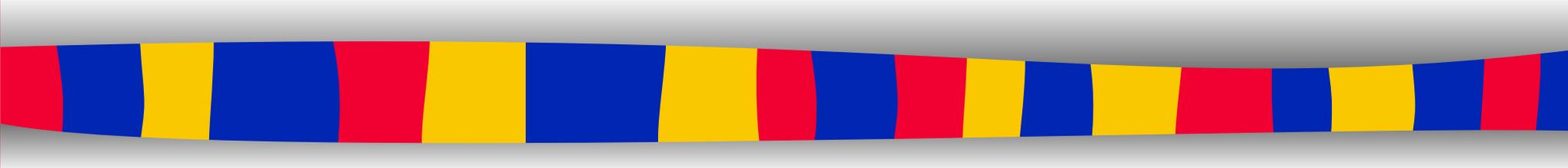


# CISC 326

## Game Architecture



### Module 6: Reference Architectures (Web Servers and Web Browsers)

**Ahmed E. Hassan**

# A Reference Architecture for Web Servers

**Ahmed Hassan and Richard Holt**



**Software Architecture Group**

**University of Waterloo**

**CANADA**

# Reference Architecture

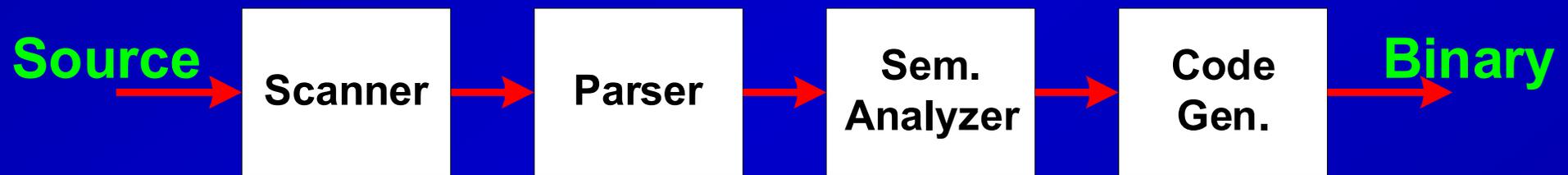
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- Architecture template for software systems in a domain
- A product architecture is an instantiation of the reference arch
- Defines the fundamental components and the relations between them
- Well known for mature domain (eg. Compilers, Operating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



# Compiler Ref. Arch.

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# Reference Architecture Benefits

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- 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

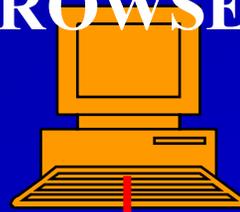
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- We present:
  - A process to derive a reference architecture by non-domain experts
  - A reference architecture for web servers
  - Mapping it to different product architectures



# The Web Server Domain

**BROWSER**



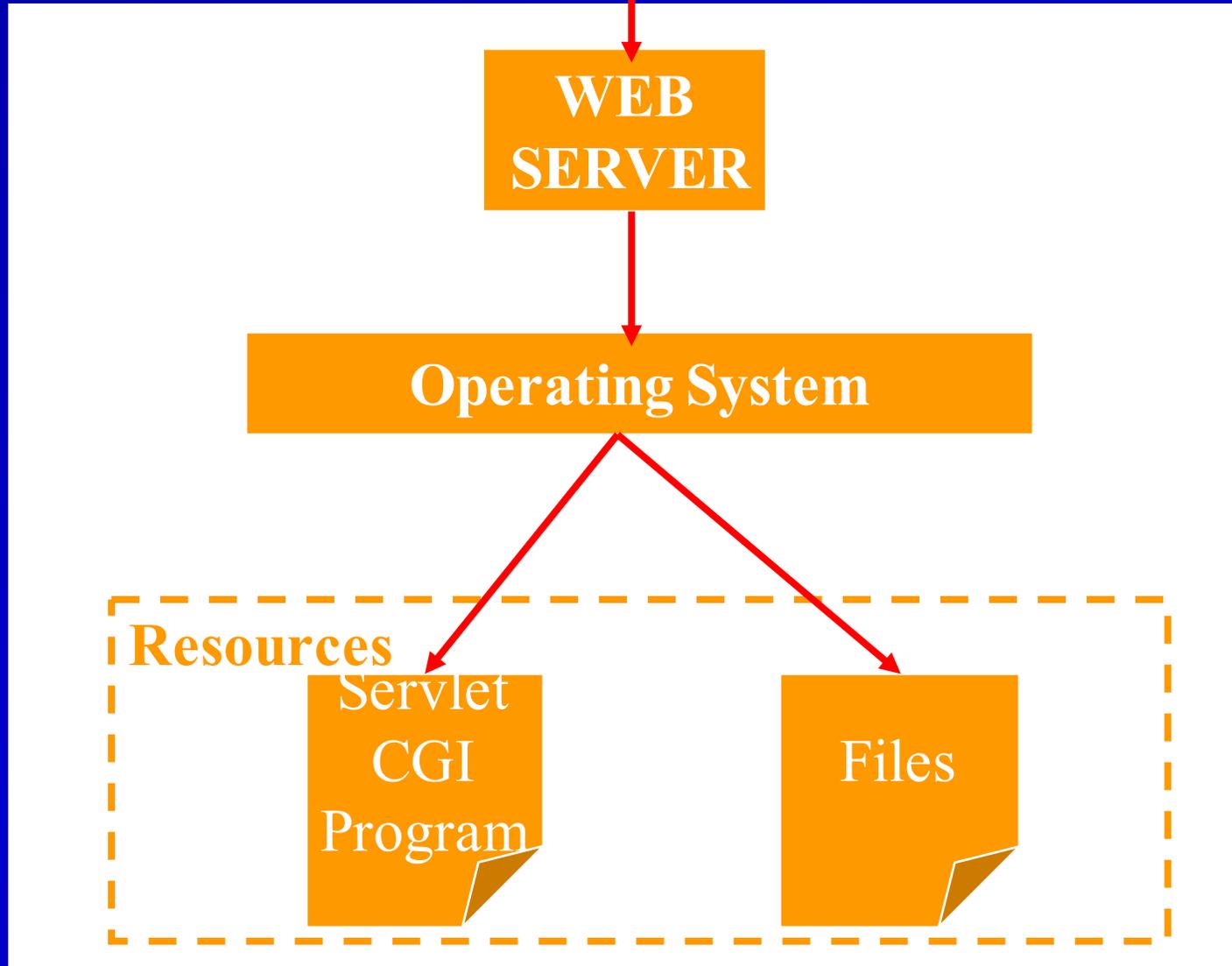
**WEB  
SERVER**

**Operating System**

**Resources**

Servlet  
CGI  
Program

Files



# Web Servers

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



# Summary: 3 Servers

Web Server	Main arch.	Dev type	1 <sup>st</sup> 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

