A Reference Architecture for Web Servers

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CANADA

Reference Architecture

- Architecture template for software systems in a domain
- A product architecture is an instantiation of the reference arch
- Defines the fundamental components and the relations between them
- Well known for mature domain (eg. Compilers, Operating Systems)

Compiler Ref. Arch.

Source → **Scanner** → **Parser** → **Sem. Analyzer** → **Code Gen.** → **Binary**
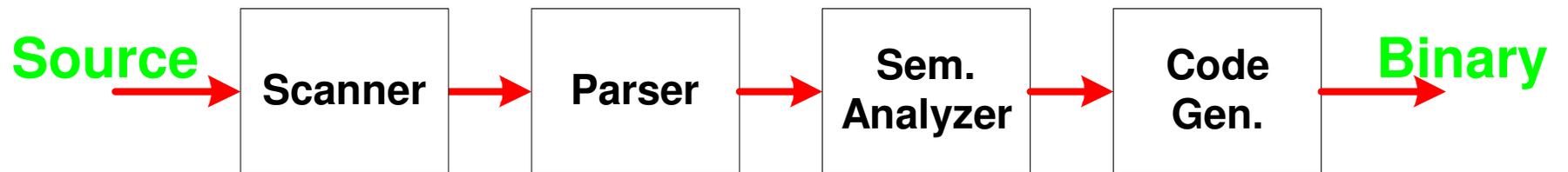
