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An Accounting Model for Dynamic Virtual Organizations

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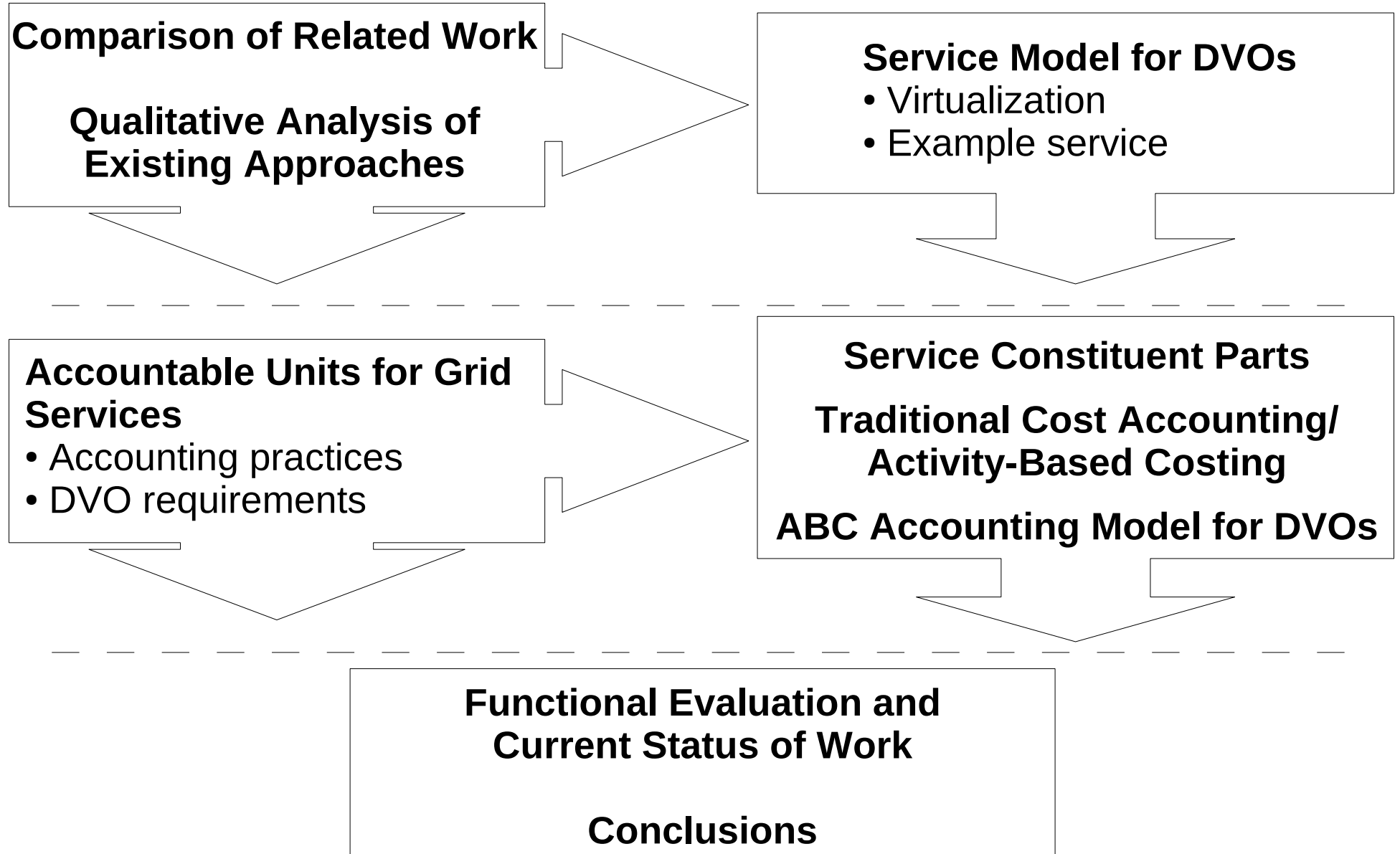
Key Goals



