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sense and simplicity

Accelerating Digital Television Innovation

Introducing jointSPACE

Bas Engel
Philips Consumer Lifestyle - Business Unit TV
ELC Grenoble, October 15, 2009

Outline

- Changing digital TV landscape
  - Managing software complexity
  - Leverage standard software assets
  - Required industry framework
- Accelerating innovation
  - Independent software asset development
  - Extending system capabilities
  - Enhancing embedded development

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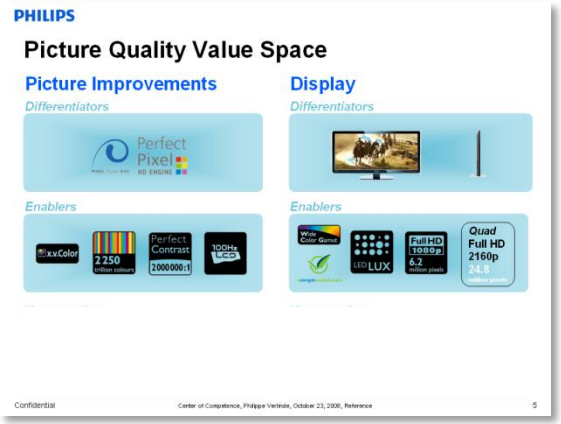
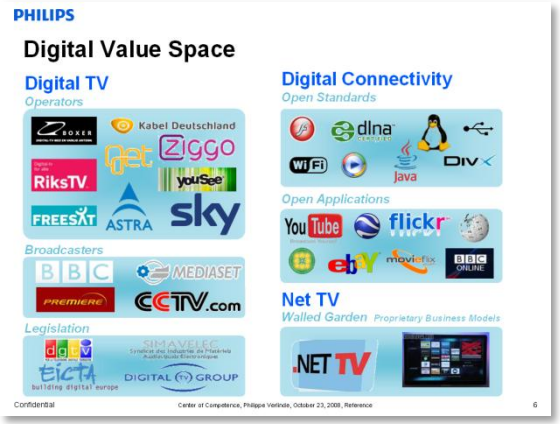
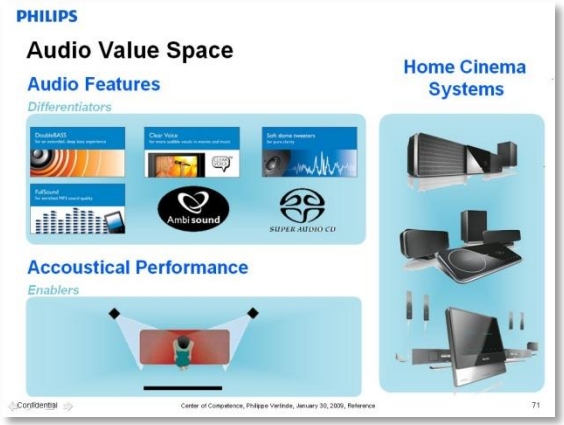
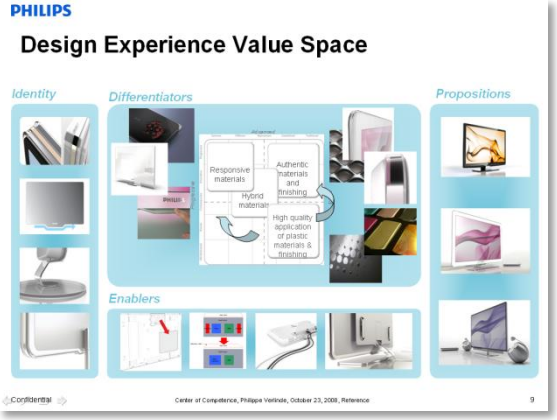
joint space
split application architecture

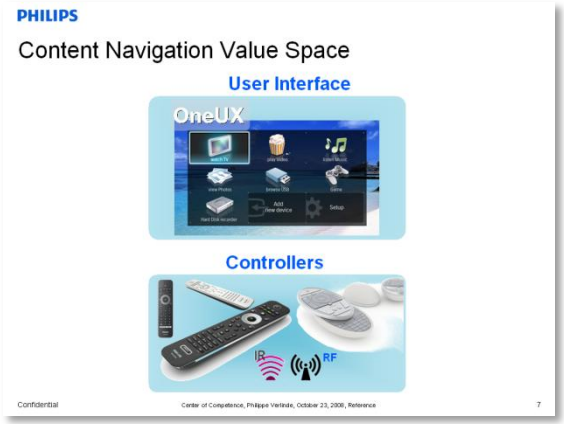
TV Value Spaces











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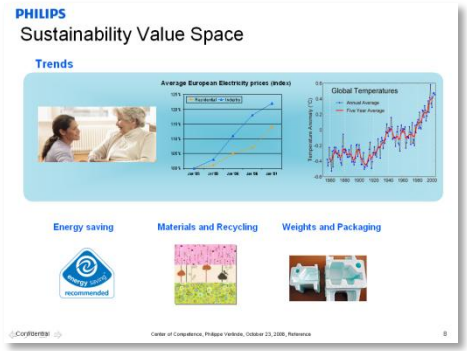
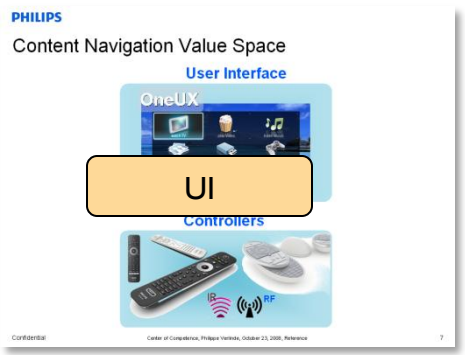
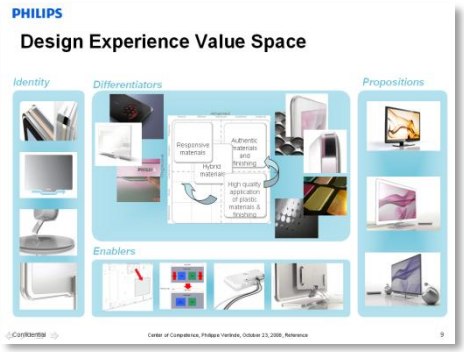
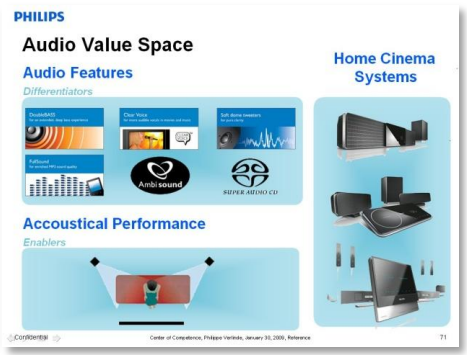
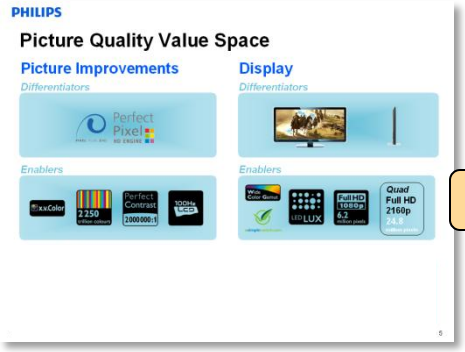
Software Driven Value Spaces

