SERVICE-ORIENTED ARCHITECTURE (CONTD..)

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L24

WORKFLOW IN SERVICE-ORIENTED ARCHITECTURES

- Basic Workflow Concepts
- Workflow Standards
- Workflow Architecture and Specification
- Workflow Execution Engine
- Scripting Workflow System Swift

WORKFLOW IN SERVICE-ORIENTED ARCHITECTURES

- "real system" consists of multiple interacting
- Grid of services involves:
  - simple sensor (perhaps only an output data stream)
  - a complete grid (a collection of services with multiple input and output message ports)
  - Grid of grid or grid of clouds.
- By adding application-specific services, one builds a distributed system to support the study of flood, gas, or electrical infrastructure.
- Workflow is used to integrate component grids and services.

WORKFLOW IN SERVICE-ORIENTED ARCHITECTURES

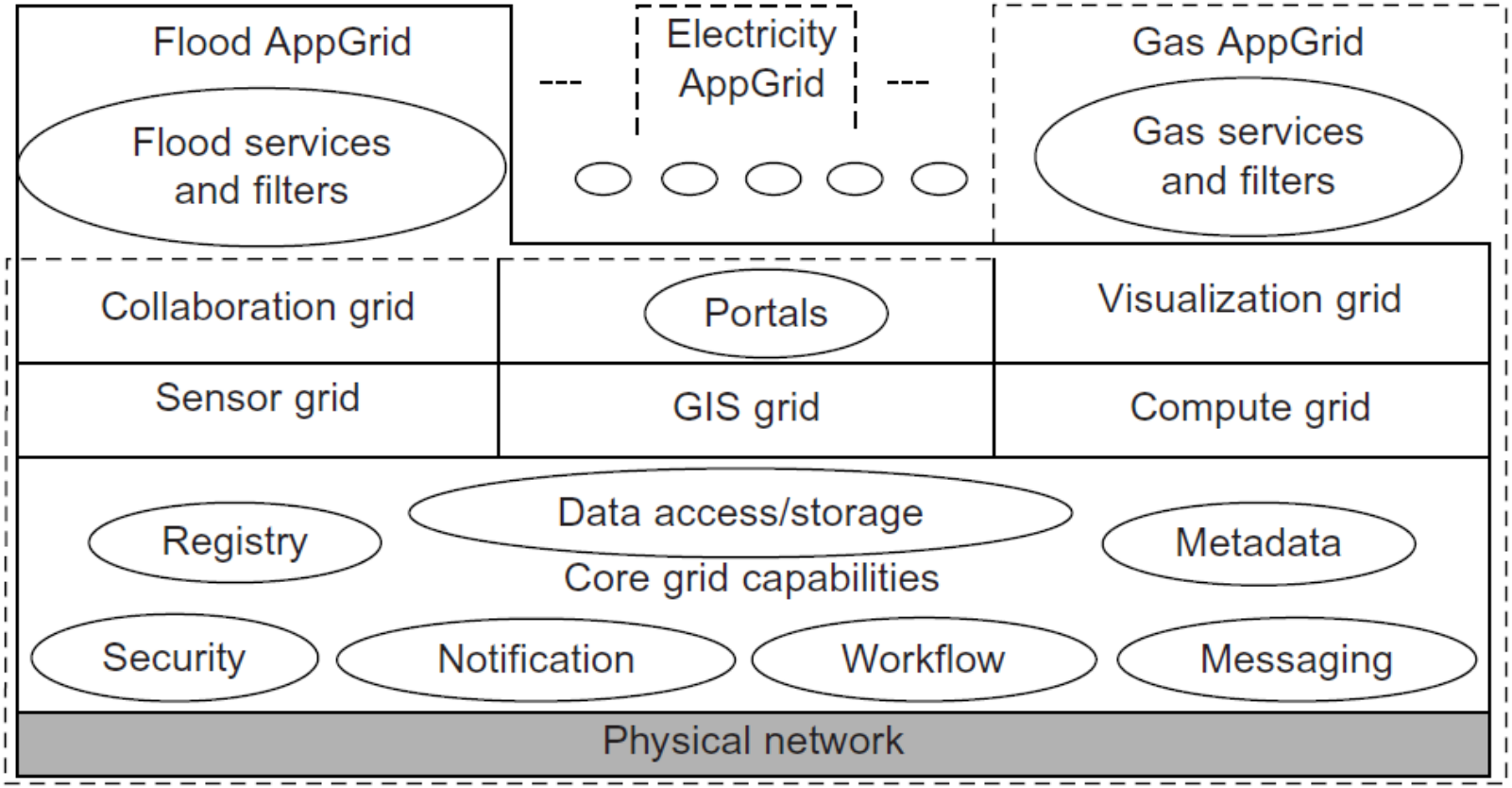

FIGURE 5.14

The concept of the grid of grids of services.