- Grid systems evolution
 - From grid computing to **service grids**
 - Virtualization of resources and services
- Dynamic Virtual Organizations (DVO)
 - **Multi-domain** service provisioning
 - Service bundles
 - Academic and commercial environment
- Resource and service usage
 - Technical vs. economic accounting
 - Consumption ↔ (economic) **costs**

Flexible cost-accounting model for DVOs needed
→ calculate costs per service request

Agenda



Comparison of Related Work

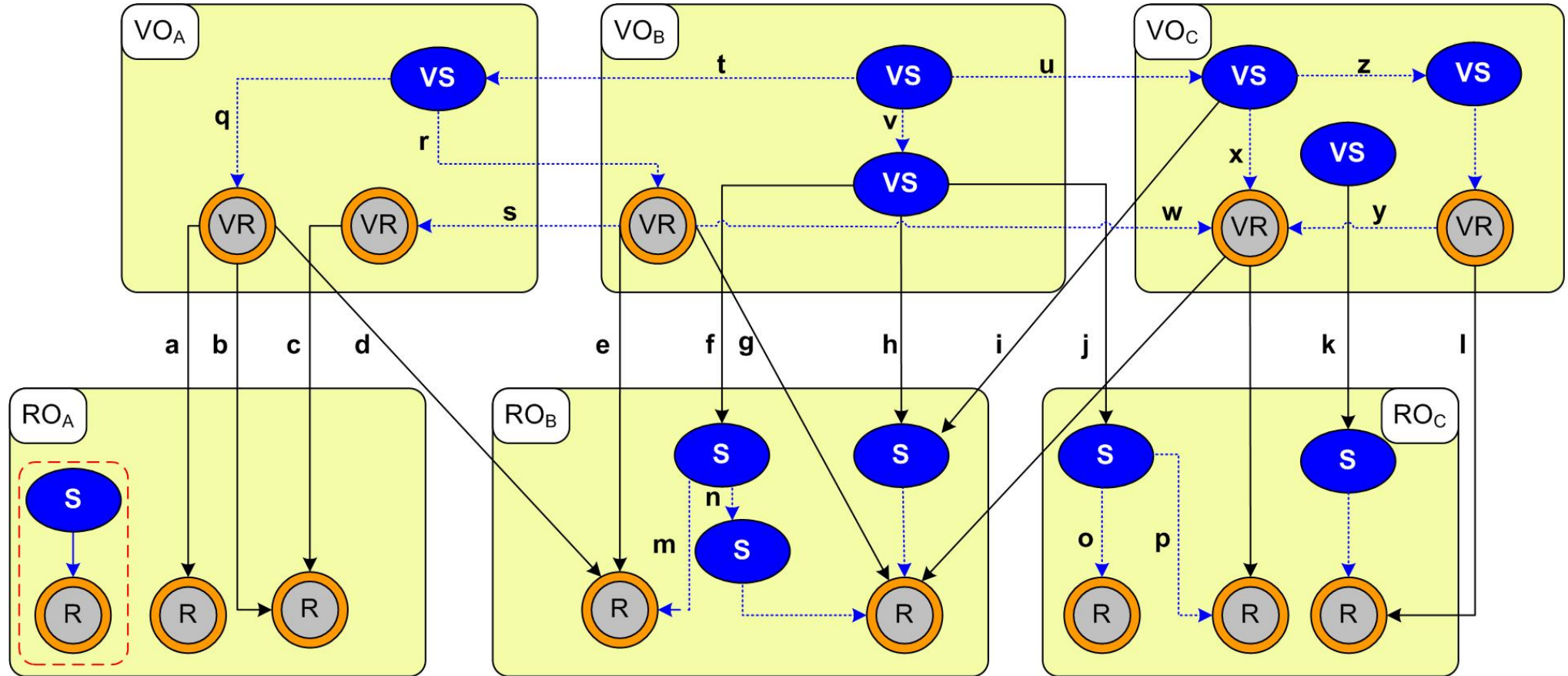
- Qualitative comparison
 - 23 criteria
 - 8 existing grid accounting approaches
- Comparison of grid accounting approaches
 - Accounting Processor for Event Logs (APEL)
 - Distributed Grid Accounting System (DGAS)
 - Grid Accounting Services Architecture/GridBank (GASA)
 - Grid Based Application Service Provision (GRASP)
 - Grid Service Accounting Extensions (GSAX)
 - Multi-organization Grid Accounting System (MOGAS)
 - Nimrod/G
 - SweGrid Accounting System (SGAS)

