Modular Modeling in OMS 3 Application: CSIP

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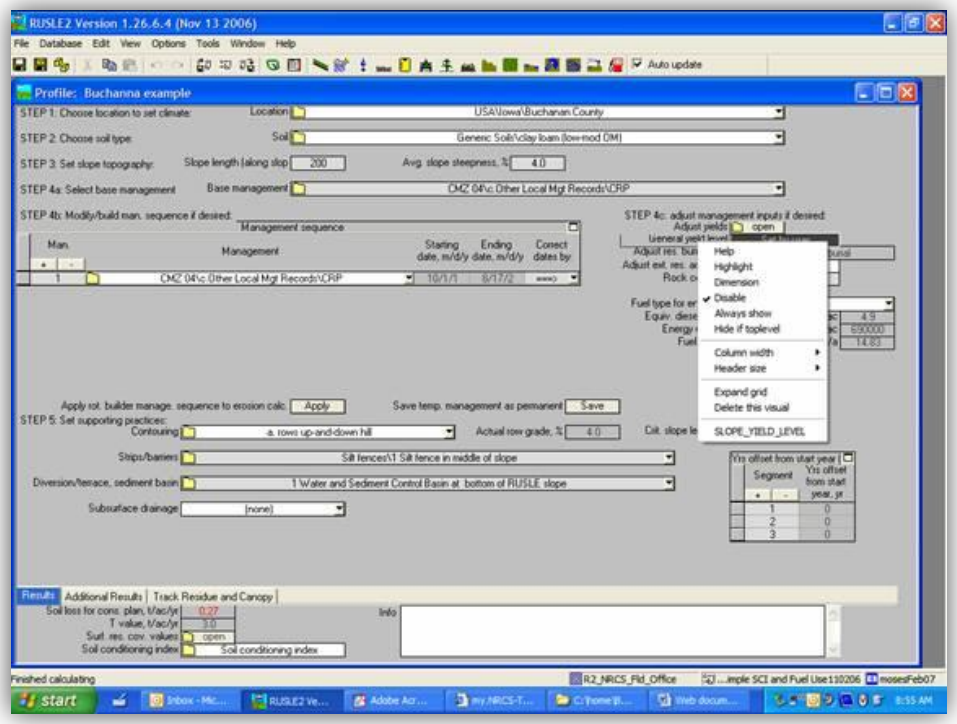
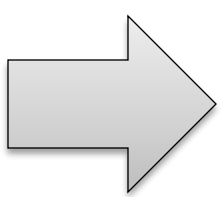
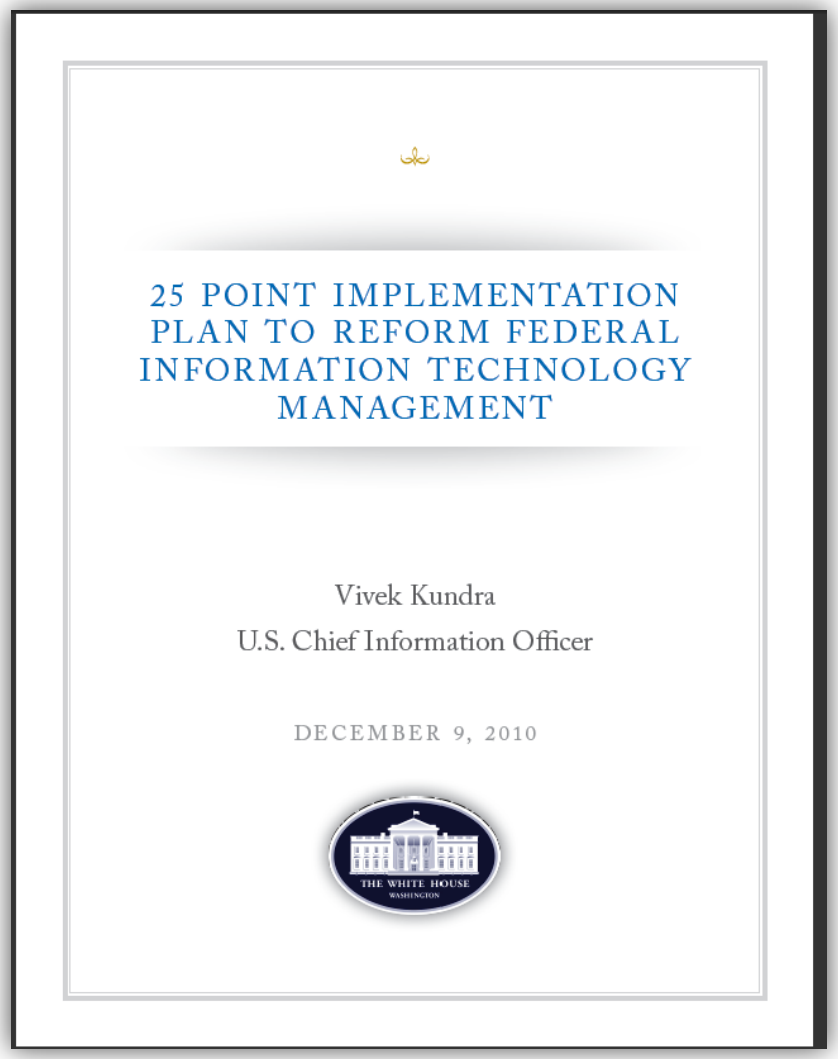
2011 SWCS Modeling Summit, Denver

