Open Source Ecosystems:
Challenges and Opportunities

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Overview

- Definition of terms (for this presentation)
- Personal history of OSS ecosystem studies
- OSS requirements practices and processes
- OSS role sets and role migration
- Component-based open architecture software systems

  - Intellectual property licenses

  - Cybersecurity

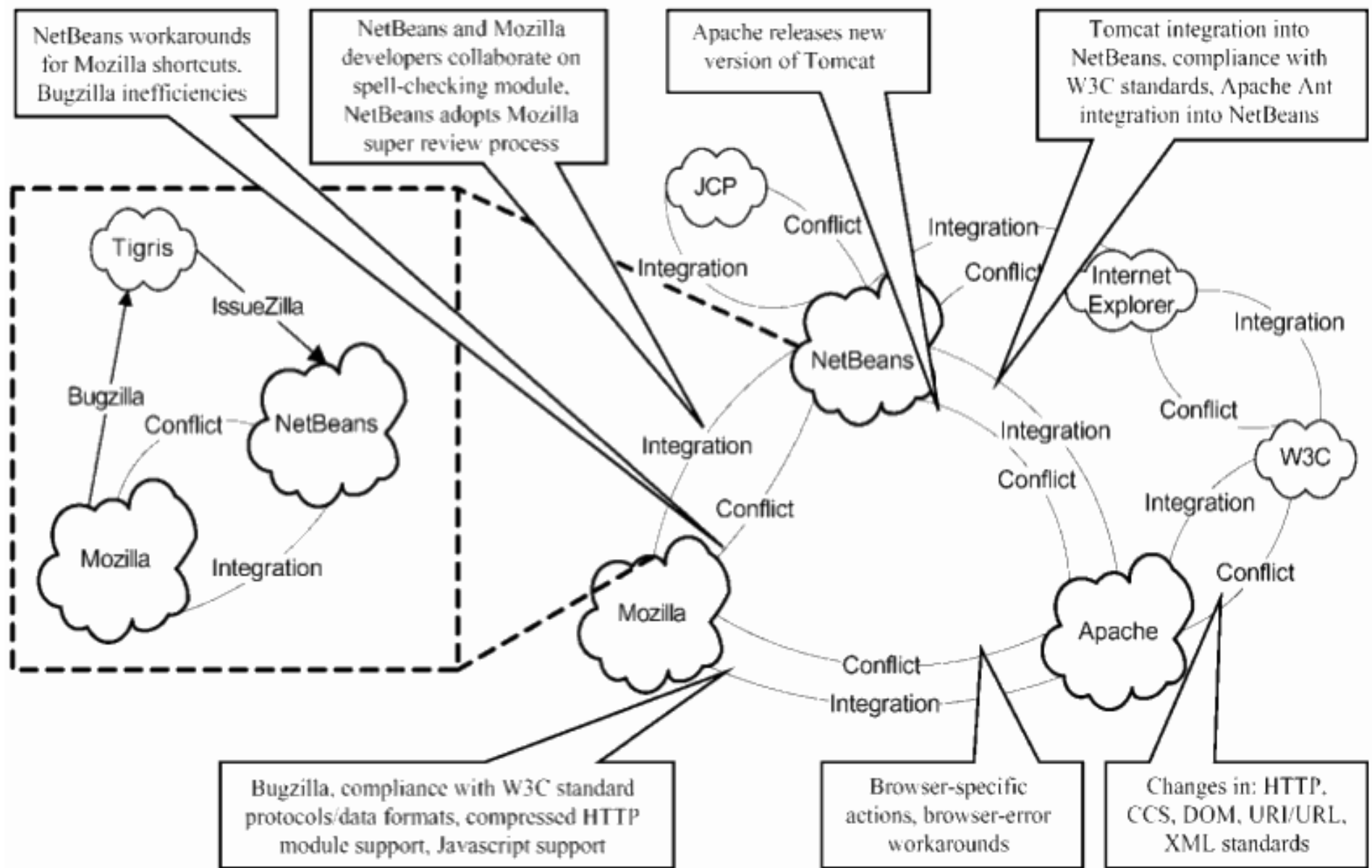- Conclusions

What is open source?

- Open source software (OSS) denotes specifications, representations, socio-technical processes, and multi-party coordination mechanisms in *human readable, computer processable* formats.

- Socio-technical control of OSS is elastic, negotiated, and amenable to decentralization.

- OSS development subsidized by participants.

What is a (software) ecosystem?

- An ecology of systems with diverse species juxtaposed in adaptive prey-predator food chain relationships.

- Economic network of processes that transform the flow of resources, enacted by actors in different roles, using tools, to produce products, services, or capabilities.

- Software supply network of component producers, system integrators, and consumers.

Personal History of OSS Ecosystem Studies

- 2000-2015 (60+ publications)
    - Computer games, defense, X-ray astronomy, Internet/Web infrastructure, bioinformatics, higher education, e-commerce, neuroscience, virtual reality.

- *Discovering* requirements practices and processes across OSS communities of practice.

- Participant *role sets*, *role migration*, and *social movements* within/across OSS projects.

- Open architecture (OA) systems with *heterogeneously licensed* components.
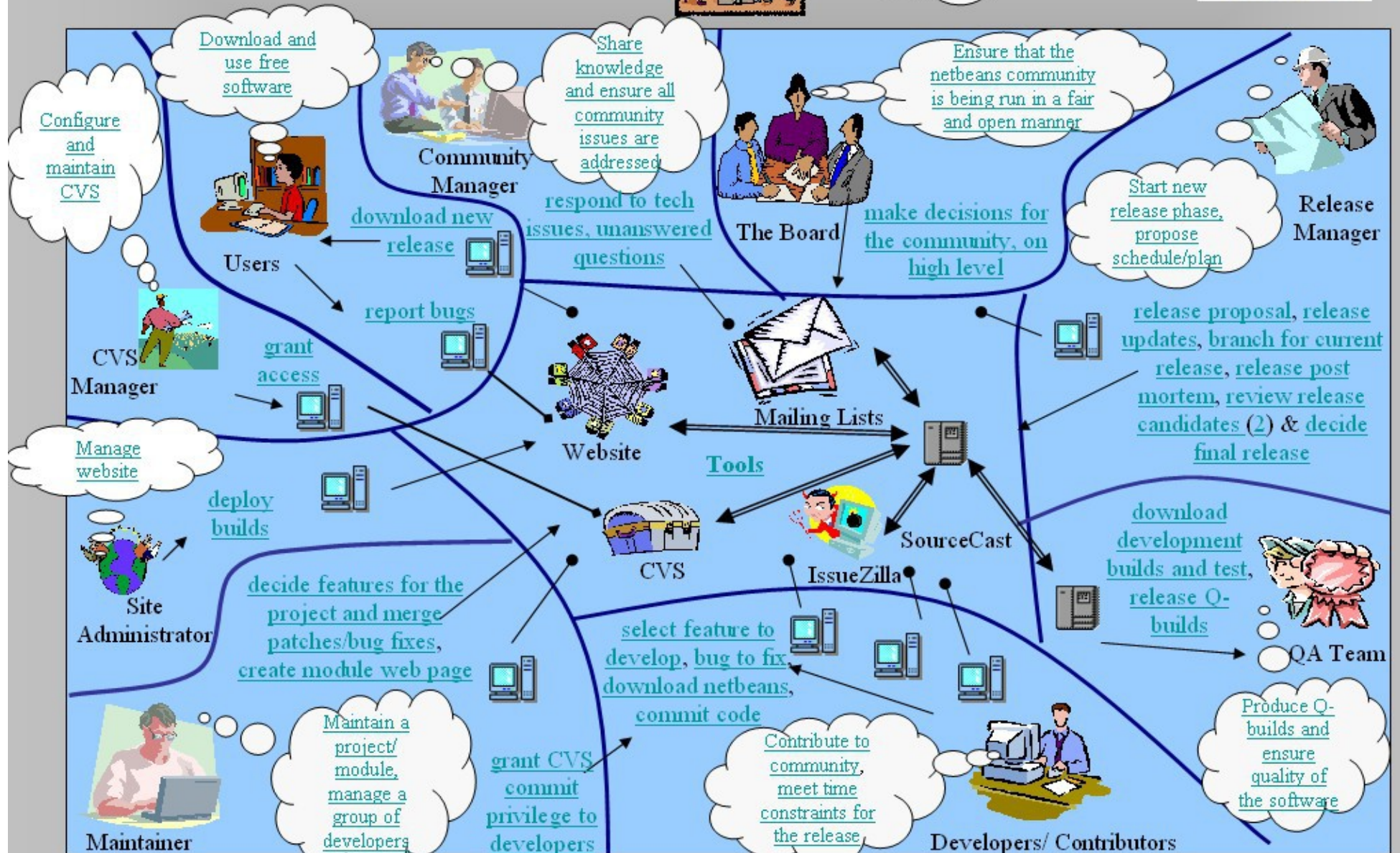
NetBeans workarounds for Mozilla shortcuts. Bugzilla inefficiencies