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- **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

Conceptual  
Architecture

Concrete  
Architecture

Apache

Conceptual  
Architecture

Concrete  
Architecture

AOLServer

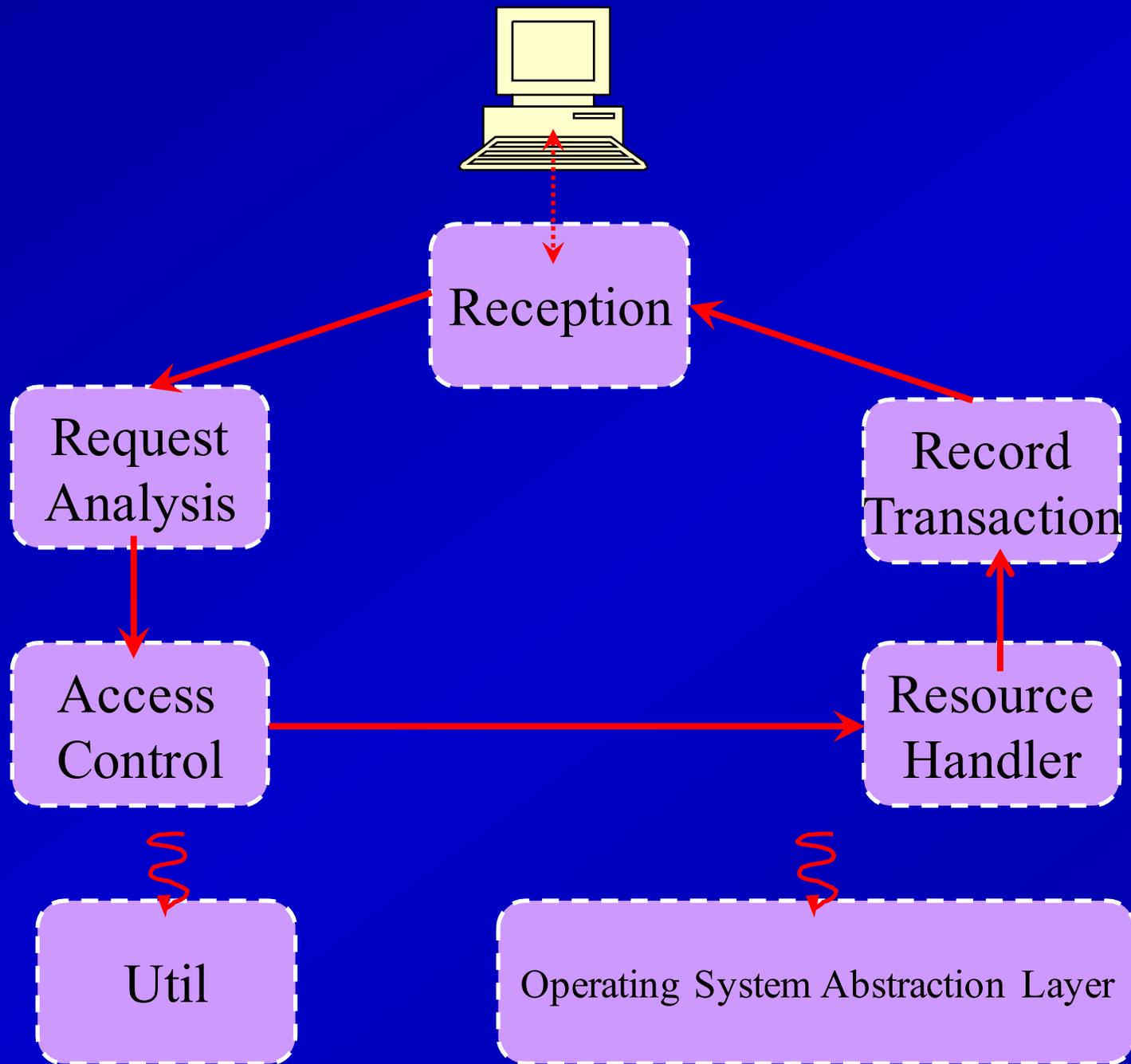
Conceptual  