Technology Shift

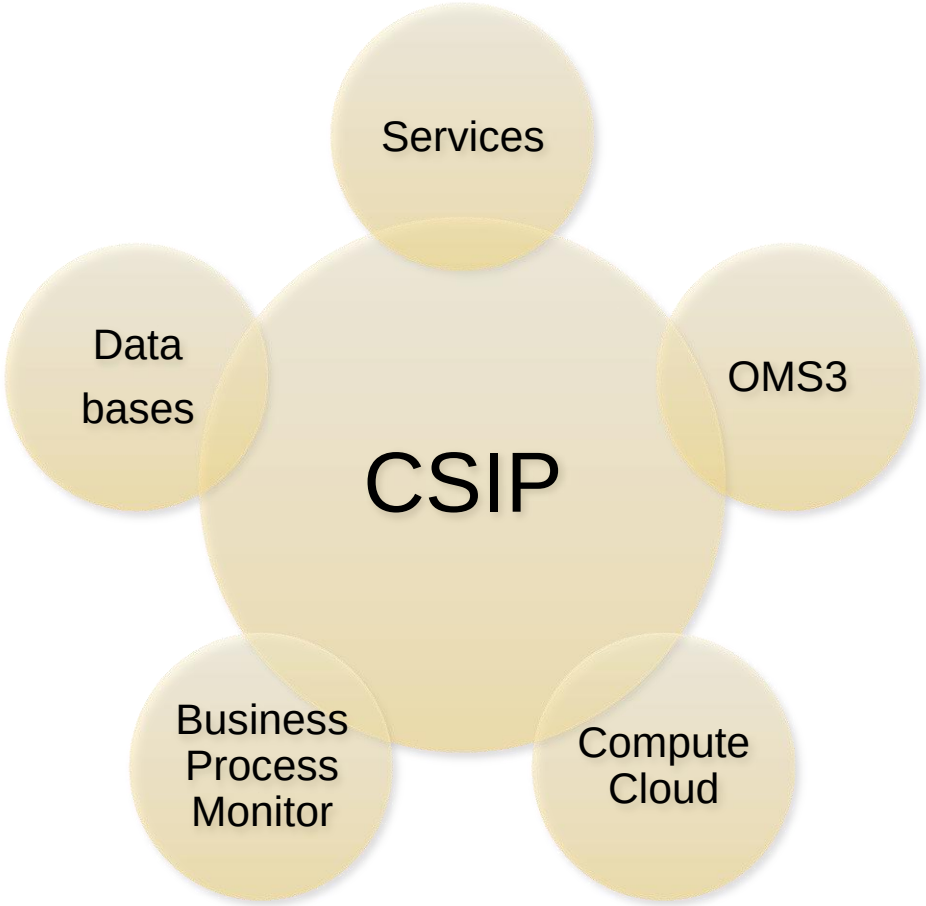




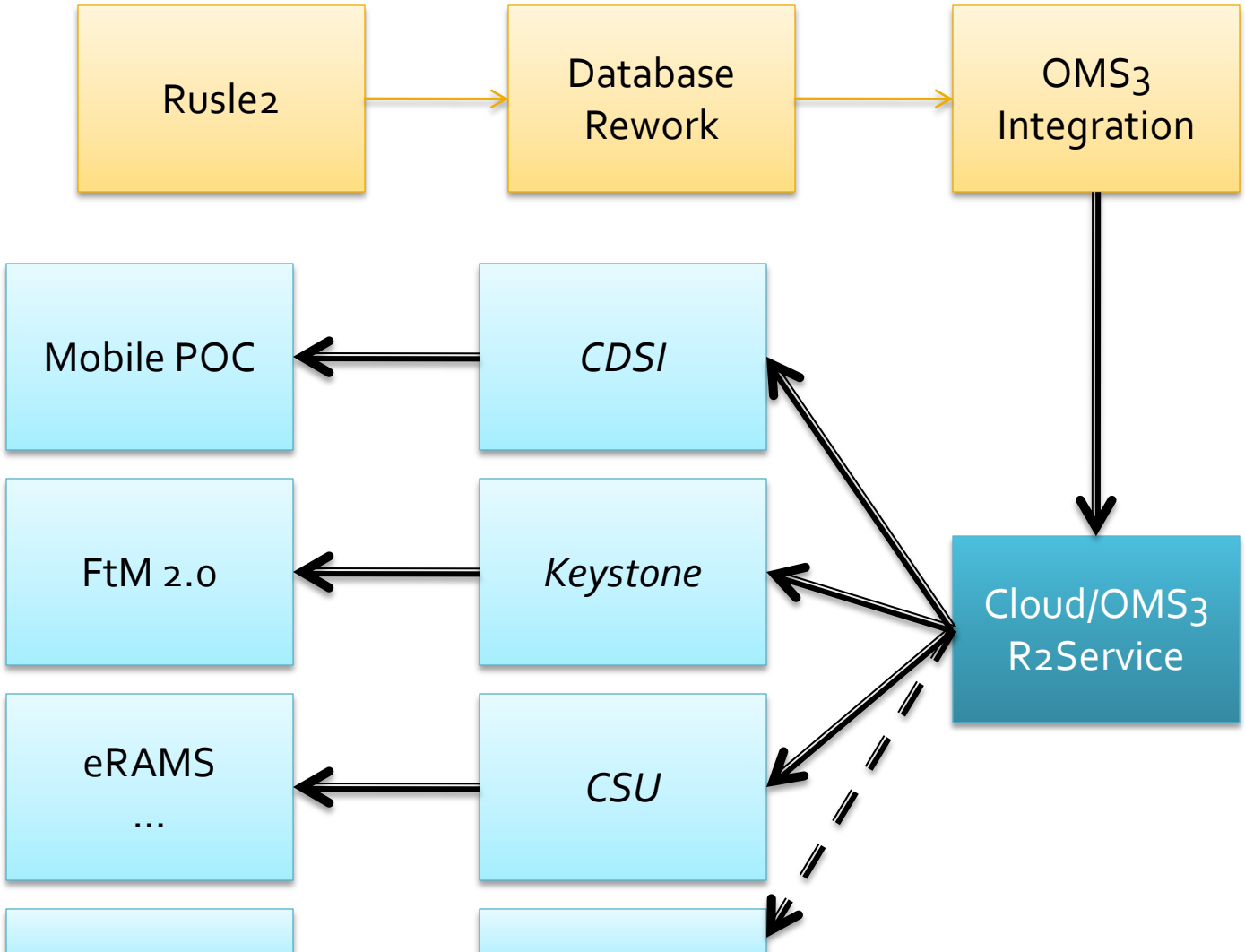
Cloud First policy

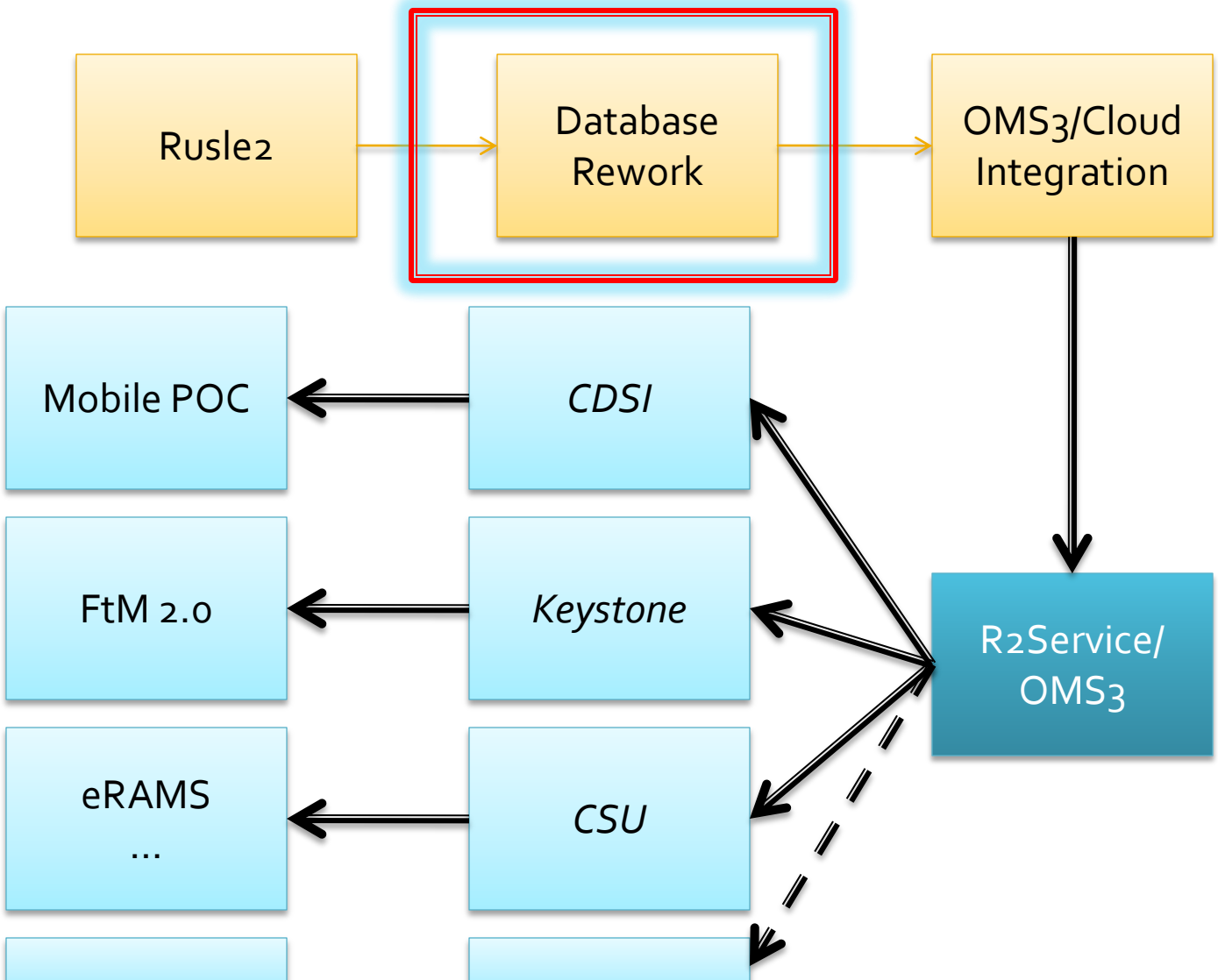


Cloud Services Innovation Platform



