



Active Networking for IPv6

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Active Network Concept





Active Networks Concept

Networks whose actions may be changed during operation either by introducing new code into routers (active extensions) or by executing code contained in a packet passing through the router (active packets)





Non-Active packets

*Static Packets: Network Elements
Constrained to Simple Functions*



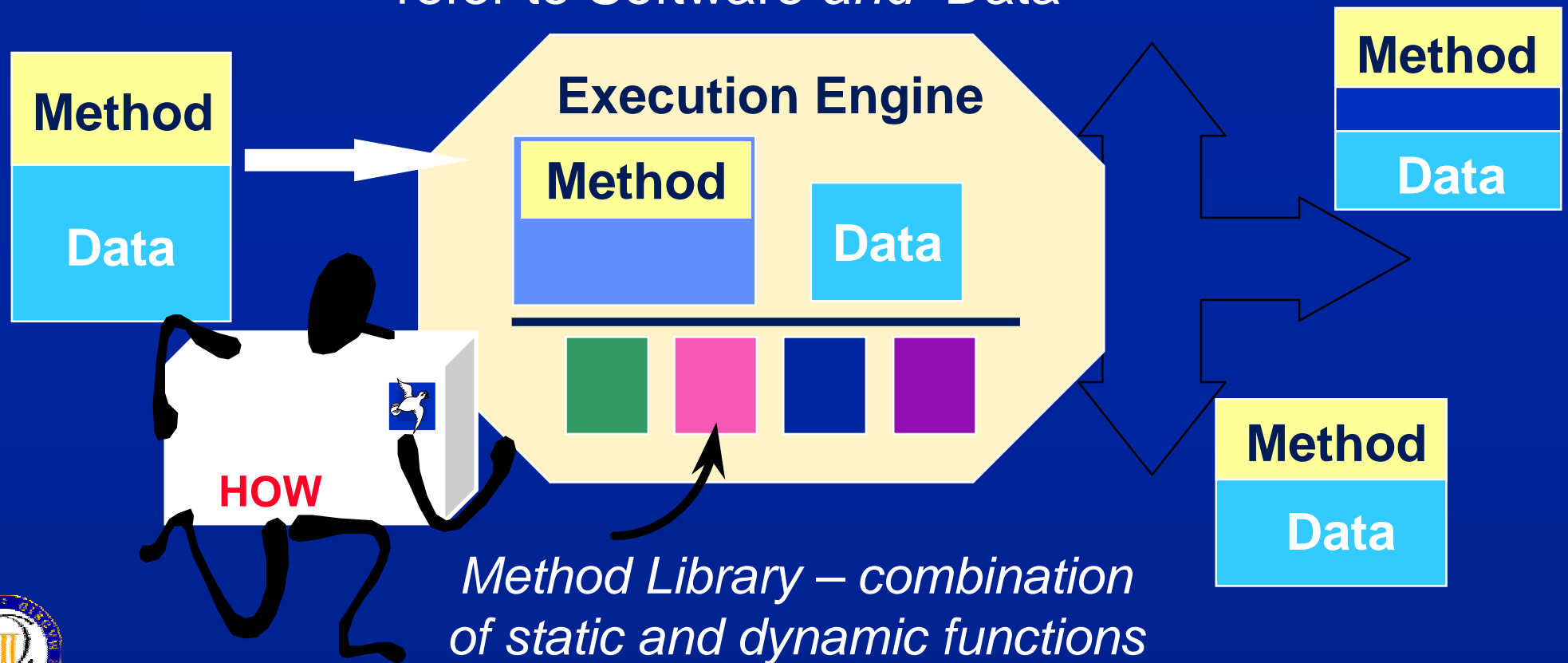
Apply routing information to address;
forward data





Active packets

Active Nodes use Active Packets to carry or refer to Software *and* Data





Goals

- ◆ Reduce the time required to develop and deploy new network services
- ◆ Enable “super-users” to develop and deploy services to suite their particular applications
 - Create a market for smart services
- ◆ Platform for experimenting with network services and features on a realistic scale





