



**Introduction to
Universal Plug and Play**

Making the Dream a Reality

- **The Dream – Easy Home Networking**
- **What is UPnP**
- **UPnP Business Opportunities - Scenarios**
- **Advantages of UPnP**
- **How UPnP Works**
- **UPnP Forum**

- ***Connecting Everything***
 - PCs, intelligent appliances, and smart objects
- ***Computing Everywhere***
 - Universal Plug and Play connectivity



Quality of Life

A Connected Environment

PCs, appliances, and services interconnect

Technologies converge, devices don't



Simplicity

Connectivity

Reliability

Tough problems...

Privacy

The Reality

Community

Convenience

Making it meaningful to consumers?

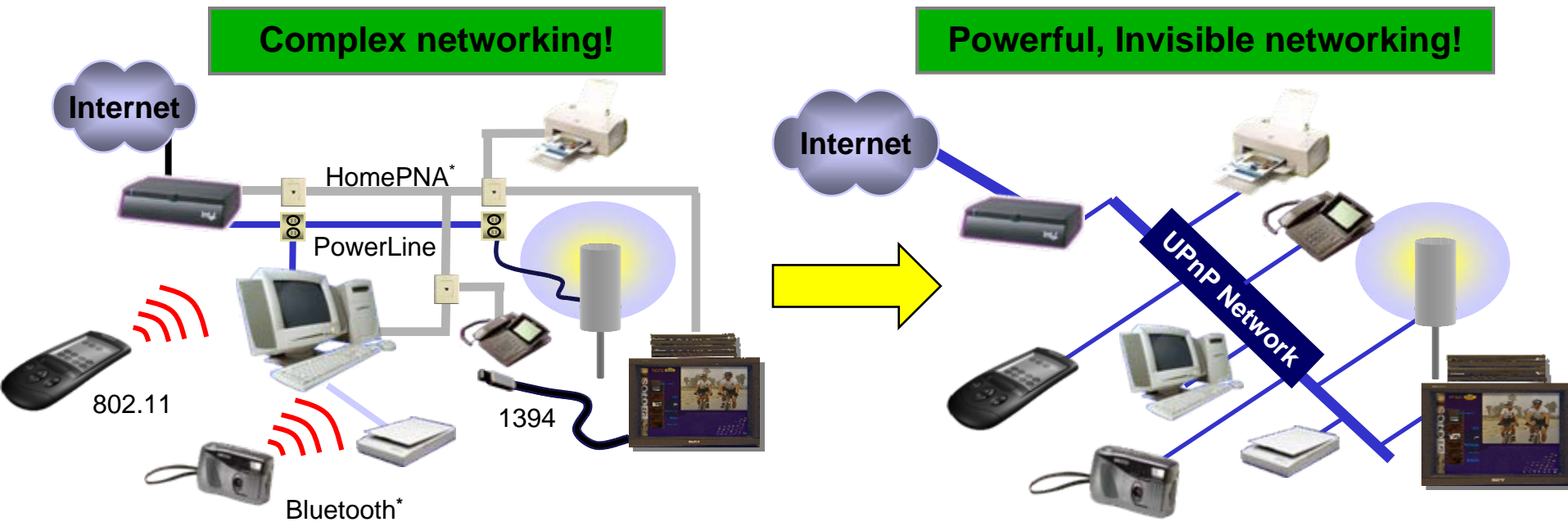
Communication

Personal security

Devices Just “Work” When They are Connected

- **Enable devices to be automatically configured when they...**
 - **Connect to a network**
 - **Communicate their capabilities**
 - **Control information to any appropriate control application**

- Create a Plug and Play experience for consumers to:
 - Easily share an Internet connection
 - Enjoy digital multimedia content on preferred devices
 - Securely access content in the home from anywhere



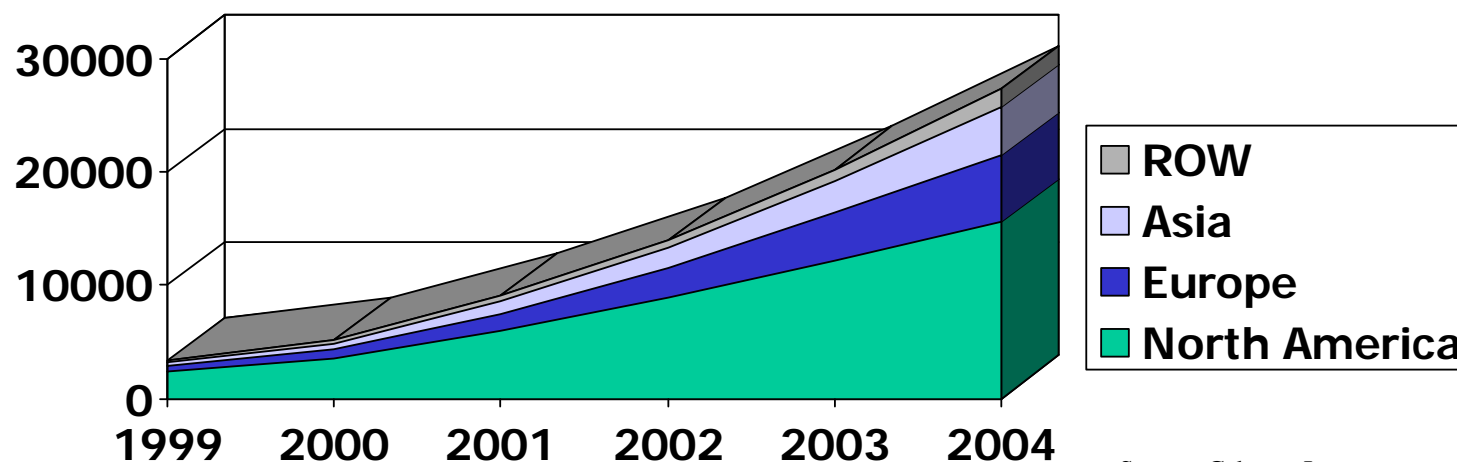
A Key Enabler

- **Provides invisible home networking**
- **Architectural framework for self-configuring, self-describing devices**
 - **Leverages existing Internet technologies**
 - **Enables dynamic peer-to-peer networking**
- **Key to making the connected home experience**
 - **Affordable, mainstream reality for users**
 - **Significant opportunity for the industry**

- **Just send data over the network**
 - No executables
 - Minimize version issues
 - Minimize security issues
- **Allows implementation to be platform & vendor specific**
 - Be agnostic re: programming language, OS
 - Update implementation w/o affecting interop
 - ▶ Improve performance
 - ▶ Reduce footprint
 - ▶ Improve capabilities
- **Agree on meaning / format of data**
 - Choose substrate of proven protocols
 - Define device (service) specific protocols in a Forum

Business Opportunities: Huge Growth!

Home Network Install Base

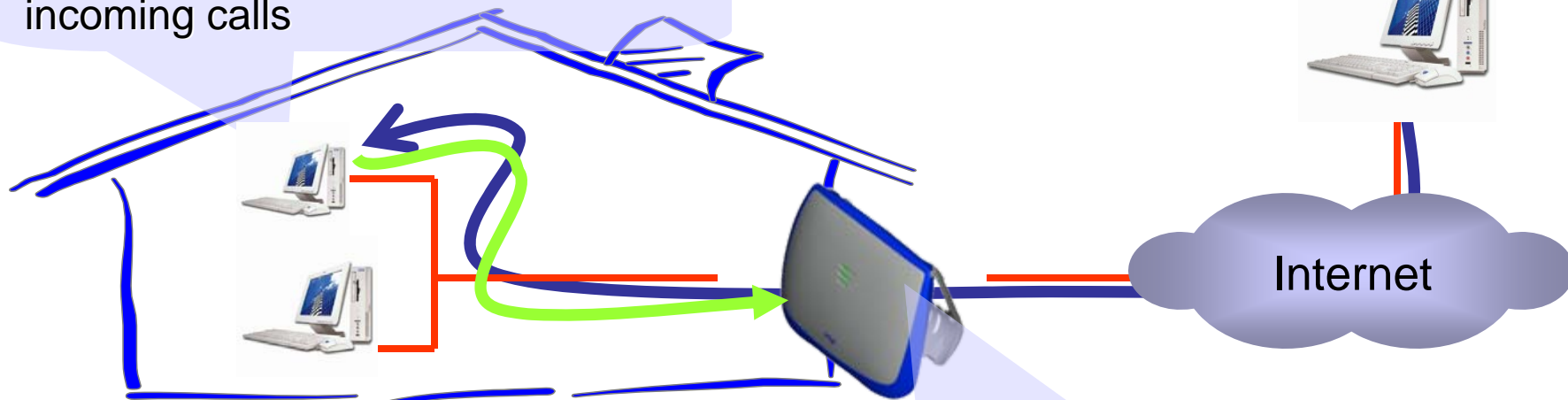


Source: Cahners-Instat

- Non-PC devices (4 billion embedded microprocessors in 1999)
- Rapidly increasing Internet adoption rates
- Strong uptake in Internet broadband deployments
- 64% of U.S. PC homes have television and PC in the same room
- 34% of U.S. PC homes have 2 or more computers
- By 2004
 - 27MM networks installed
 - 48.5MM nodes / year run rate
 - Services a \$3BB / yr business