Reference Architecture Benefits

- Documents existing well-proven designs
- Helps build complex systems
- Provides a common vocabulary
- Aids in the comparison of different architectures in the same domain
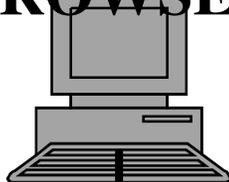- Improves code reuse

Paper Overview

- We present:
  - A process to derive a reference architecture by non-domain experts
  - A reference architecture for web servers
  - Mapping it to different product architectures
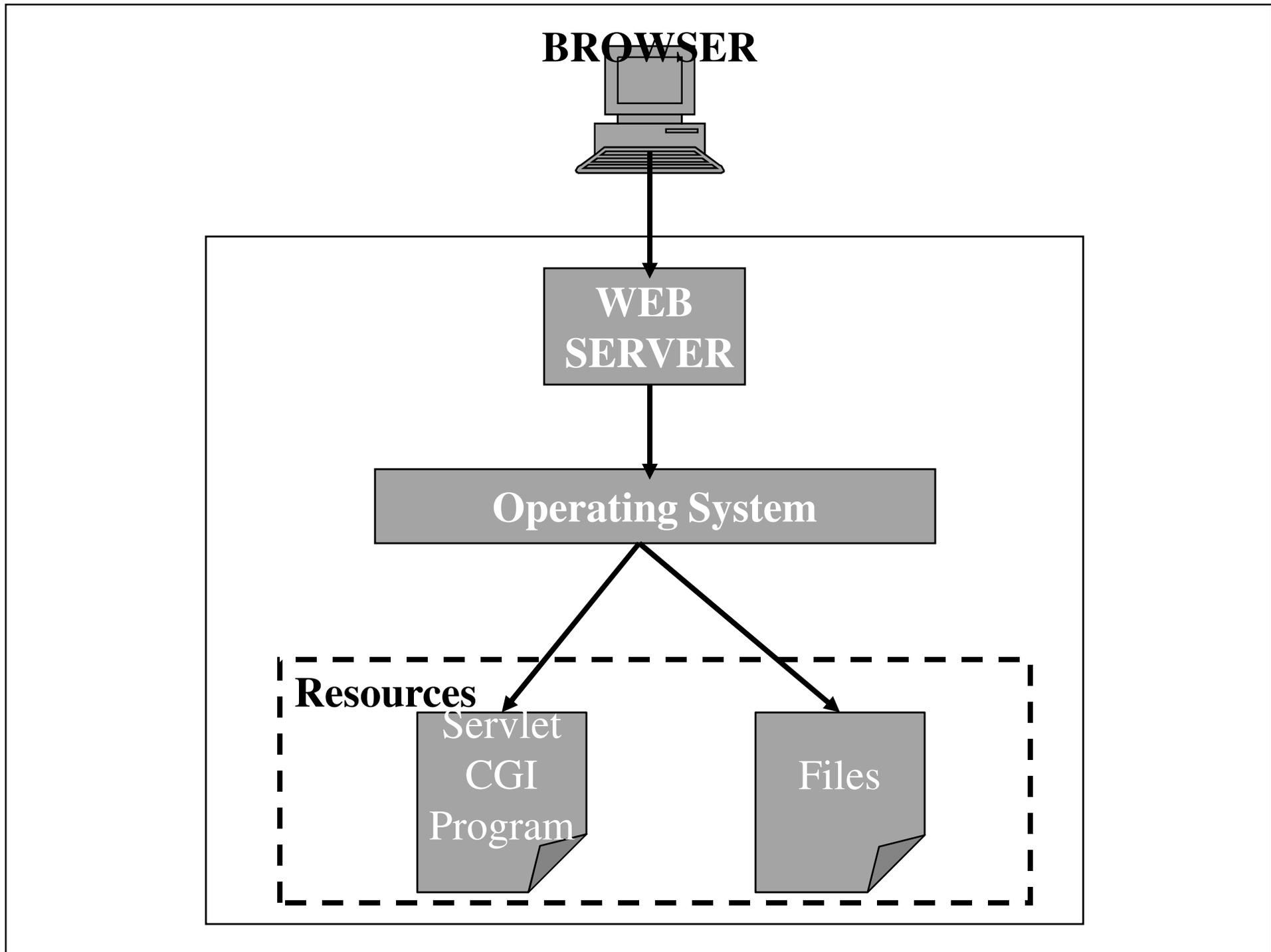
The Web Server Domain