BASIC WORKFLOW CONCEPTS

- **Workflow means an approach to program the interaction between the services.**
- **AKA "software coordination", "Service orchestration", "service or process coordination", "service conversation", "web or grid scripting", "application integration," or "software bus.**
- **It is an area of active research with different approaches emphasizing control flow, scheduling, and/or data flow.**

BASIC WORKFLOW CONCEPTS
(CONTD..)

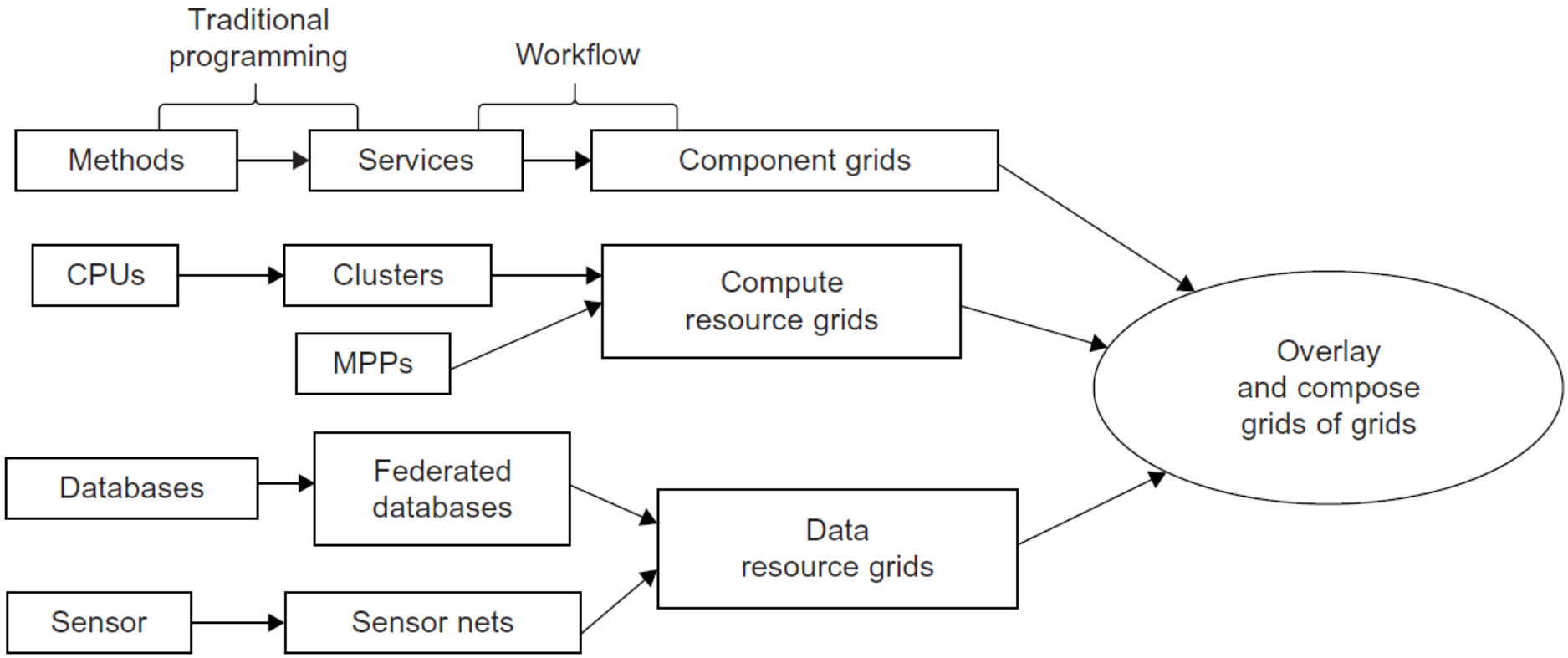

FIGURE 5.15

Hierarchical computing, data, and programming abstraction.

WORKFLOW STANDARDS (CONTD..)