NetBeans and Mozilla developers collaborate on spell-checking module. NetBeans adopts Mozilla super review process

Apache releases new version of Tomcat

Tomcat integration into NetBeans, compliance with W3C standards, Apache Ant integration into NetBeans

Bugzilla, compliance with W3C standard protocols/data formats, compressed HTTP module support, Javascript support

Browser-specific actions, browser-error workarounds

Changes in: HTTP, CCS, DOM, URI/URL, XML standards

netBeans.org

Sun Microsystems

Funds, support, Promote Java/Open source

Sun microsystems — take it to the nth

Configure and maintain CVS

Download and use free software

Share knowledge and ensure all community issues are addressed

Ensure that the netbeans community is being run in a fair and open manner

Community Manager

The Board

Release Manager

Users

download new release

respond to tech issues, unanswered questions

make decisions for the community, on high level

Start new release phase, propose schedule/plan

report bugs

CVS Manager

grant access

Manage website

deploy builds

Website

Mailing Lists

Tools

release proposal, release updates, branch for current release, release post mortem, review release candidates (2) & decide final release

Site Administrator

decide features for the project and merge patches/bug fixes, create module web page

CVS

IssueZilla

SourceCast

download development builds and test, release Q-builds

QA Team

Maintain a project/ module, manage a group of developers

grant CVS commit privilege to developers

select feature to develop, bug to fix download netbeans, commit code

Contribute to community, meet time constraints for the release

Produce Q-builds and ensure quality of the software

Maintainer

Developers/ Contributors

Link to all Use Cases

Link to Tools

Links to all Agents

Legend: Boxes are *activities* (using *informalisms*); Ellipses are *resources* required or provided; Actor *roles* in boldface; *flow dependencies* as arrows.

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netbeans_req_release.pml (0)

Process: 0

/home/jnoll/projects/peos,
- ReviewNetBeans
- SetReleaseDate
- branch
  - ChangeBuildBranchNar
  - MakeInstallTarForEachl
  - UploadInstallTarFilesTo
  - UpdateWebPage
  - MakeReadmeInstallatior
  - SendReleaseNotificatior
  - ExecuteAutomaticTestS
  - ExecuteManualTestScri
  - iteration
    - ReportIssuesToIssuezi
    - UpdateStandingIssueS
  - PostBugStats
  - ExamineTestReport
  - WriteBugFix
  - VerifyBugFix
  - CommitCodeToCvsCod
  - UpdateIssuezillaToRefle
- iteration
  - ChangeBuildBranchNar
  - MakeInstallTarForEachl
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  - iteration
    - ReportIssuesToIssuezi
    - UpdateStandingIssueS
  - PostBugStats
  - ExamineTestReport

Issuezilla - Konqueror

Location Edit View Go Bookmarks Tools Settings Window Help

Location: http://www.netbeans.org/issues/query.cgi

netBeans.ORG

Downloads | Products | Plugins | Docs & Support | Community | About

USERNAME
PASSWORD   LOGIN

PRINTABLE VERSION

HOME > Community

Project Issue Tracking: netbeans.org

Issue   New | Query | Reports
Tracking:

Jump to Issue [   ]

Query   This page lets you search the database for recorded issues.

Issue type: **Component:**   **Subcomponent:**   **Submit query**

DEFECT   **UNCATEGORIZED**   *ALL*
ENHANCEMENT   3rd-party   *NEW*
FEATURE   a11y   accessibility
TASK   accelerators   actions
PATCH   ant   annotations
                 antlr   ant

Status: **Resolution:**   **Priority:**

UNCONFIRMED   FIXED   P1
NEW   INVALID   P2
STARTED   WONTFIX   P3
REOPENED   LATER   P4

IconW | 1 | 2 | 3 | 4 | jnoll@localhos... | Console | emacs@localh... | Peos | Konqueror | 17:42:57

Artifact ecologies and *repositories* enable collaboration in OSS development

Email lists	Discussion forum	News postings	Project digests
IM/Internet Relay Chat	Scenarios of usage	How-to guides	Screenshots
FAQs; to-do lists: item lists	Project Wikis	System documentation	External publications
Copyright licenses	Architecture diagrams	Intra-app scripting	Plug-ins
Code from other projects	Project Web site	Multi-project portals	Project source code
Project repositories	Software bug reports	Issue tracking databases	Blogs, videos, photos, etc.

A *meritocratic* role sets, role hierarchy, and role migration paths for OSSD
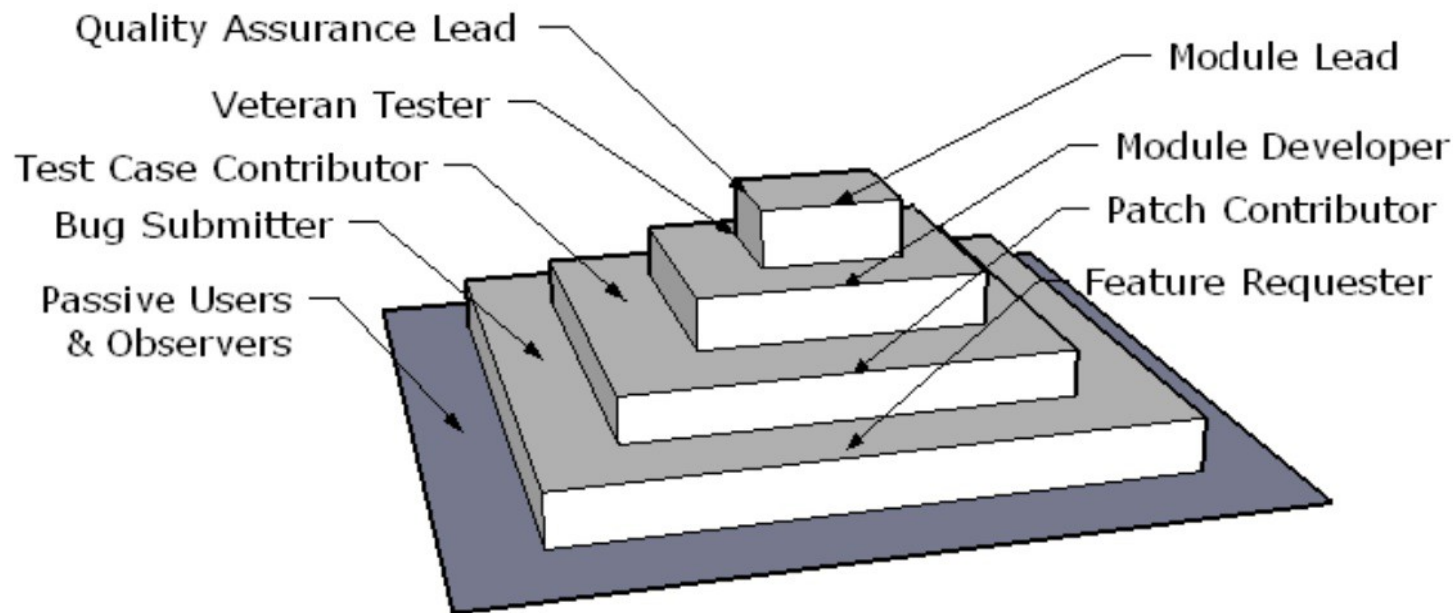
Figure 2. An "onion" pyramid representation of a generic OSSD project organizational hierarchy with multiple role-sets and advancement tracks.

