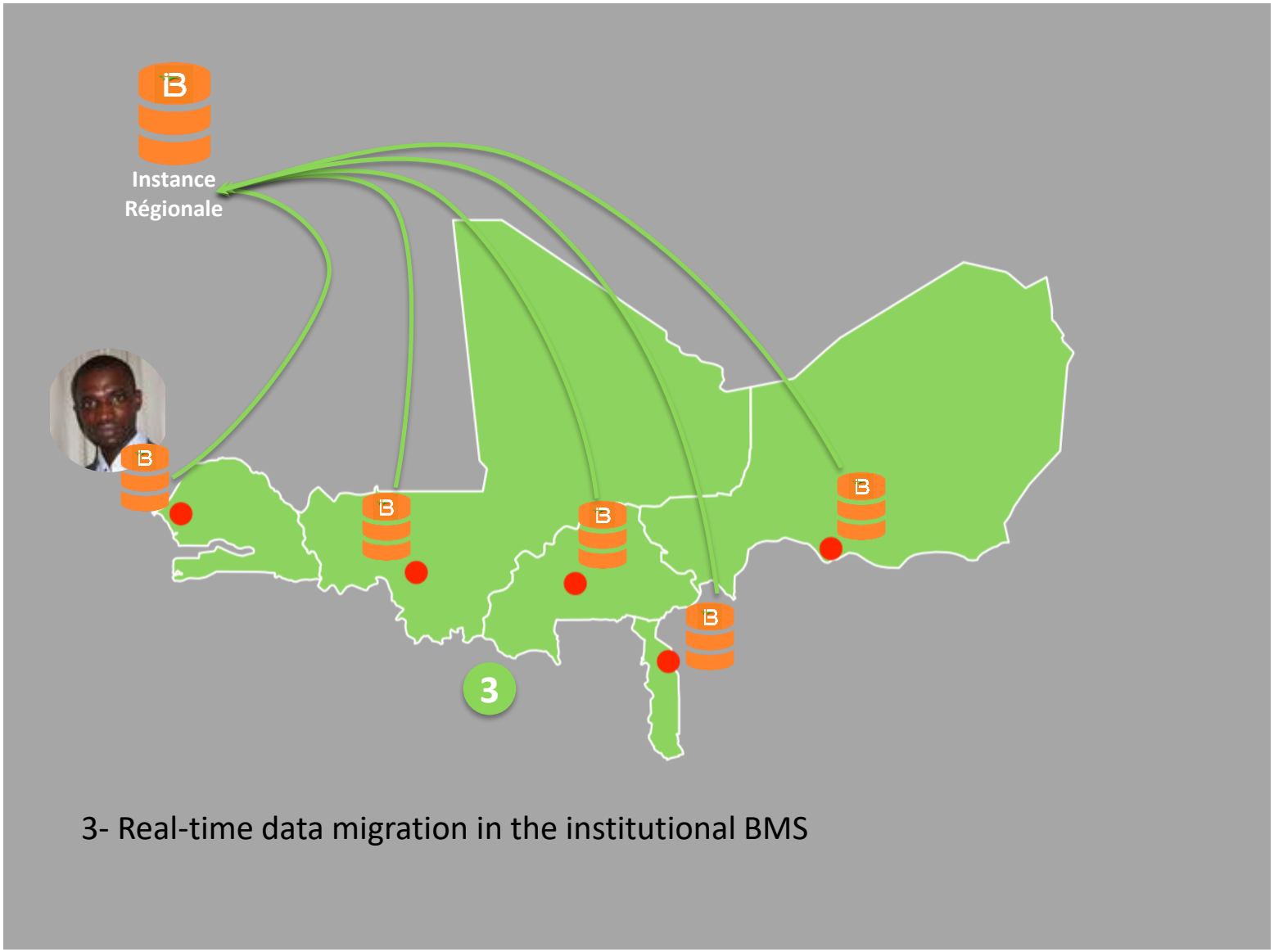
3- download Fieldbook via national instances

1- Trials Design in The regional BMS Instance

4- Shared data in the regional instance national instances.