UPnP Residential Gateway Example

Ip telephony application listens for incoming calls



Application re-configures, Internet Gateways, NAT and Firewall on a per-call basis

■ End User Benefits:

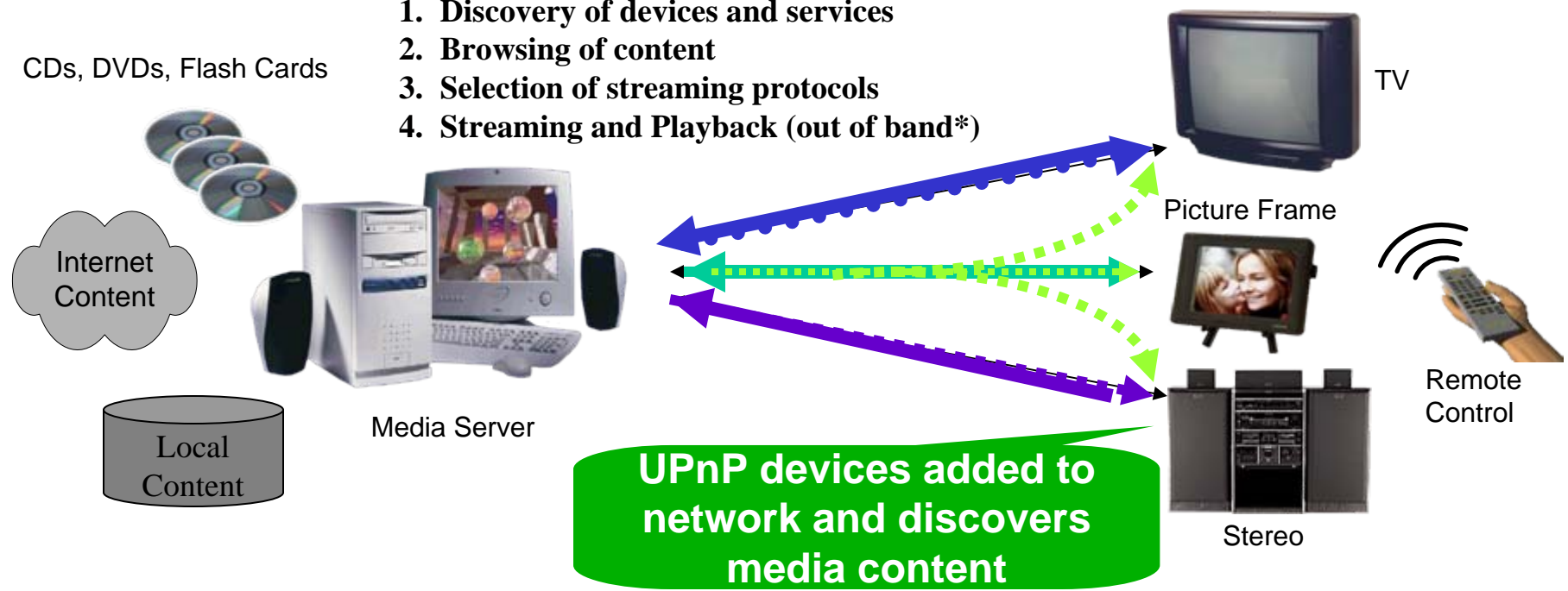
- Automates real-time setup and configuration of Internet applications
- Multi-player gaming, streaming audio/video, VoIP
- Enables software to automatically setup and configure the NAT and Firewall
- End user no longer needs to configure network

■ Service Provider Benefits:

- Eliminates support calls for NAT, firewall, gaming configuration
- Enables customer self-provisioning for enhanced services
- Reduces barriers to deploy voice, video, gaming, etc.

Audio & Video Example

1. Discovery of devices and services
2. Browsing of content
3. Selection of streaming protocols
4. Streaming and Playback (out of band*)



End User Benefits:

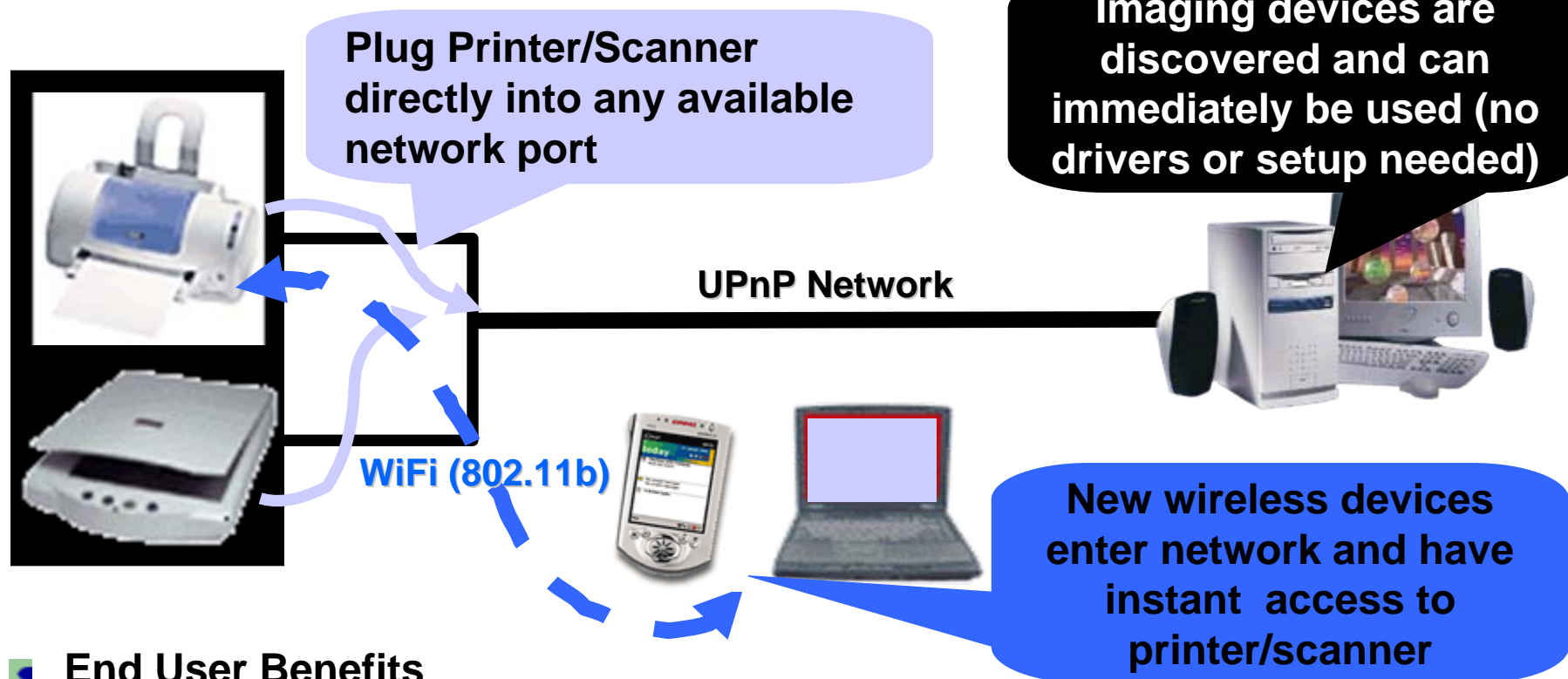
- Discover A/V content on all UPnP devices and PCs and share across home network
- Stream content easily from any device to any device on home network
- Control point offers rich, easy to use interface for creating and managing media
- Supports DVD, CD, play list, photo album, live broadcast, etc

Manufacturer and Service Provider Benefits:

- Highly extensible – any data type, any transfer protocol, any combination of server, render, and control point
- Highly scalable – ultra low resource devices (cameras, EPF) up to high-end servers (PCs, media servers, Internet, broadcasts, PVR).