OA software ecosystems
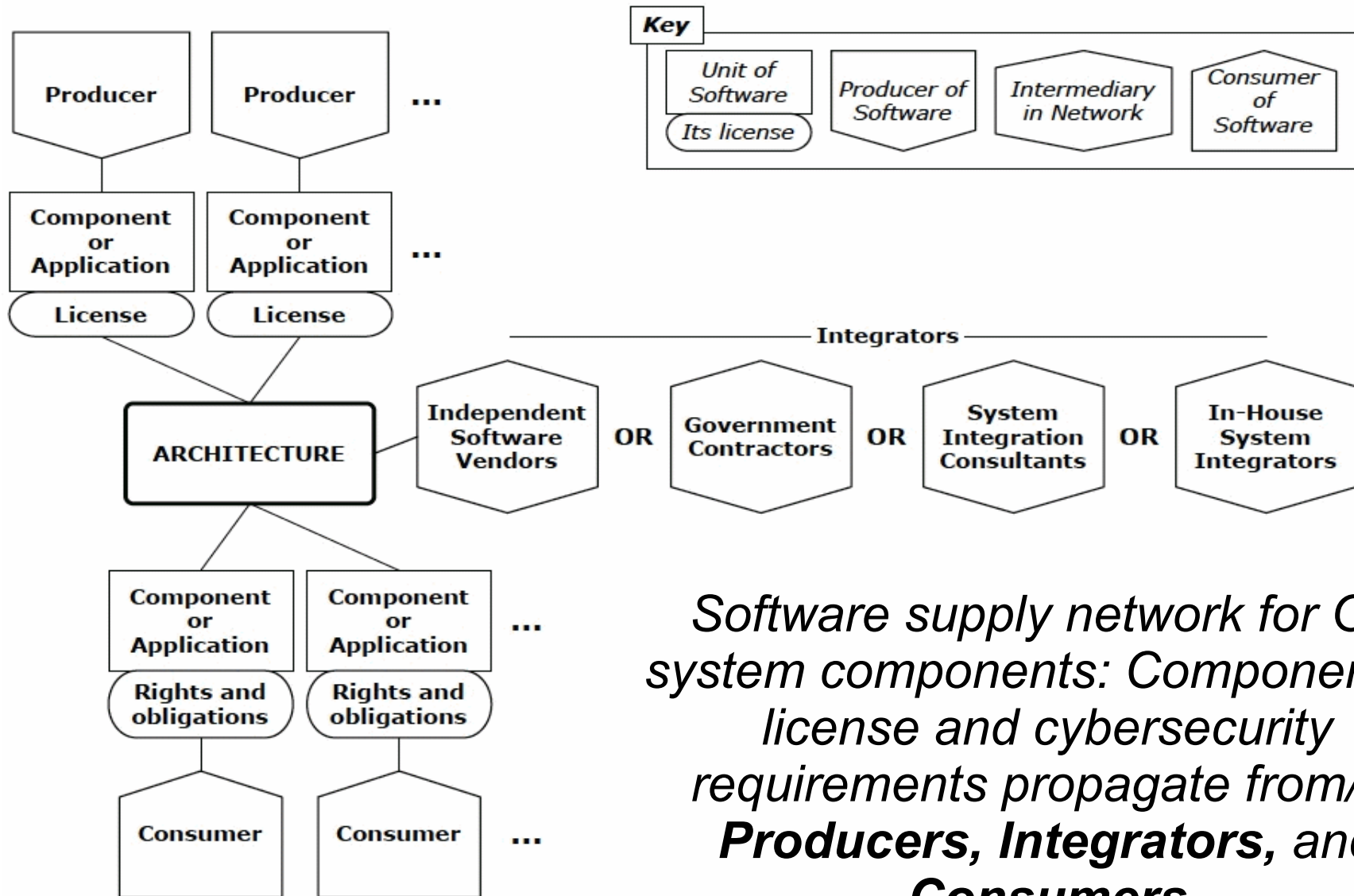
Software supply network for OA system components: Component IP license and cybersecurity requirements propagate from/to **Producers, Integrators,** and **Consumers**

OA development ecosystems
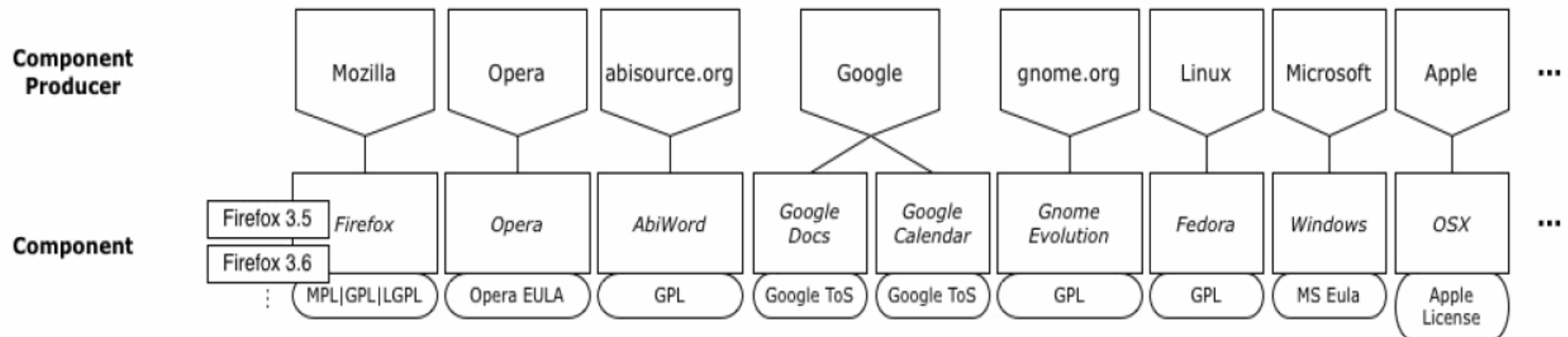
A sample elaboration of producers (vendors), software component applications, and IP licenses for OA system components.

Open Architectures, OSS, and OSS license analysis

- *Goal*: identify software architecture principles and IP licenses that mediate OA
- OSS elements subject to different IP licenses
- Govt/business policies and initiatives now encouraging OA with OSS elements
- How to determine the requirements needed to realize OA *strategies* with OSS?