Architecture

Concrete  
Architecture

Jigsaw



# Web Server Reference Architecture



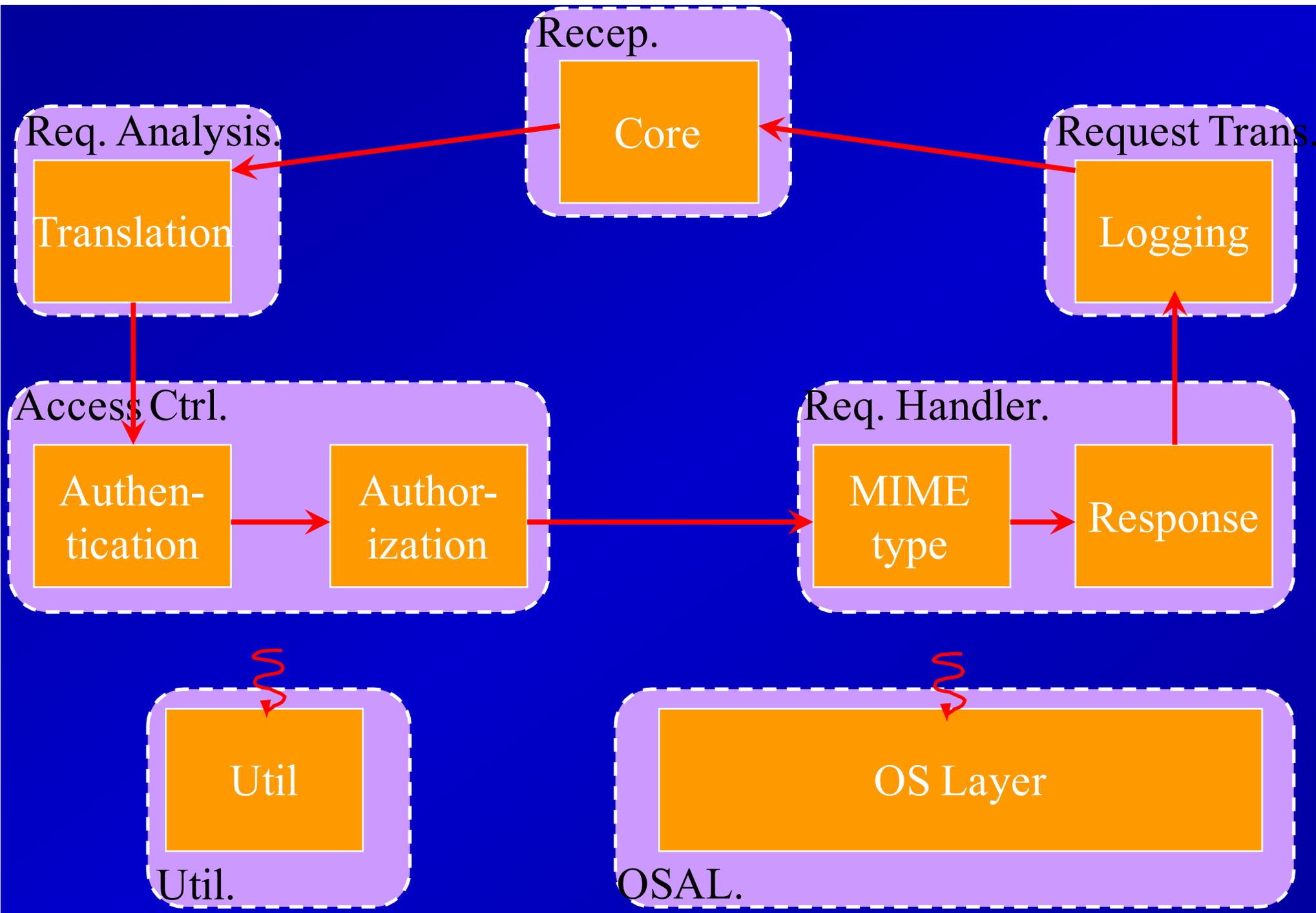
## Web Server Reference Architecture

→ Control flow

~ All depend on

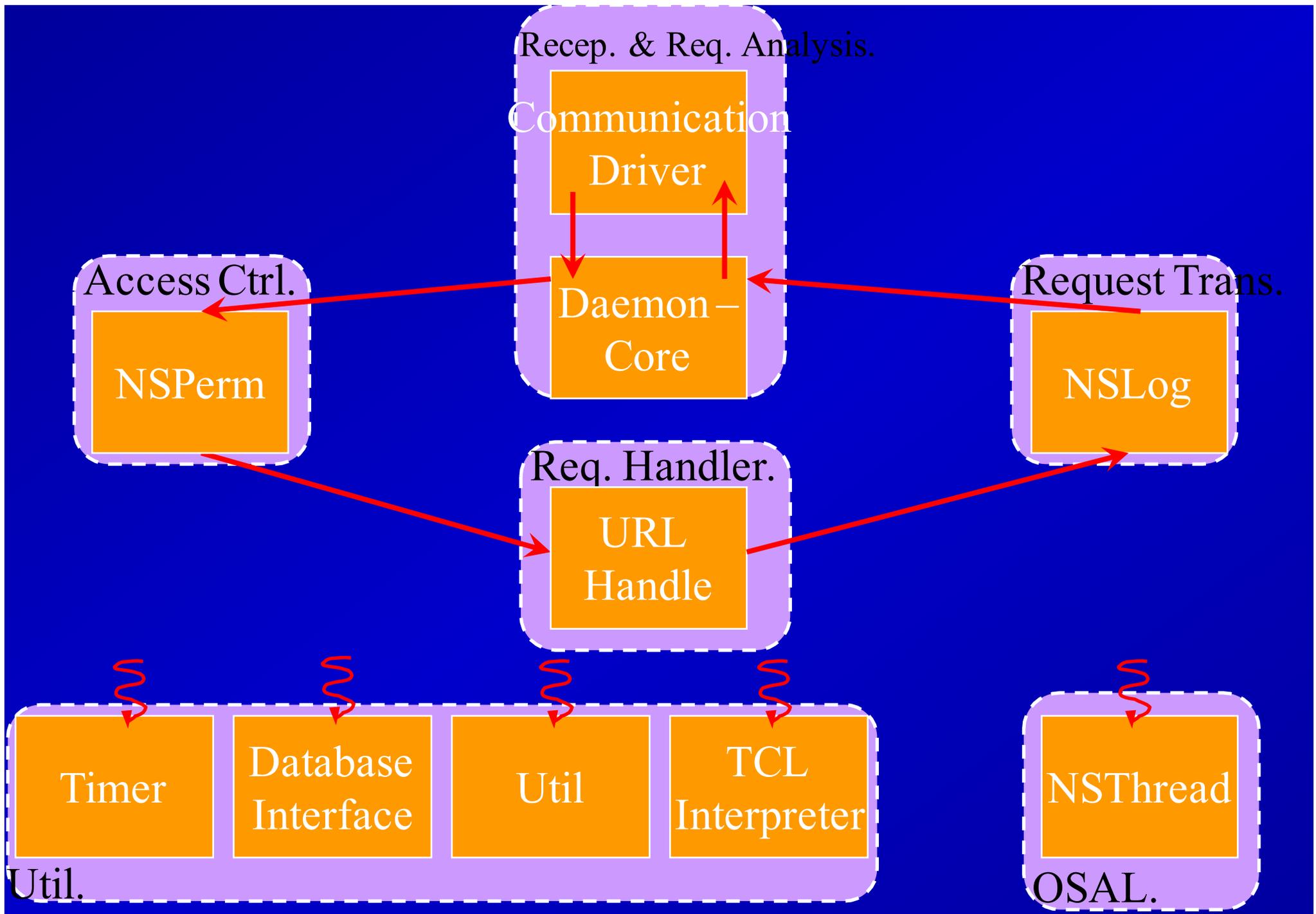
# Mapping the Reference Architecture to a Web Server

