Liquid software
Multi-device ownership meets web programming

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Software industry is moving at unforeseen speed (although in Finland we are missing a big part of fun)

Reflections @ Sun Labs 2006:

- The widespread adoption of the World Wide Webis reshaping our world in various ways.

- Documents, photos, music, videos, news and various other artifacts and services have already started migrating to the Web.

- Many industries (e.g., publishing and entertainment) are currently undergoing dramatic transformations.

- The software industry is (was?) on the brink of a similar transformation, or a paradigm shift

Now?

"If you are not moving at the speed of the marketplace you are already dead – you just haven't stopped breathing yet"
- Jack Welsh

Desktop
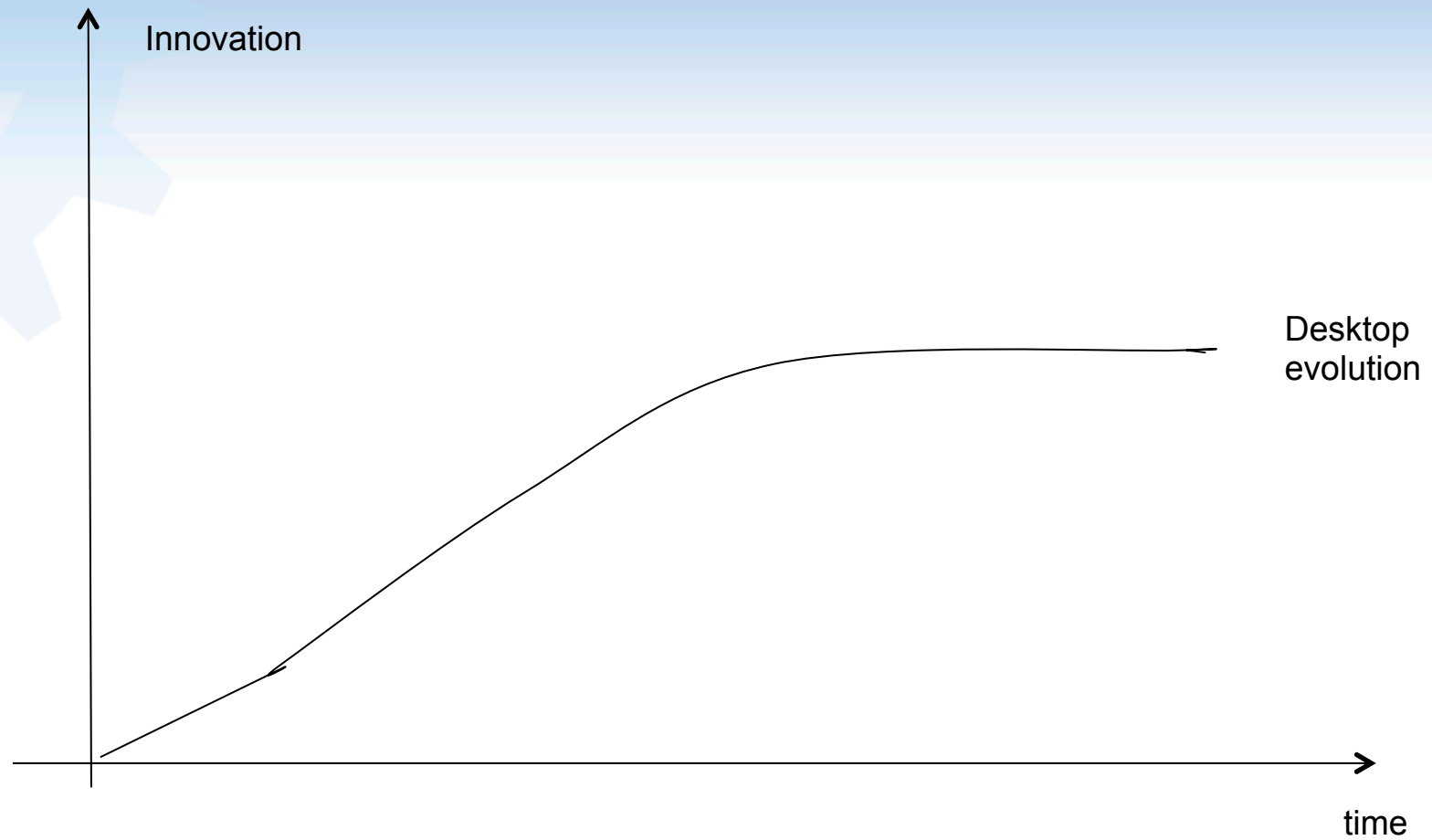
Have you ever wondered what it would be like to live in Star Trek…..