Example : Rusle2 CSIP



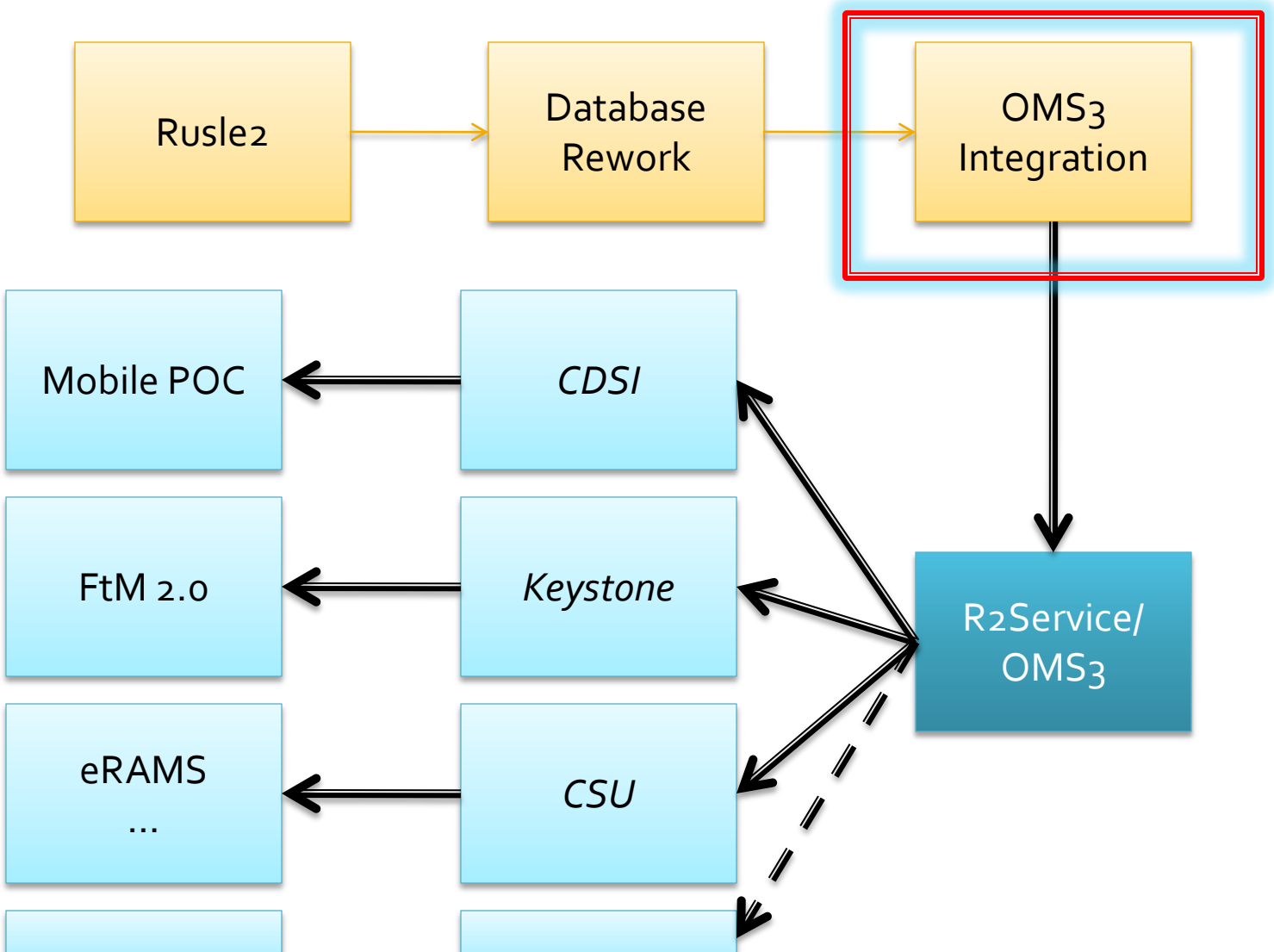

Rusle2
Database Rework
OMS3/Cloud Integration
Mobile POC
CDSI
FtM 2.0
Keystone
eRAMS ...
CSU
R2Service/ OMS3