BROWSER

WEB SERVER

Operating System

Resources

Servlet CGI Program

Files

Web Servers

- Apache
- Microsoft - IIS
- Netscape - iPlanet Server
- AOL Server
- Jigsaw

Summary: 3 Servers

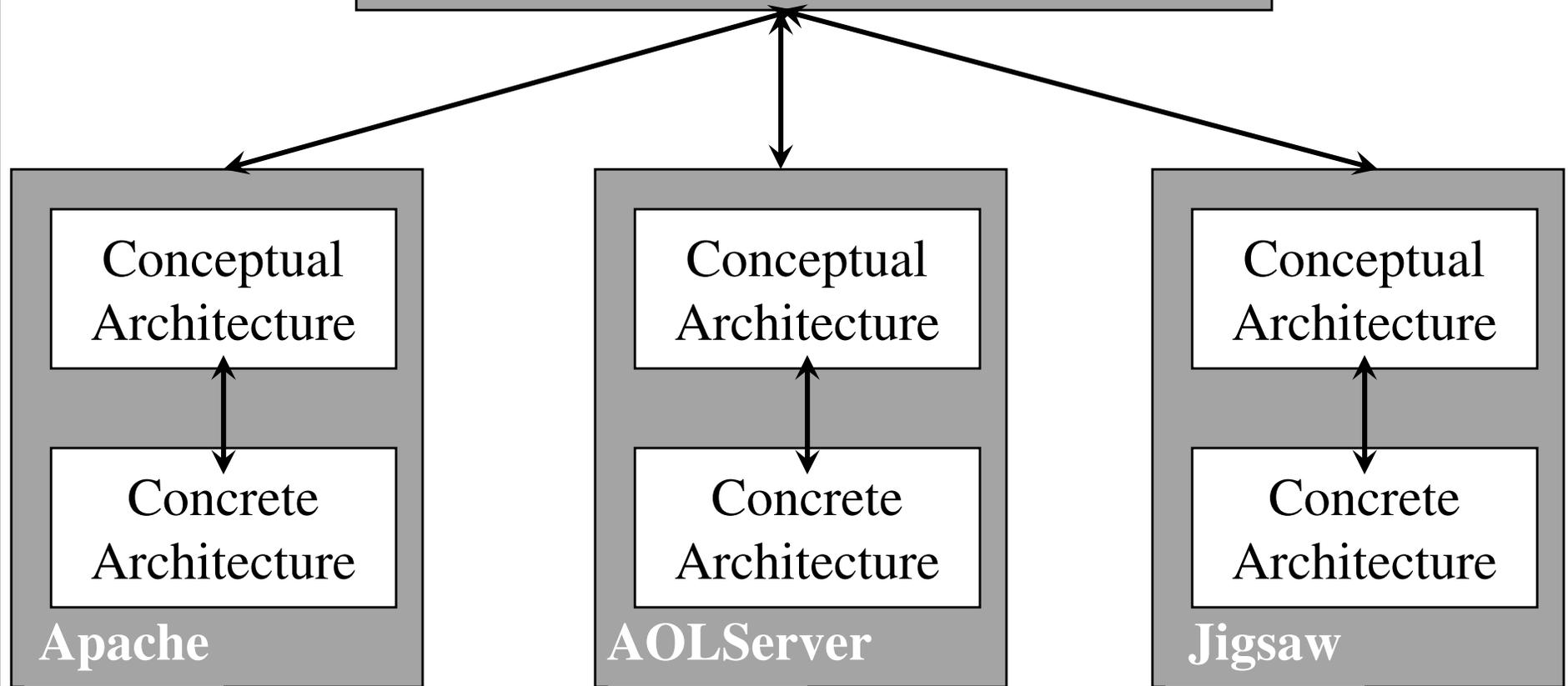| Web Server	Main arch.	Dev type	1st release	Code size (KLOC)	Lang.	Arch. stable
Apache	Robert Thau	Open source	April 1995	80	C	5 yrs
AOL Server	-	Commercial	May 1995	164	C & TCL	-
Jigsaw	Yves Lafon	Experimental	May 1996	106	Java	2.5 yrs

Conceptual vs. Concrete Architecture

- Conceptual Architecture:
  - Resides in the head(s) of the developer(s)
  - Mental model: incomplete, inaccurate, ideal
- Concrete Architecture:
  - Extracted from the system's implementation
  - Many mismatches with the conceptual architecture

Process for Deriving Ref. Arch.