# The Apache Web Server



Apache Conceptual Architecture Mapping

# The AOL Web Server



AOL Server Conceptual Architecture mapping

# Mapping Summary

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- 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



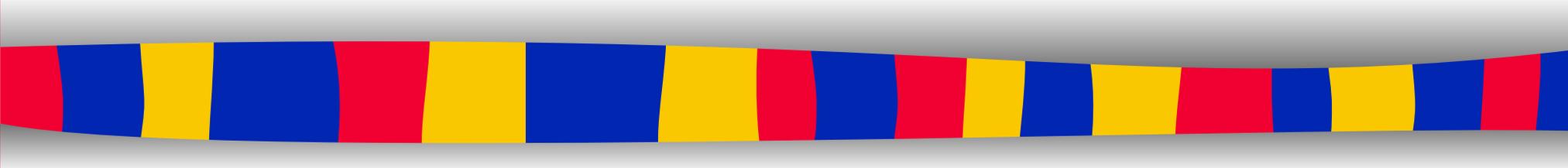
# Conclusions

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- Ref. arch.: Framework to assist in forward and reverse engineering
- Conceptual arch: Each server maps nicely to the derived reference architecture
- Needs more validation



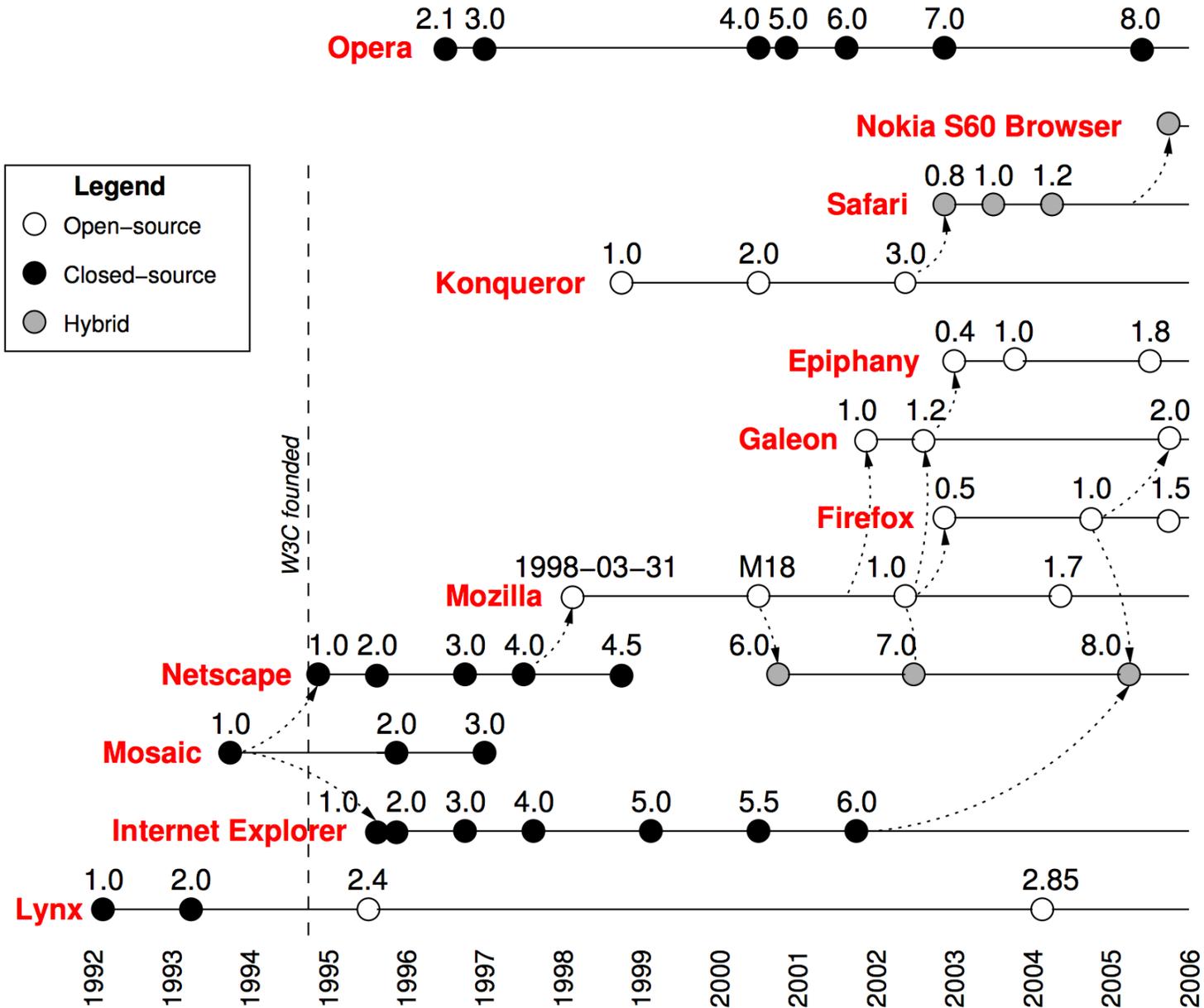
# Reference Architectures for Web Browsers