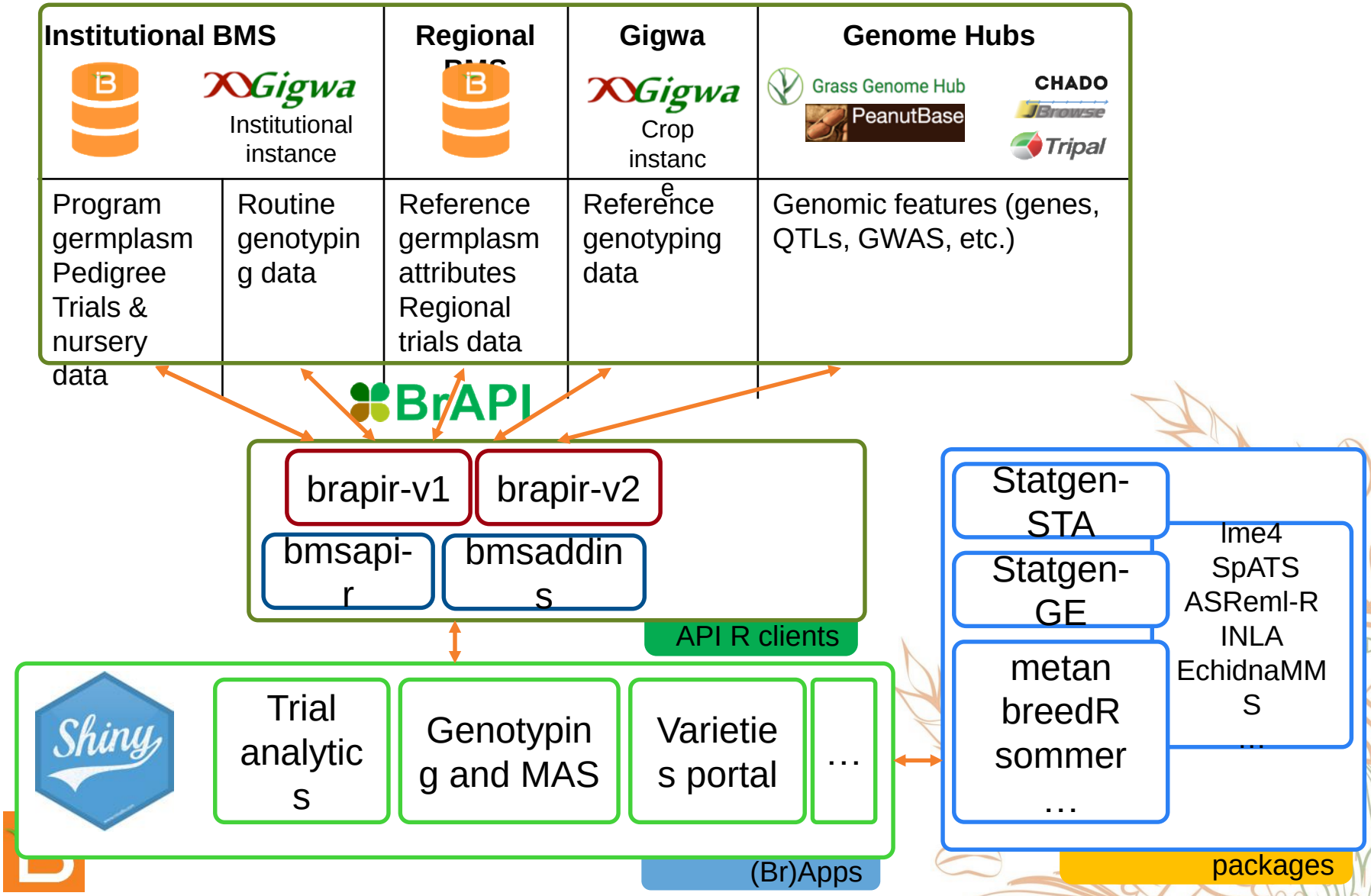
BMS-IAVAO network: Link with national BMS

Network charter under review



3- Real-time data migration in the institutional BMS

Analytical applications development Framework



Next Step: Development and adoption of a research data management policy

- **Components of a RDM policy**
  - Institutional Support (infrastructure, software, and training for research staff)
  - Ownership (Owned by Inst. subject to legal and contractual obligations)
  - Internal Access (RD will be shared freely within the institute and with partners particularly if it is collected with public funds)
  - External Access (Researchers are encouraged to publish data under a creative commons OS license)
  - Attribution(Researchers shall be recognized and reqarded for collection, documentation and sharing of data)
  - Quality(Data will be collected and annotated in such a way as to be fit for the intended purpose. There will be a Plan, defined Stewardship, Quality specifications, and Quality assurance and Audit)
  - Ethics (RD will be handled respecting legalities and ethics especially those relating to private life and genetic resources)
  - Preservation (In central repositorie(s) regularly synchronized and backed up.
    Storage with meta data and attribution)
- **Progress of development of RDM policy**
  - Senior management of ISRA, INERA, INRAN and CSIR have all been approached and agree that development of an RDM policy and an urgent need;
  - INERA : Adopted;
  - ISRA, CSIR-SARI and CRI : Draft submitted to the management for validation;
  - INRAN: Draft under review.