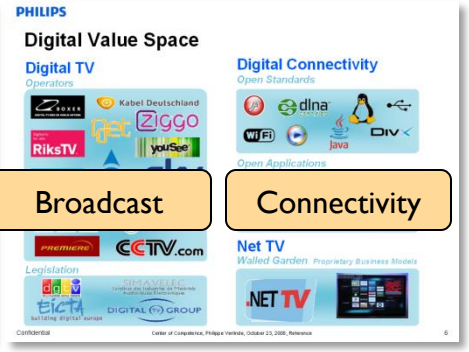












Supporting — Leading

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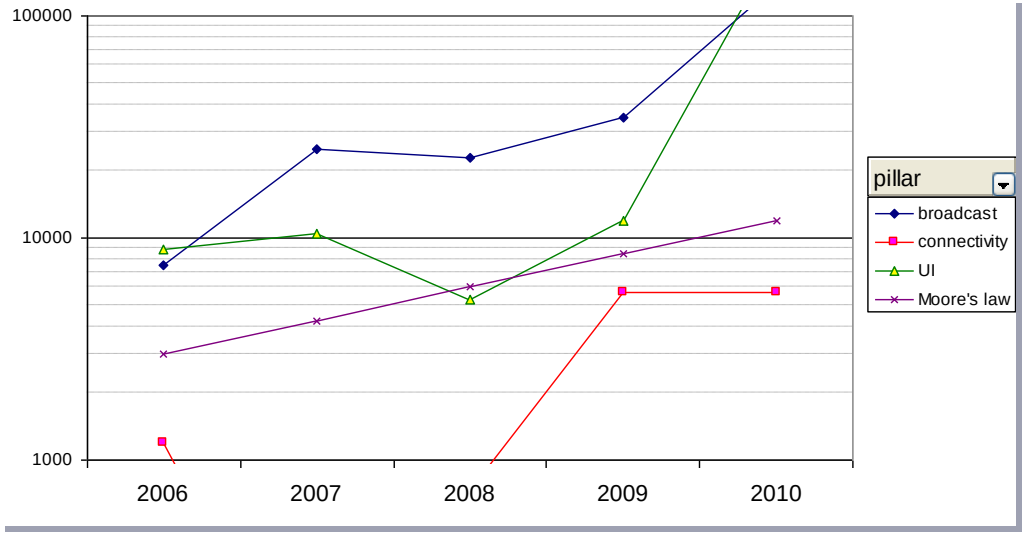
Software Value Space Growth



Code

RAM

Software value spaces accelerates beyond Moore's lay

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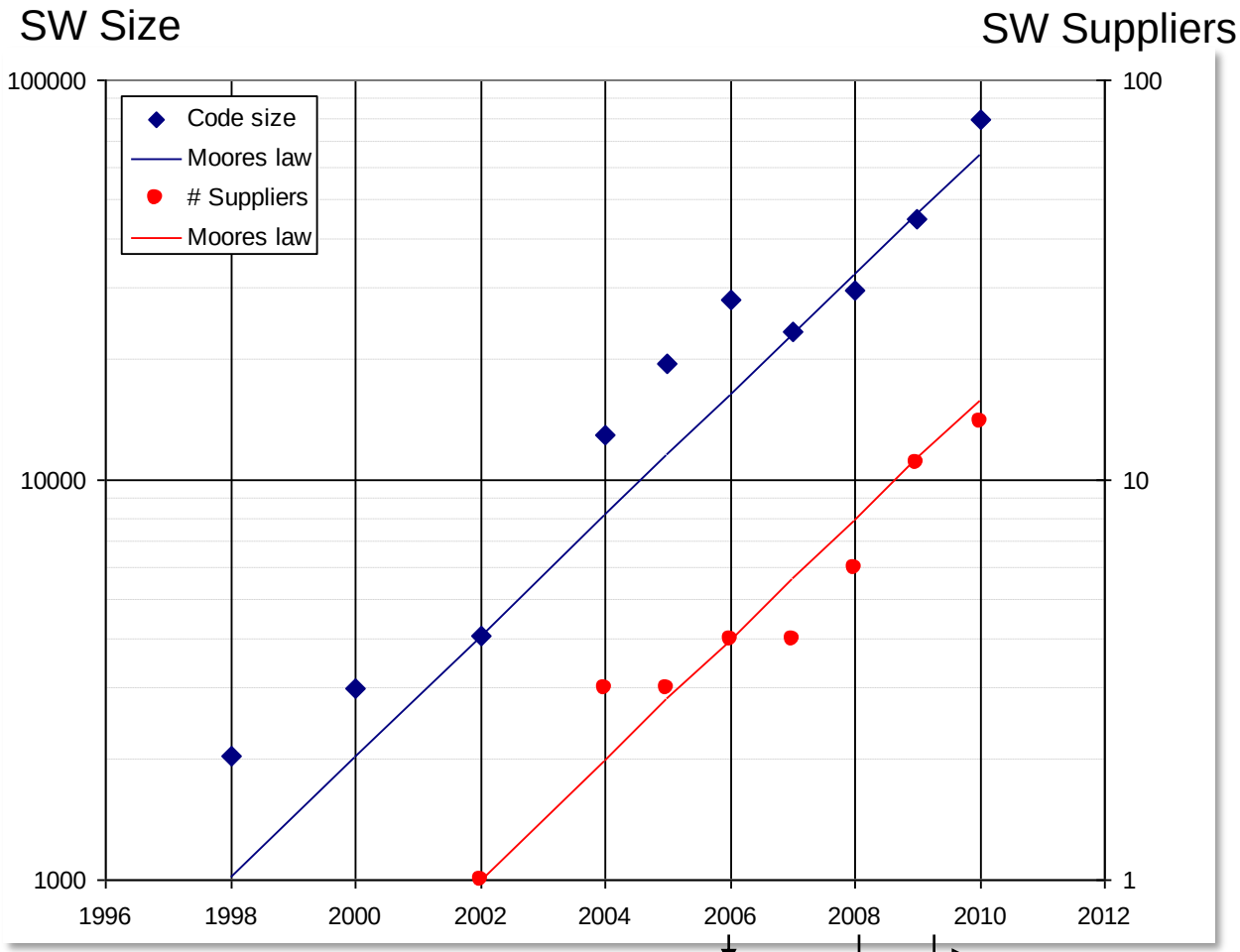
Software Featuring Dominates Growth