* Out of band = not UPnP Constrained

UPnP Imaging Example



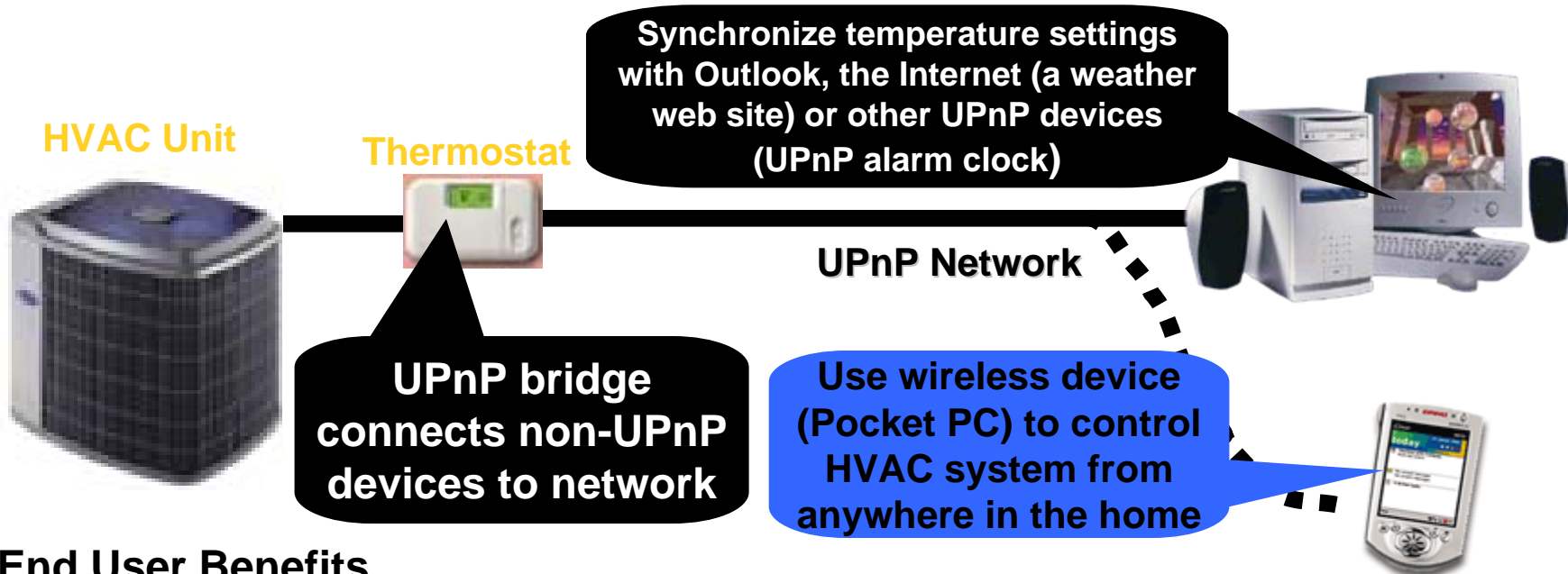
■ End User Benefits

- No need to install or share printer on the PC or and manually connect all devices to the network (no networking knowledge needed)
- Automatically discover printer/scanner and no need to search for new imaging devices added to the network.

■ Manufacturer and Retailer Benefits

- Reduce customer and service support with driver questions and how to network printer on home network
- Ability to print and scan from an extended range of devices not support previously (Pocket PCs, Cell Phones, Web Tablets)

UPnP Automation Example



■ End User Benefits

- Customizable and easy control of heating, venting, AC unit, motion sensors, lighting and security (personal environment presets)
- Save money on energy bills (set temperature automatically from occupancy or depending on outside temperature)
- Synchronize home settings with PC programs (Outlook calendar, Internet weather)
- Enable secure remote access into the home via the Internet and control UPnP devices.

■ Manufacturer and Retailer Benefits

- UPnP enabled automation systems add much more functionality over existing proprietary control panels (more desirable over existing technology)
- New opportunities for manufacturers to extend additional features available to the PC, Internet, or other devices (more revenue with new business models, software and service offerings)

Benefits of UPnP

- **Widely supported networking specification**
- **No device configuration, just Plug and Play**
- **Small footprint software component on the device**
- **Utilizes standard Internet protocols to talk to LAN**
- **Independent of OS, language, or physical connectivity**
- **Robust and dependable**
- **Growing value of UPnP logo**

UPnP simplifies device connectivity for makers and users of devices

UPnP is Cost Effective

For Appliances and Smart Objects

- **Lightweight by Today's Standards**
 - TCP/IP stack is about 35K bytes of x86 code and 29K gates
 - Embedded HTTP Web server is about 25K bytes of x86 code and 64K gates
 - An entire OS can fit into one Read Only Memory (ROM)
- **No Royalties for Basic UPnP Interoperability**
 - Other proprietary solutions require significant royalties
- **UPnP Enables Remote User Interface Via Browser**
 - Cheaper than integrated LCD panels and keypads
 - Authored with HTML, XML, and scripting

Bottom Line Impact

Improving Your Business

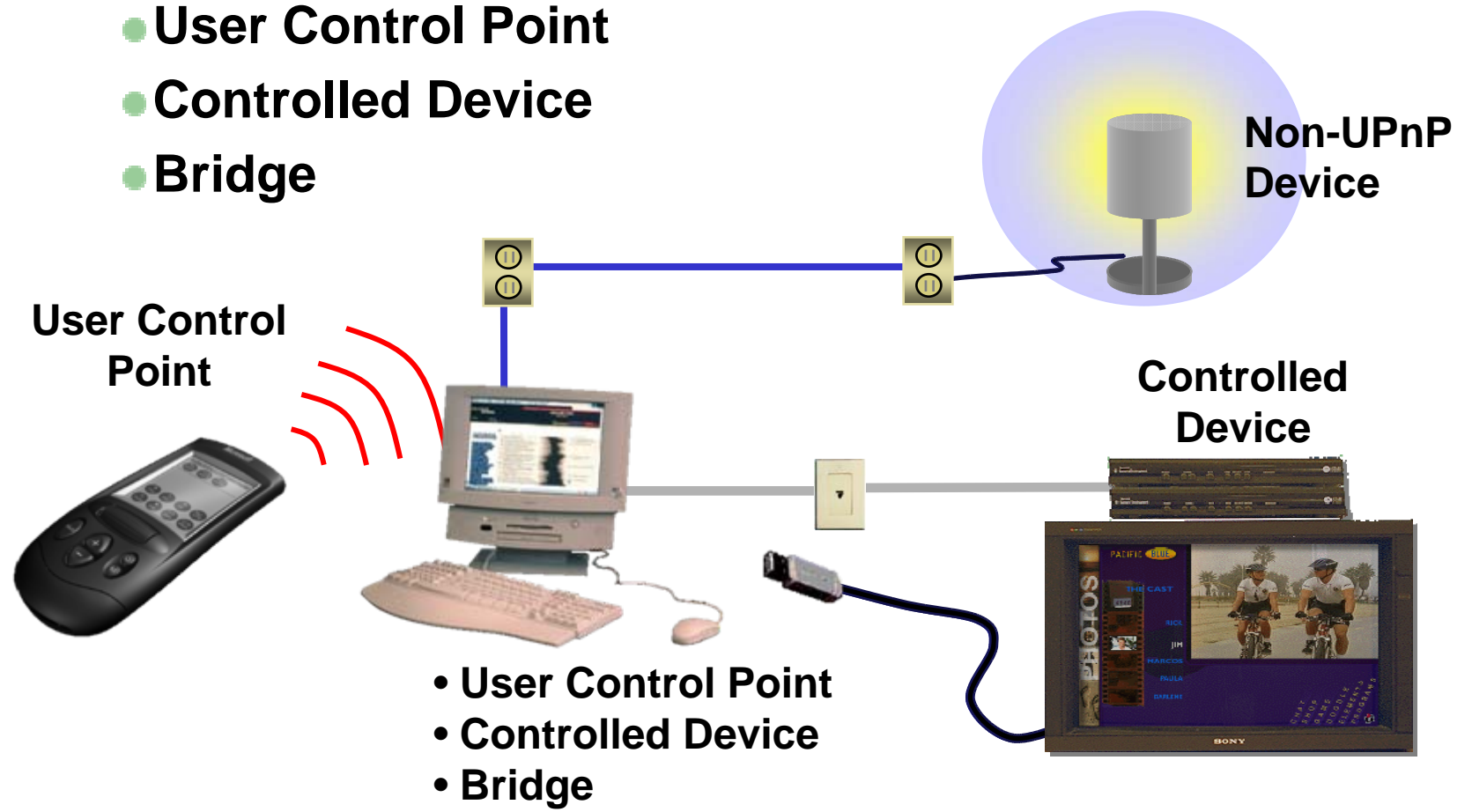
- **Improve customer experience = repeat sales**
- **Enhance interop between your devices and others**
- **Expand relationships with other Forum members**
- **Reduce \$\$ spent on customer support**
- **Reduce your time to market**

