Programabilidade de Redes

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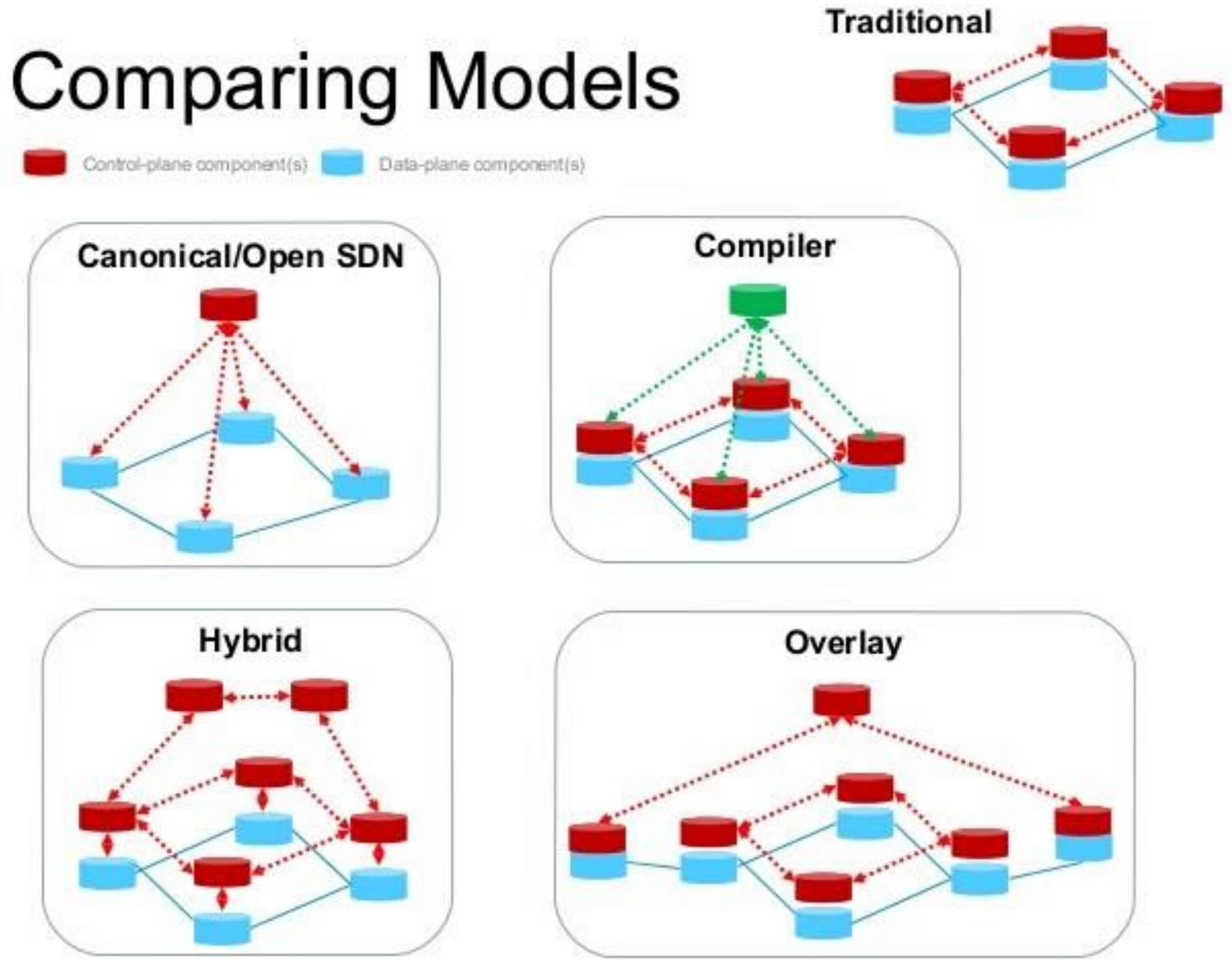
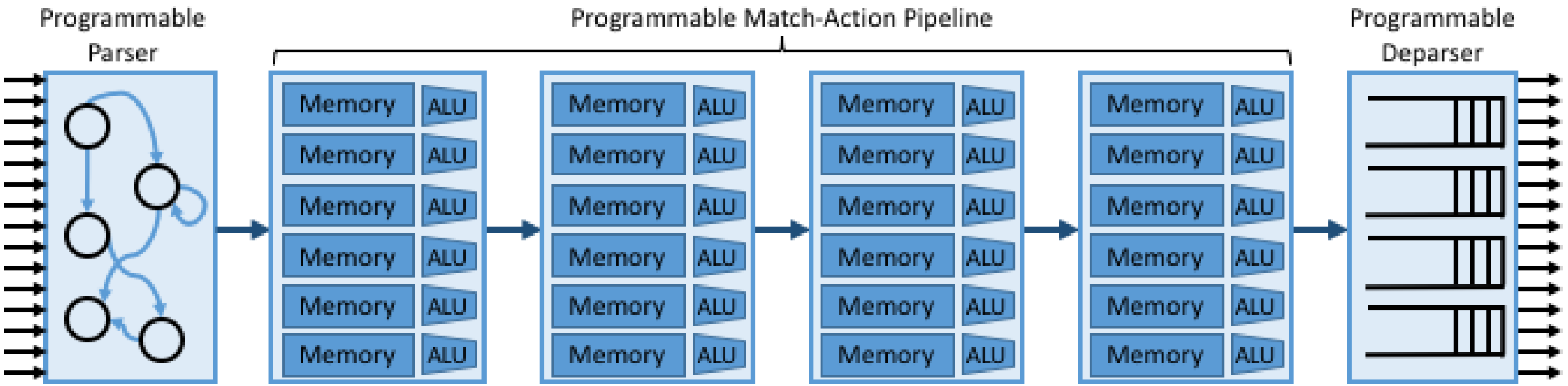
Live Intra Rede - Tecnologias emergentes aplicadas as redes, 24 de maio de 2022