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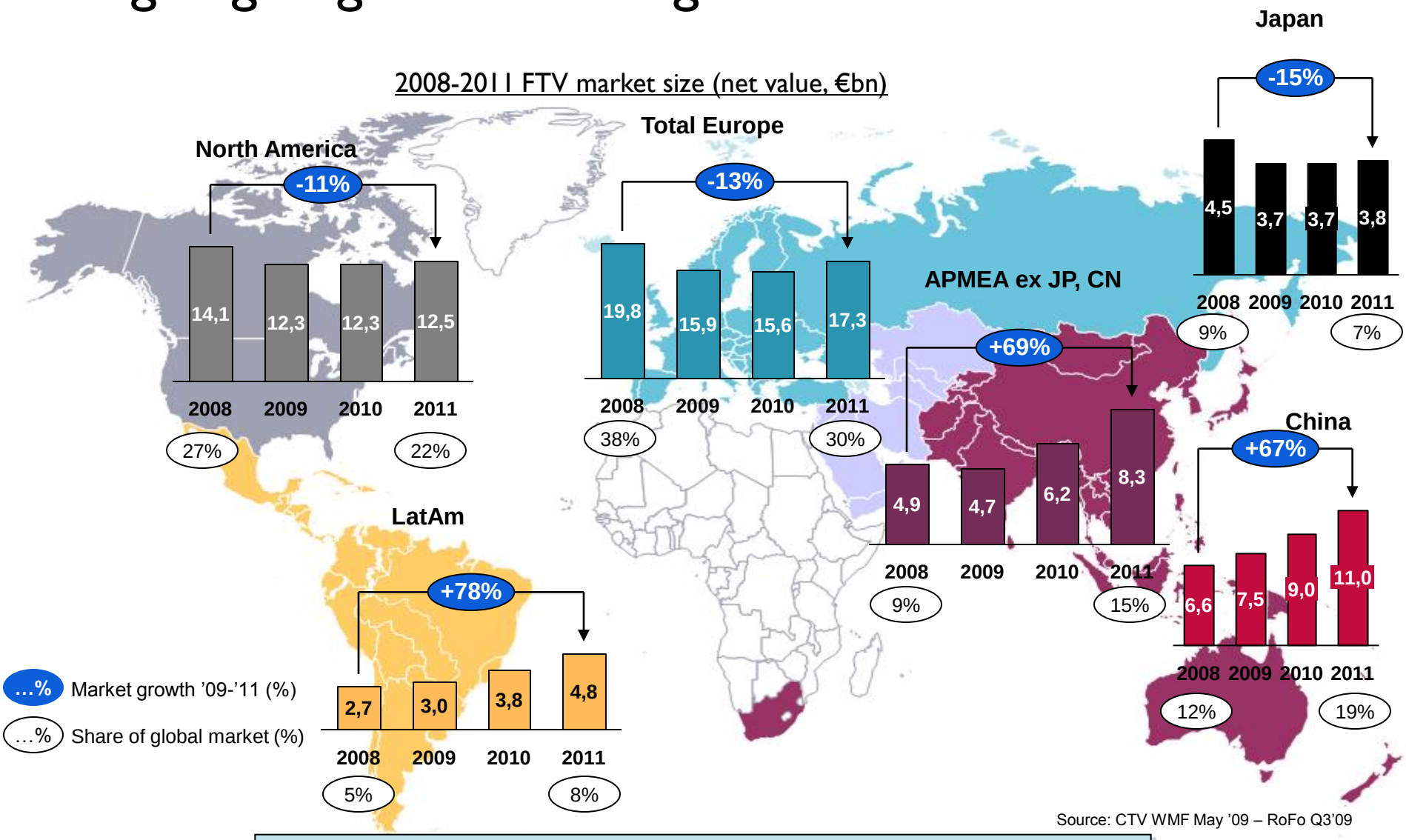
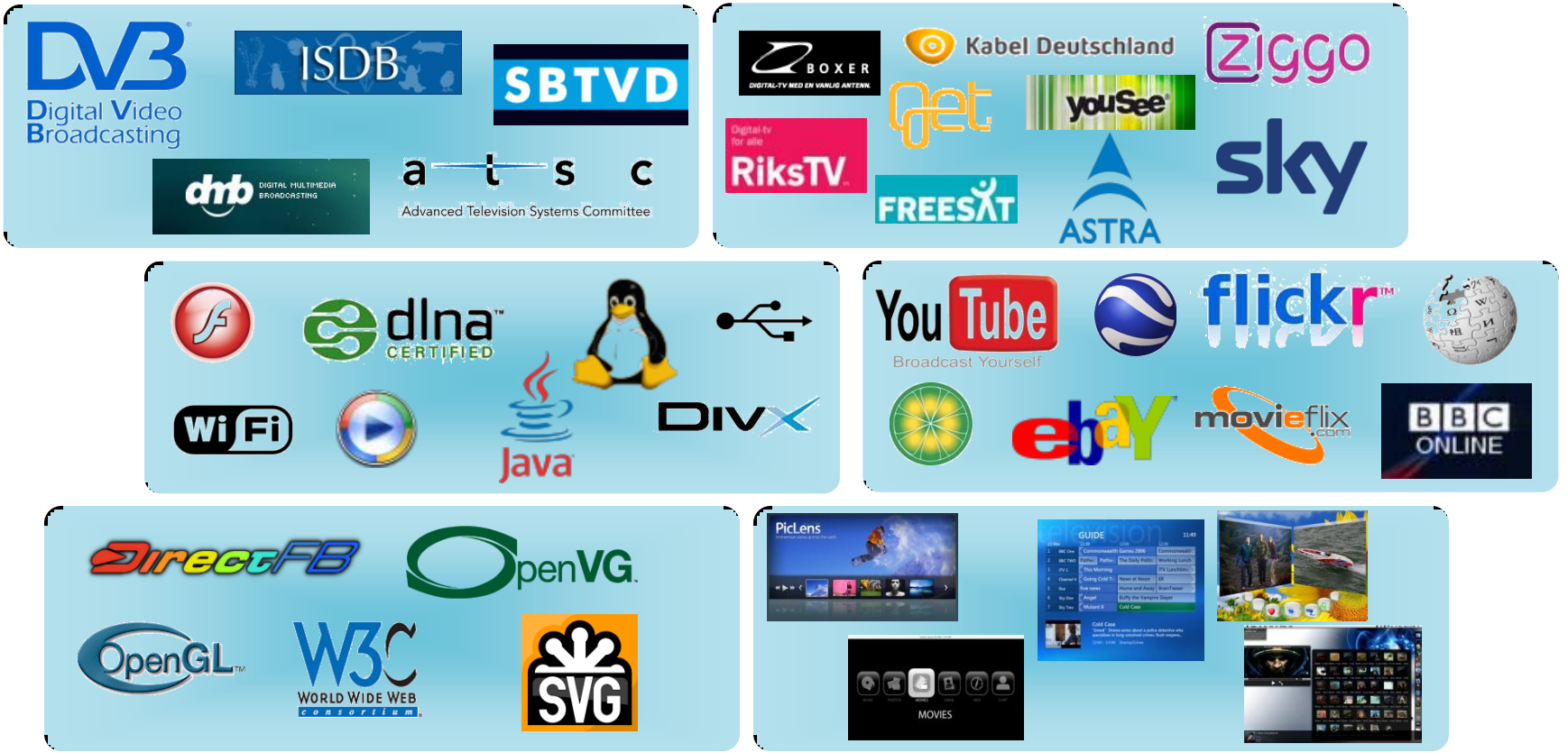
Ongoing Regional Challenges



Source: CTV WMF May '09 – RoFo Q3'09

Digital broadcast value space continues to expand

Ongoing Digital Featuring



Maximize Reuse of Development and Maturing Effort

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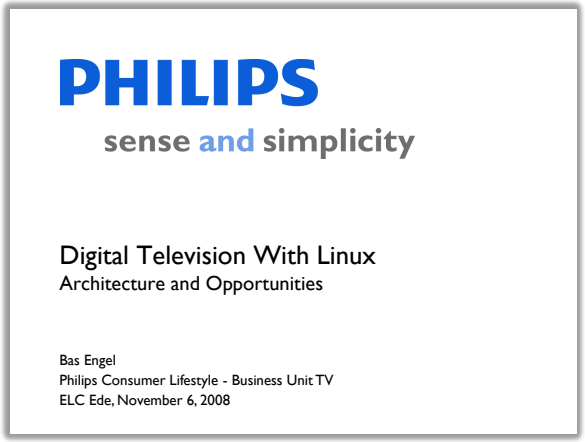
Managing SW Complexity And Diversity

- Had to change from highly integrated architectures to distributed ones
  - Fast and predictable integration of system extensions
  - Avoid an extensive (re)validation cycle

- Need to manage building blocks fully independently
  - Allowing independent software asset development
  - Limited asset correlation, cater for extensions without knowing all details

- Defined solutions for multi-client connection and resource management
  - AM sets destination, clients control source
  - Applications can request resources dynamically
  - Independent application lifecycle and execution

SPACE concept presented at 2008 ELC



Industry Recognition

- All suppliers are facing ongoing demand to deliver software featuring
  - Internet browsers, DLNA, broadcast standards, UI improvements, etc
  - Closely following Moore's Law
- Both suppliers and A brands have a similar challenge in delivering this
  - Can no longer develop all IP in-house, must leverage standard solutions
  - Standard solutions that must fit a standard system context
- Standard system context requires some industry standard framework
  - No proprietary concepts and source code
  - Based on a industry framework, not a standard with compliancy rules