IPv6 and Active Networking





IPv6 support for AN

◆ Next-header structure

☞ Extensible options: active-code-carrying options

◆ Security

☞ safe code loading and active flow processing

◆ Flow label

☞ efficient per-flow processing

◆ Routing header

☞ select active nodes forward & backward

◆ IPv6 Router Alert option (2 => AN packet)

☞ transparency and efficiency





Requirements

- ◆ Both IPv6 and active protocols can be used simultaneously
- ◆ Active nodes can route plain old IPv6 datagrams at speed comparable to “passive” IPv6 routers
- ◆ Experiment to gauge cost/benefits
- ◆ Scale to very large global active networks
- ◆ Provide mechanism to ensure the security and safety of active nodes and active network





An IPv6 Active Network Architecture





GCAP Project

- ◆ GCAP (I ST 10504): "Global Communications Architecture and Protocols for new QoS services over I Pv6 Networks"
- ◆ Active Networking support to GCAP protocols and experiments
- ◆ Active Network Services in core routers and edge-devices





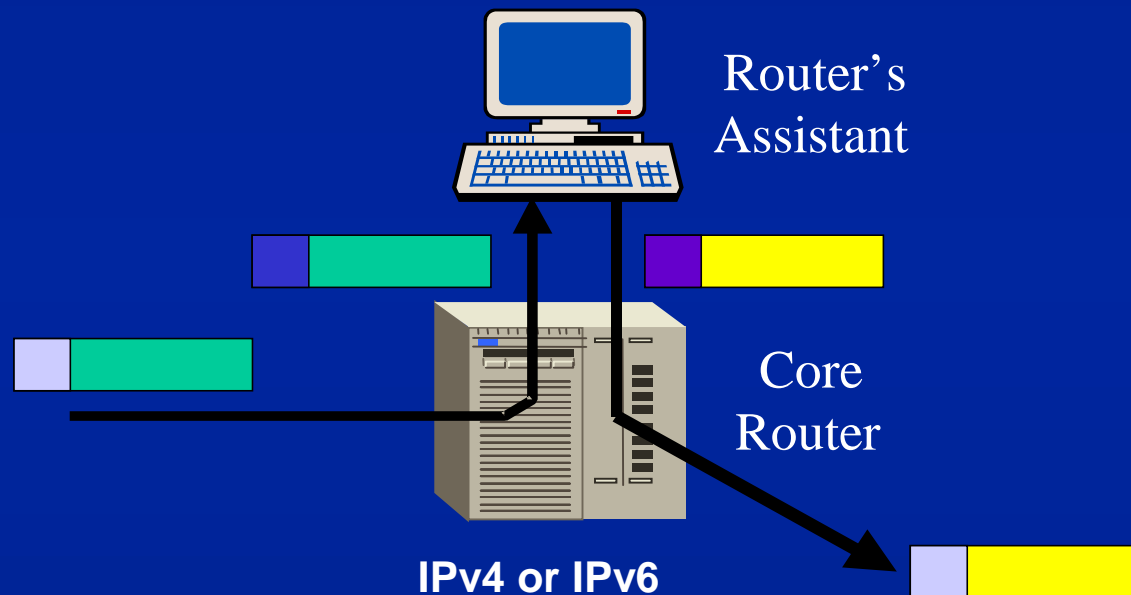
Architecture

- ◆ Preserving normal router operation
 - Router - Assistant architecture
- ◆ Full control over packets from L3 to L7
- ◆ Security:
 - Code upload by network administrator
 - Code download using SSL
- ◆ Active Node Location Transparency
 - Packets are NOT explicitly addressed to Routers (nor Assistants) across the network
 - ... but get processed by the network whatsoever
- ◆ JAVA based