Reference Architecture for Web Servers

Apache

Conceptual Architecture

Concrete Architecture

AOLServer

Conceptual Architecture

Concrete Architecture

Jigsaw

Conceptual Architecture

Concrete Architecture

Web Server Reference Architecture

Reception

Request Analysis

Record Transaction

Access Control

Resource Handler

Util

Operating System Abstraction Layer

Web Server Reference Architecture

Control flow

All depend on
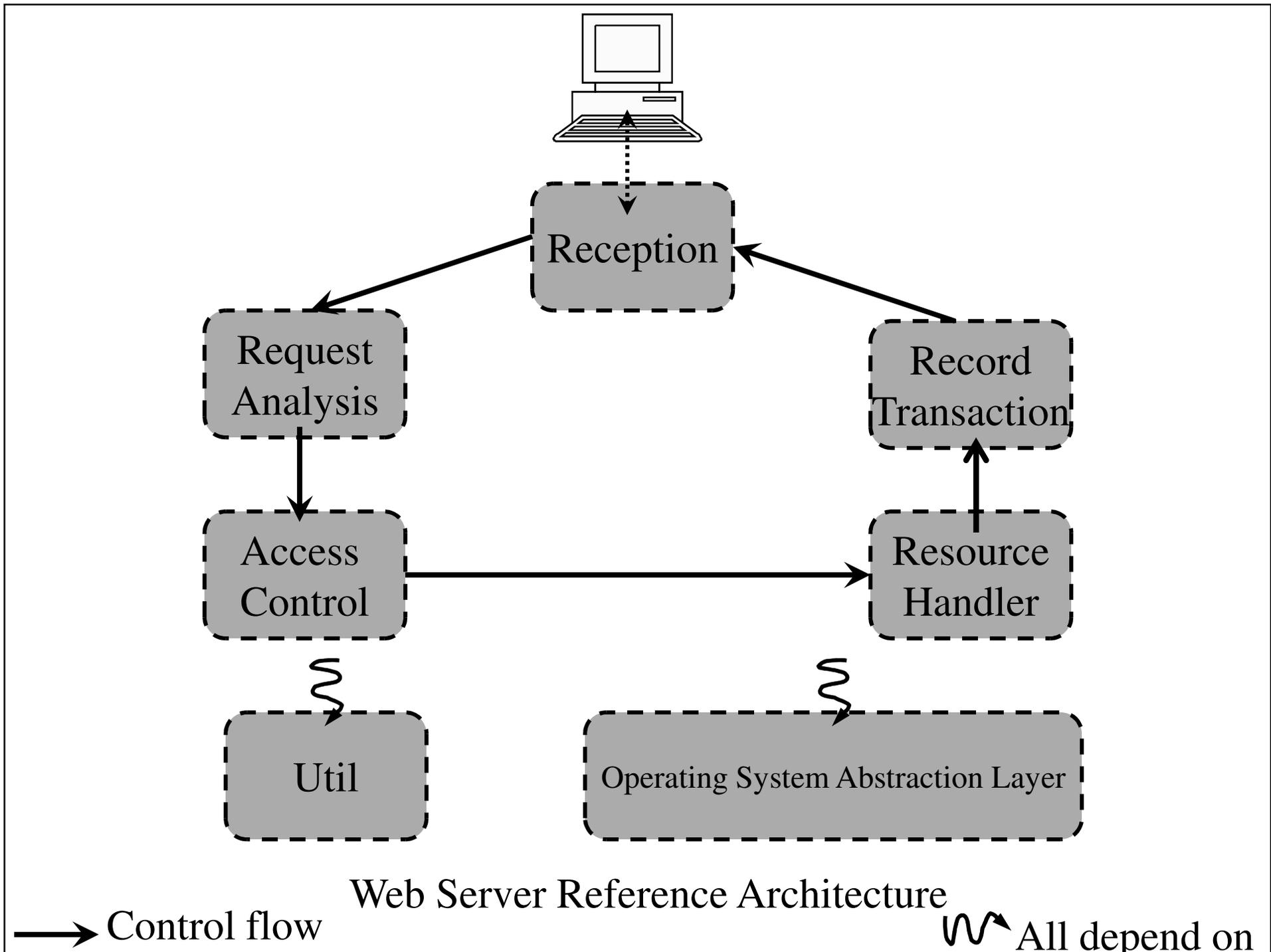
Mapping the Reference Architecture to a Web Server

The Apache Web Server

Recep.

Core

Req. Analysis.

Translation

Request Trans.

Logging

Access Ctrl.

Authen-
tication

Author-
ization

Req. Handler.

MIME
type

Response

Util

Util.