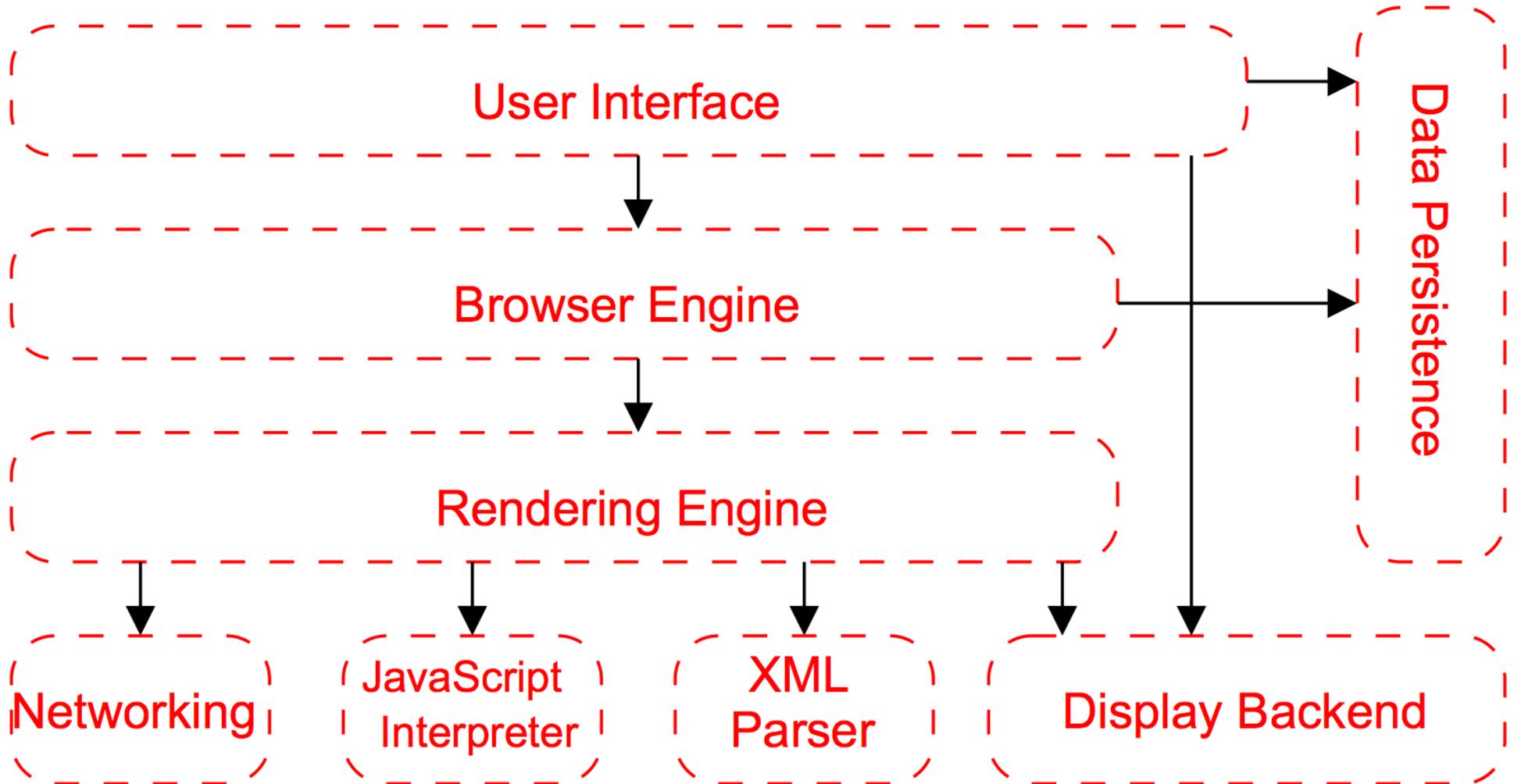
**A Case Study in Architectural  
Analysis: The Evolution of the  
Modern Web Browser**