The Router-Assistant Concept

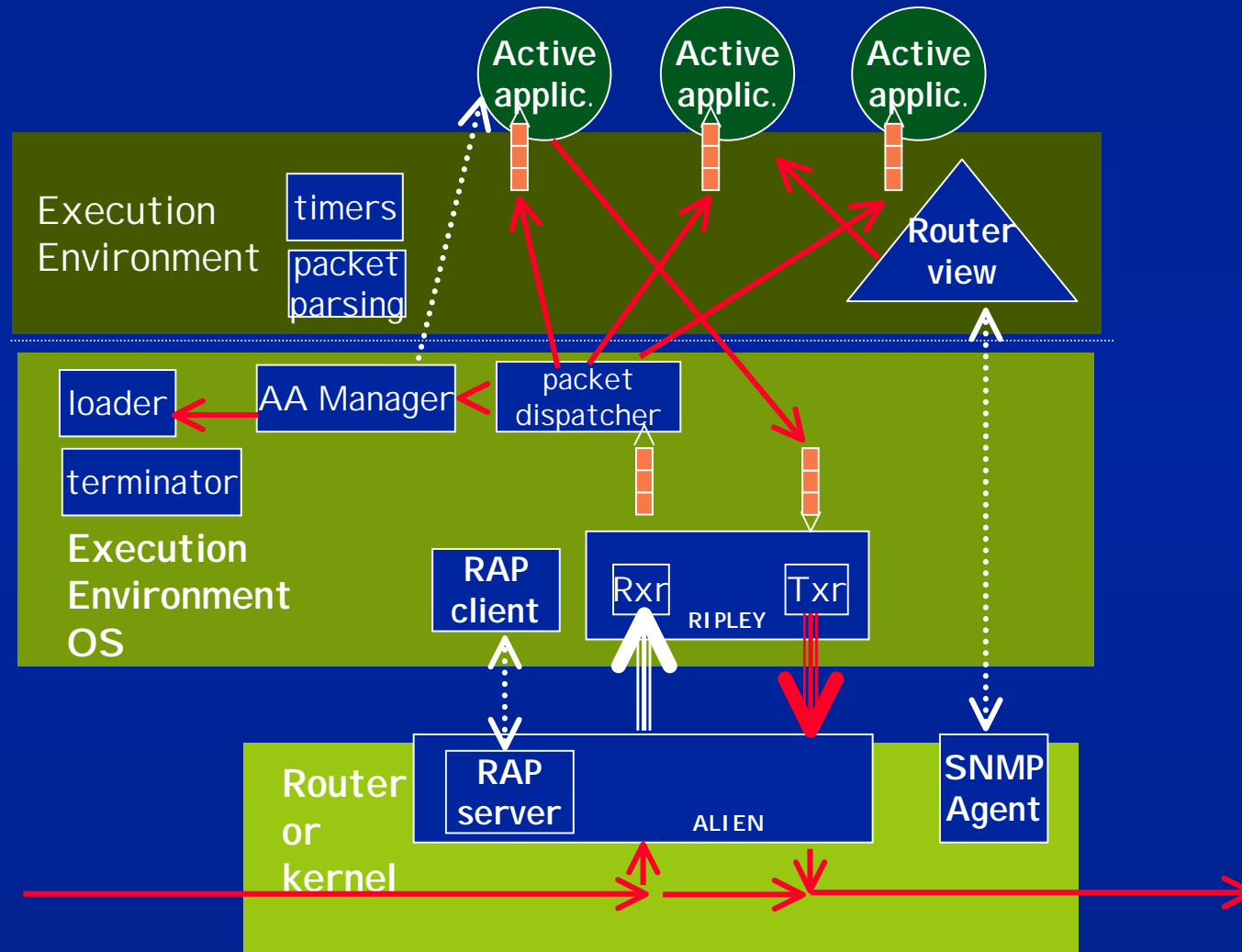


- Router's Assistant: performs packet processing up to application level
- Router: provides transparent active networking





GCAP Execution Environment





Conclusions





Conclusions

- ◆ Active Network over IPv6 offers a flexible and scalable network solution
- ◆ "pasive" packets forwarded without performance penalty
- ◆ Active Packets services executed in Assistant devices => processing load is balanced
- ◆ Satisfactory Security level based on service restriction