Qualitative Analysis of Existing Approaches

Criteria	APEL	DGAS	GASA	GRASP	GSAX	MOGAS	Nimrod/G	SGAS
Interoperability and portability	In parts	In parts	In parts	Not specified	In parts	In parts	Yes	Yes
Scalability	Yes	In parts	No	Not specified	Yes	In parts	Yes	Yes
Integration	In parts	In parts	In parts	Not specified	In parts	Yes	Yes	Yes
Interorganizational accounting	Yes	Yes	Yes	Not specified	Yes	Not specified	Not specified	Yes
Flexibility and extensibility	Yes	Not specified	Yes	Not specified	Yes	In parts	In parts	Yes
Support of existing standards	No	No	In parts	In parts	In parts	Not specified	Not specified	Yes
Multi-provider scenario support	No	No	No	No	No	No	No	No
Customer-specific accounting data visualization	Yes	No	No	Not specified	Not specified	Yes	Not specified	No
User transparency	Not specified	Not specified	Not specified	Not specified	Not specified	In parts	Not specified	In parts
Heterogeneous resource accounting	In parts	Yes	Yes	In parts	Not specified	In parts	Not specified	No
Virtual resource accounting	No	No	No	No	No	No	No	No
Virtual service accounting	No	No	No	No	No	No	No	No
Virtualization concept	No	No	No	No	No	No	No	No
Support of high dynamics	Yes	In parts	In parts	Not specified	Not specified	In parts	Yes	Yes
Security	Not specified	Yes	Yes	Not specified	Yes	Yes	Not specified	Yes
Standardized, generic interfaces	No	No	No	Not specified	In parts	Not specified	Yes	In parts
Support of various accounting units	Yes	Yes	Yes	Not specified	Yes	Not specified	Not specified	No
Precision and abundance	Yes	Yes	Yes	Yes	Yes	Yes	Not specified	Yes
Different accounting policies support	Yes	Yes	Not specified	Not specified	Yes	No	Not specified	In parts
Reliability and fault tolerance	Not specified	Not specified	In parts	Not specified	Not specified	Not specified	Not specified	Yes
Administration and management	Not specified	In parts	Not specified	Not specified	Not specified	Not specified	Not specified	Yes
Verification	Not specified	Yes	Yes	Not specified	Not specified	Not specified	Yes	Yes
Open source	Yes	Yes	Yes	No	No	Not specified	Yes	Yes