**Alan Grosskurth and Michael W.  
Godfrey**

# History of Web Browsers



# Reference Architecture

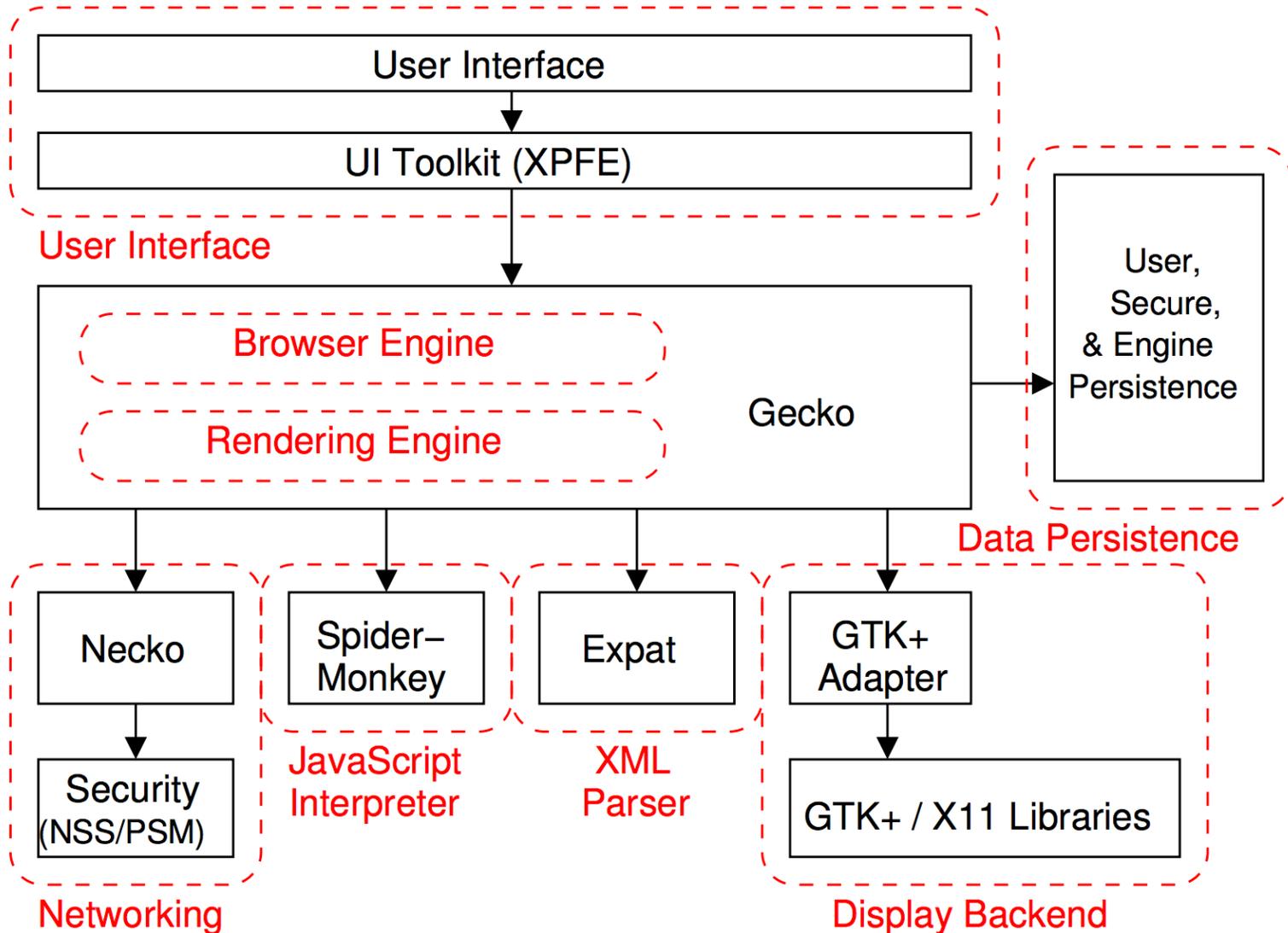


# Studied Browsers

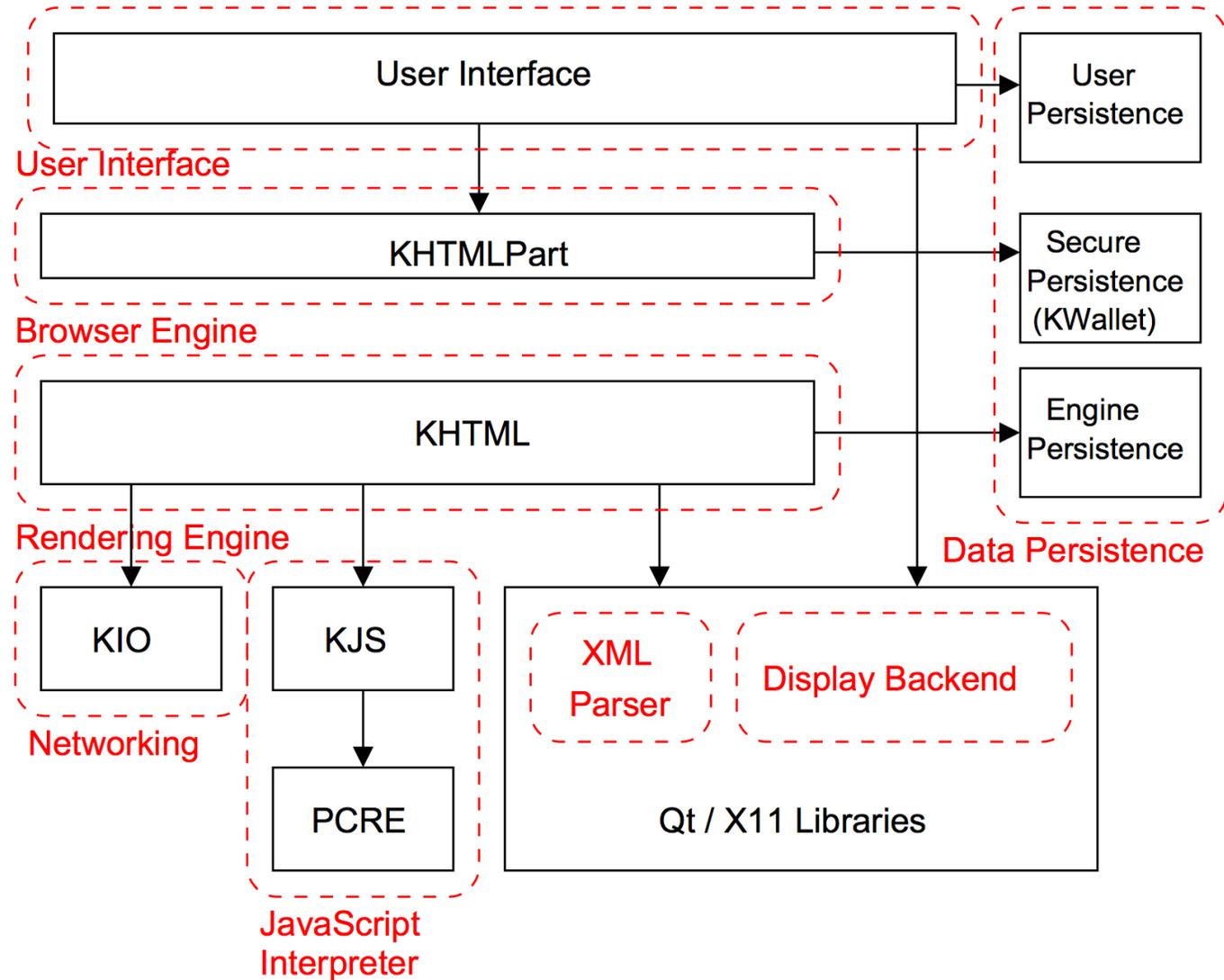
Table 1: Approximate web browser statistics