Legacy GDB Data Stores

- Embedded XML in SQLite DB
- Multiple copies of data
- Need to update every computer
- Sharing over network
- Versioning
- Ad hoc solution
- Administration & Security
- Foreign data formats

CSIP Rusle2 Data Storage

- Data stored on central server(s)
- Access over internet / network with Multiple protocols
  - file:/ http:/ ftp:/ https/ ...
- Minor changes to model I/O
- Versioned database
- DB Access Module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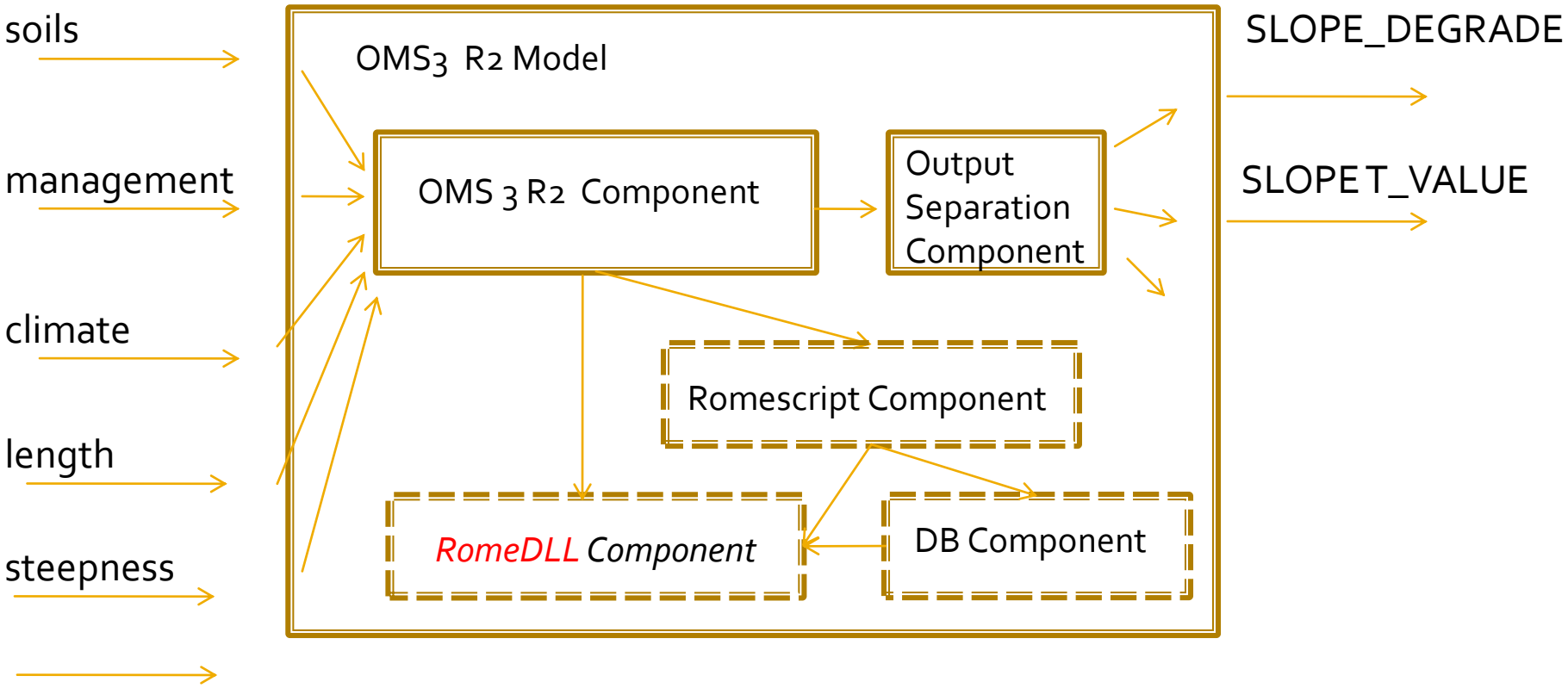
Rusle2 OMS3 Modules



Rusle2 / OMS3

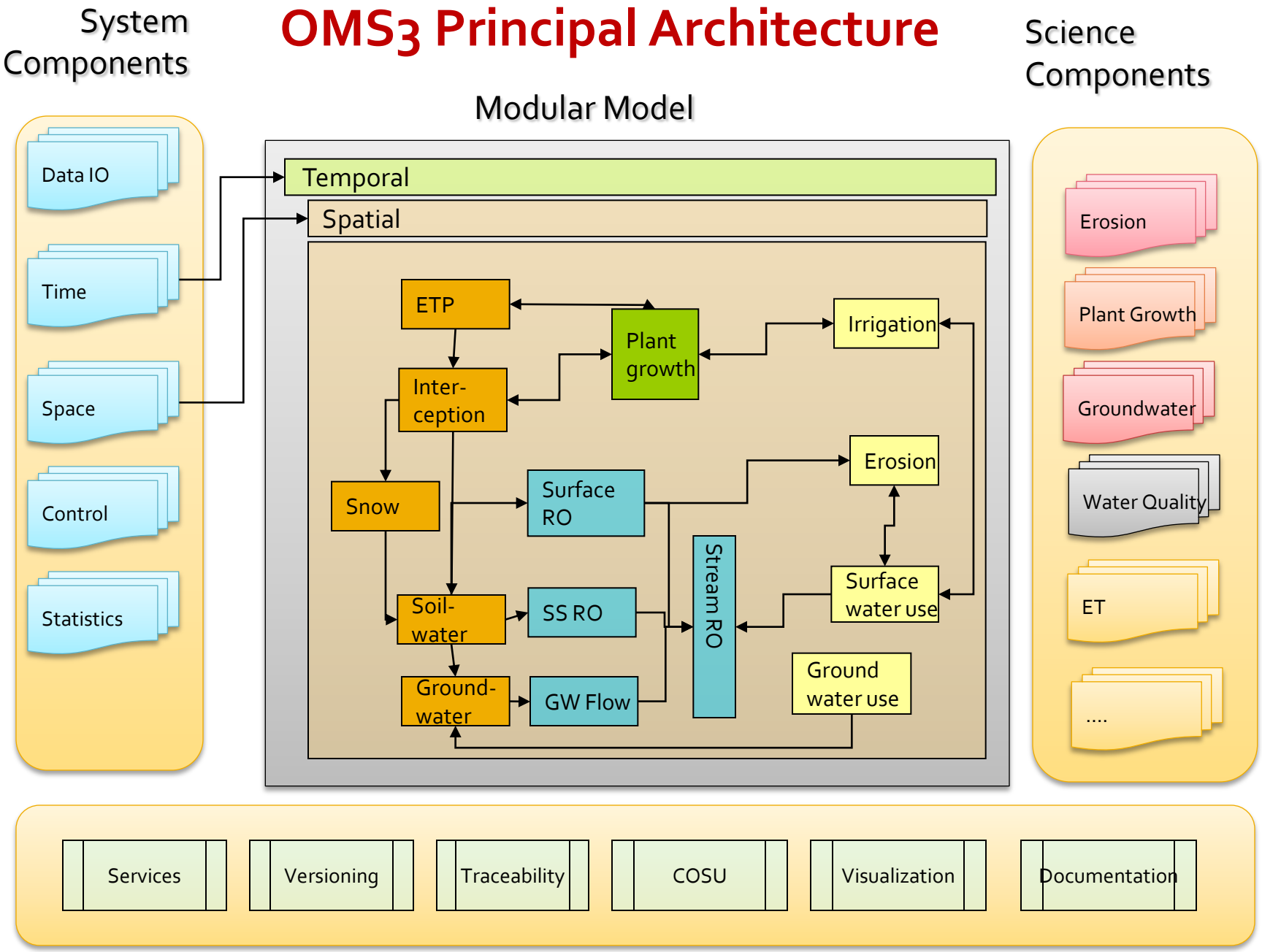
- Based on modified legacy Rusle2 DLL
- Embedded OMS3 Model
  - Annotation-based bindings in OMS3.1
  - Rusle2 database access Module