UPnP adds value to your bottom line

UPnP Control Point vs. Device

■ Three Classes of UPnP Entity

- User Control Point
- Controlled Device
- Bridge



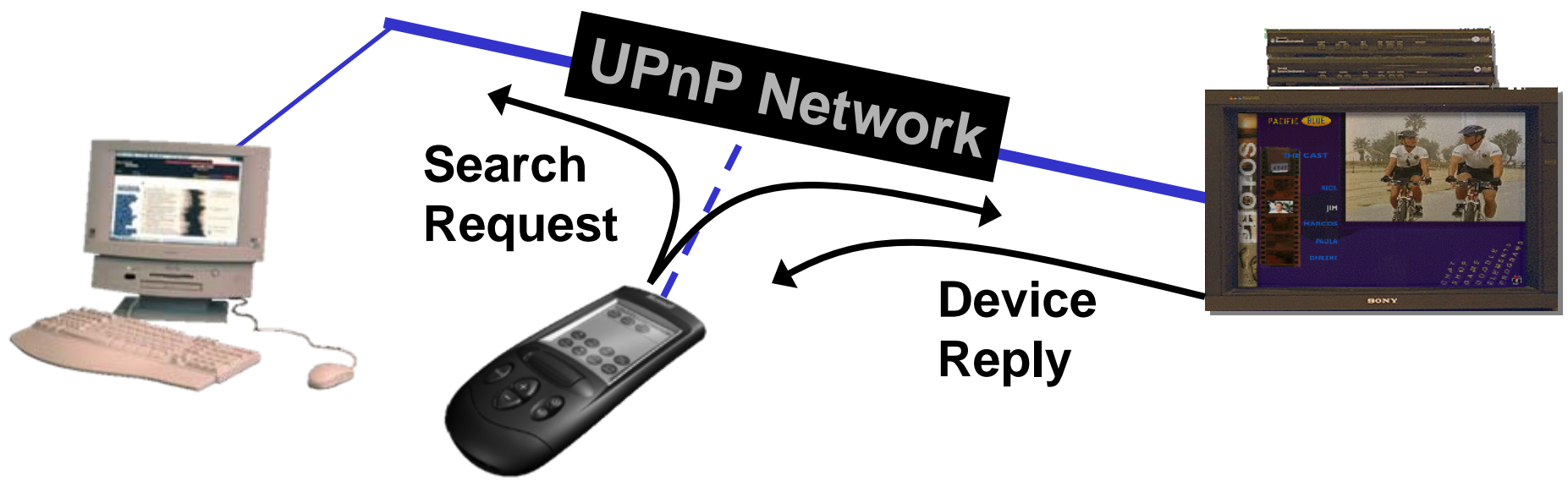
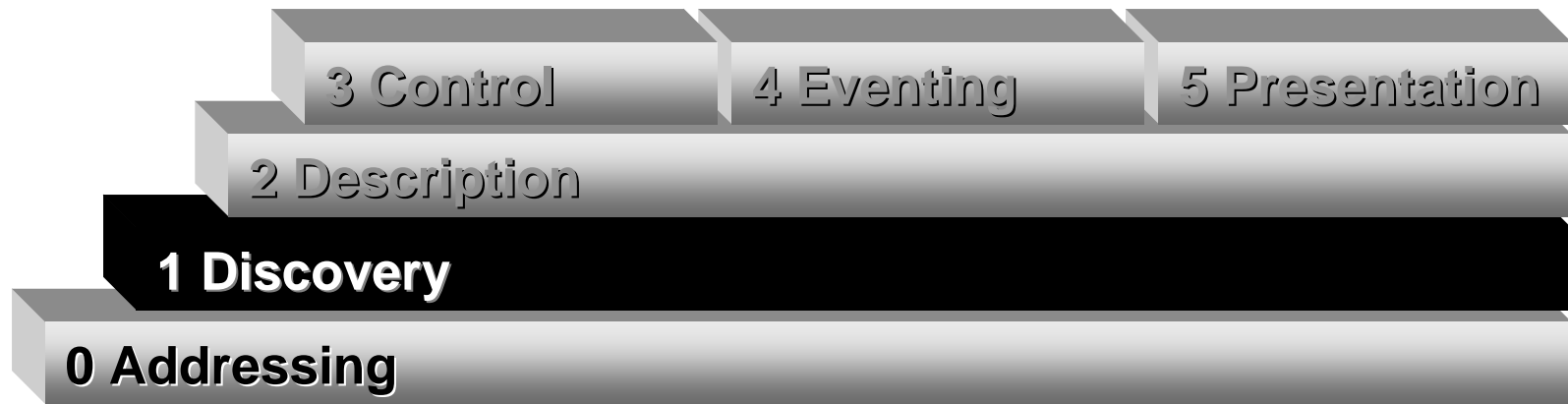
- User Control Point
- Controlled Device
- Bridge



- 0 **Control point and device obtain an address to participate in the network**
- 1 **Control point finds all devices and device advertises its availability**
- 2 **Control point learns about device capabilities**
- 3 **Control point invokes actions on device**
- 4 **Control point listens to state changes of device**
- 5 **Control point controls device and/or views device status using an HTML UI**

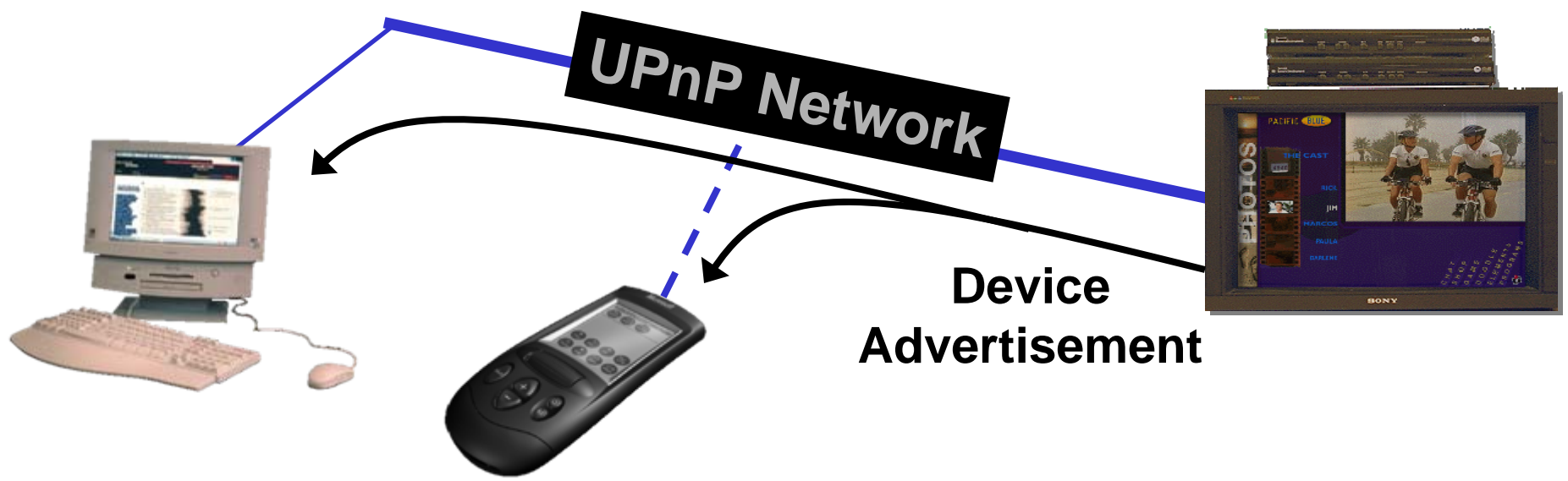
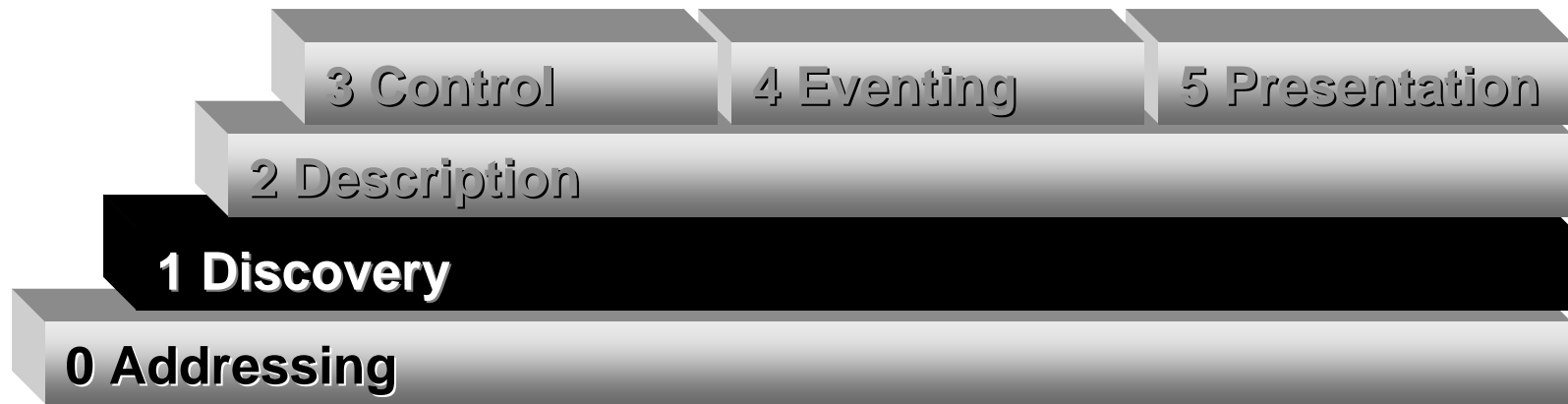
UPnP Architecture