Project	Version	Language	Files	kLOC	Start
Mozilla	1.7.3	C++, C	10,700	2,400	1998
Konqueror	3.3.2	C++	3,150	600	1996
Epiphany	1.4.6	C++, C	7,230	1,540	2000
Safari	1.2	C++, Obj C	> 1,550	>230	2003
Lynx	2.8.5	C	200	120	1989
Mosaic	2.7b6	C	295	88	1993
Firefox	1.0	C++, C	10,700	2,400	2002

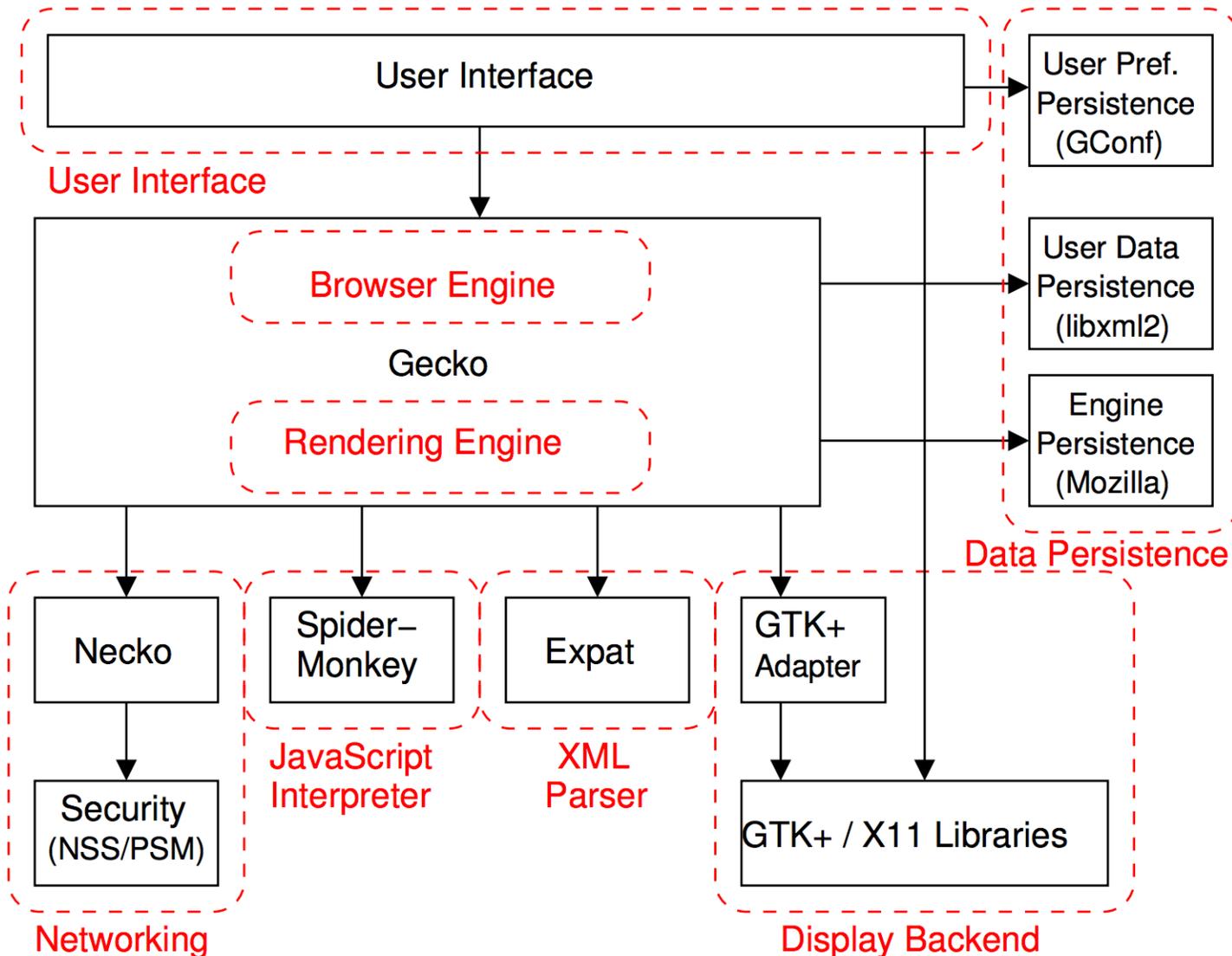
# Mozilla



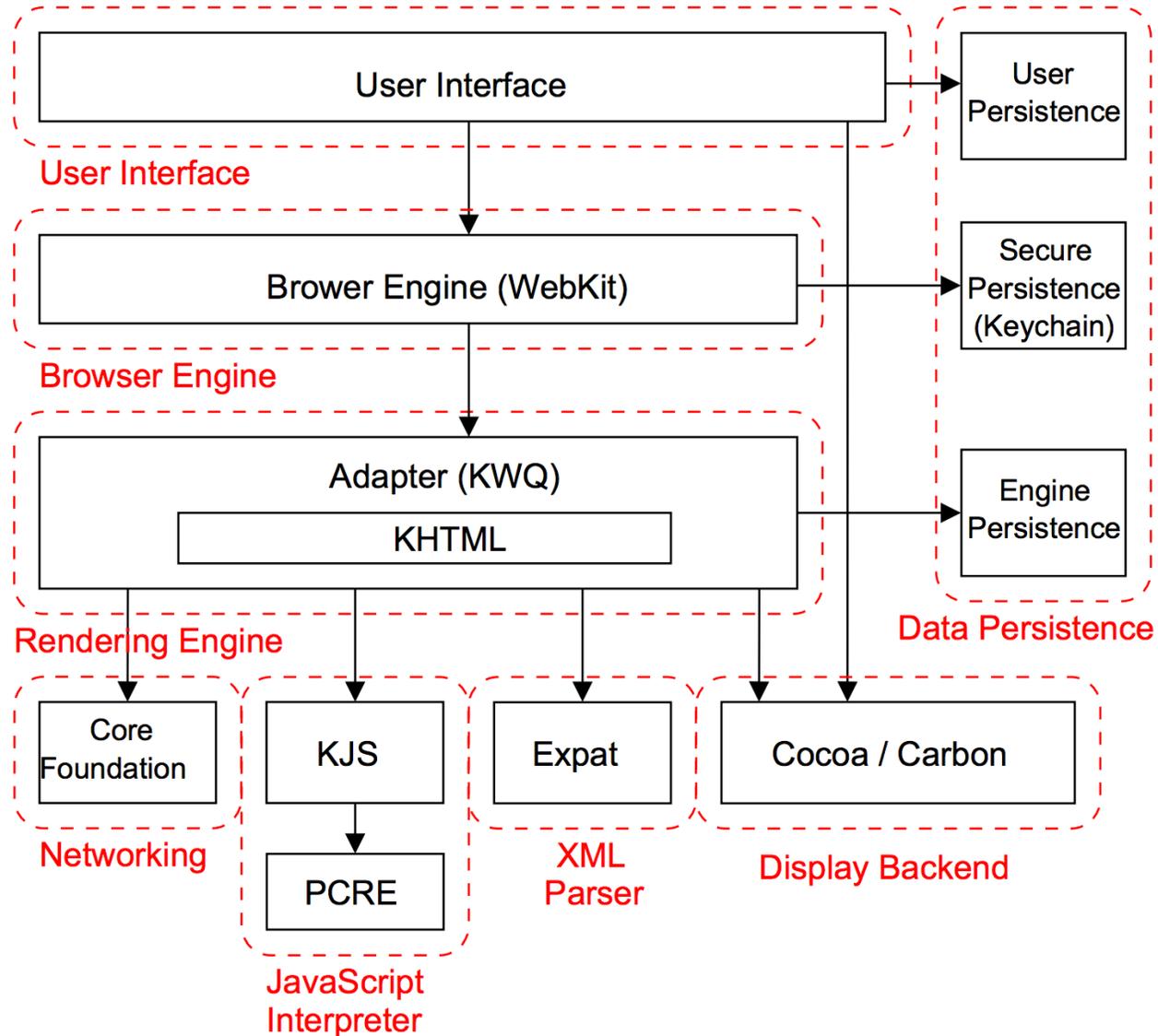
# Konqueror



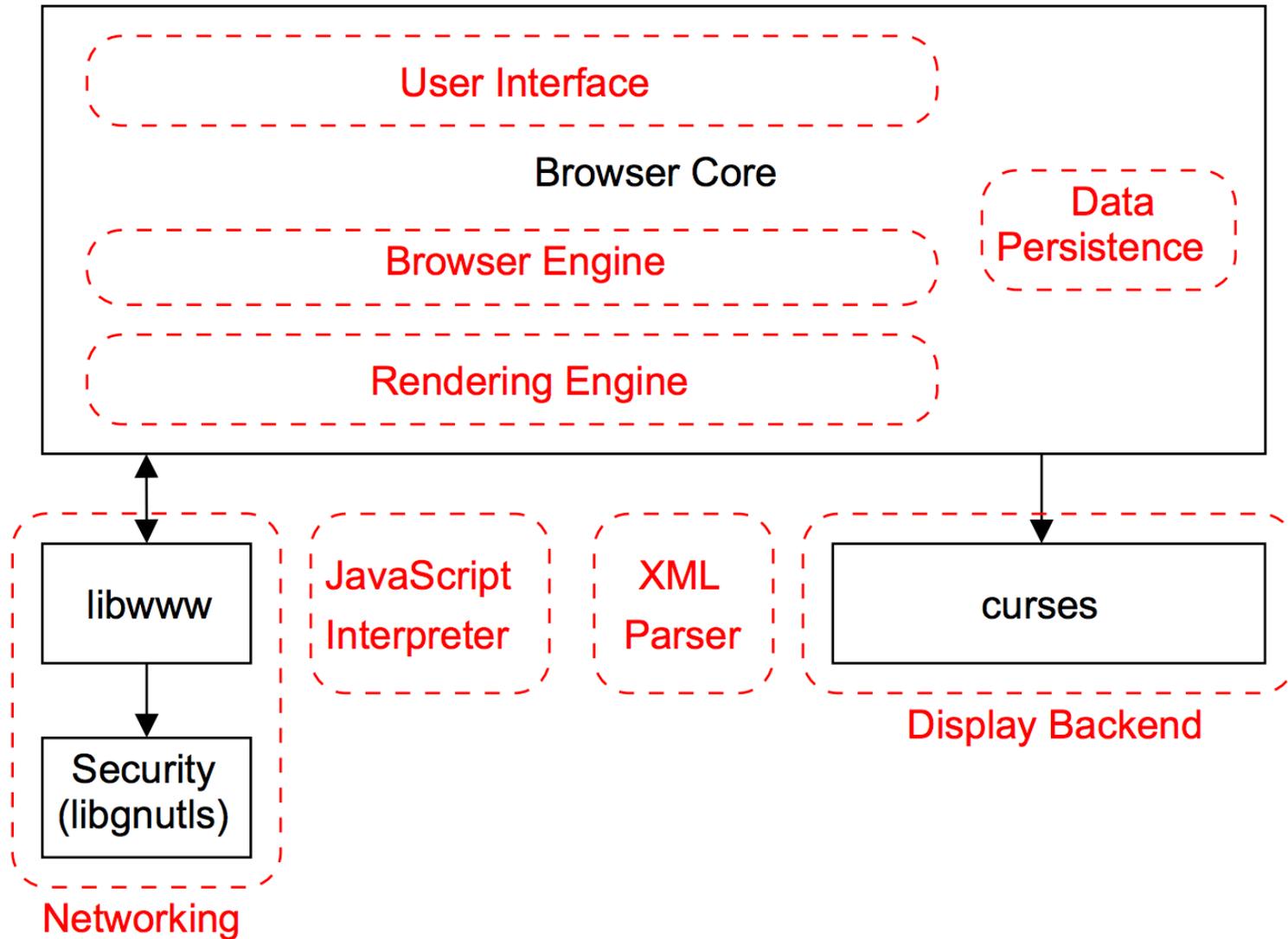
# Epiphany



# Safari



# Lynx



# Mosaic