BMS impact across the crop value chain

- Increased efficiency (crop cycle preparation, data capture and analysis)
  - ✓ Better products/varieties are developed in less time

- Better data quality, less “finger mistakes” facilitate QA/QC, link phenotyping-genotyping germplasm lists
  - ✓ Products have value & meet user needs-align with product profiles

- Keeps institutional memory and data ownership
  - ✓ Ensure business continuity in cases of staff turnover
  - ✓ Storage of variety fact sheets/attributes information from generation to generation- allow genetic gains analysis

- Better data documentation (standardized protocols, data exchange intra/inter- country, meta-analysis)
  - ✓ Standardized trait ontologies allow sharing of germplasm or trait information across networks.

Key Challenges and recommendations

Despite having more than 300 users in WCA with most germplasm and breeding data uploaded in institutional BMS instances, the level of BMS adoption as a day-to-day tool can be improved!

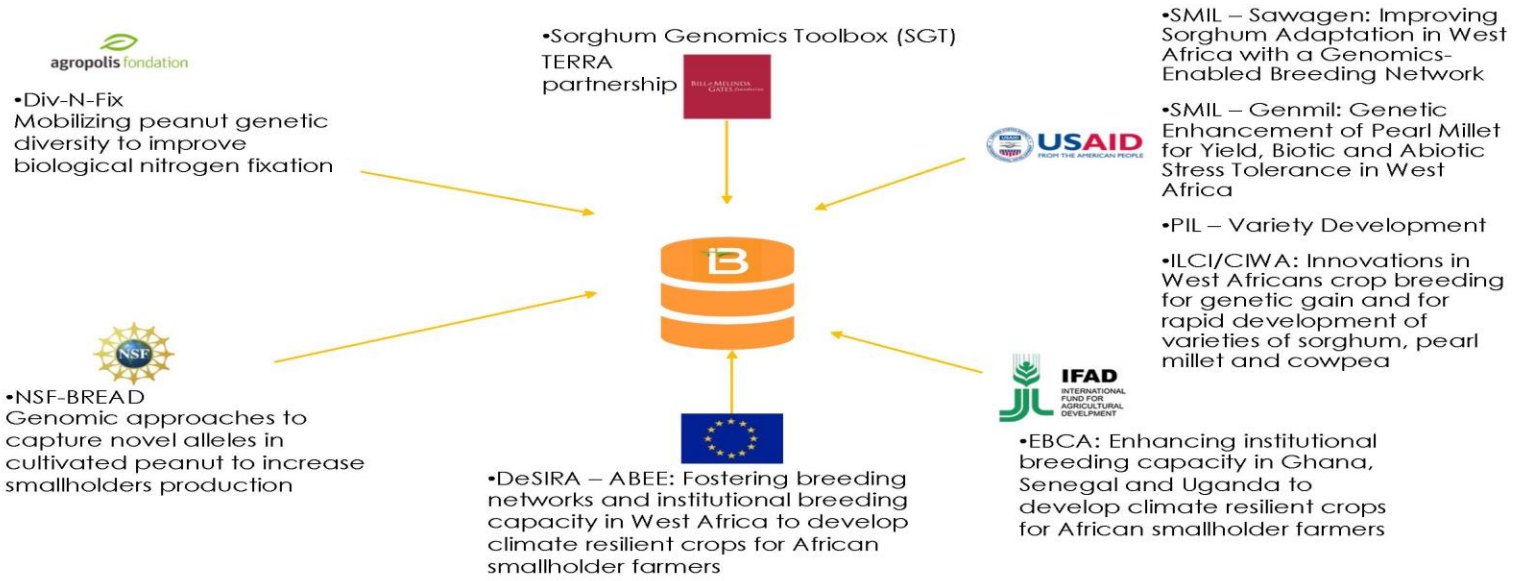
- **BMS is NOT always comprehensively used for all steps of the breeding cycle**
  - ✓ Commitment from upper management in reinforcing institutional adoption and use BMS as M&E tool.
  - ✓ Development and implementation of an institutional data management Policy
- **High level of staff turn-over in public sectors**
  - ✓ Incentives from management to keep the champions

- Modern tools and services are key in delivery of resilient crop varieties to small holder farmers.
- The tools and technologies to digitize breeding are available to most, if not all, plant breeders in Africa.
  - ✓ It is up to institutions' management to ensure and commit as they have the capability to access these technologies

The shift from deployment to adoption will happen through commitment of institutions to use best available technologies

Acknowledgment- Our donors

A diversified portfolio ease BMS adoption



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Thank you for your attention!