Discovery: SSDP



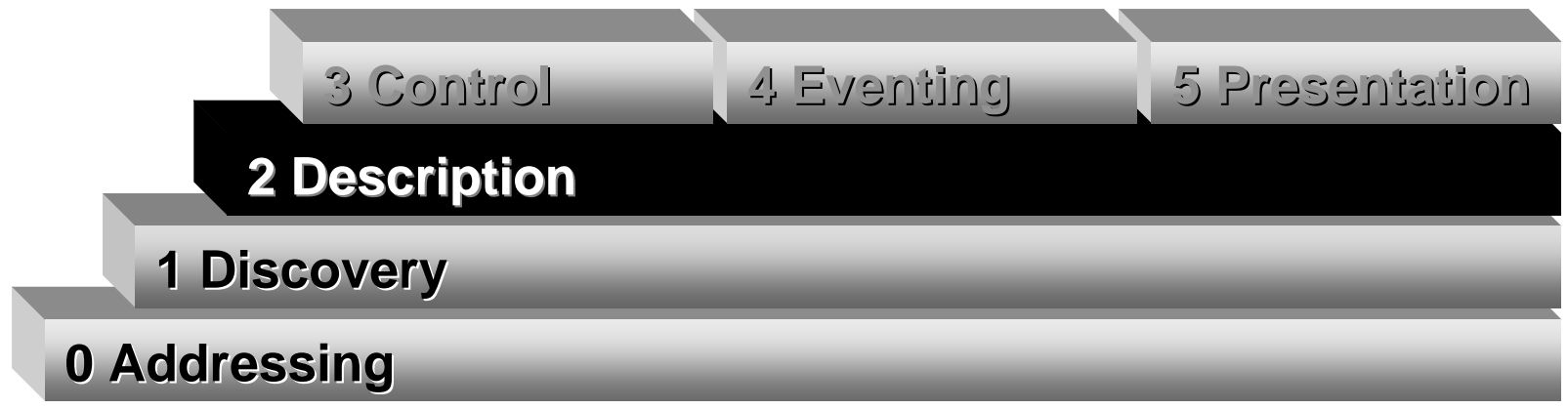
UPnP Architecture

Discovery: SSDP

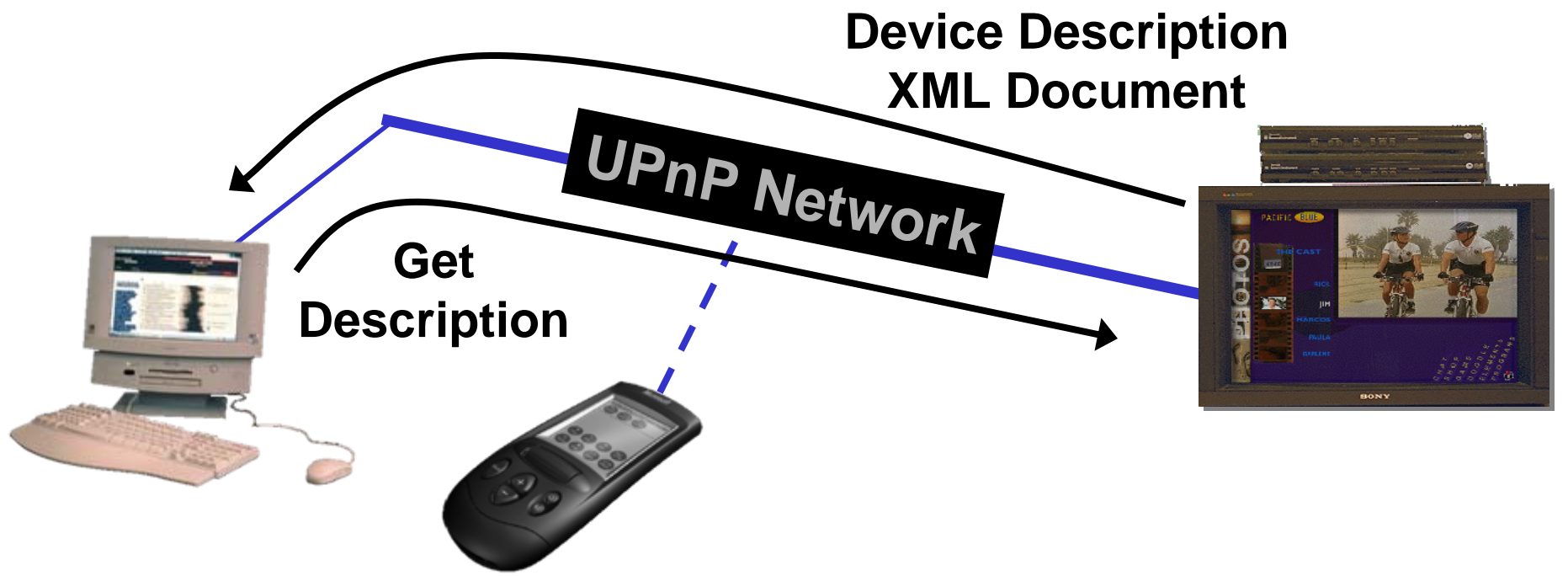


UPnP Architecture

Description: XML

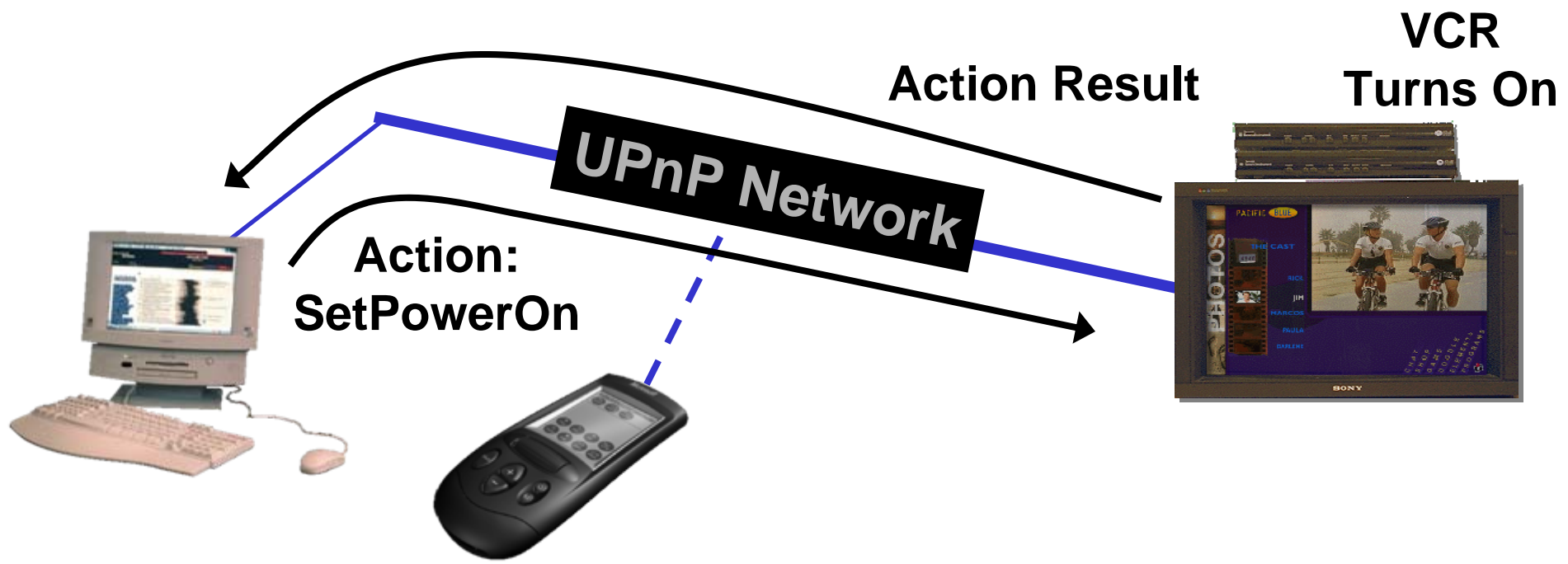