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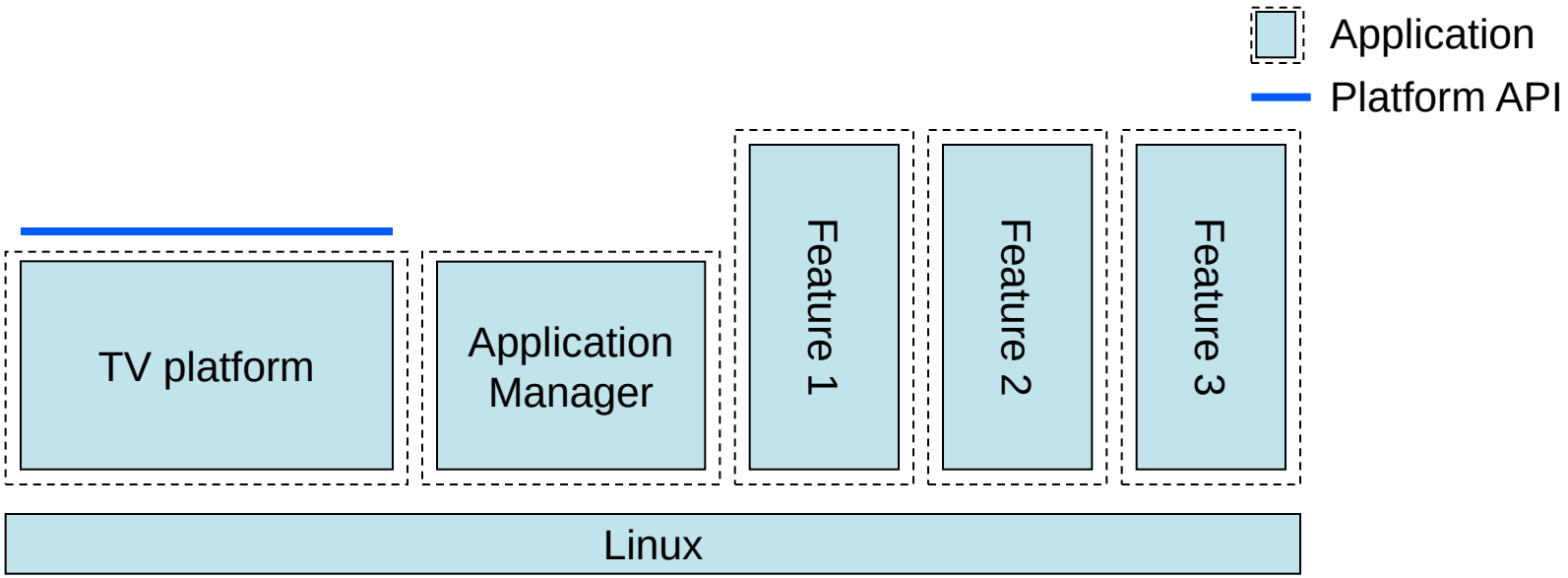
Industry Framework Requirements



SPlit Application arChitecturE

- The resources in the system are explicitly and centrally managed
- The client applications are system context unaware
- System integrity driven by centrally managed application lifecycle, focus, and visual layout
- Fast and predictable system extension (process architecture, libraries)

Application orthogonality
System behavior must be independent of the application composition

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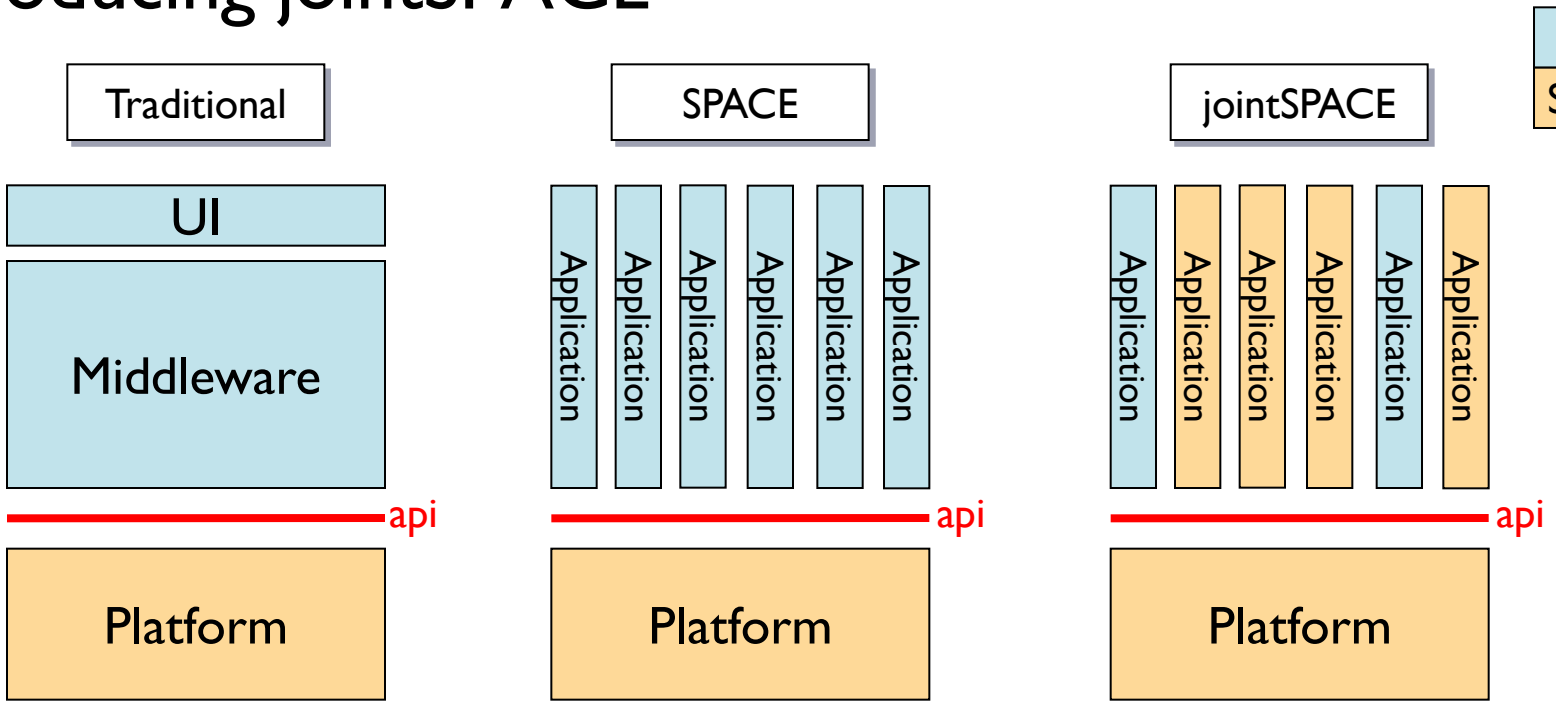
Introducing jointSPACE



- 'Traditional' platform only engagement not feasible anymore
  - Both for suppliers as well as for PCL
- 'SPACE' enables required architecture flexibility
  - Still fully PCL system integration responsibility
- 'jointSPACE' drives extensibility and supplier leverage
  - Customer (Philips) differentiation on top of standard system

Win-Win: Supplier Value Space

- Joint engagement on system context increases supplier value
  - Philips Consumer Lifestyle (PCL) engaged to mature supplier assets
  - Standard supplier assets can be reused for non-PCL engagements
- Lower threshold for additional TV customers to engage with supplier
  - Proven system maturity with supplier reference solution
  - Optimal cost spreading across customers
- Drives supplier to create top performance end-2-end systems
  - Enables pro-active plan by the supplier for system performance
  - Customer investments driven by customer specific innovation

Supplier value space is a system partnership

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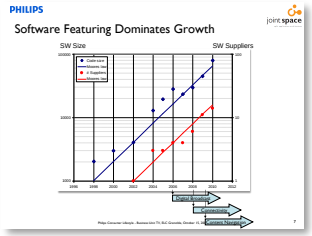
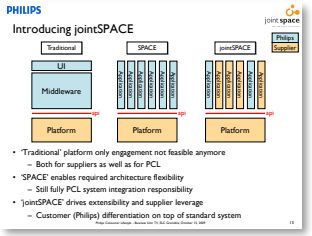
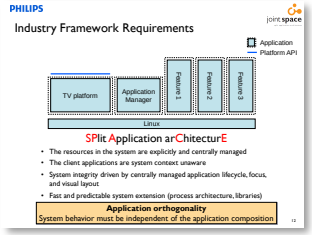
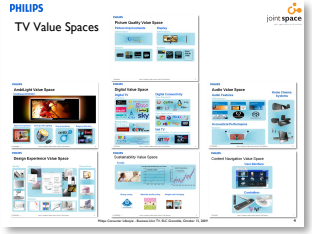
Changing Digital TV Landscape