Source: W. Scacchi and T. Alspaugh, Emerging Issues in the Acquisition of Open Source Software within the U.S. Department of Defense, *Proc. 5th Annual Acquisition Research Symposium*, Vol. 1, 230-244, NPS-AM-08-036, Naval Postgraduate School, Monterey, CA, 2008.
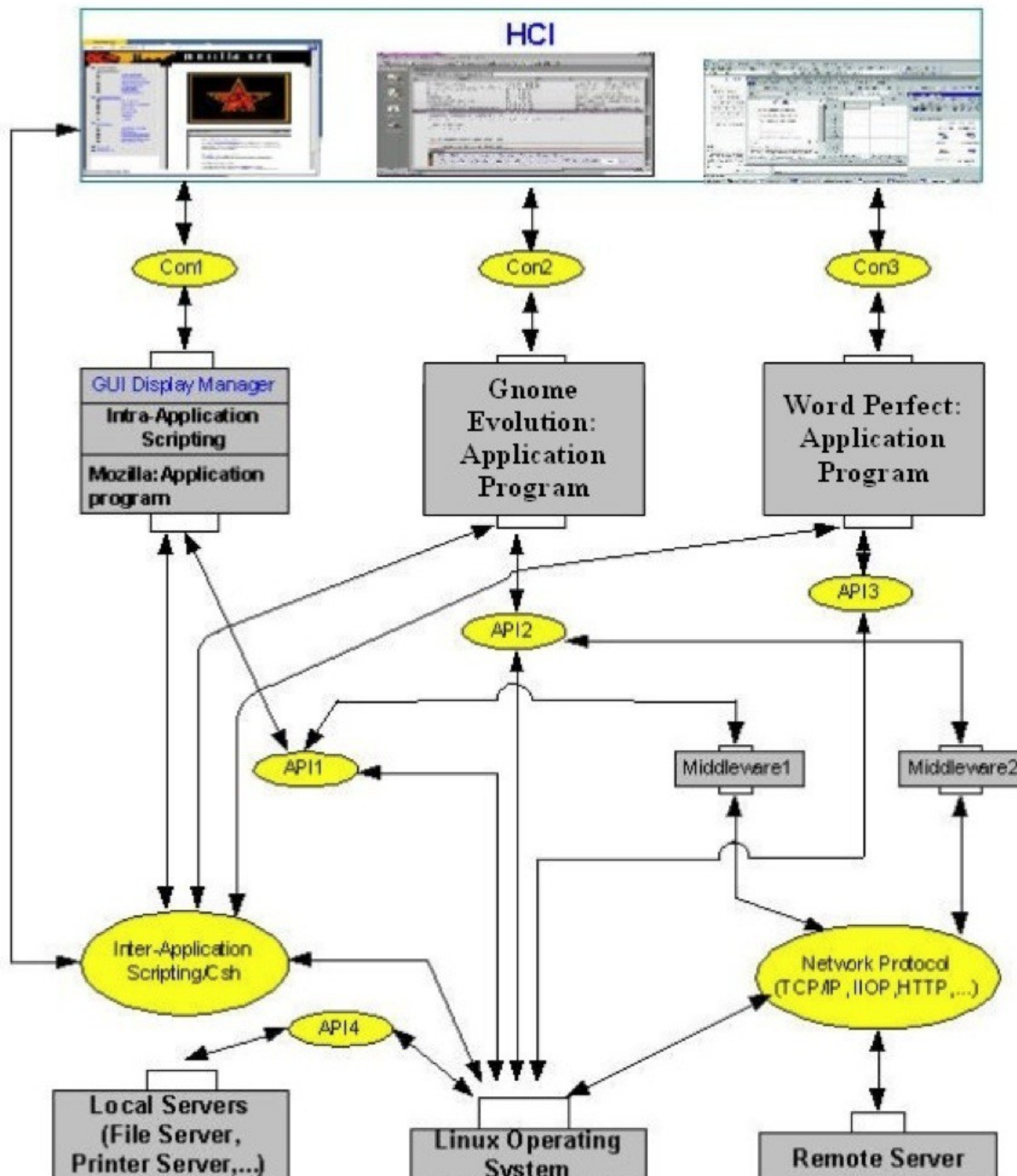
Legend: Grey boxes are *components;* ellipses are *connectors;* white boxes are *interfaces*; arrows are data or control *flow paths*; complete figure is architectural design *configuration*

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OSS elements subject to different IP/Security licenses

- Intellectual Property and Security licenses stipulate <u>rights</u> and <u>obligations</u> regarding use of the software components/systems

- How to determine which rights and obligations will apply to a component-based configured system?
  - At *design-time* (maximum flexibility)
  - At *integration build-time (*may/not be able to redistribute components at hand)
  - At *release deployment run-time* (may/not need to install/link-to components from other sources)

Source: T. Alspaugh, H. Asuncion, and W. Scacchi, Intellectual Property Rights Requirements for Heterogeneously Licensed Systems, in *Proc. 17th. Intern. Conf. Requirements Engineering (RE09)*, Atlanta, GA, 24-33, September 2009.