"Captain, we need to invert the tractor beam, upload it by excactly 23.181%, and redirect its power to the impulse engines"

- "Make it so, Mr. Data"

Desktop	Mobile desktop
Exploratory tasks	Focused actions
Long sessions	Rapid movement
No news since 1980s	Evolving paradigms
WIMP	Gestures
User experience reveals implementation technology	Things seemingly happen by magic
Reactive	Proactive
Leading the way until 2007	Took over the innovation in 2007

Desktop and mobile
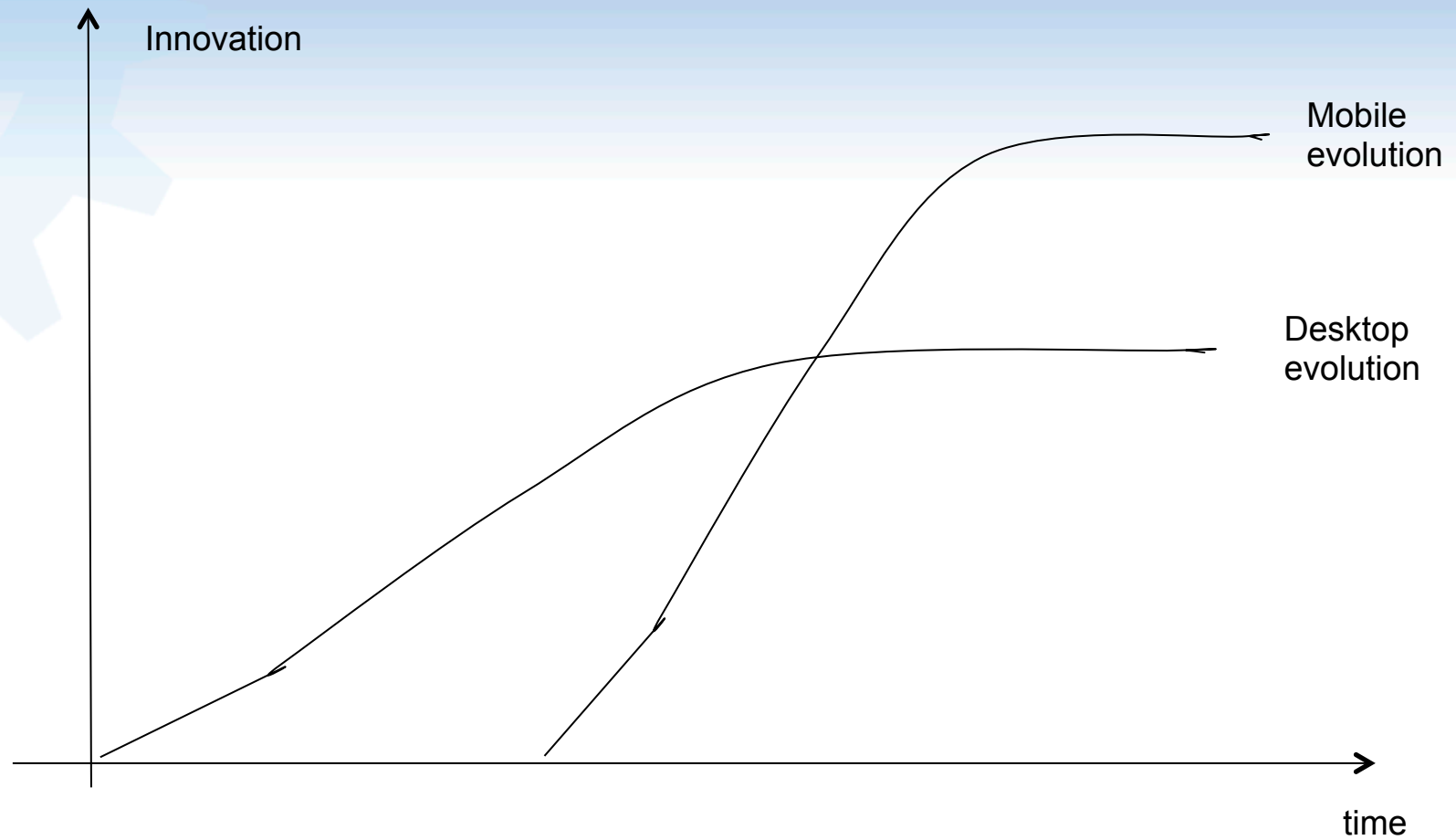
Which will be the preferred way to consume data and services for the user of the future?