- Continued software growth requires new engagement model
  - Develop systems as a joint responsibility
- Joint engagement increases overall value
  - Mature supplier assets, leverage SW investments
- SPACE gives necessary control points for customization
  - Recognized in the industry by leading TV platform suppliers
- Enables TV manufacturer to focus on differentiation
  - Accelerating innovation










Accelerating Innovation
Independent software asset development, Extending system capabilities, Enhancing embedded development
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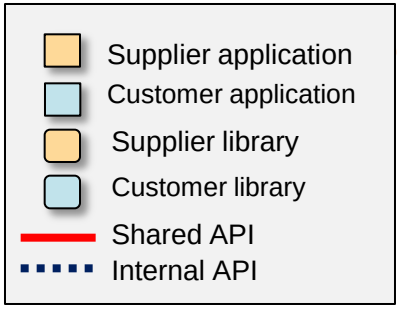
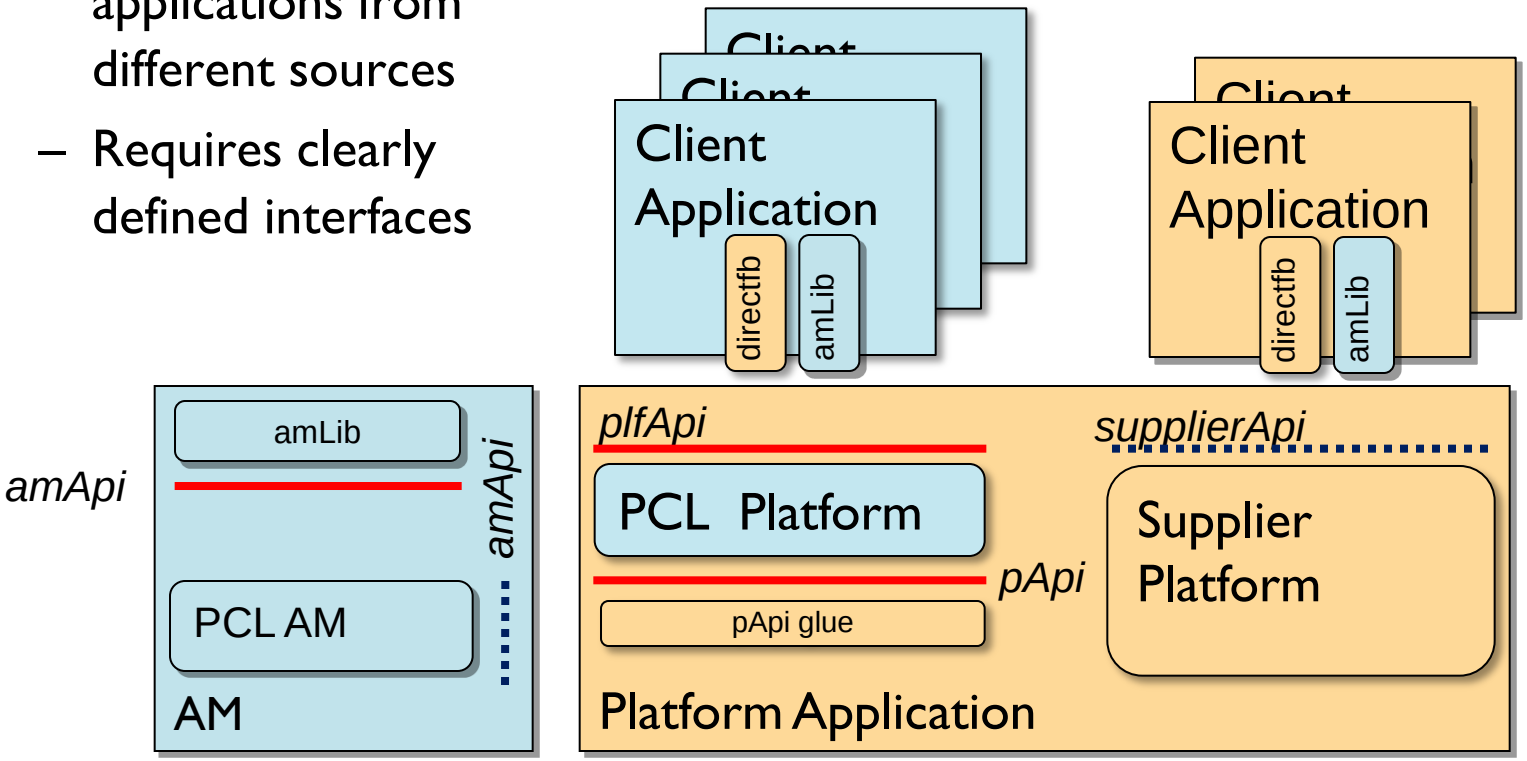
jointSPACE Engagement

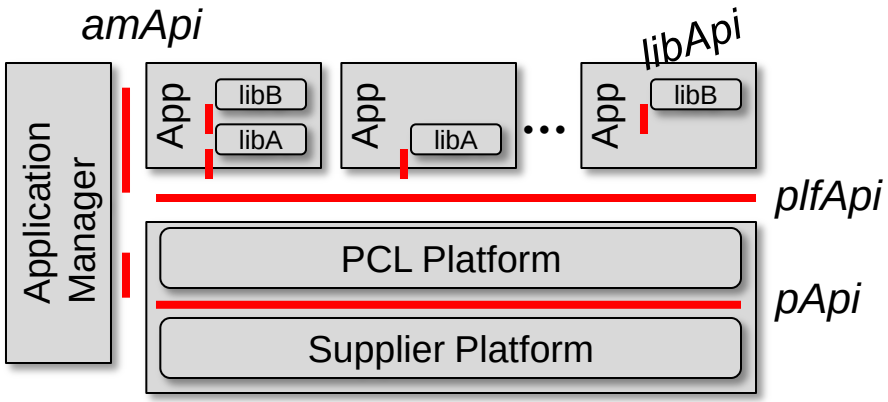


- Infrastructure provided by supplier (Linux, DirectFB)
- Supports applications from supplier and customer
  - Need to support applications from different sources
  - Requires clearly defined interfaces

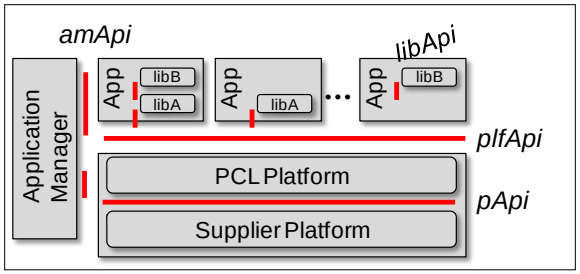


jointSPACE Porting API

- APIs between SPACE building blocks are called the "Porting API"
  - amApi: by client applications to make requests to application manager
  - plfApi: by client applications controlling the platform application
  - pApi: internal API between PCL plfApi and supplier platform interface
  - libApi: for data sharing across client applications