- Central data store, document oriented
- Rusle2/OMS3 bundled as model application, … later virtual machine

Modeling Framework

- "Separation of concerns" [Dijkstra 1974]
- Reusability of services such as I/O procedures, science processes, presentation utilities, and integration approaches
- Separation of a modeling solution in separate units (module or component)

OMS3 Principal Architecture



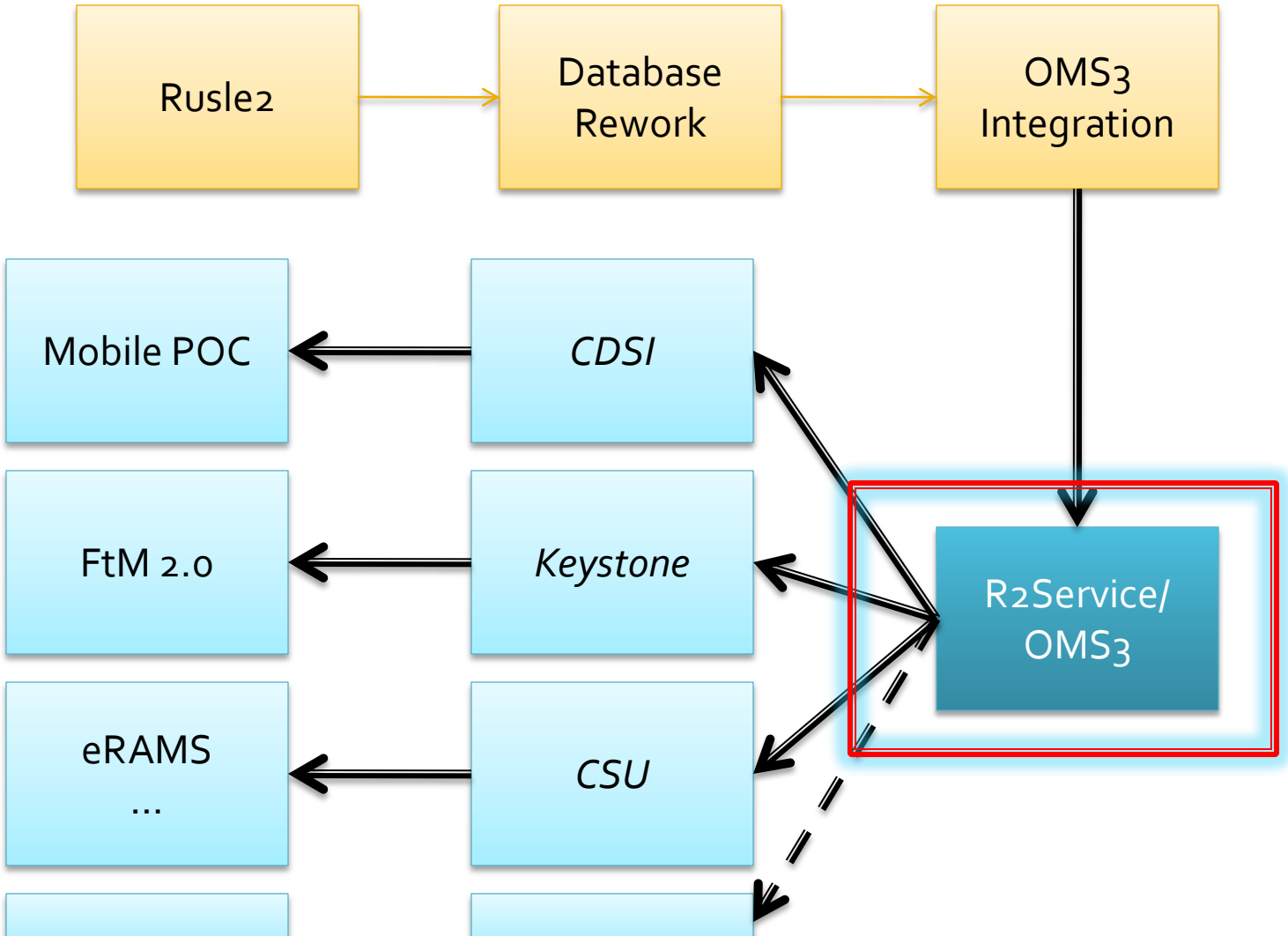
Object Modeling System

- Software Framework and System for Environmental Modeling
  - Used for Development, Application, and Deployment of models
  - Based on 'state of the art' software engineering methods
  - Models are based on "Science building blocks" = software components
- Models: PRMS/AgES/RUSLE2/McCabe/Geotop/IAEA(ISO) …

OMS3 increases efficiency

- 1) OMS3 Invasiveness Study (Lloyd 2010)
  - Cross Language/Modular Framework Model implementation and Model Metrics Analysis
  - Size & complexity reduction ~10 - 15%
- 2) Detailed COCOMO (Boehm 1981)