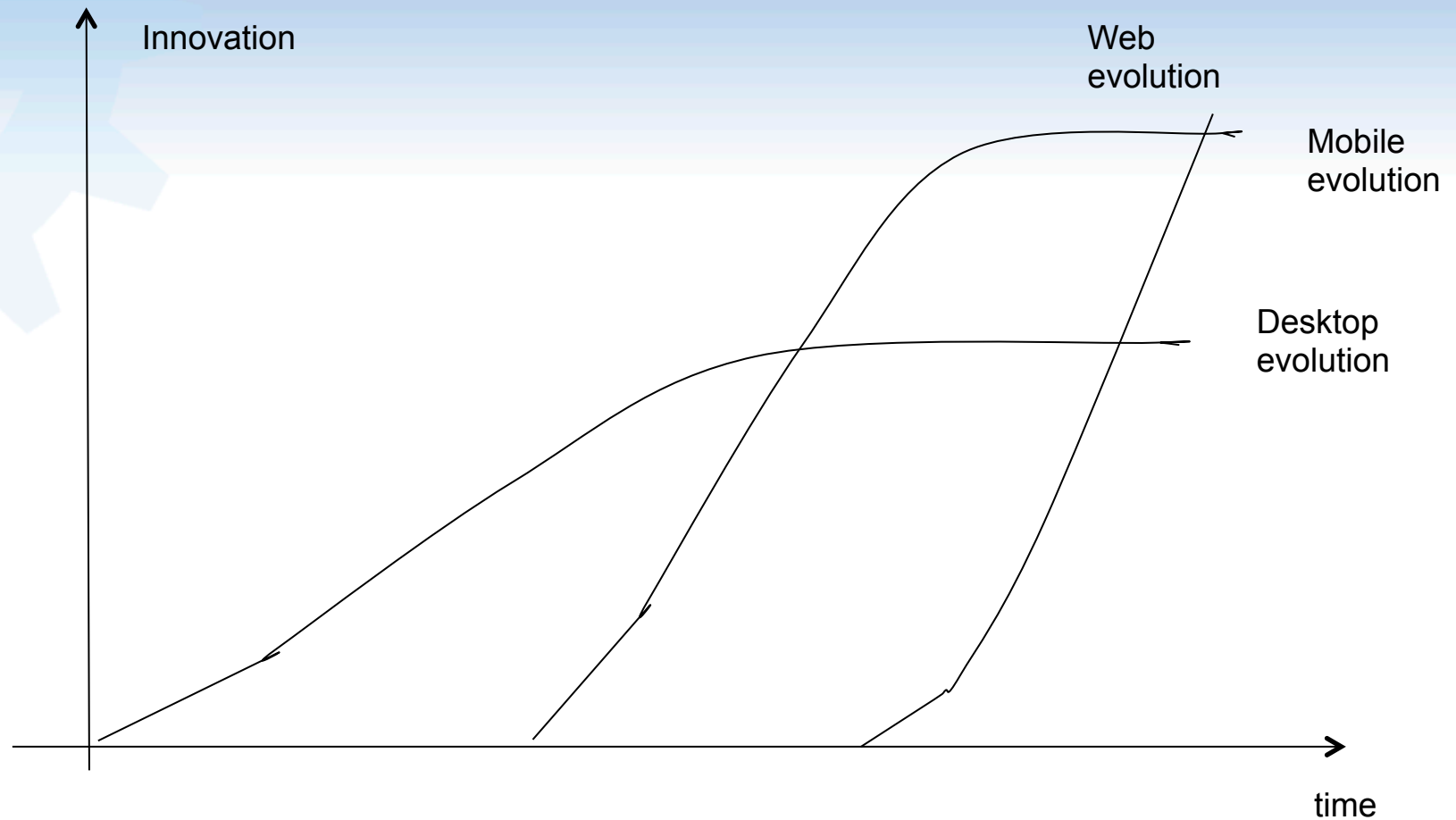| **Desktop**	**Mobile desktop**
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Long Live the Web: a Call for Continued Open Standards and Neutrality,