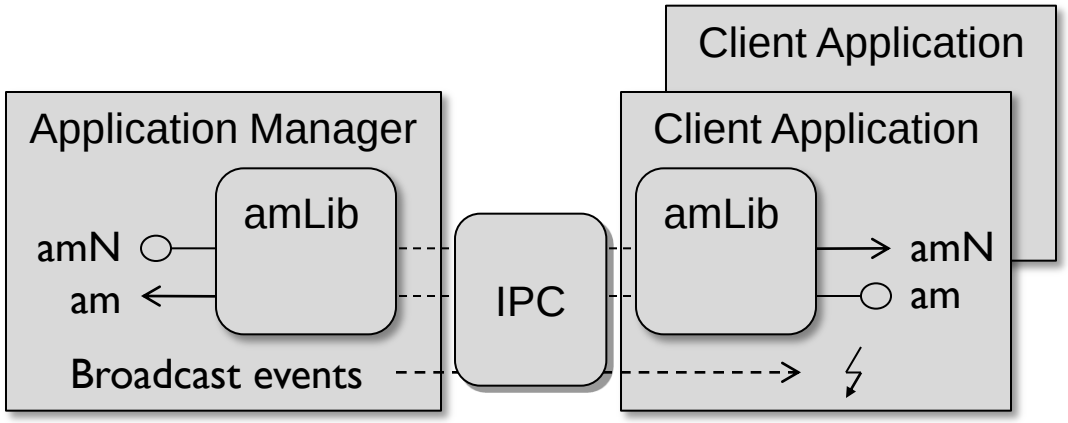


amAPI



- Defines the interaction between Application manager and applications
  - Consist of a functional API and broadcast events
  - Asynchronous in both directions

- The Application Manager can address individual client applications
  - The Linux process ID (PID) will be used for this
  - The library (amLib) enables event broadcasts via IPC



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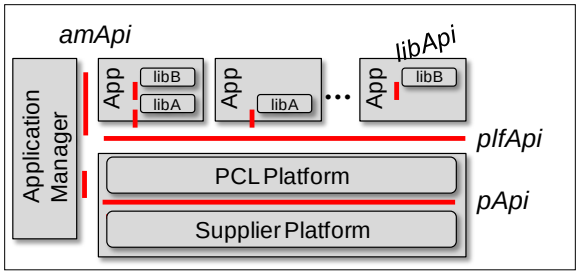
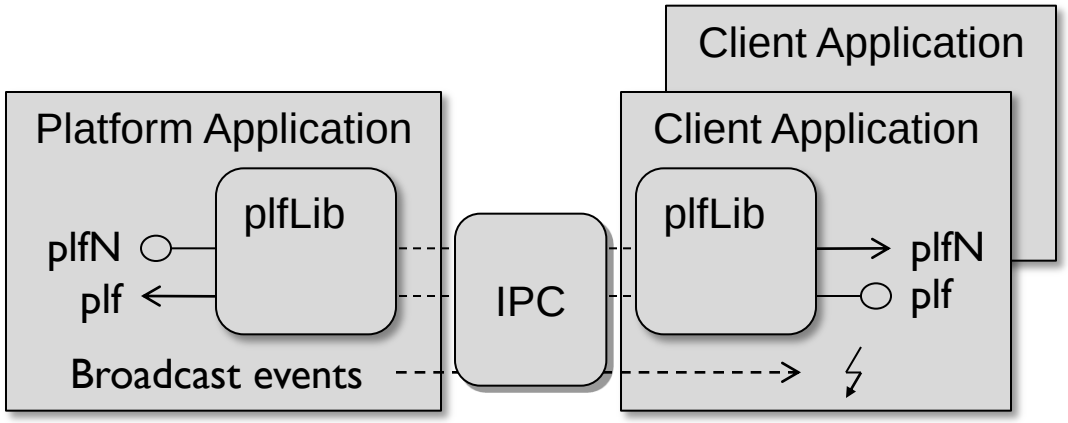
plfAPI



joint space
split application architecture

- Defines the interaction between Platform Application and applications
  - Consist of a functional API and broadcast events
  - Can be synchronous from application to Platform Application
  - Always asynchronous from Platform Application to applications

- The library (plfLib) enables broadcast events via IPC
  - During initialization IPC connection is established



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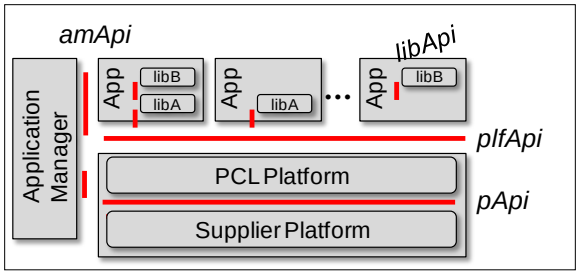
pAPI



joint space
split application architecture

- pApi defines the AV API as the platform porting layer
  - Derivative of plfApi (without resource management ID)
  - Must be implemented by suppliers

- Internal to Platform Application
  - No client application can access this API
  - Suppliers are the only users

- Must be used within process boundary
  - To avoid overload of IPC traffic between pApi and plfApi
  - Hence supplier glue and PCL platform code always in single process

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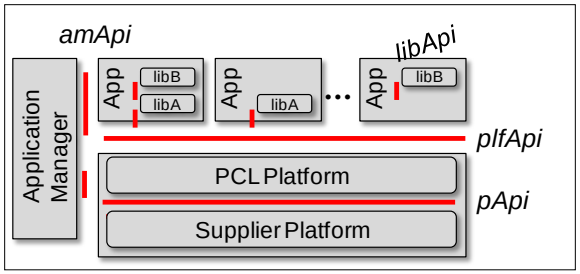
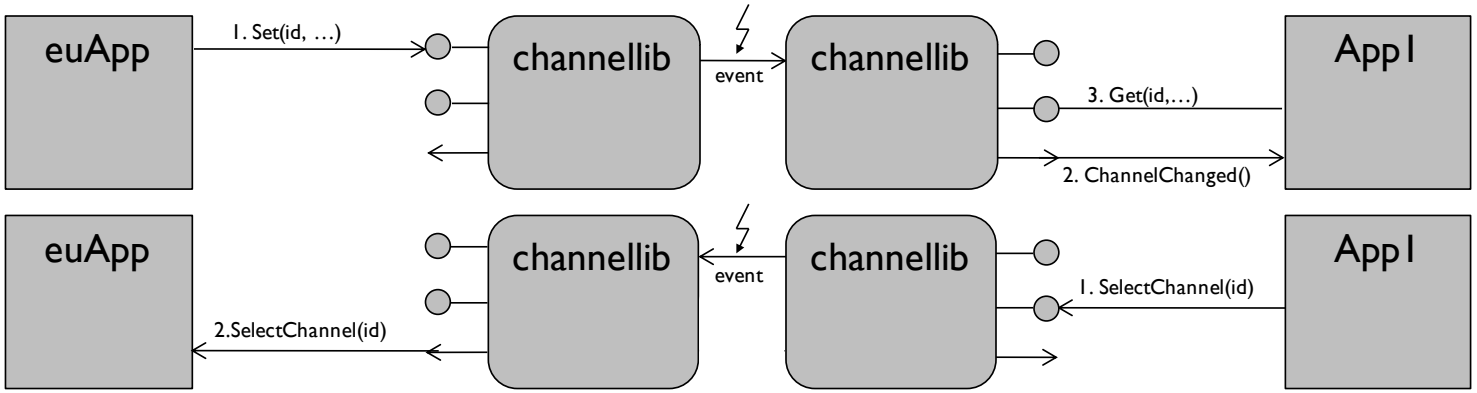
libApi



joint space
split application architecture

- General concept of SPACE is that applications do not communicate
  - Any application can gather data needed by other applications
  - Data must be shared, without creating application dependencies

- Concept used are (shared) libraries
  - Library relies on broadcast events to inform changes to applications
  - Provides a functional API, hiding communication channel



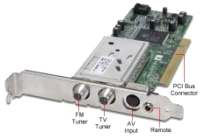
Porting Guide

- Detail description of SPACE framework
  - SPACE Concept, API Concepts, Application Lifecycle, Application States, Resource Management, Connection Management, Application Switch, Audio Video Control, Audio Video Platform Interfaces, Application Data Sharing