Design-time view of an OA system
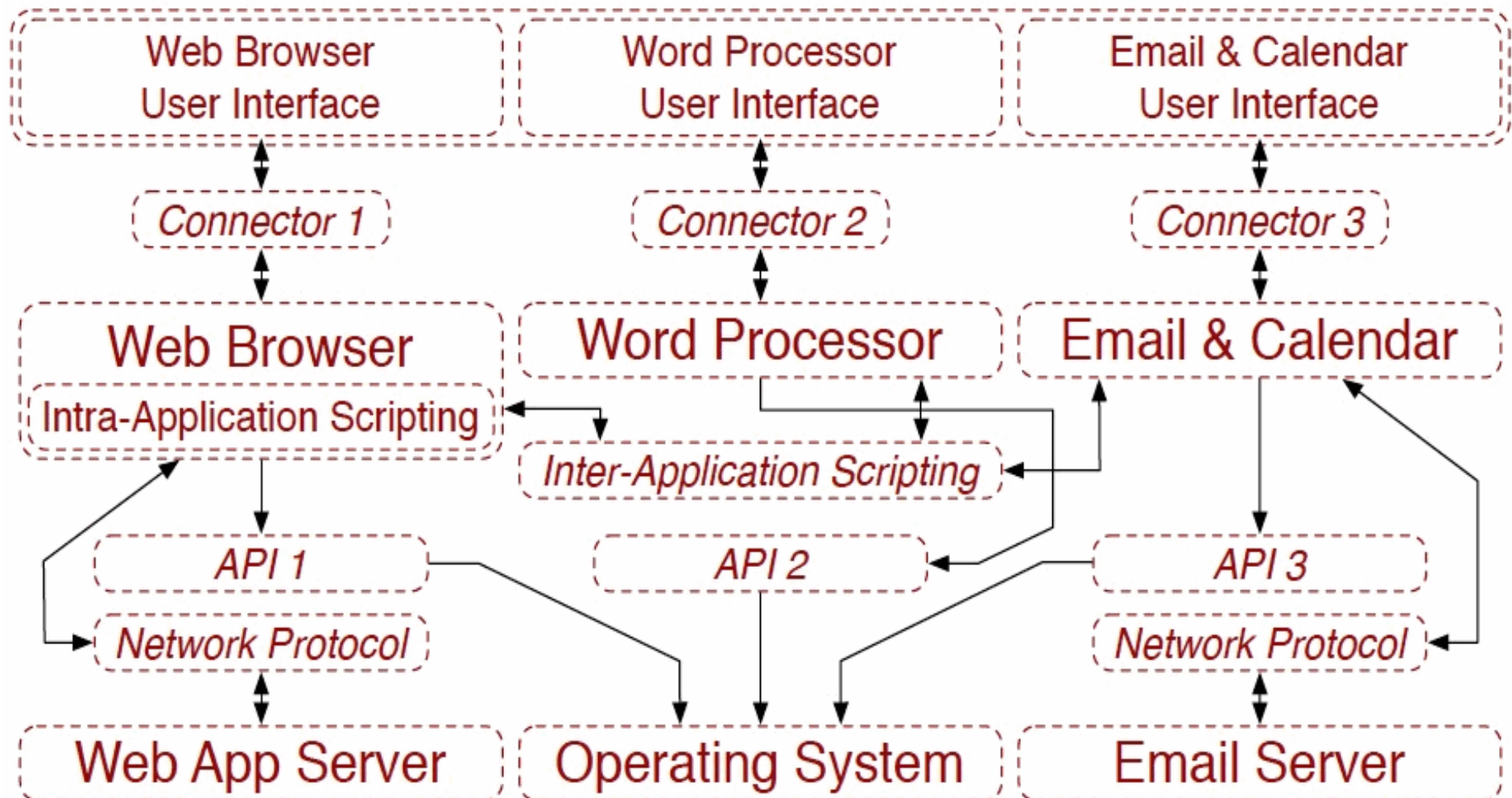
Software product line of *functionally similar* OA system alternatives
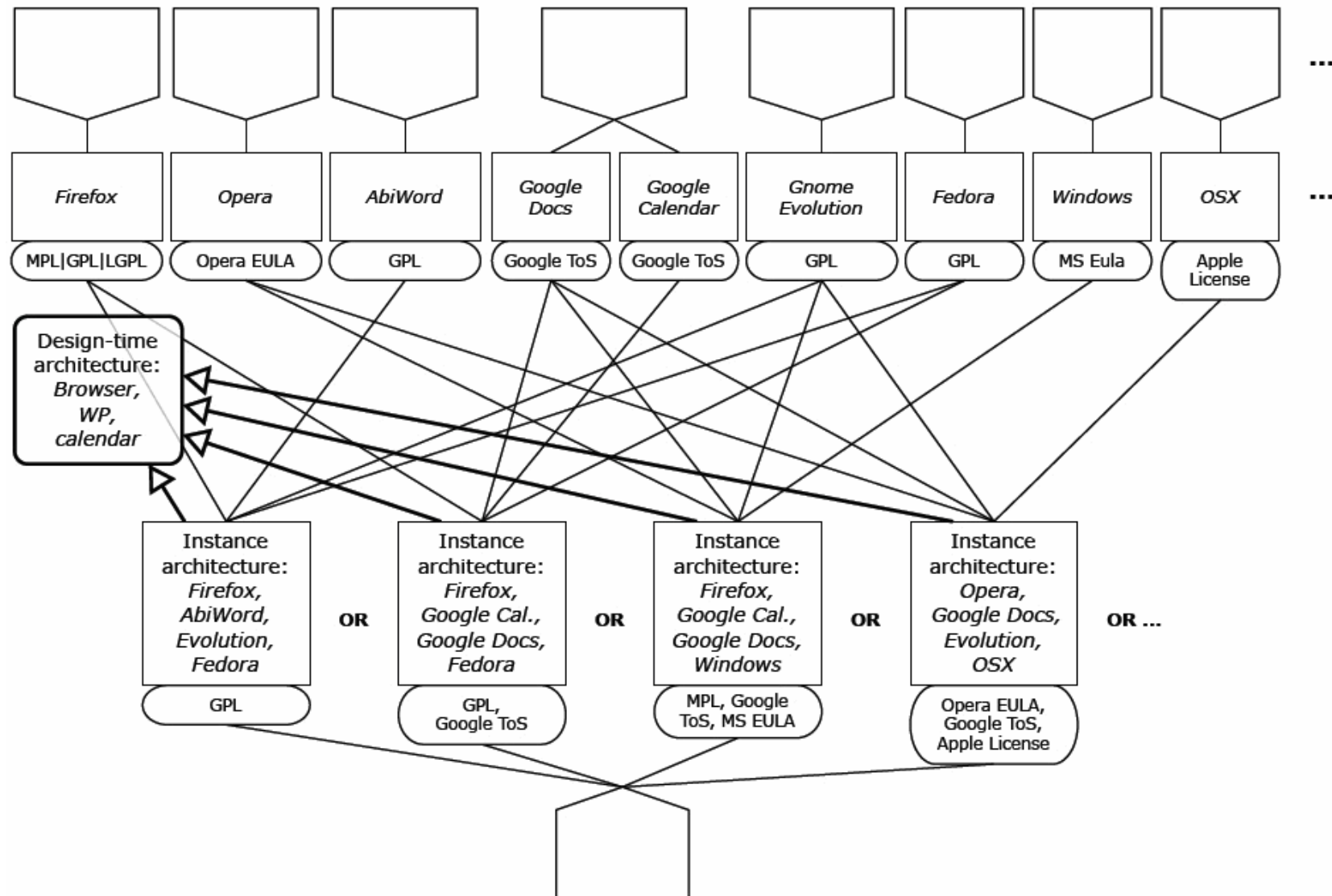
Product line selection of one alternative system configuration
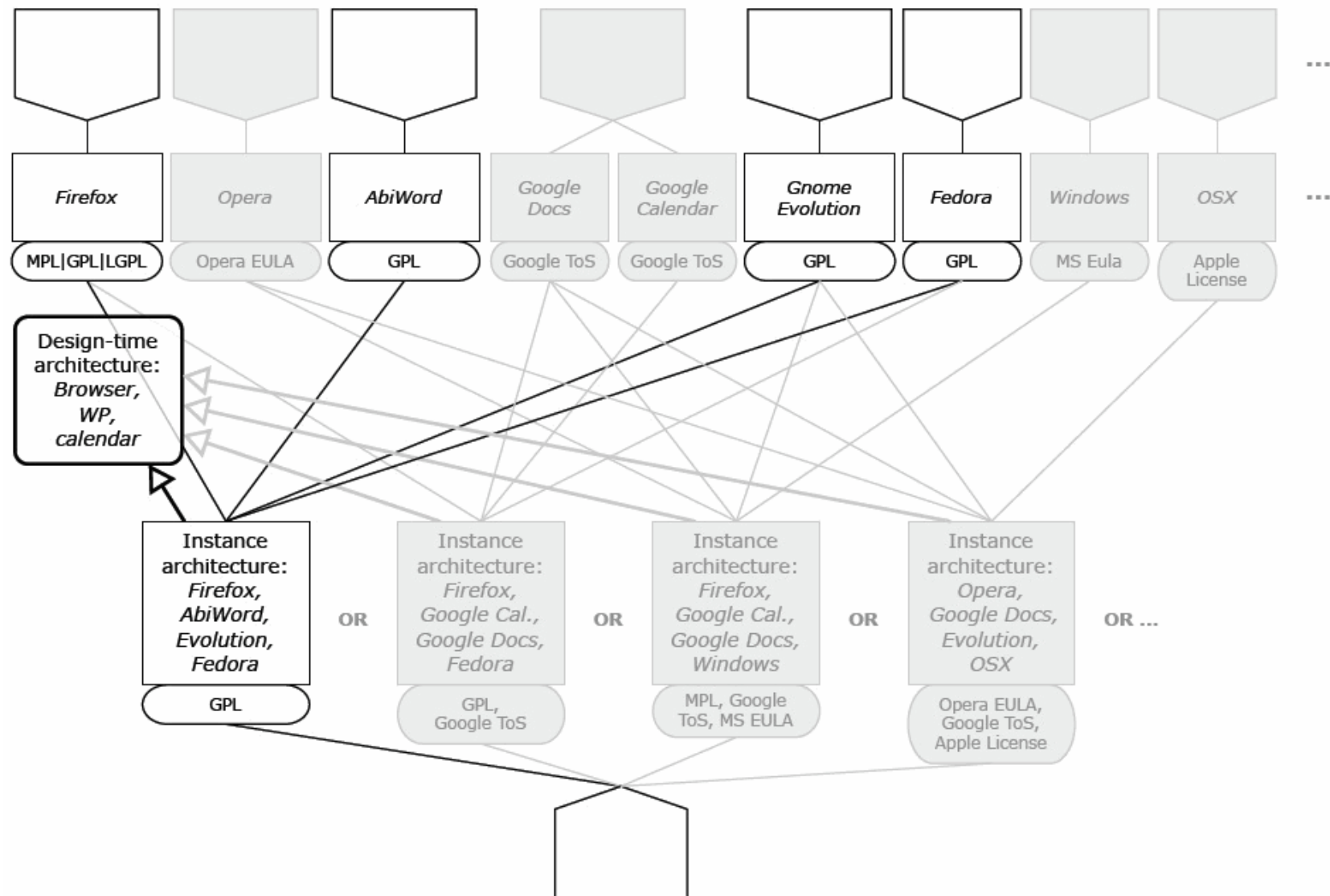