40% - 50% reduction in model development/deployment costs using OMS3 vs. traditional approaches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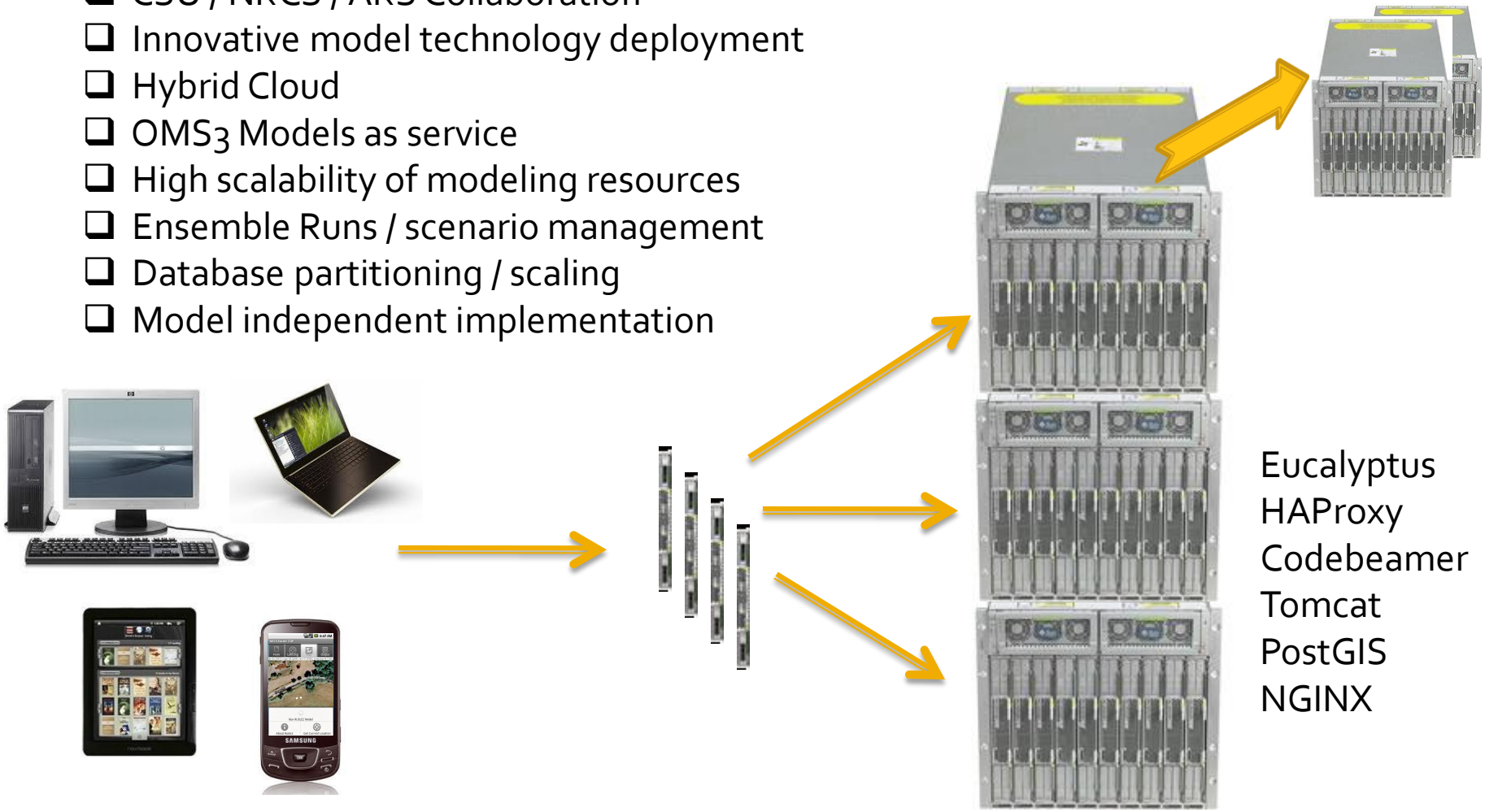
CSIP Cloud

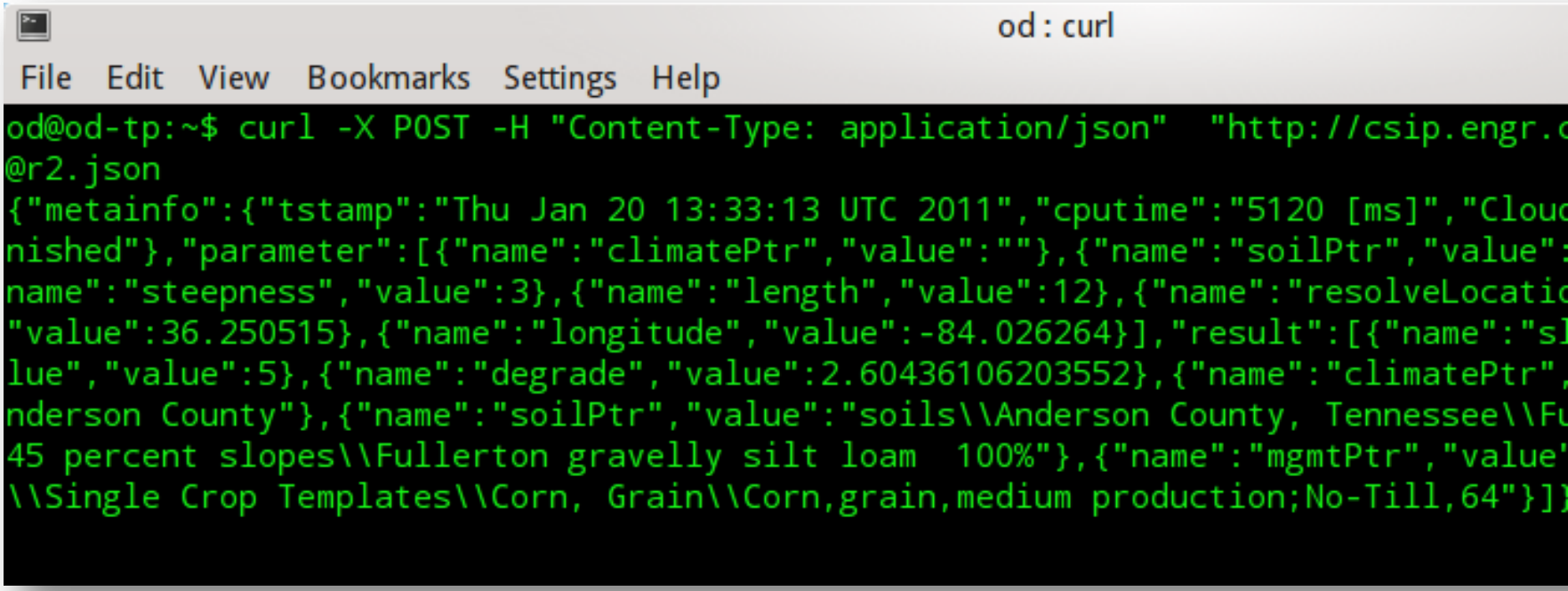
- CSU / NRCS / ARS Collaboration
- Innovative model technology deployment
- Hybrid Cloud
- OMS_3 Models as service
- High scalability of modeling resources
- Ensemble Runs / scenario management
- Database partitioning / scaling
- Model independent implementation