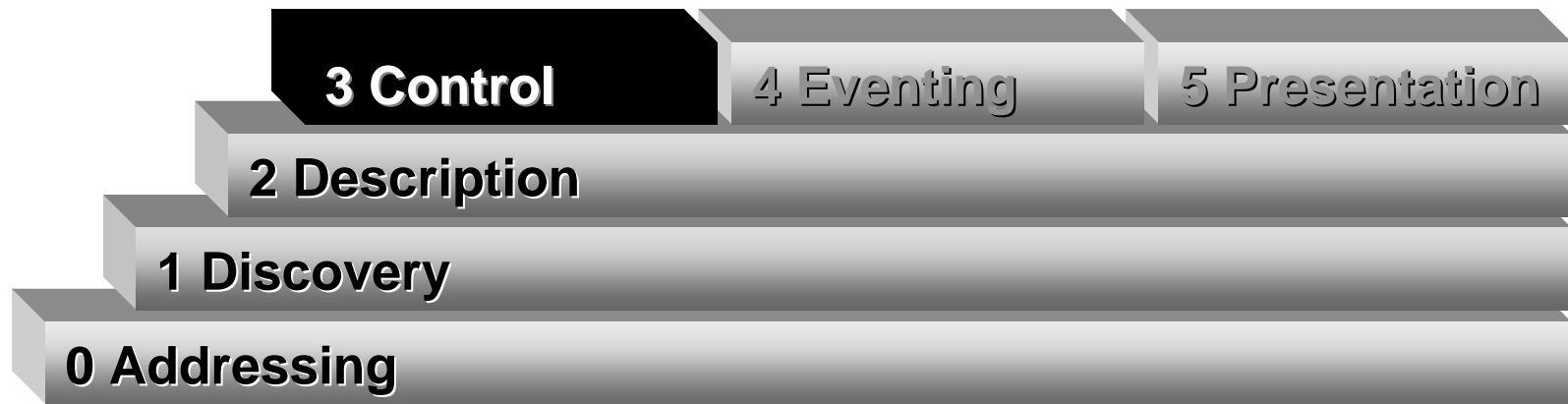


**Device Description
XML Document**



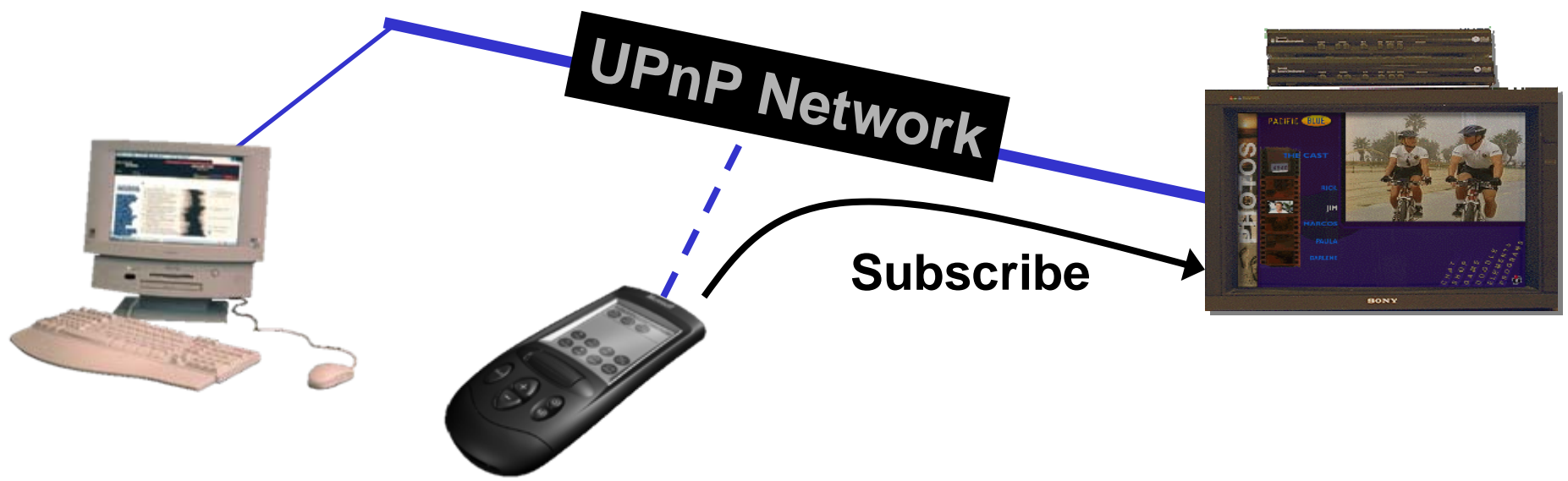
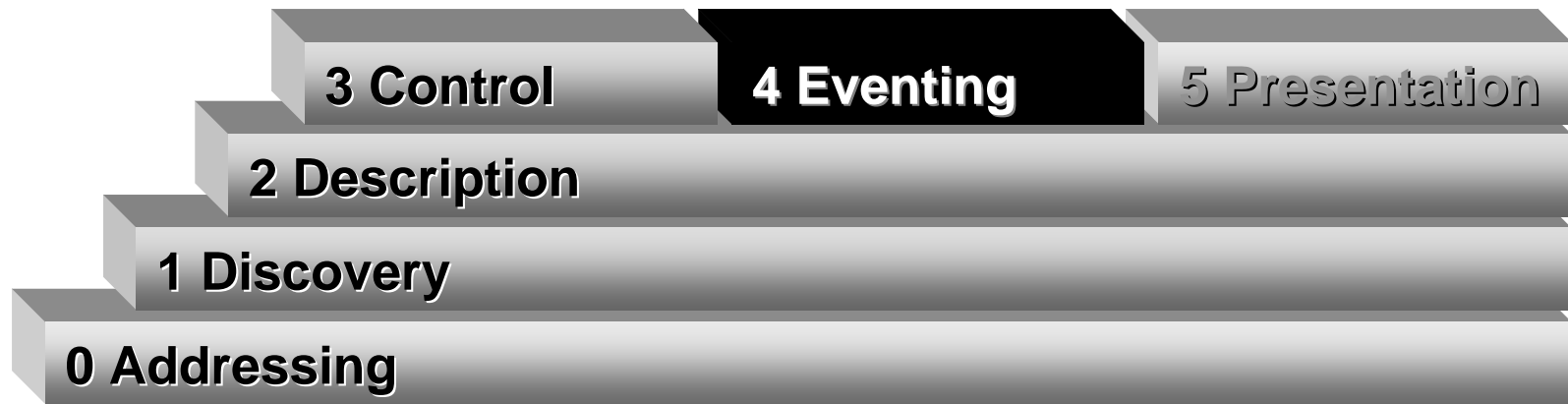
UPnP Architecture