OS Layer

OSAL.
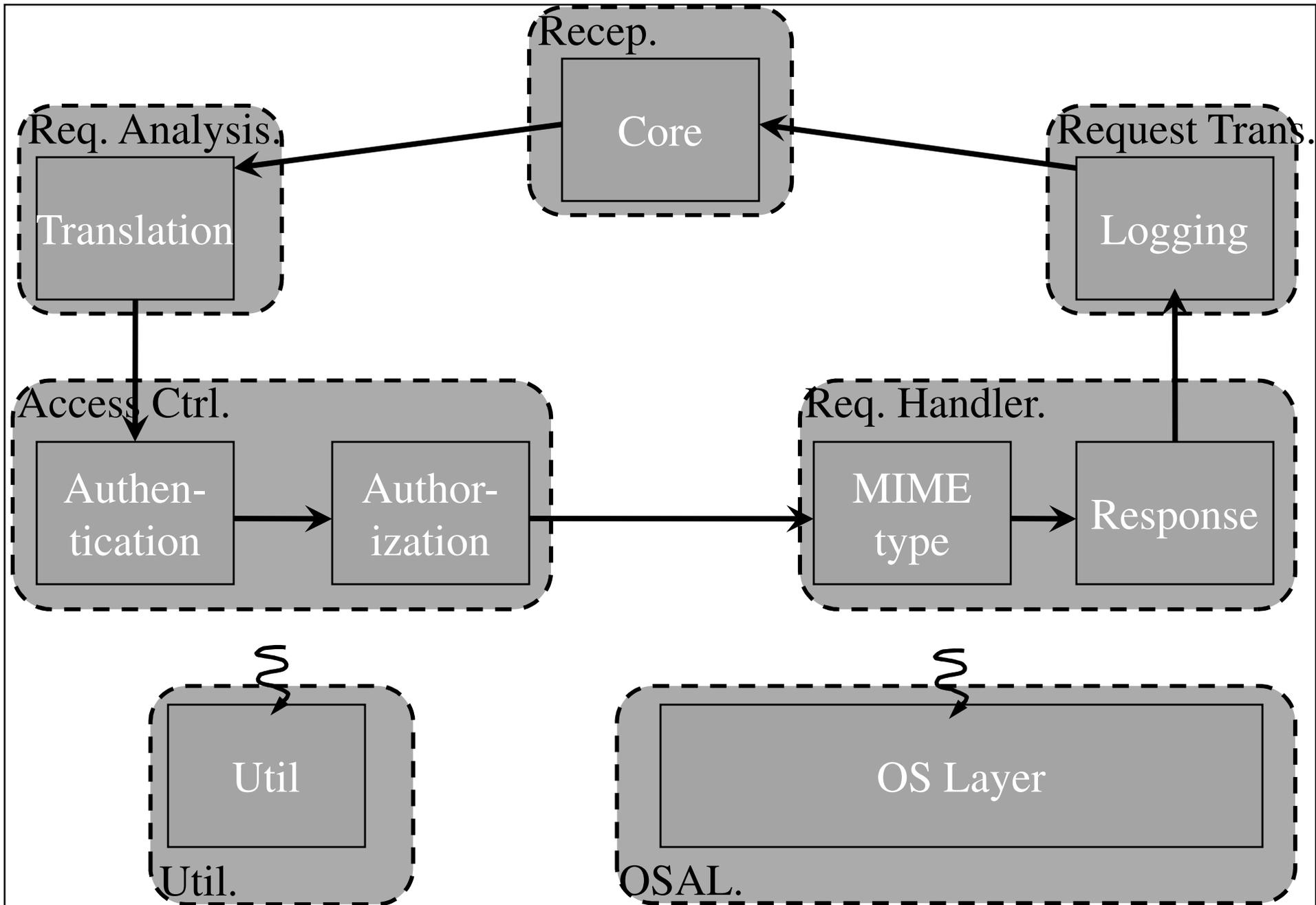
Apache Conceptual Architecture mapping

The AOL Web Server

Recep. & Req. Analysis.

Communication Driver

Daemon – Core

Access Ctrl.

NSPerm

Request Trans.

NSLog

Req. Handler.

URL Handle

Timer

Database Interface

Util

TCL Interpreter

Util.

NSThread

OSAL.