CSIP ModelServices

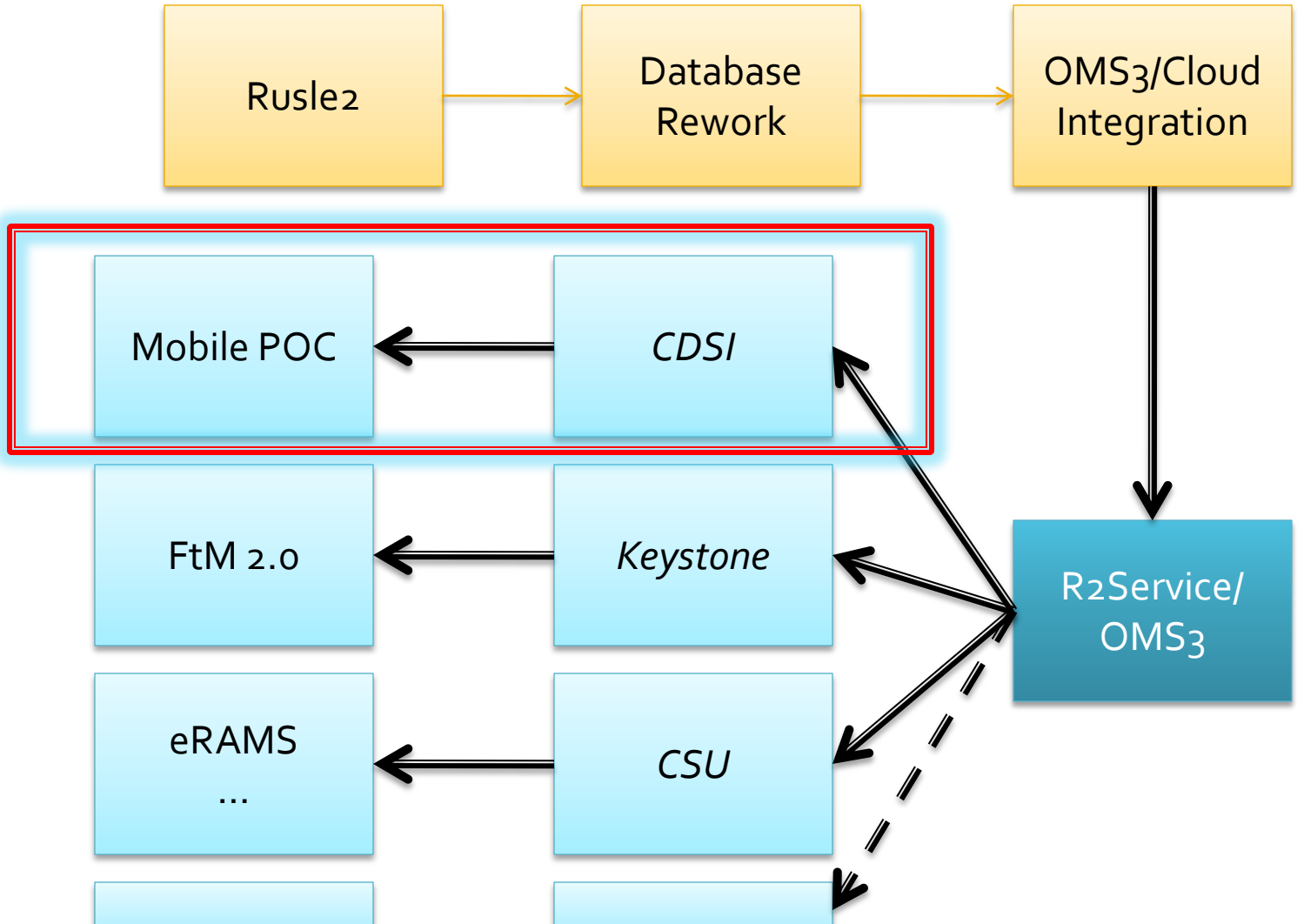
- OMS3 Model services
  - Rusle2
  - EFH2
  - **Energy**
  - (AgES-W)
- Data services
  - management lat/long lookup (R2 keys)
  - soils lat/long lookup
  - climate lat/long lookup
  - full R2 database

RUSLE2 ModelServices



REST/JSON Protocol, e.g.:

```
curl -X POST -H "Content-Type: application/json"
"http://csip.engr.colostate.edu:8081/rest/m/rusle2" -d @r2.json
```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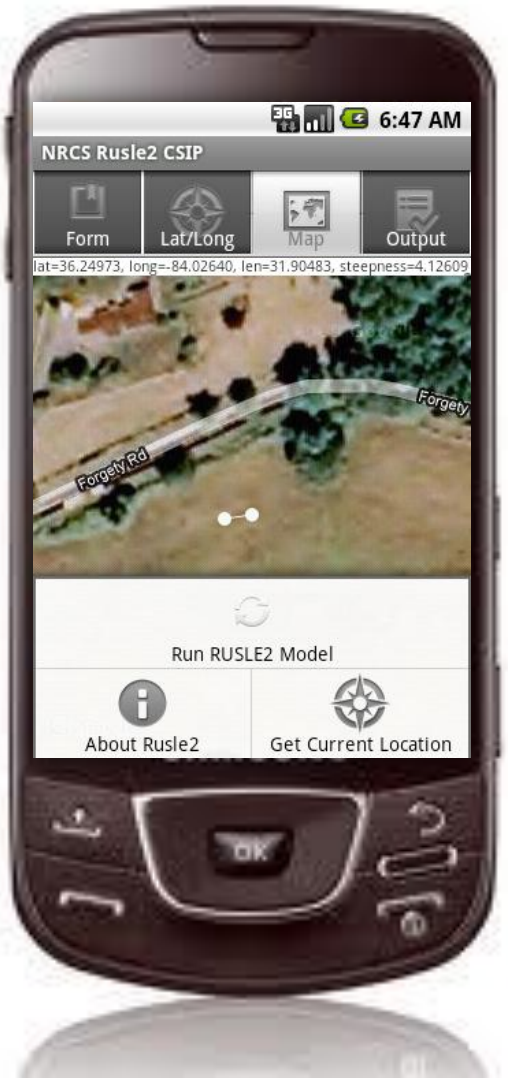
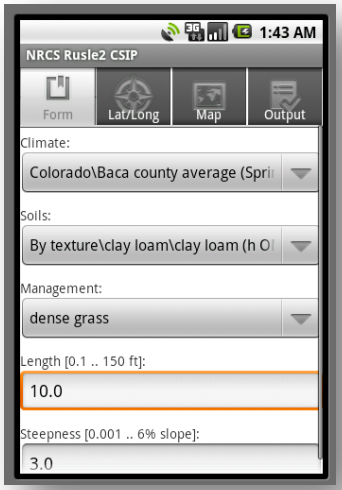
Mobile POC