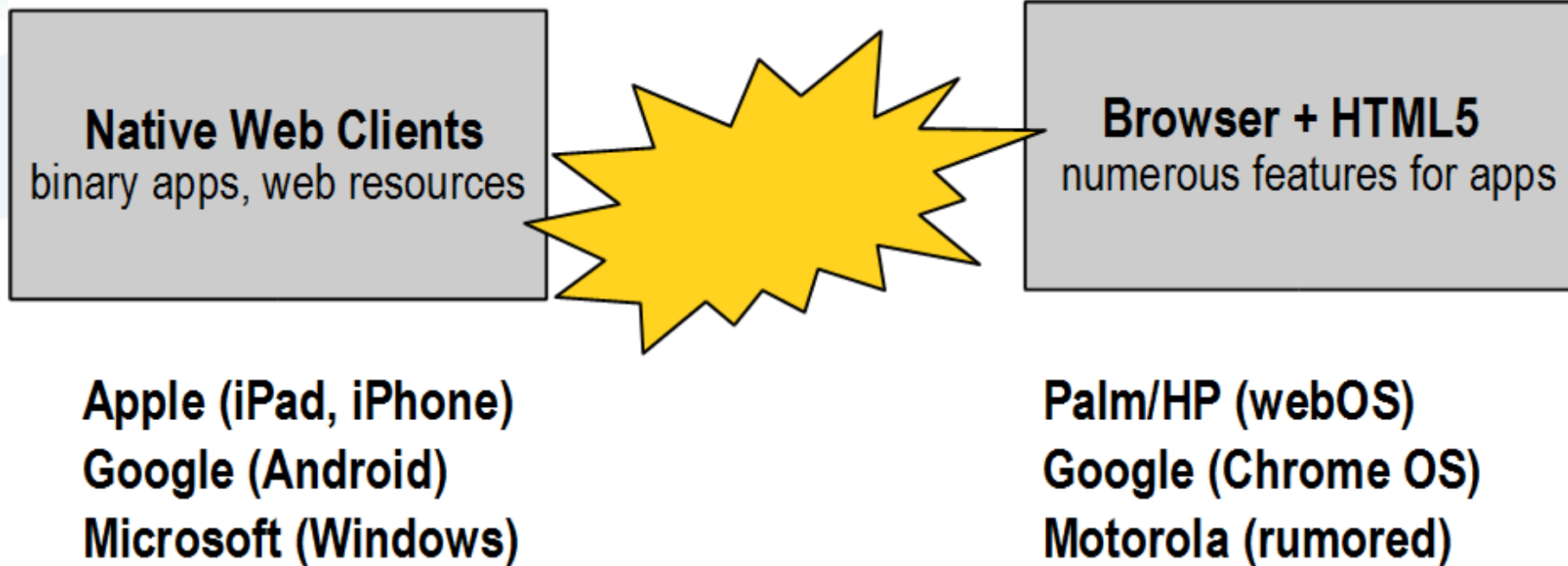T. Berners-Lee, Scientific American, vol 303, nr 4 (Dec), 2010, pp.56-61.

"The web should be open to avoid predatory single-vendor lock- in"

Desktop and mobile and web

Battle of the decade

Native Web Clients
binary apps, web resources

Browser + HTML5
numerous features for apps

Apple (iPad, iPhone)
Google (Android)
Microsoft (Windows)

Palm/HP (webOS)
Google (Chrome OS)
Motorola (rumored)

Today's situation?

- Stagnation towards Android and iOS

- Services follow from one device to another in the form of installable applications

- Tizen and related approaches loosing ground rapidly

- Two islands; mobile and desktop domains with different development approaches that have little in common

Why Should We Care?

Realization:Web apps do not live by the same rules!

Web applications and services are liberated from several fundamental restrictions that have prevented several types of applications earlier.

All data in the world is constantly available for web applications to mix and match in development

Mashups that combine data, images, and other content from numerous web sites into an integrated experience.