Table 5.9 Workflow Standards, Links, and Status

Standard	Link	Status
BPEL Business Process Execution Language for Web Services (OASIS) V 2.0	http://docs.oasis-open.org/wsbpel/2.0/wsbpel-v2.0.html; http://en.wikipedia.org/wiki/BPEL	April 2007
WS-CDL Web Service Choreography Description Language (W3C)	http://www.w3.org/TR/ws-cdl-10/	November 2005, not final
WSCI Web Service Choreography Interface V 1.0 (W3C)	http://www.w3.org/TR/wsci/	August 2002, note only
WSCL Web Services Conversation Language (W3C)	http://www.w3.org/TR/wscl10/	March 2002, note only
WSFL Web Services Flow Language	http://www.ibm.com/developerworks/webservices/library/ws-wsfl2/	Replaced by BPEL
XLANG Web Services for Business Process Design (Microsoft)	http://xml.coverpages.org/XLANG-C-200106.html	June 2001, replaced by BPEL
WS-CAF Web Services Composite Application Framework including **WS-CTX, WS-CF,** and **WS-TXM**	http://en.wikipedia.org/wiki/WS-CAF	Unfinished

WORKFLOW STANDARDS

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WS-CTX Web Services Context (OASIS Web Services Composite Application Framework TC)	http://docs.oasis-open.org/ws-caf/ws-context/v1.0/OS/wsctx.html	April 2007
WS-Coordination Web Services Coordination (BEA, IBM, Microsoft at OASIS)	http://docs.oasis-open.org/ws-tx/wscoor/2006/06	February 2009
WS-AtomicTransaction Web Services Atomic Transaction (BEA, IBM, Microsoft at OASIS)	http://docs.oasis-open.org/ws-tx/wsat/2006/06	February 2009
WS-BusinessActivity Framework (BEA, IBM, Microsoft at OASIS)	http://docs.oasis-open.org/ws-tx/wsba/2006/06	February 2009
BPMN Business Process Modeling Notation (Object Management Group, OMG)	http://en.wikipedia.org/wiki/BPMN; http://www.bpmn.org/	Active
BPSS Business Process Specification Schema (OASIS)	http://www.ebxml.org/; http://www.ebxml.org/specs/ebBPSS.pdf	May 2001
BTP Business Transaction Protocol (OASIS)	http://www.oasis-open.org/committees/download.php/12449/business_transaction-btp-1.1-spec-	Unfinished

WORKFLOW ARCHITECTURE AND SPECIFICATION

- Workflow system have two components:
  - Programming language
  - Runtime components
- Workflow specification
  - Scripting-base workflow – similar to Python, JavaScript, Perl

WORKFLOW ARCHITECTURE AND SPECIFICATION (CONTD..)