A security capability specification encapsulating the *design-time* configuration via multiple virtual machine containers
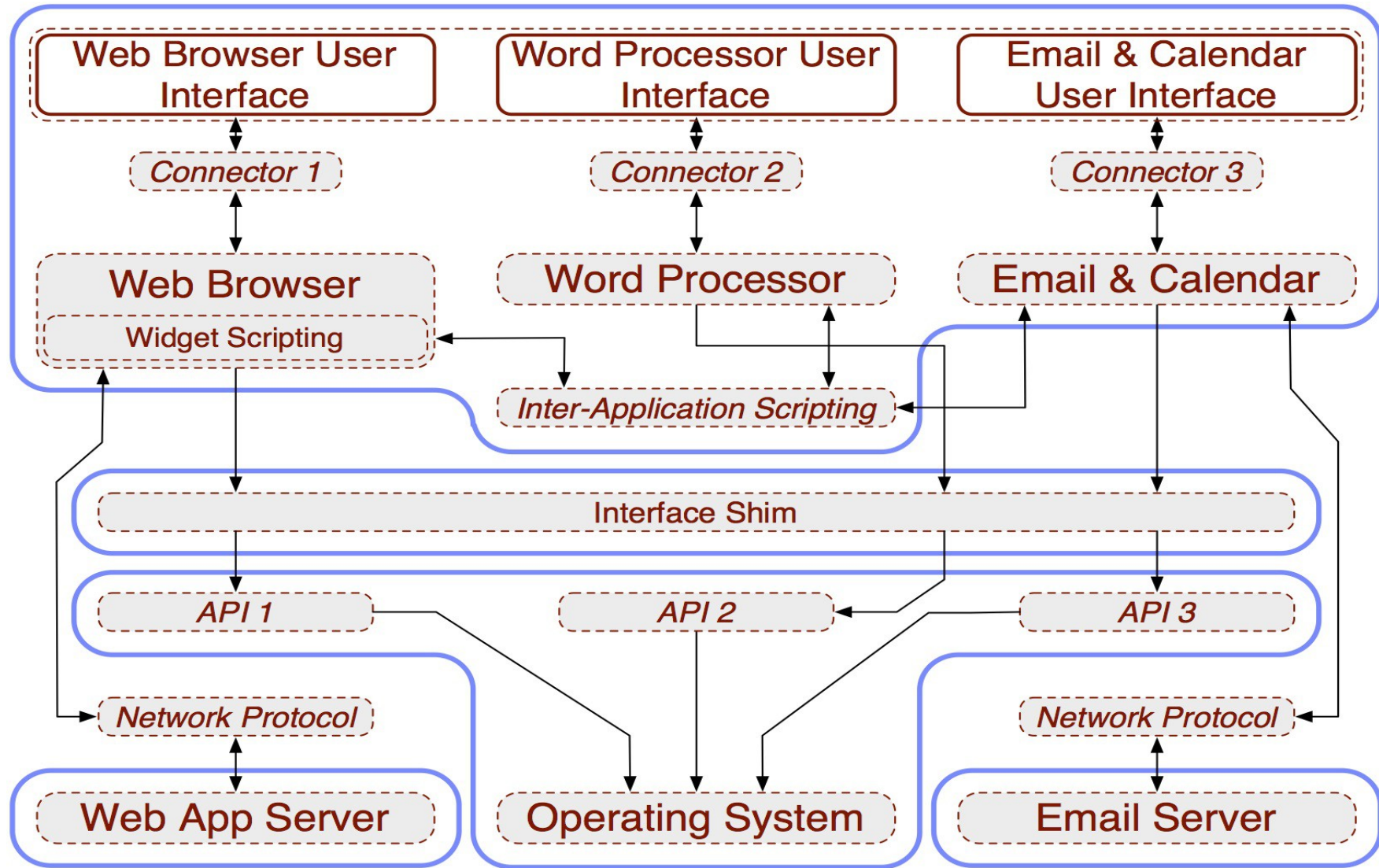
Build-time view of OA design selecting *OSS* product family alternatives
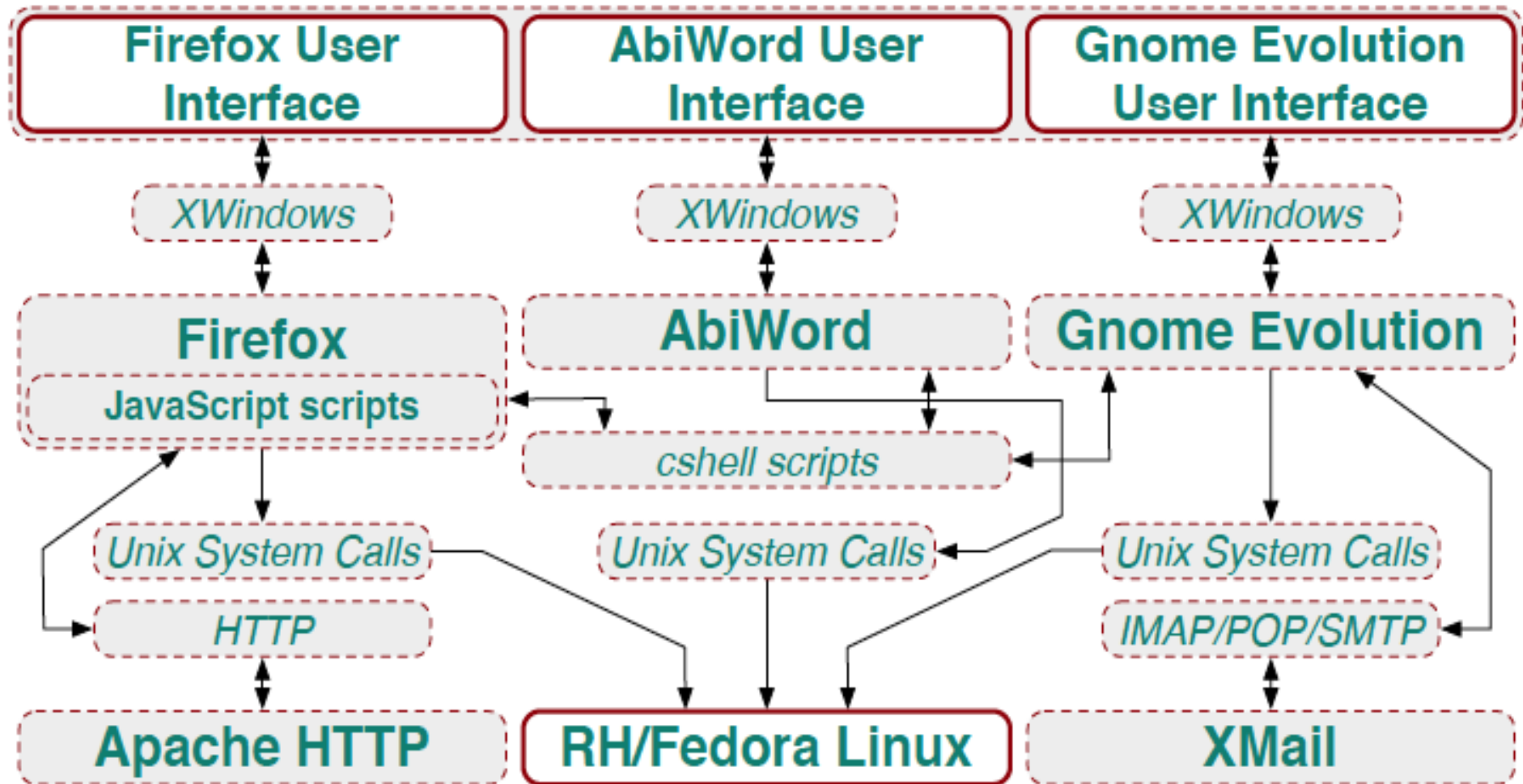
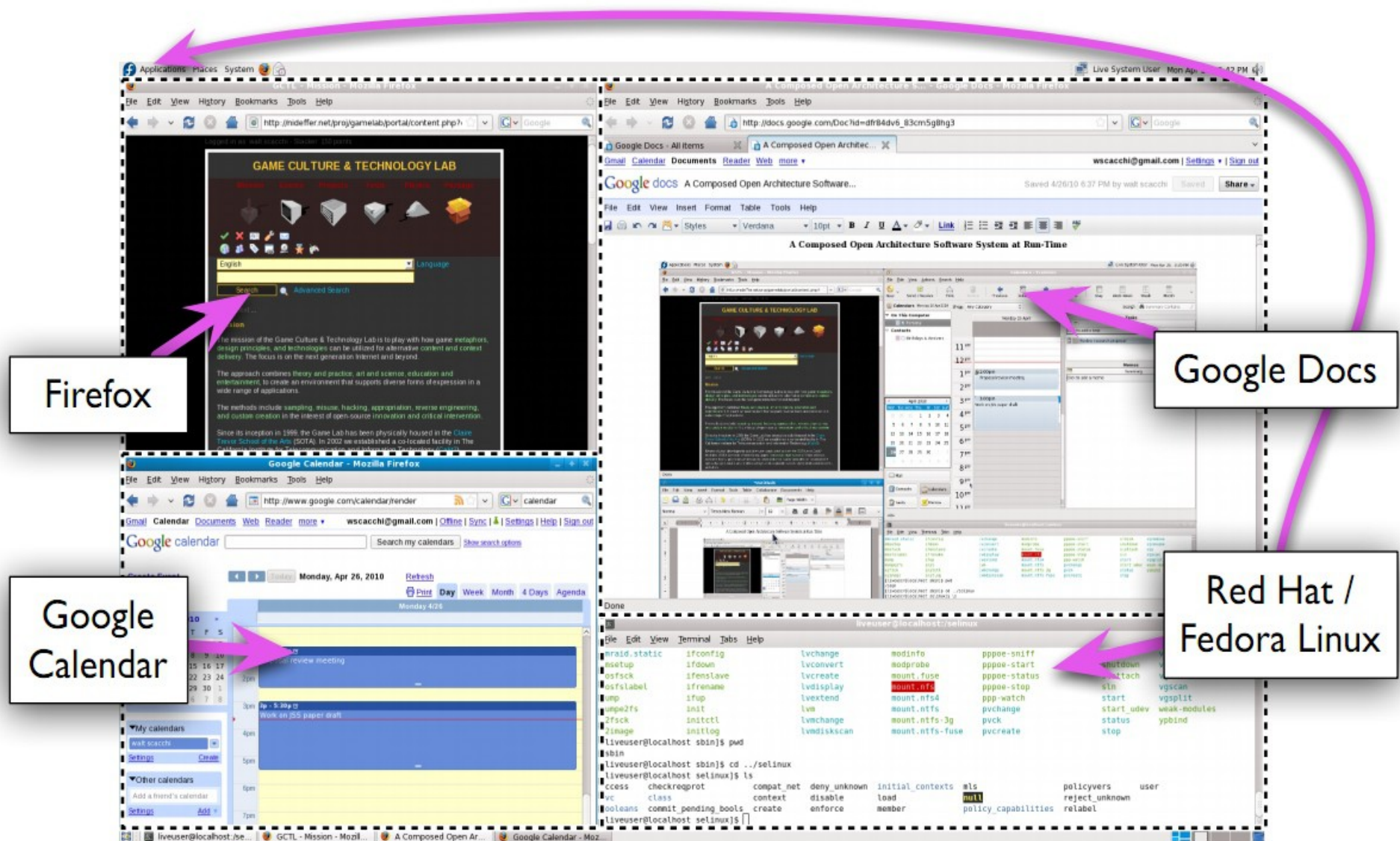# Run-time deployment view of OA system family member configuration