- Android Application
- USGS Elevation service
- GPS enabled
- CSIP R2 execution
  - data service
  - model service

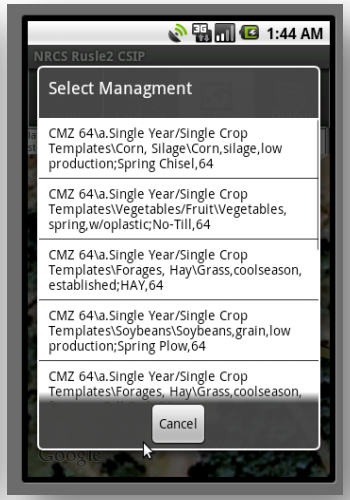
Rusle2 Mobile POC



Manual Parameter Selection

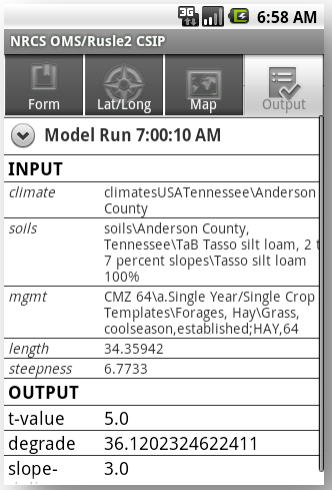
Transect Definition

USGS Elevation Service



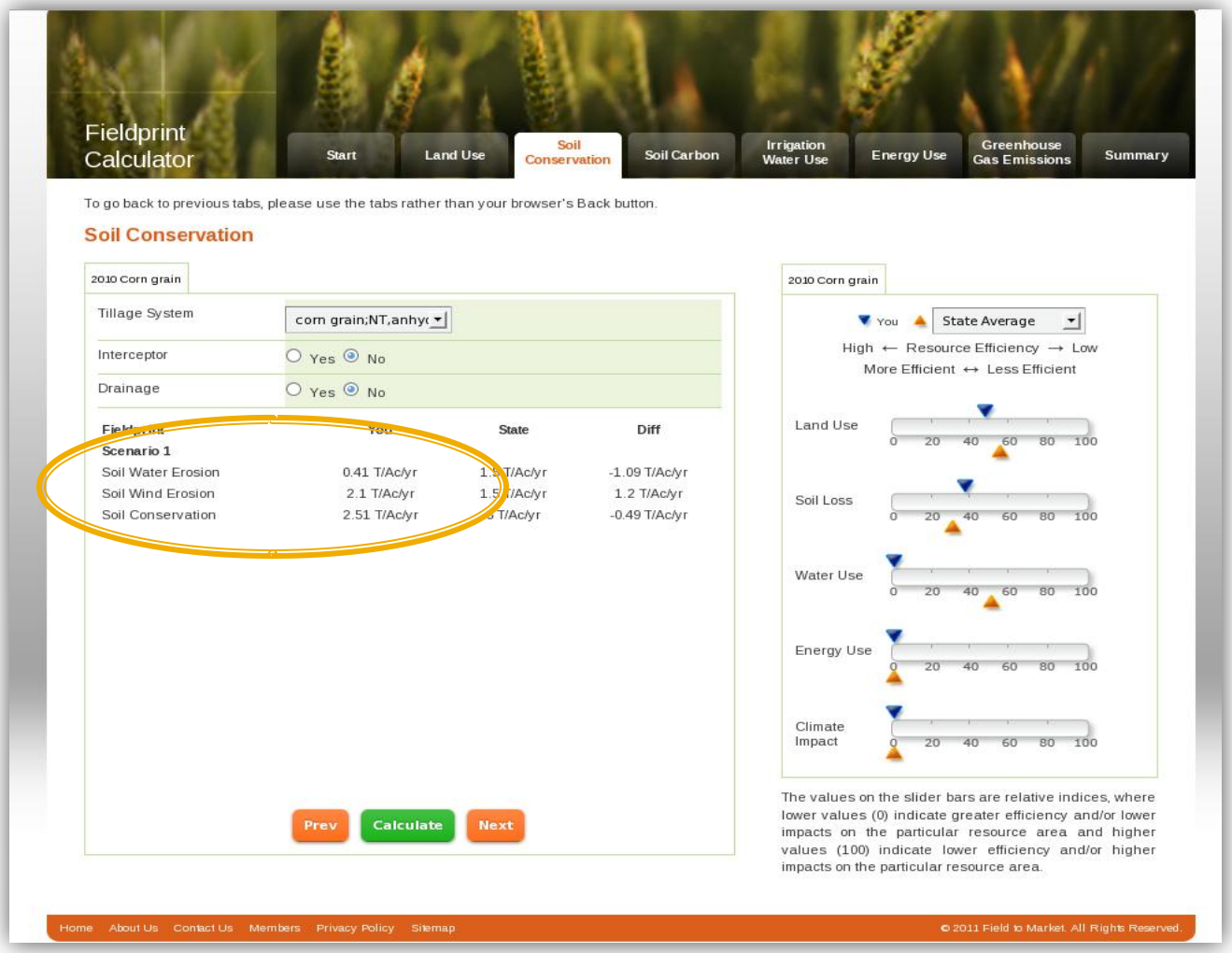
Location based Management Selection

Remote Model Execution of Rusle2 in CSIP/OMS3



Model Results

Keystone Alliance
Field to Market Calculator 2.0 Design
Soil Conservation Metric Screen



Conclusion

- CSIP prototypes NRCS model deployment for enhanced decision making.
- Emphasizes on modular science components supporting conservation planning for CDSI
- OMS3/CSIP offers a technology path streamlining legacy model integration and research model advancement
- OMS3 increases efficiency in model development; thus ensures rapid deployment