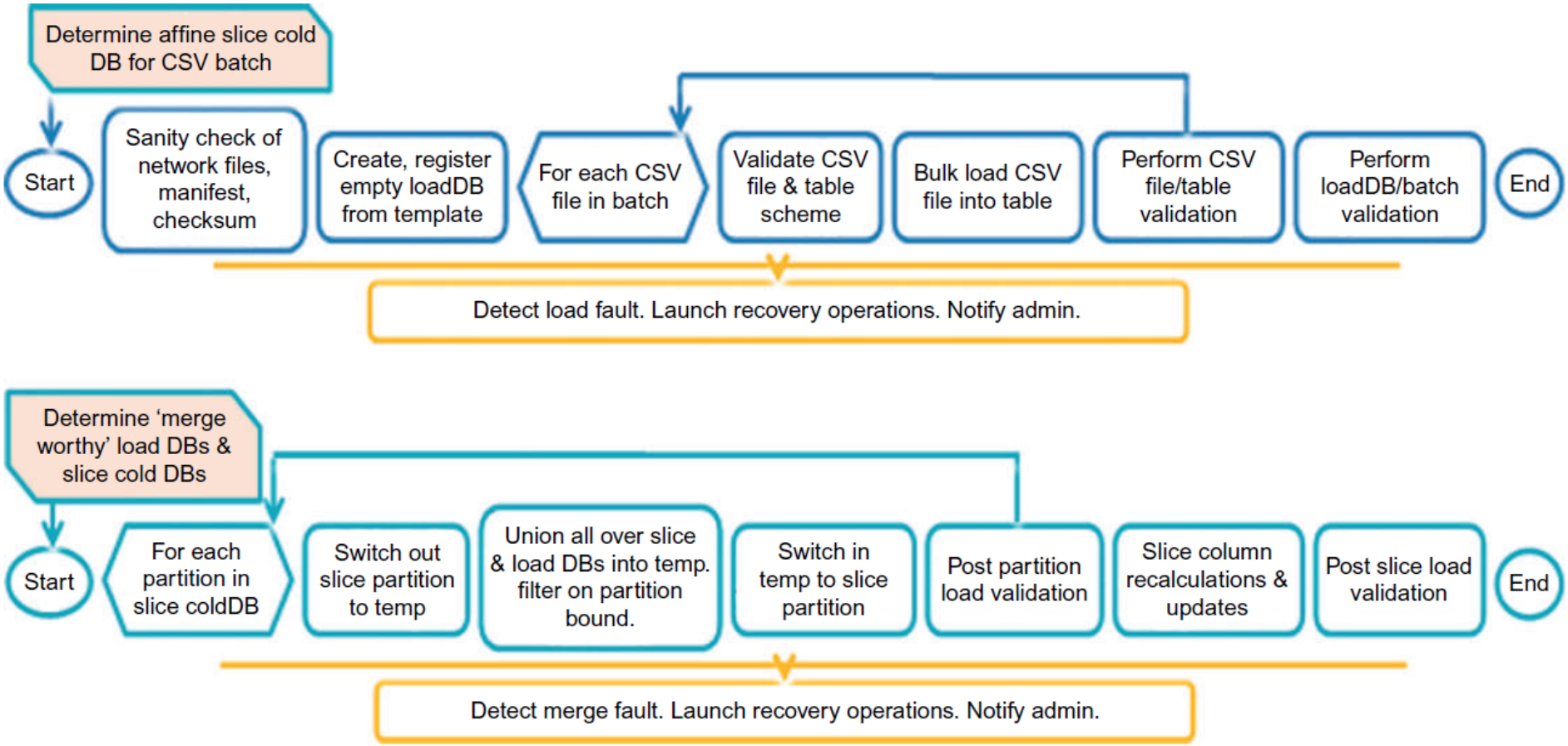

FIGURE 5.16

Two typical (Load and Merge) workflows from the Pan-STARRS astronomy data processing area.

(*Courtesy of Barga, et al. [129]*)

WORKFLOW EXECUTION ENGINE

- **Workflows domains are from meteorology and ocean modeling, bioinformatics and biomedical workflows, astronomy and neutron science.**
- **These are examined according to their size, resource use, graph pattern, data pattern, and usage scenario.**
- **A more general workflow structure is that of the DAG, which is a collection of vertices and directed edges, each edge connecting one vertex to another such that there are no cycles.**
- **Specifies the interaction between the constituent services or activities.**
- **One important technology choice is the mechanism for transferring information between the nodes of the graph.**

WORKFLOW EXECUTION ENGINE (CONTD..)

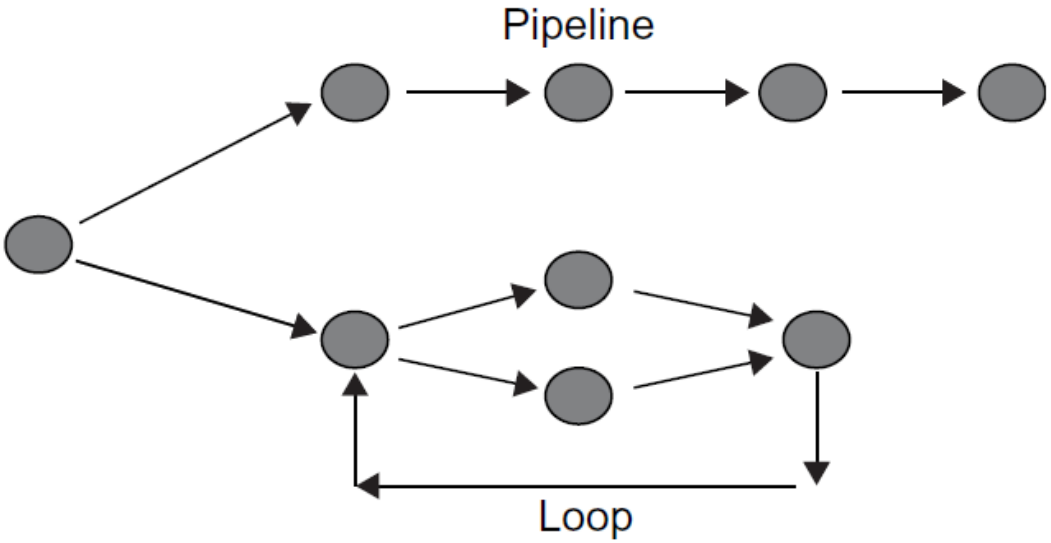

FIGURE 5.18

A workflow graph that includes subgraphs illustrating pipelines and loops.

WORKFLOW EXECUTION ENGINE (CONTD..)