■ Yes
■ In parts
■ No
■ Not specified

Service Model for DVOs



Accountable Units for Grid Services

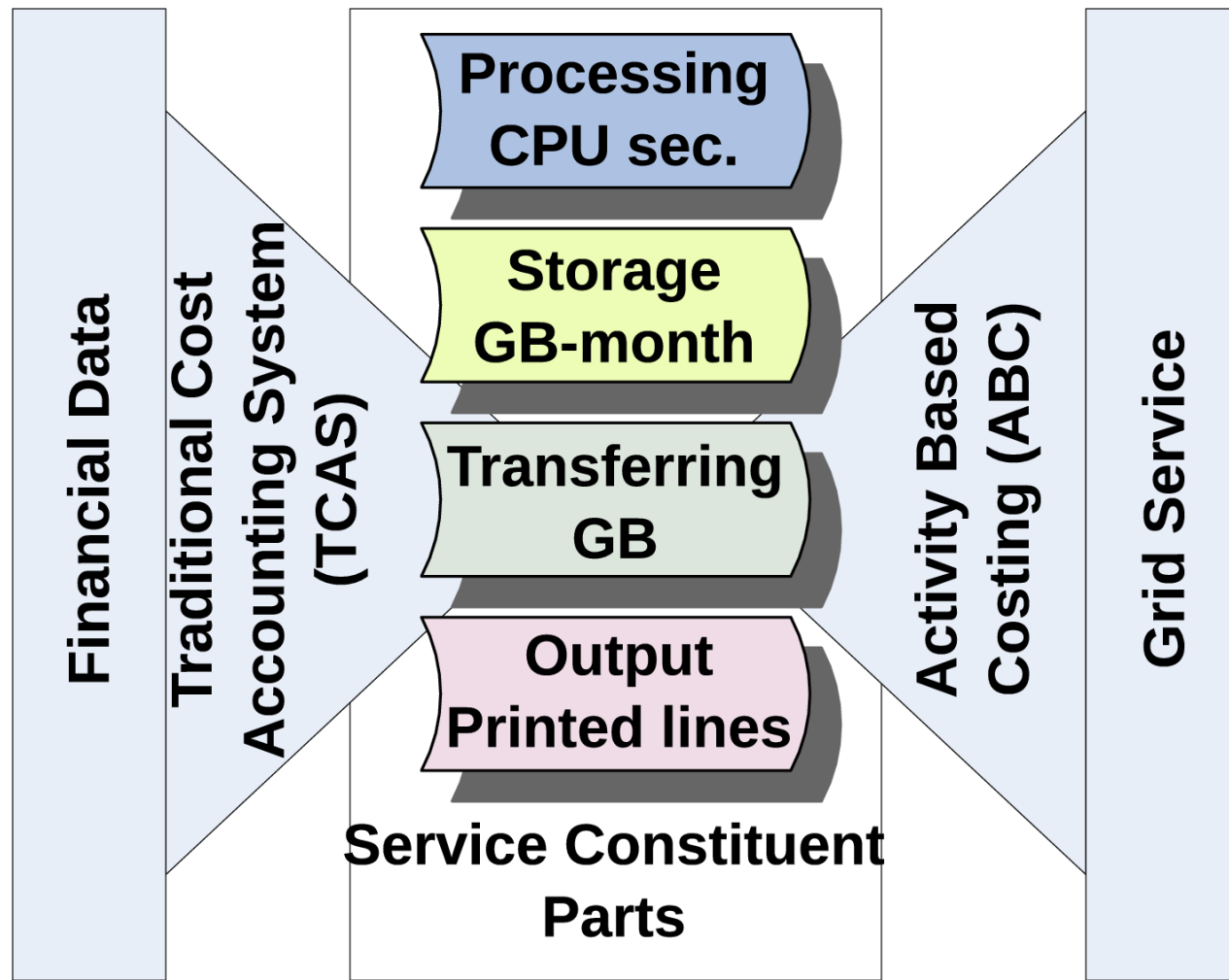
- Accountable units
 - Range of measurable units
 - Basis for charge calculation
 - **Central constituent part** of accounting models
- Requirements on accountable units
 - Technical vs. economic accounting
 - External/financial vs. **internal/cost accounting**
 - Economic costs ↔ resource consumption
 - Direct vs. indirect (attribution keys) costs
 - Causality principle → **cost drivers**

Accountable units ...

... express resource/service consumption → resource-specific
... relate to the cost causing fact/event → financial/cost accounting
... depend on metering information → technical implementation