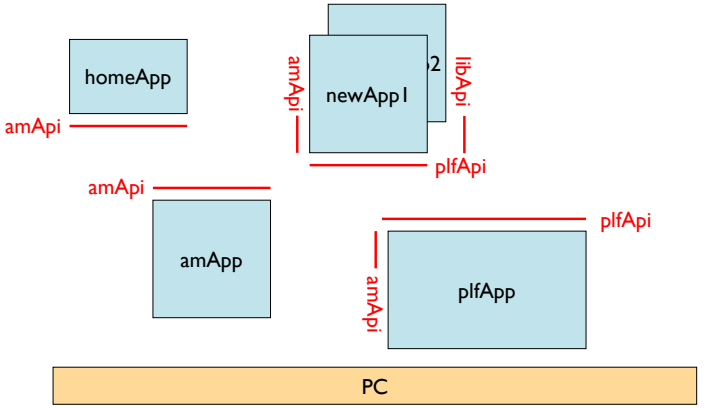
- All APIs documented and publically available
  - API behavior explicitly described, including detailed sequence charts
  - amApi, plfApi, pApi, libApi

Innovation Carrier

- PC enables fast prototyping of future TV use-cases
  - Enhanced multi-window
    - Compose multiple input streams
    - Real window rendering on PC
  - Enhanced graphics acceleration
    - OpenGL, SVG, Flash, DirectFB 2.0
  - All via PC cards and prototype extensions



- jointSPACE released on SourceForge
  - Sample applications
  - Complete documentation
  - SPACE fully available on PC using simulated platform



SourceForge Archive

- jointSPACE on Linux/PC implementation available via SourceForge
  - Link http://jointspace.sourceforge.net

- The following can be downloaded
  - Porting Guide (pdf file)
  - HTML documentation for the APIs (amAPI, plfApi, papi)
  - Source Code package

- Current source code release focused on the APIs
  - Interface interaction and system dynamics

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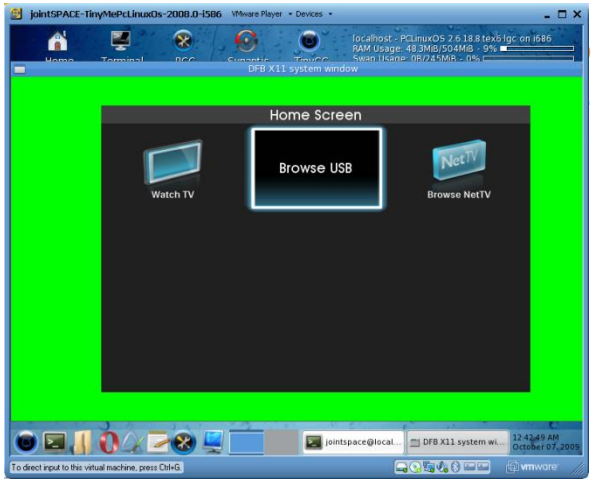
Developing For jointSPACE



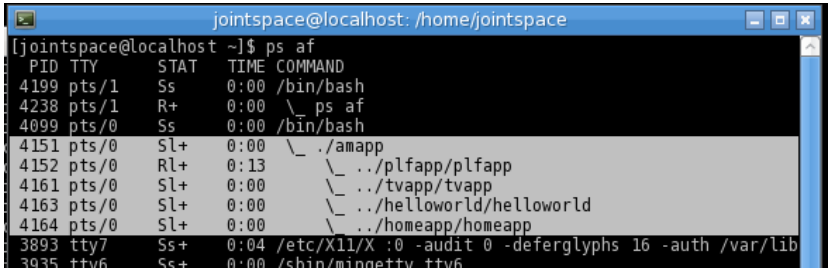
- Any recent Linux distribution expected to be usable
  - Validated for Ubuntu distribution
    - For “non-standard” Linux system, check steps in install.sh
  - Specific version of DirectFB, FusionDale and SaWMan required
    - See directfb/directfbinstall.txt for instructions

- Available are executables and libraries with required header files
  - Application Manager; Hello World, Home, Platform, and TV Application

- Each executable has a makefile
  - Using the file common.mk from the root
    - Two targets are supported: <appname> and clean
  - The BASE environment variable needs to be set correctly
    - Adapt common.mk or run setenv.sh

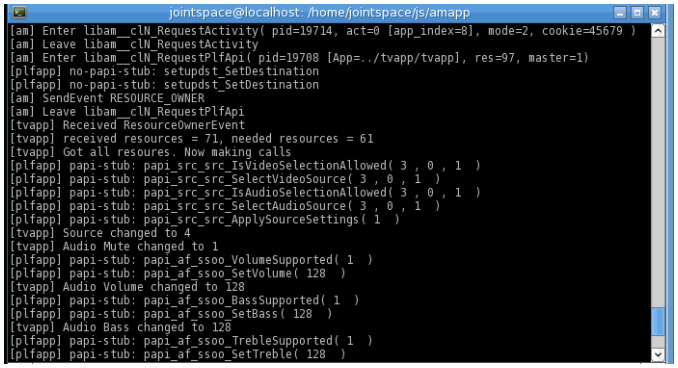
Simple Starting Point

- HomeScreen application is available
  - 'm' toggles HomeScreen, Navigation via cursor key, selection via Enter
  - In Watch TV (tvapp), the 'o' toggles a menu with calls to plfApi



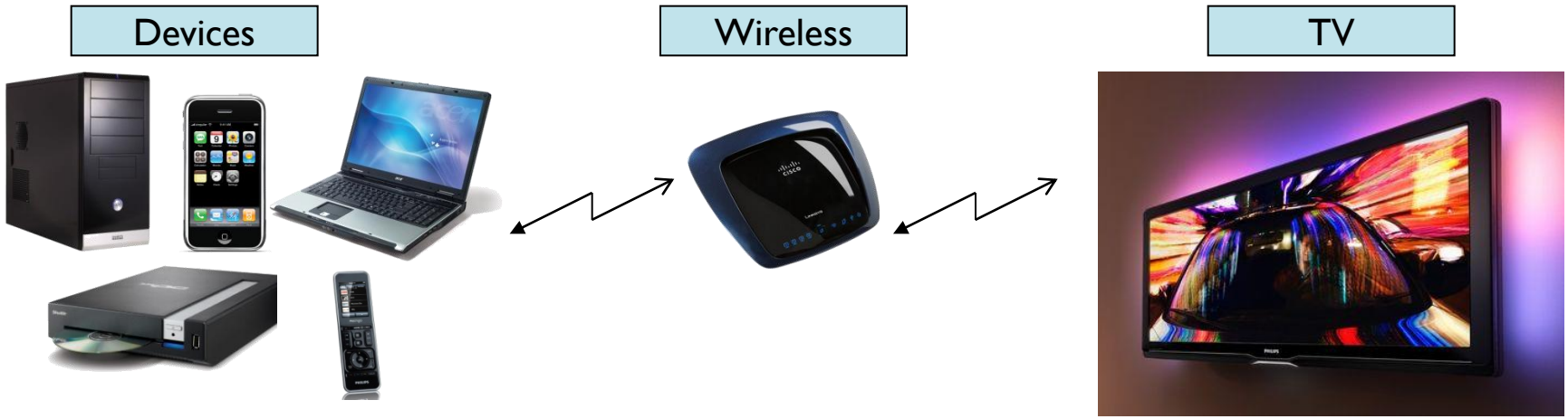
- amApp that manages the applications
  - Configured via application.lst file
  - Subset of amApi is implemented
  - Application launch and switch, focus switch, resource management

- While running console output is generated
  - Giving insight in which calls are executed.
  - Indicates program that generated the output



Accelerate Embedded Development

- Will enable remote access to TV via IP network connection
  - plfApi, amApi, libApi will become (partly) remote accessible
  - APIs are remotely accessible via xml-rpc
  - Leverage TV platform for AV decoding and rendering



- Run TV related applications on other devices
  - Using available interfaces to develop new applications
  - E.g. an Android application interacting with the TV