Unforeseen opportunities for innovation

Example: http://woozor.us

Content is the king vs. apps are the king

Data

- Build on web hosting in various forms with different business models

- Global and increasingly open (at least via prescription)

- Enables mixing and matching via various forms

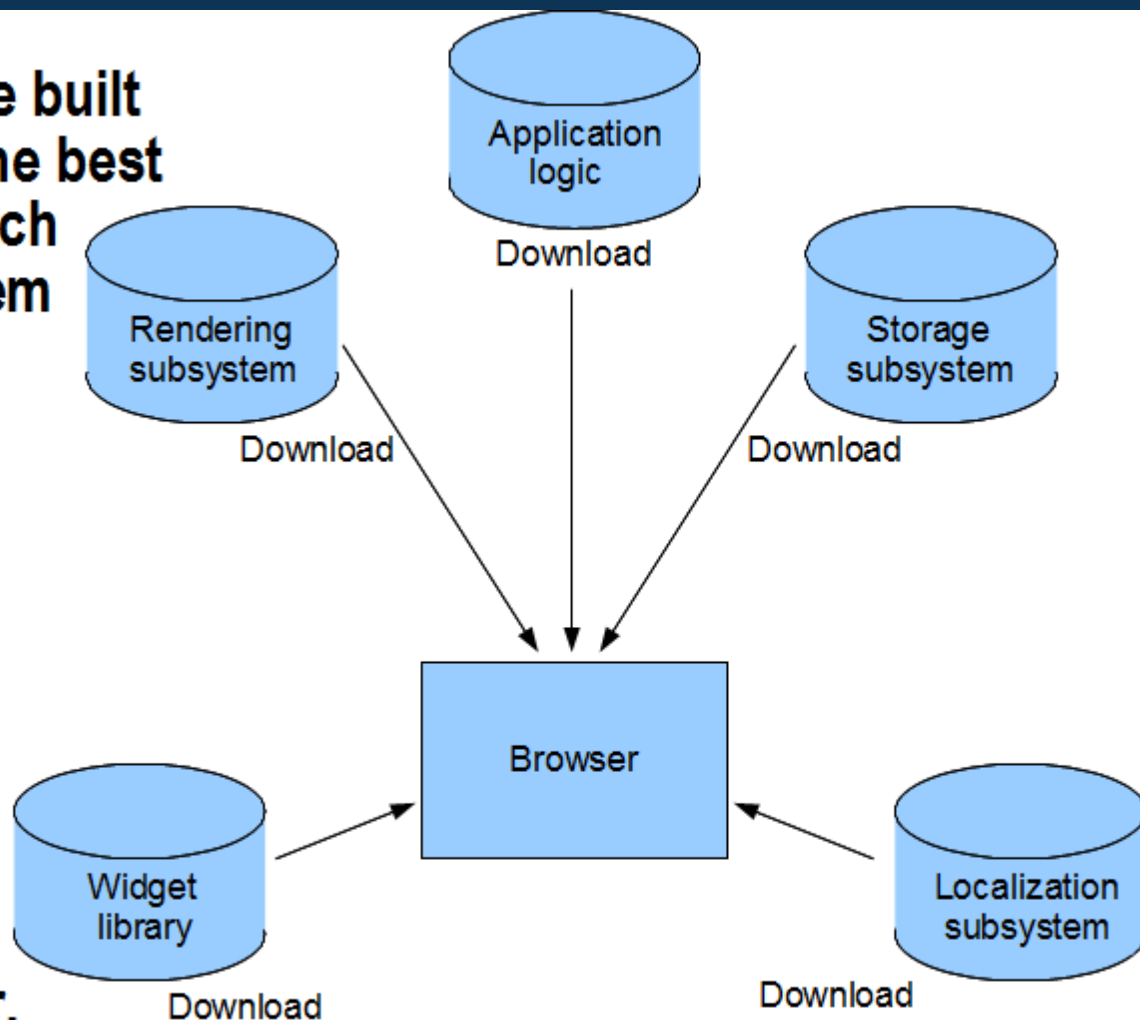- Possible also to implement APIs to provide software-as-a-service

Apps

- Build on established installations and business model

- Device (or ecosystem) specific installation, binary code

- Everything is in a different silo; interoperability only through manufacturer terms

- Data not made available to other systems

The future of software as a "social mashup"

In the future, software will be built by dynamically combining the best available components for each purpose by downloading them dynamically from different web sites.

No static linking; everything downloaded on demand.

Software development will be an inherently social activity between developers who do not necessarily know each other.