AOLServer Conceptual Architecture mapping
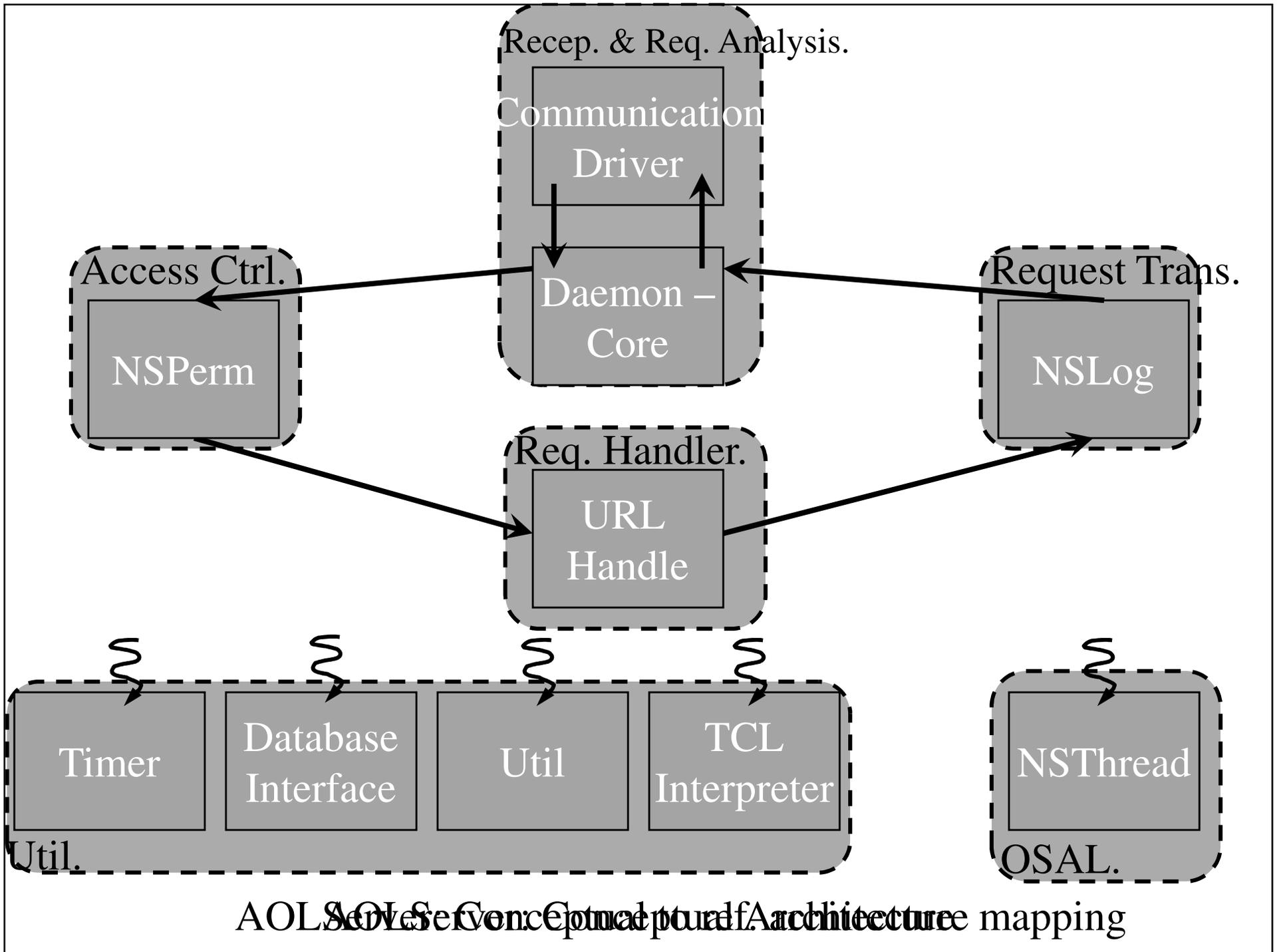
Mapping Summary

- Conceptual arch. of 3 servers maps nicely to ref. arch.

- Main differences are splitting and merging of subsystems

- The derived architecture is independent of development methodology

Conclusions

- Ref. arch.: Framework to assist in forward and reverse engineering

- Conceptual arch: Each server maps nicely to the derived reference architecture

- Needs more validation