4. INTERNETWORKING

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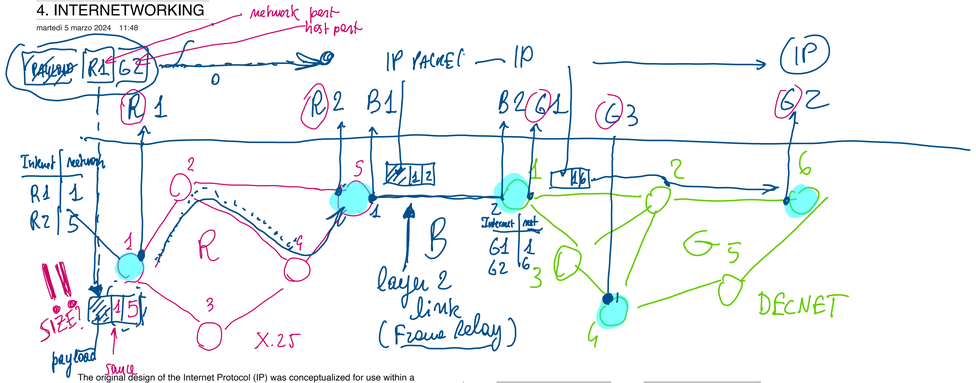

The original design of the Internet Protocol (IP) was conceptualized for use within a variety of network architectures, many of which operated at the network layer (Layer 3) of the OSI model, such as DECnet, AppleTalk, and X.25. Unlike today's common use where IP is encapsulated within Layer 2 protocols like Ethernet, PPP (Point-to-Point Protocol), or HDLC (High-Level Data Link Control), it was initially adapted to function with these Layer 3 protocols. For instance, X.25, which is a packet-switched network standard, facilitated the transmission of data across diverse networks by providing a uniform way to route packets through different network services.

In the early years of the internet, the network landscape was quite heterogeneous. Networks ranged from small LANs with proprietary protocols such as AppleTalk, designed for ease of use in small business and educational settings, to more complex WANs that employed DECnet for robust and scalable interconnectivity among diverse systems. The concept was to create a 'network of networks' in which these diverse systems could communicate seamlessly. This was made possible by routers and gateway devices that translated and facilitated the flow of IP packets across the various network protocols and architectures.

Consider a scenario where multiple networks exist: Network A runs DECnet, Network B operates with AppleTalk, and Network C employs X.25.
Each network functions independently, with its own set of routing protocols and addressing schemes. Communication between these networks requires translation and routing services. For example, a device in Network A (DECnet) that wishes to communicate with a device in Network C (X.25) sends its data through a gateway. This gateway is capable of interpreting the DECnet protocol, converting it to the IP packets, and then re-encapsulating these IP packets into the format required for transmission over X.25 to reach Network C.
This methodology allowed the internet to emerge as a global virtual network, overlaying the infrastructure of many different physical networks. While each network retained its unique addressing and routing protocols, IP served as the unifying fabric that enabled their intercommunication. This foundational feature of IP has been vital to the scalability and widespread reach of the internet, allowing it to connect billions of devices with diverse communication technologies.
Over time, the adoption of IP has become more direct, with Layer 2 technologies like Ethernet becoming prevalent for local and wide area networks. The original Layer 3 protocols like DECnet and AppleTalk have largely faded into the background, but their influence is evident in the flexible and robust nature of IP communication. The adaptability of IP to be encapsulated within different transport mechanisms has been a cornerstone of its success and its enduring presence in the realm of digital communication.

Suite	OSI Layer 3 (Packet)
X.25	Packet Level Protocol (PLP) Packet
IPX (Internetwork Packet Exchange)	IPX Packet
AppleTalk	DDP (Datagram Delivery Protocol) Packet
DECnet	DECnet Packet
CLNP (Connectionless Network Protocol)	CLNP Packet
ATM (Asynchronous Transfer Mode)	ATM Cell*
Banyan VINES	VINES Packet

If the internet destination is in R
the network destination is resolved by network
otherwise the network destination is the gateway R2