Application logic
Download

Rendering subsystem
Download

Storage subsystem
Download

Widget library
Download

Browser

Localization subsystem
Download

Today's web browsers do not support these kinds of applications yet!

Fundamental impedance mismatch

Web Development	Conventional SW Development
- Documents	- Applications
- Page / form oriented interaction	- Direct manipulation
- Managed graphics, static layout	- Directly drawn, dynamic graphics
- Instant worldwide deployment	- Conventional deployment
- Source code and text favored	- Binary representations favored
- Development based mostly on conventions and "folklore"	- Development based on established engineering principles
- Informal development practices	- More formal development
- Target environment not designed for applications	- Target environment specifically intended for applications
- Tool-driven development approach	- A wide variety of development approaches available

Multi-Device Ownership
– The Next Game Changer

Multi-Device Ownership – The Next Game Changer

Today, the digital life of people in developed markets is dominated by PCs and smartphones.

- ~350 million new PCs + one billion smartphones sold worldwide in 2013.

- Today, the average consumer in the U.S. or Europe has two primary computing devices: a personal computer (usually a laptop) and a smartphone; after Apple's successful launch of the iPad, many people carry a third device – a web tablet.

While it may be tempting to think that today's PC and smartphone centric world will simply be extended with yet another device, in reality the number of network-connected devices that people use in their daily lives is expanding much more dramatically.

Liquid Software Demonstrated

Corning, Inc., A Day Made of Glass 2, 2012

http://www.youtube.com/watch?v=jZkHpNnXLB0

Liquid Software

Multiple device ownership should be as casual, fluid and hassle-free as possible.

- Model of computation that is constantly available, capable of delivering meaningful value even in a few moments, without requiring active attention from the user's part.

- As much a mindset as a specific set of technologies – the idea is to make technologies themselves so natural, effortless and calm that they will effectively disappear.

A central aspect of a true casual computing experience is the ability to move fluidly from one device to another.

Liquid Software in a nutshell

By liquid software, we refer to an approach in which applications and data can flow from one device or screen to another seamlessly, allowing the users to roam freely from one device to another, no longer worrying about device management, not having their favorite applications or data, or having to remember complex steps.

Liquid Manifesto

1) In a truly liquid multi-device computing environment, the users shall be able to effortlessly roam between all computing devices.

2) Roaming between multiple devices shall be as casual, fluid and hassle-free as possible.

3) The user's applications and data shall be synchronized transparently between all the computing devices that the user has, insofar as the application and data make sense for each device.

4) Whenever applicable, roaming between multiple devices shall include the synchronization of the full state of each application, so that the users can seamlessly continue their activities on any device.

5) Roaming between multiple devices shall not be limited to devices from a single vendor ecosystem only.

6) The user shall remain in full control regarding the liquidity of applications and data.

Web Programming Research @ TUT (Lively@TUT)

We started a research team on web programming @ TUT back in 2006

- http://lively.cs.tut.fi/

Academic accomplishments so far:

- 3 doctoral theses, about 15 master's theses
- annual seminars with different themes
- about 60 academic publications

Focus on constructive work (build first, publish later)

We are actively recruiting new Ph.D. students!

Contributions

Lively Kernel (with Sun Labs): An environment that runs inside the browser and can transform running applications between different instances

- A. Taivalsaari, T. Mikkonen, D. Ingalls, and K. Palacz, Web browser as an application platform: The Lively Kernel experience. *Sun Microsystems Laboratories Tech Report* TR-2008-175, 2008.
- J. Kuuskeri, J. Lautamäki, and T. Mikkonen, Peer-to-peer collaboration in the Lively Kernel. Proc. *25th ACM Symposium on Applied Computing*, 2010, pp. 812-817.

Lively for Qt (with Nokia): A mobile-enabled version of the Lively Kernel based on the Qt framework

- Mikkonen, T., Taivalsaari, A. and Terho, M. Lively for Qt: A Platform for Mobile Web Applications. ACM Mobility Conference, Nice, France, September 2-4, 2009.

Contributions

HTML5 agent framework (own IPR): An approach where HTML applications can travel between different devices and continue their execution

- K. Systä, L. Järvenpää, and T. Mikkonen, HTML5 agents – mobile agents for the web. Proc. International Conference on Web Information Systems and Technologies 2013 (WebIST'13, Aachen, Germany, May 8-10), 2013, pp. 37-44.