Firefox

AbiWord

Gnome Evolution
email, calendar

Red Hat /
Fedora Linux
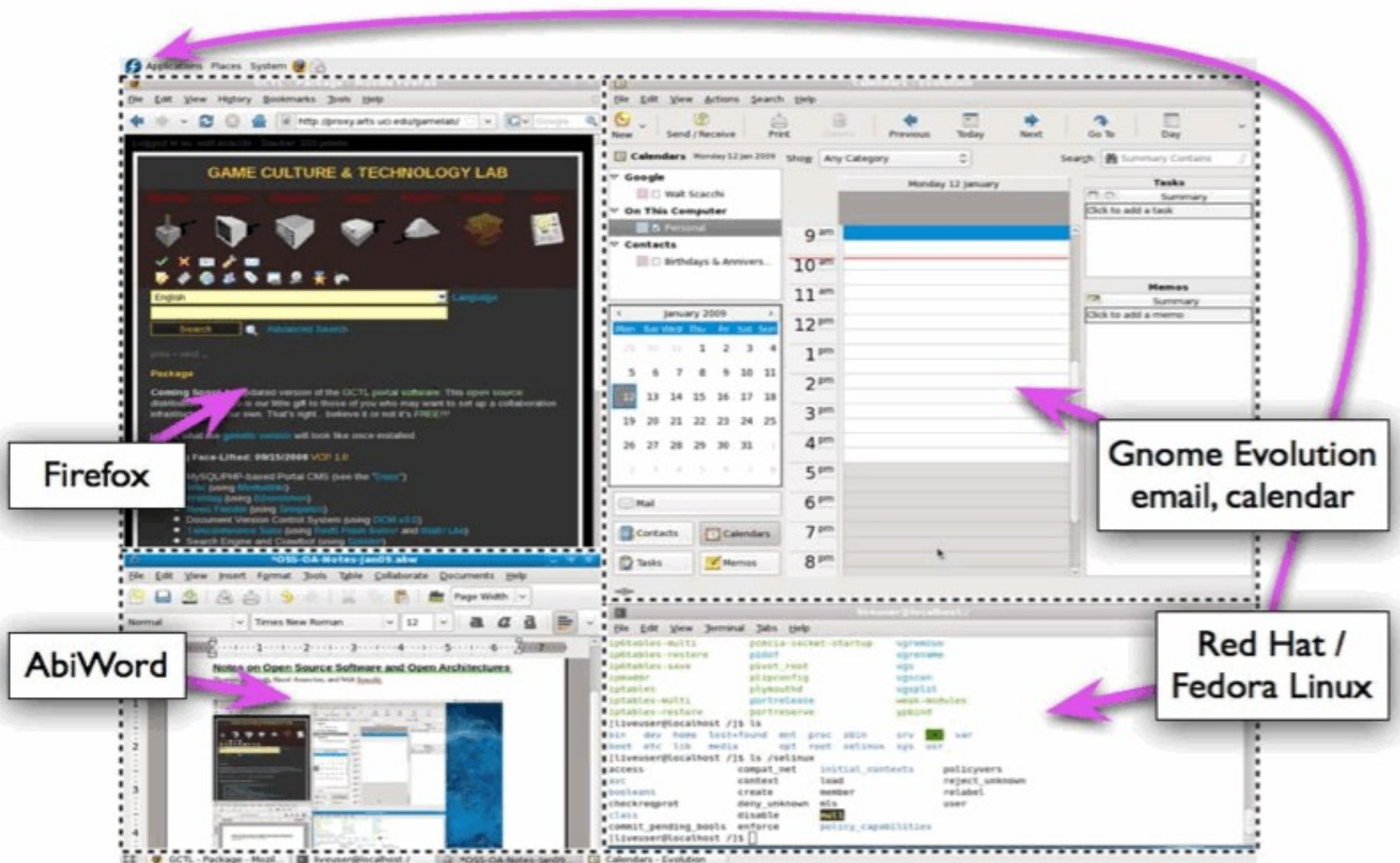
Product line selection of different functionally similar alternative
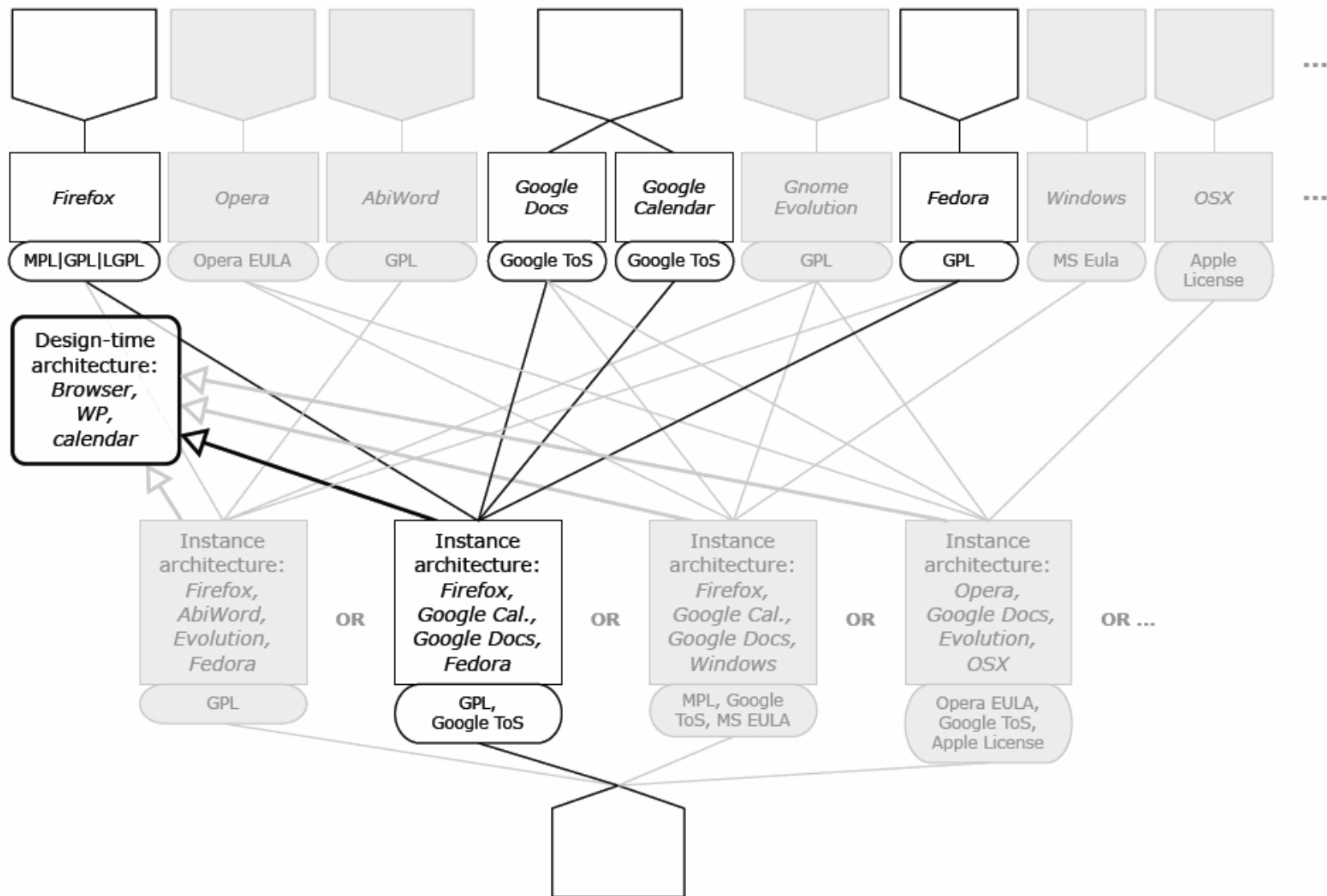
Run-time deployment view of a similar alternative OA system configuration