Shorter Lead-Time of Innovations

- Applications on PC in general needs to be constrained running on TV target
  - Unrestricted access to system resources cannot be granted
  - Ensuring system stability, performance and DRM restrictions

- Application must be constrained using a number of techniques
  - Disallow super-user power (remove POSIX capabilities)
  - Fine-tune system access using SMACK
  - Constrain memory usage via cgroups
  - Restrict CPU usage (e.g. via cpulimit, cgroups, or priorities)
  - SMACK for Digital TV discusses some of the technologies required
    - Paper by Embedded Alley
    - Presentation at this conference

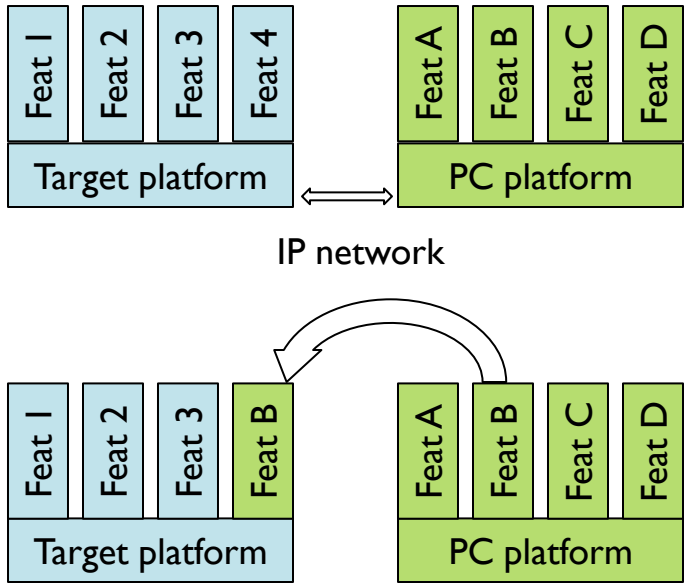
DirectFB 2.0 Further Enhances SPACE

- Enhanced application and window management
  - Animated application (window) transitions
  - Extended sub window support (multiple depth levels)
  - Support for different graphics APIs (e.g. OpenGL, Native 2D, …)

- Enhanced distributed UI capabilities (Voodoo)
  - Drawing down by an external device, final rendering done by TV
  - Window creation must be aligned with TV based amApp
  - Enables the use of different graphics cores for various tasks

Distributed TV Development

- Features developed in jointSPACE PC framework can be made available on TV
  - Framework on target and PC are identical (same API)
- Applications will be able to control target remotely
  - Using IP network
  - Requires specific pairing with TV
- Applications can be deployed on target directly
  - Requires recompilation only
  - Constrained by target resources

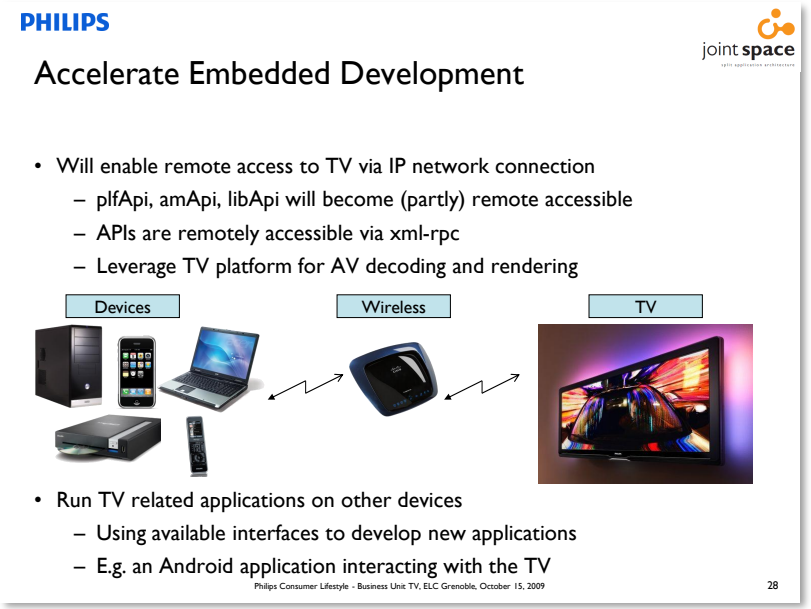


Enabling jointSPACE

- Philips internet TVs will be jointSPACE enabled in due time
  - Allowing applications to be developed outside TV target (e.g. using PC)

- Enabling others to develop new applications
  - And experience them on the actual TV

- SourceForge archive will be extended
  - With remote TV access
  - Available application interfaces



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Driving Open Innovation

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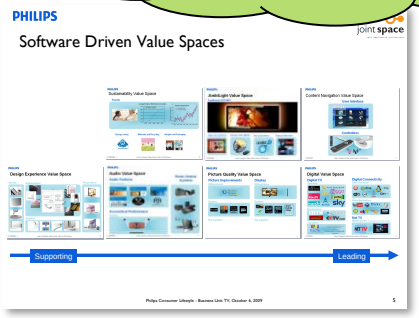
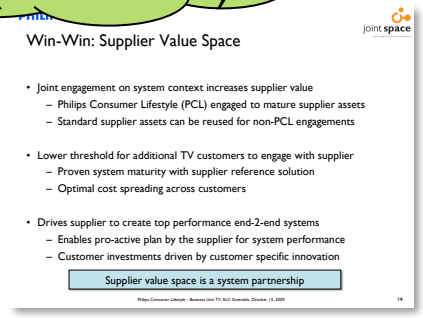
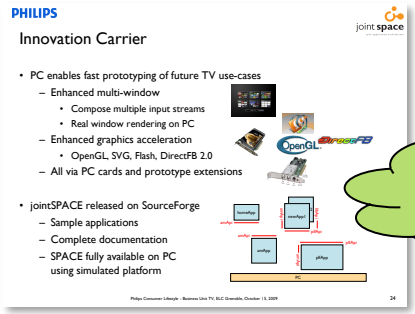


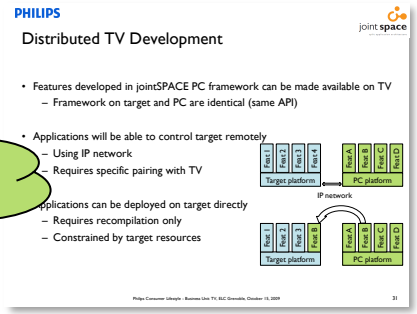
Suppliers (HW & SW)



jointSPACE

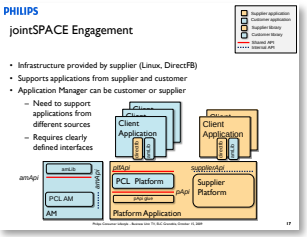


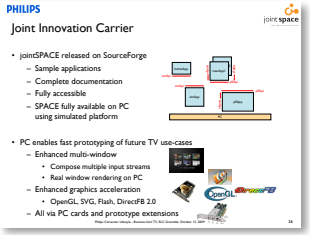
Innovators

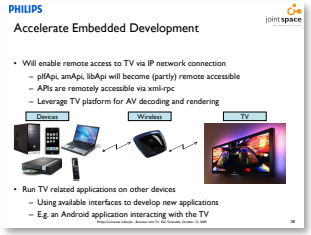


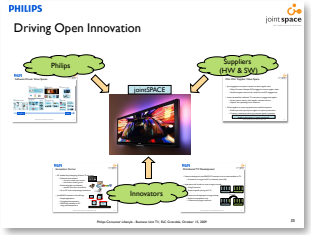
Accelerating Innovation

- jointSPACE engagement requires clear framework description
  - Enabling independent asset development
- SPACE framework used to create a new opportunity
  - Public PC environment to develop new applications
- Digital TV innovation must be made accessible and usable
  - Enabling the TV for external application development
- Towards open innovation
  - Working with an community of innovators







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