Control: SOAP

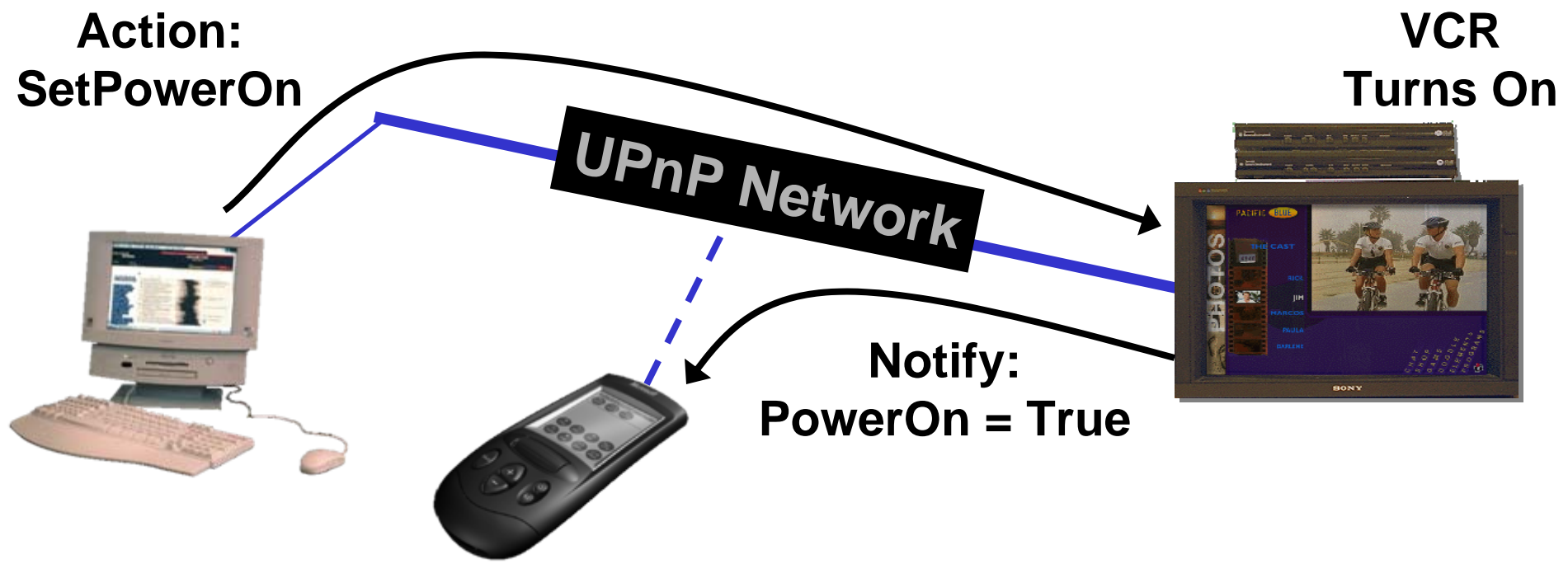
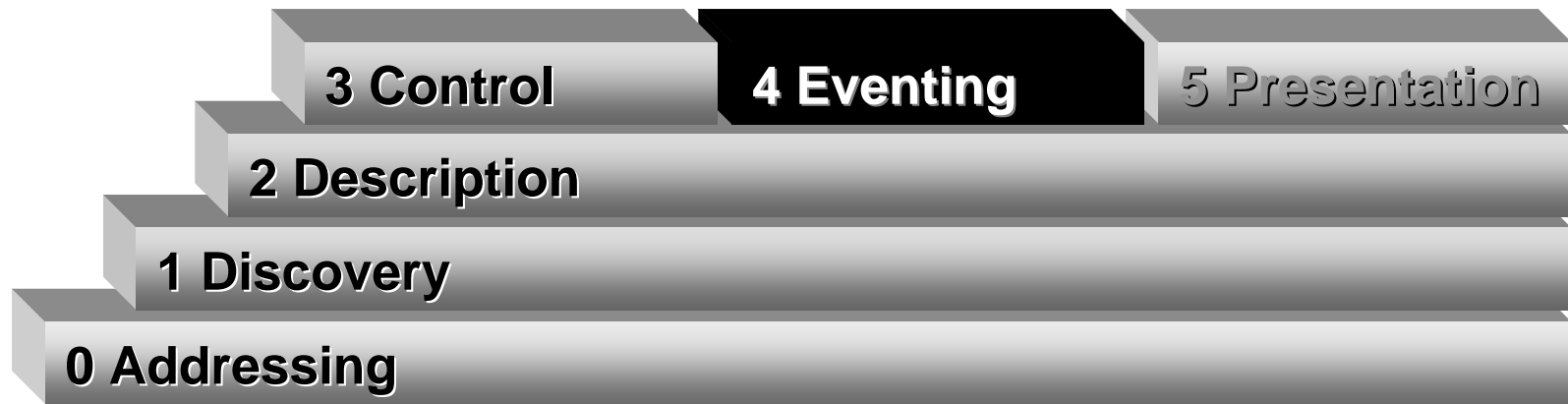


UPnP Architecture

Eventing: GENA

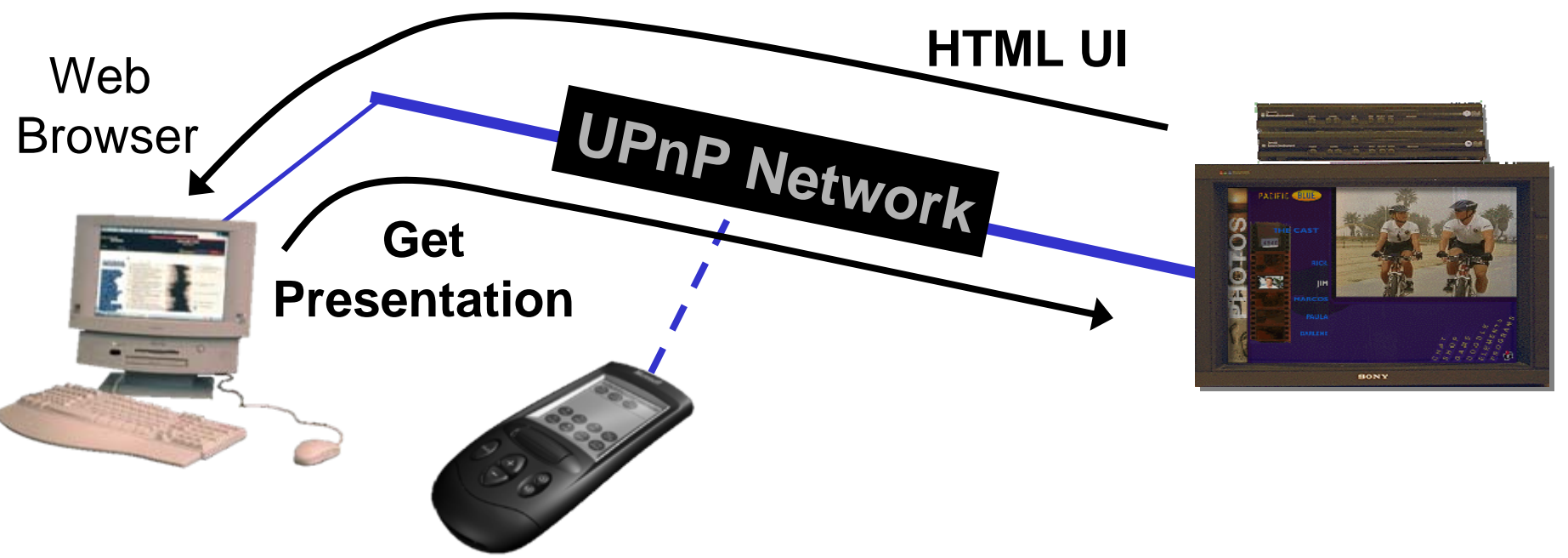
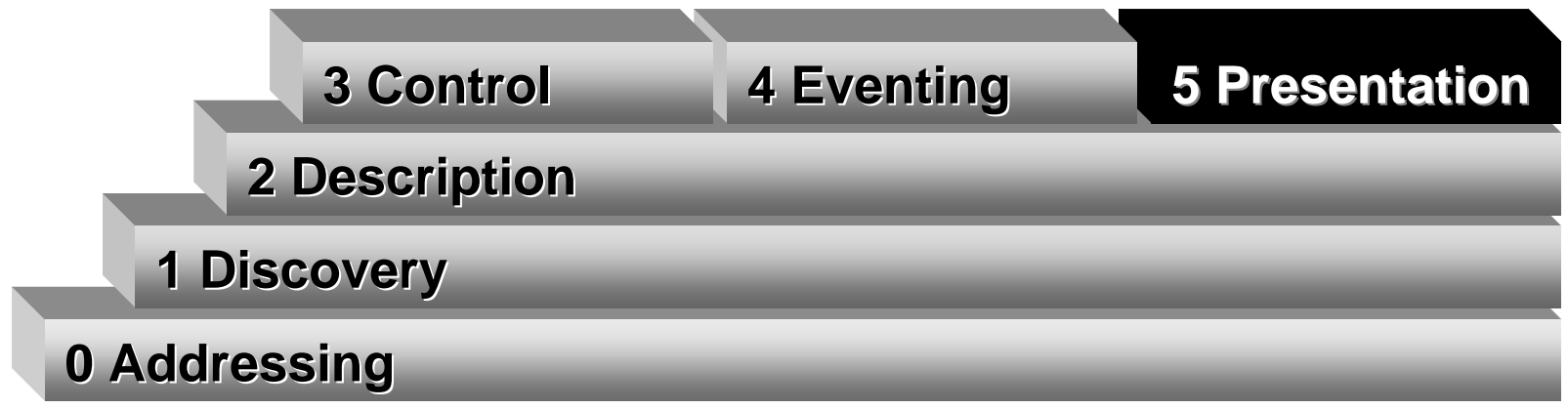