Social Devices (originally with NRC, now own IPR): An approach where mobile devices independently coordinate their actions

- Mäkitalo, N., Pääkkö, J., Raatikainen, M., Myllärniemi, V., Aaltonen, T., Leppänen, T., Männistö, T. and Mikkonen, T. Social Devices: Collaborative Co-located Interactions in a Mobile Cloud. In Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia, ACM, 2012.

Life-cycle of a mobile agent
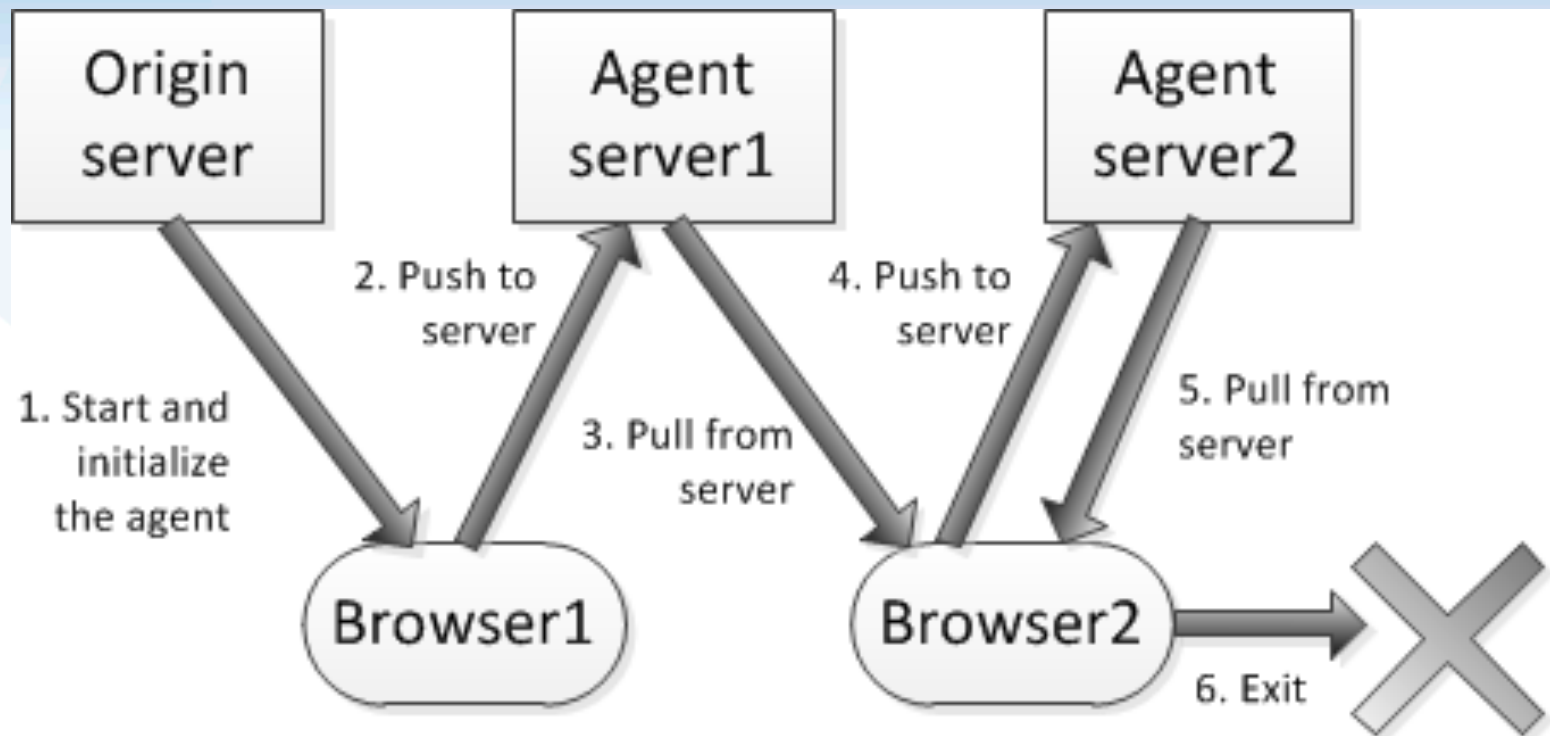
Mobile devices
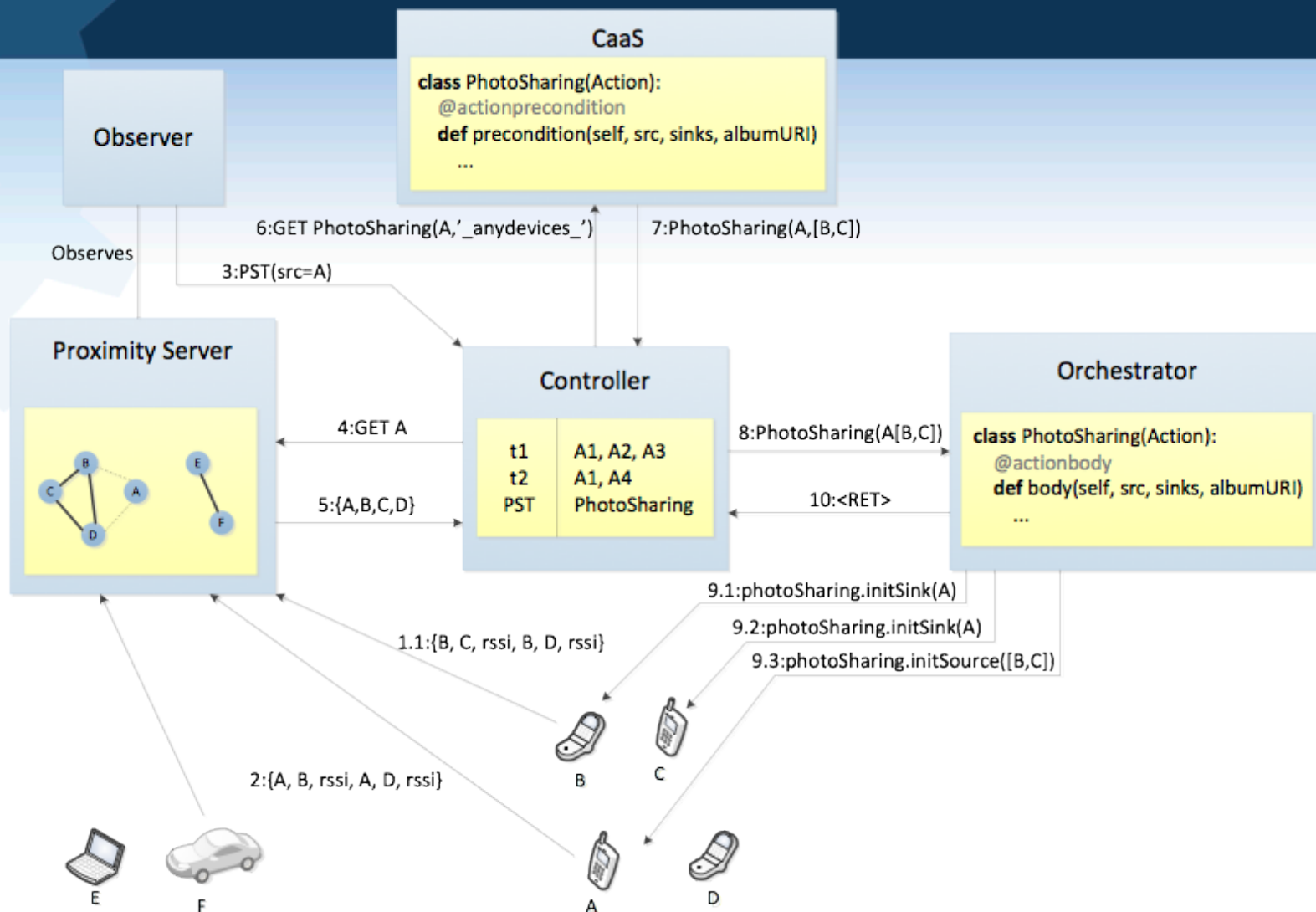
Conclusions

Liquid software will dramatically change the way people develop, deploy and use software.

No more installations!
>	Applications will simply run off the Web.

No more upgrades!
>	Always run the latest application version.

Instant worldwide deployment!
>	No middlemen or distributors needed.

No CPU dependencies, OS dependencies, ...
>	The Web is the Platform.

For future reading: http://lively.cs.tut.fi/publications/ LiquidSoftwareManifesto-2013.pdf

Questions?