***THANKS FOR YOUR
ATTENTION***





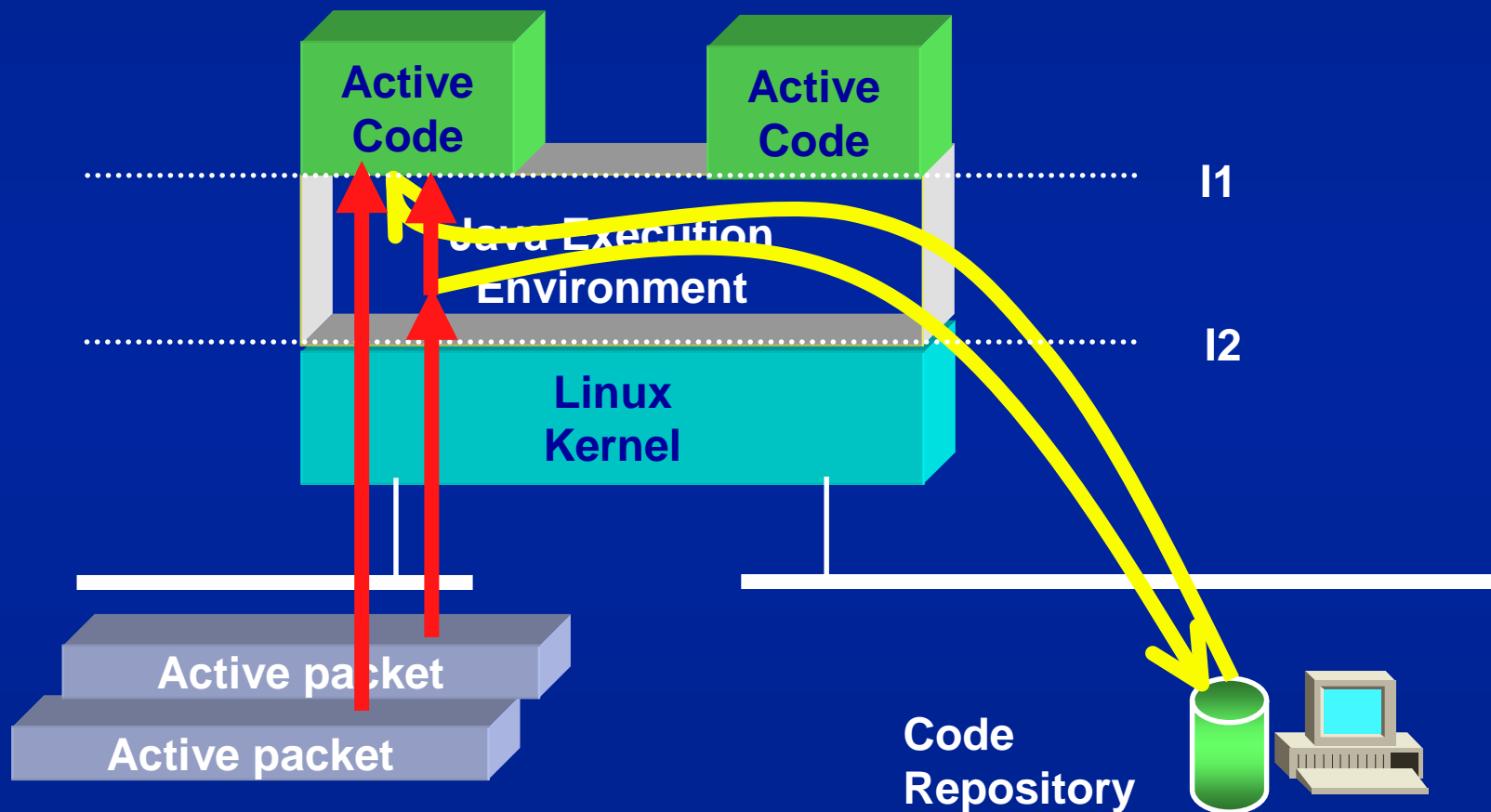
Potential Applications & Services

- ◆ Large-scale Network Prototyping
- ◆ Fast deployment of services
- ◆ Reliable Multicast Support
 - NAK filtering
 - Information aggregation
- ◆ Multimedia Support
 - Transcoding
 - multi-QoS
- ◆ Intelligence
 - real-time net status and re-programming
- ◆ Network management





Prototyping: stand-alone solution





RFC-2711 IPv6 Router Alert option

0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	Value (2 octets)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	------------------

- ◆ **Value:** A 2 octet code in network byte order with the following values:
 - 0 => Datagram contains a Multicast Listener Discovery message
 - 1 => Datagram contains RSVP message
 - 2 => Datagram contains an Active Networks message
 - 3-65535 => Reserved to IANA for future use.