Build-time view of OA design selecting *proprietary* product family alternatives
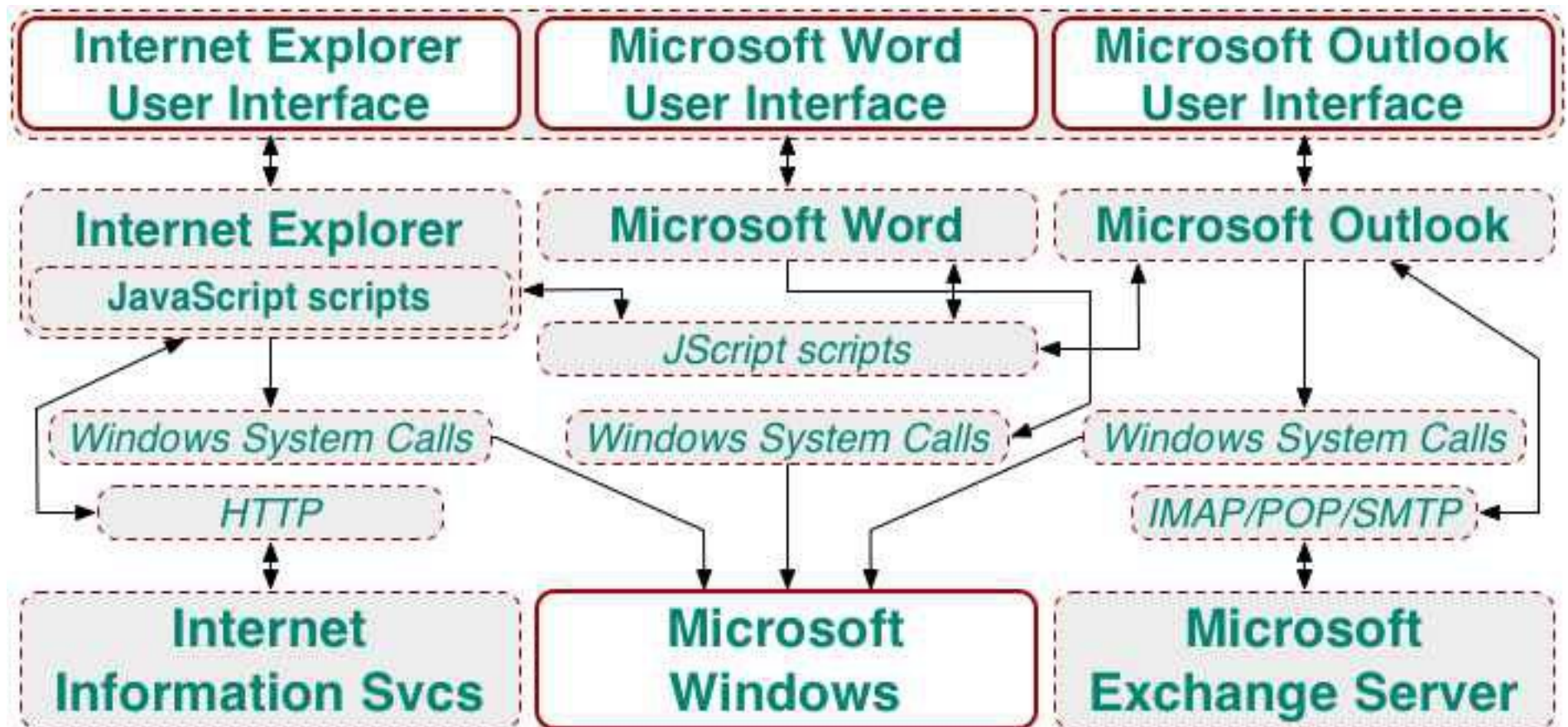
Conclusions

- OSS ecosystems can be:

    - modeled, analyzed, and understood, via

    - discovery of actor practices and processes, that

    - manipulate artifact ecologies, with

    - different tools and repositories, across

    - diverse OSS project communities.

- OSS ecosystems pose new challenges and opportunities in *Intellectual Property* and *Cybersecurity*.

- OSS ecosystems *can be shaped and stimulated* to act via *strategic actions*.

Acknowledgements