- There are often two communication systems in workflow environments corresponding to “control” and “data,” respectively.
- Obviously, the control communication would usually have small messages and very different requirements from the data network.
- In this regard, one should mention the “proxy model” which is often used in grid architectures and workflow.

SCRIPTING WORKFLOW SYSTEM SWIFT

- Swift is a parallel scripting language in which application programs are represented as functions and variables can be mapped to files.
- Structure and array abstractions are used to manipulate sets of files in parallel.
- Swift has a functional data-flow-based execution model in which all statements are implicitly parallel.
- Parallel looping constructs explicitly specify large-scale parallel processing.
- Figure 5.19 shows the architecture of the Swift workflow system.

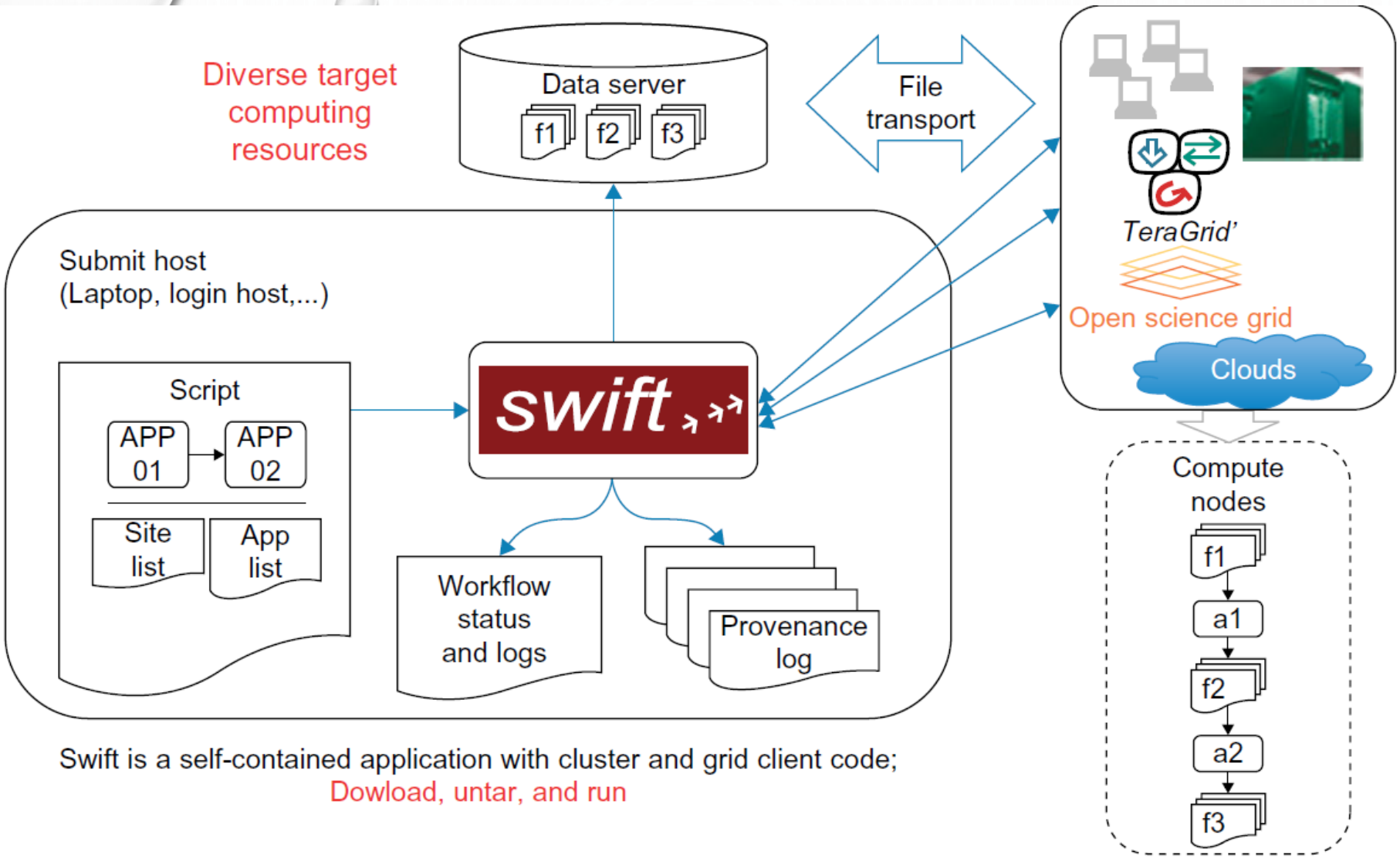

FIGURE 5.19

Swift workflow system architecture.

NEXT CLASS