Eventing: GENA



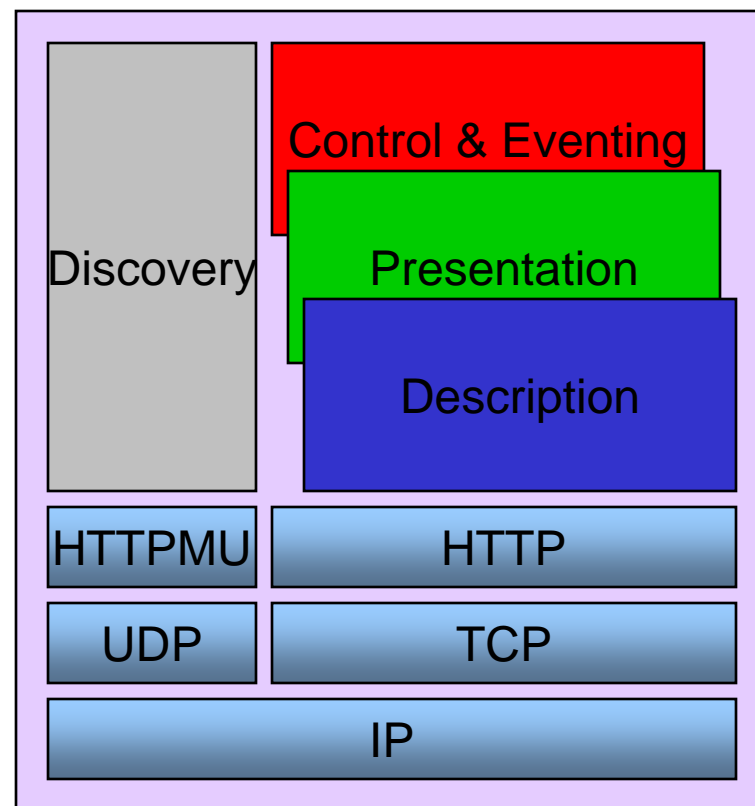
UPnP Architecture

Presentation: HTML



Anatomy of a UPnP Device

- Networking stack
- Discovery server
- Description server
- Presentation server
- Control & Eventing Services



Microsoft Windows® UPnP Support

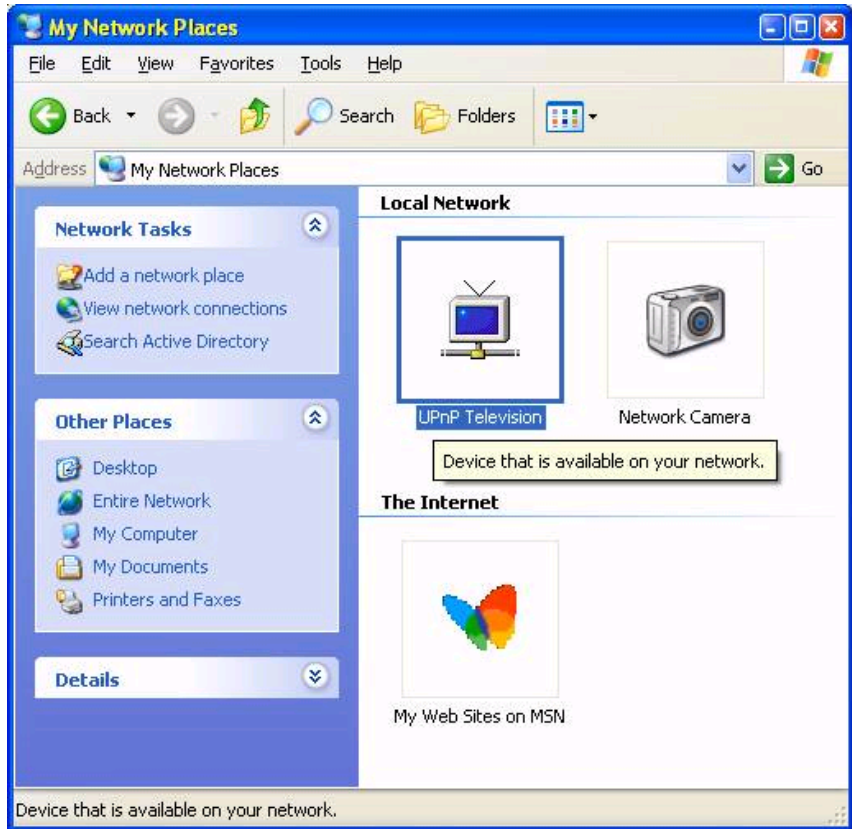
Windows ME

- First operating system to include UPnP support
- Control Point API
 - ▶ Rich set of interfaces for discovering, controlling and receiving events from devices.
- Shell integration
 - ▶ UPnP device icons displayed in My Network Places folder
 - ▶ Double clicking on the device permits Web-based control

Windows XP

- Expands UPnP support beyond Windows ME
- Provides UPnP-enabled NAT traversal support
- Complements other extensive home networking support

Windows UPnP Users Interface



■ **Non-profit industry standards consortium**

- ▶ Framework for efficient industry collaboration
- ▶ Develop Device Control Protocols (DCPs) for a broad class of devices
- ▶ Provide for the test qualification and interoperability of UPnP devices

■ **A market development organization**

- ▶ Promotion, evangelism and marketing activities to promote UPnP brand recognition worldwide

■ **Pragmatic**

- ▶ Open to all
- ▶ No cost to participate in Forum
- ▶ Simple intellectual property policies

- **UPnP Forum**
 - www.upnp.org
- **Allegro Software**
 - www.allegrosoft.com
- **Gatespace**
 - www.gatespace.com
- **Intel**
 - www.intel.com/ial/upnp
- **Metro link**
 - www.metrolink.com
- **Microsoft**
 - www.microsoft.com/hwdev/upnp
 - www.microsoft.com/homenet
- **Virata**
 - www.virata.com/products/upnp.htm

Participant Roles

Steering Committee

- Provide leadership
- Introduce working groups, appoint chairpersons, and monitor progress
- Help accelerate schedules and resolve any working committee logjams
- Approve standardization of device schema submitted by working groups

Working Groups

- Groups consist of: A/V, Appliances, Home Automation & Security, Imaging, and Internet Gateway
- Create device schema
- Submit device schema for standardization

Participant Roles

- **Technology Committee**
 - Works directly with the various working groups to produce efficient standards for each class of device
 - Assists in the development and guidance of developing UPnP technology for new working groups
- **Marketing Committee**
 - Builds the brand of UPnP for logo'd products
 - Creates programs for UPnP Forum Member companies to become involved through various activities.

- **Industry momentum towards standard technology**
- **UPnP simplifies home networking and expands business opportunities**
- **UPnP is supported by industry leaders in a variety of device and service categories**

UPnP adds value to your bottom line, make products NOW!

- **Join the UPnP Forum**
 - Info at www.upnp.org
- **Join a working committee**
 - Contribute, define, adopt
- **Build UPnP enabled products**
 - Use Forum member companies tool kits for rapid deployment of products
- **Evangelize UPnP technology**



Enabling the Interconnected Lifestyle

www.upnp.org