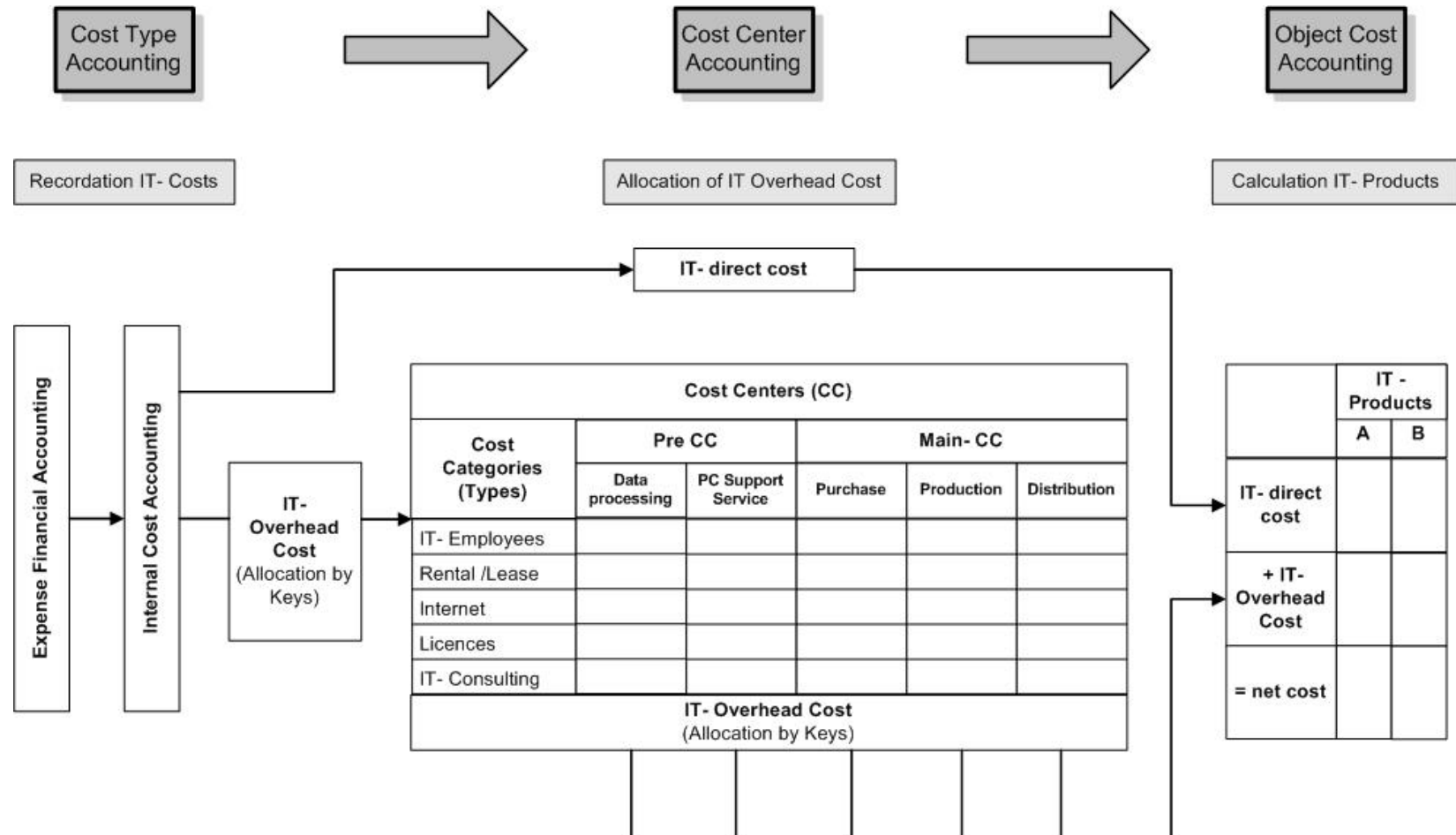
Service Constituent Parts

- Processing
 - CPU, main memory
 - CPU seconds, MIPS, ...
- Storage
 - Secondary storage
 - Backup, archive
 - Volume x duration
- Transferring
 - Grid data transfer
 - Internal, external
 - Volume, QoS, ...
- Output
 - Tangible output
 - Printed lines, volume, ...



Traditional Cost Accounting/Activity-Based Costing (1)

- Traditional Cost Accounting System (TCAS) Procedure

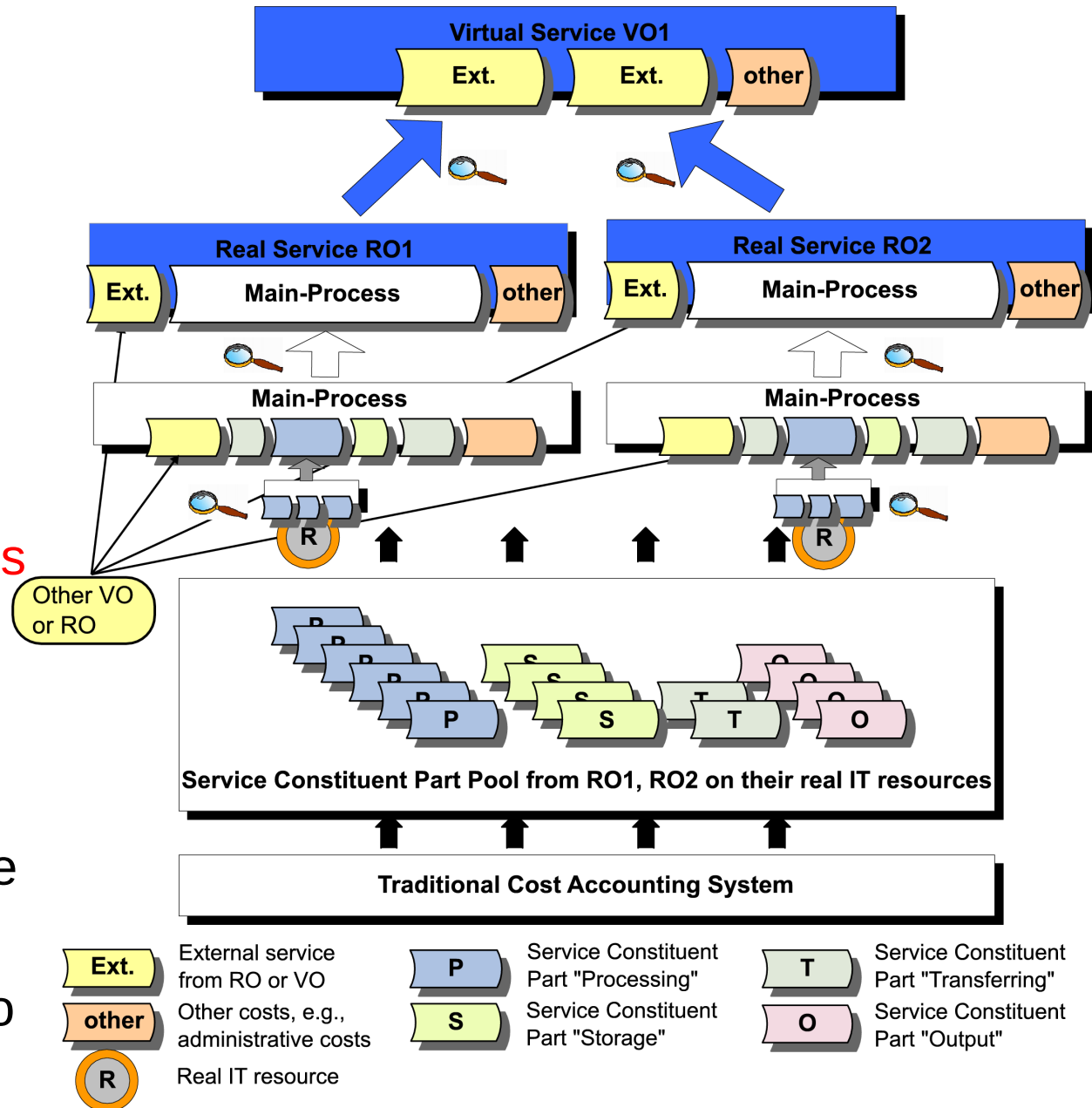


- TCAS pros/cons

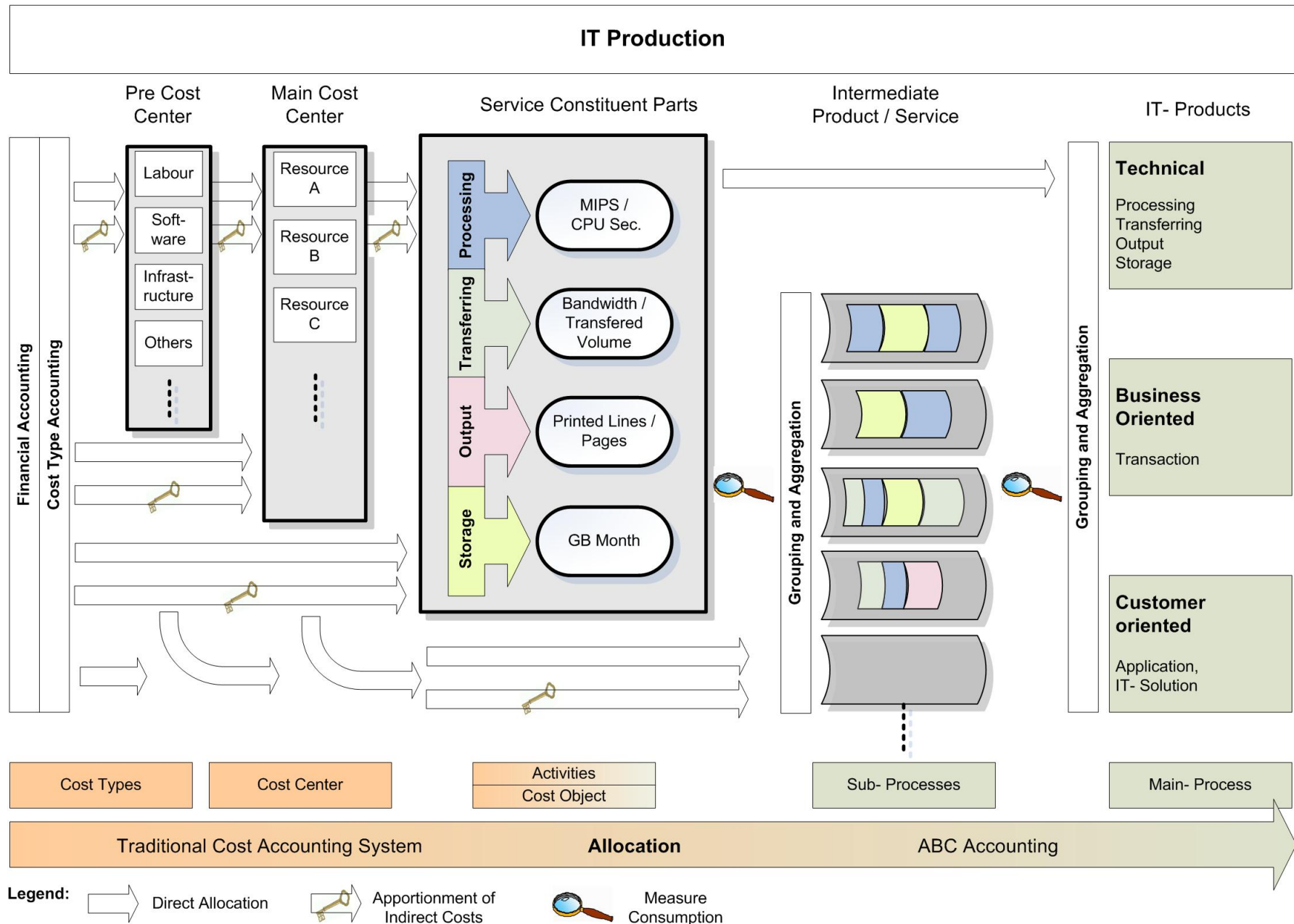
- Seamless interaction with financial data
- Product/service view lacking

Traditional Cost Accounting/Activity-Based Costing (2)

- ABC principles
 - Cost objects consume activities
 - Activities consume resources
 - Resource consumption main cost driver
 - Cause-effect relationships
- ABC procedure
 1. Activity/service hierarchy
 2. Resource-specific service constituent part pools
 3. Assign costs according to activity rates



ABC Accounting Model for DVOs



Functional Evaluation and Current Status of Work

- Requirements check
 - ✓ **Resource-specific** accountable units
 - ✓ Respect relevant **cost drivers**
 - ✓ Seamless interaction with existing financial data
 - ✓ Compatible with retrievable metering information
- DVO service model compliance check
 - ✓ **Multi-provider** service provisioning support (“External”)
 - ✓ **Virtualization** of resources and services
- Current status of work
 - **Full evaluation** at High Performance Computing Center Stuttgart
 - Full evaluation at Leibniz Computing Center Munich

Conclusions

① Flexible accounting model for DVOs based on solid economic foundation

② Service constituent parts determine resource-based accountable units interlinking TCAS with ABC

**③ Support of requirements and DVO service model
→ Full evaluation ongoing**

Thank you

for your attention!