Arquiteturas de Redes Programáveis



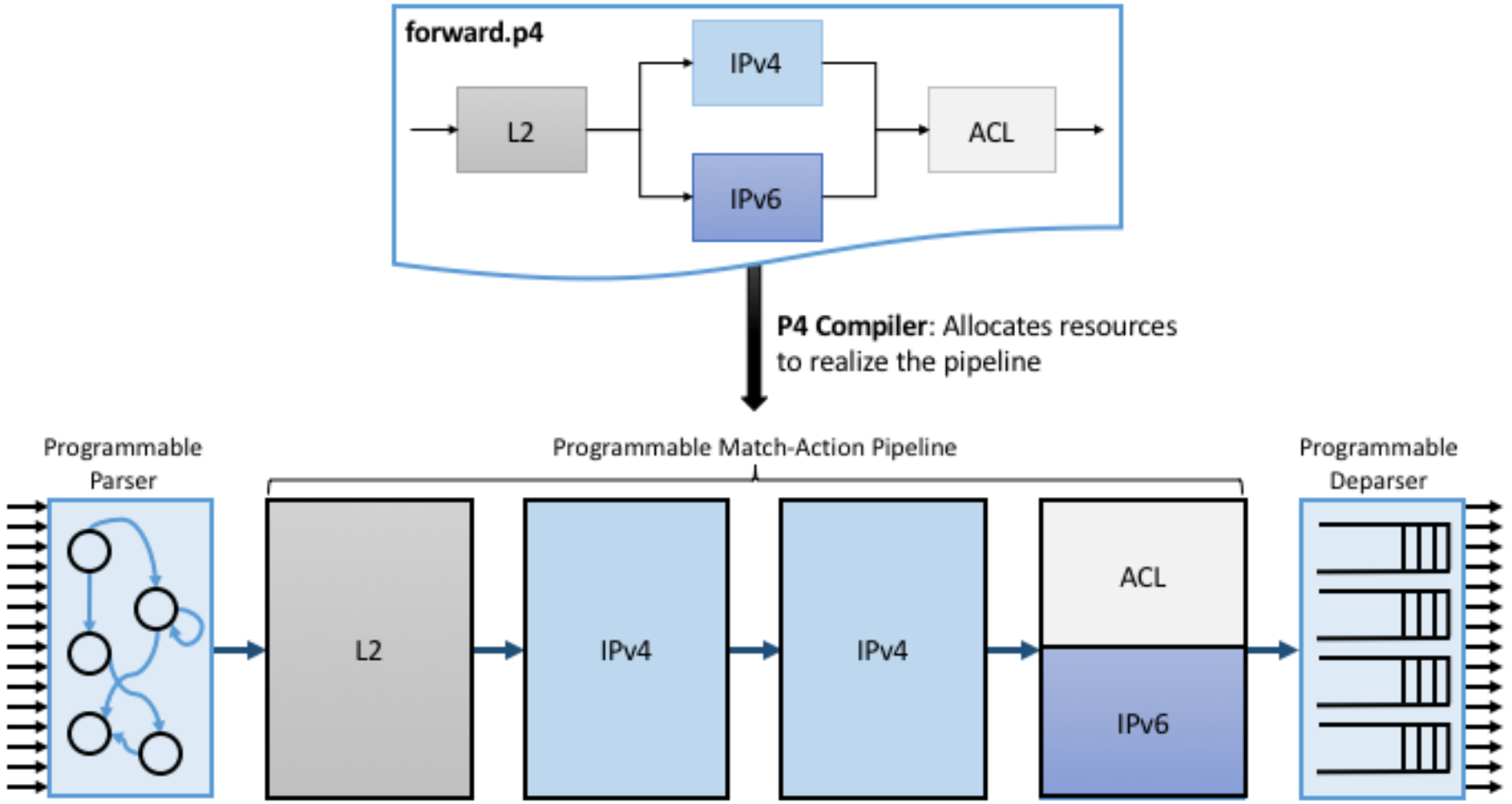
Fonte: C. Rothenberg (INTRIG/UNICAMP)

PISA (Protocol Independent Switch Architecture)



Fonte: Software-Defined Networks: A Systems Approach

P4 (Programming Protocol-independent Packet Processors)



Fonte: Software-Defined Networks: A Systems Approach

Ecossistema P4

ECOSYSTEM CATEGORIES

- [ ] Compilers (8)
- [ ] Hardware (17)
- [ ] Network Operating Systems (8)
- [ ] P4 Core (4)
- [ ] P4 Functions (10)
- [ ] Services (1)
- [ ] Solutions (19)
- [ ] Targets (15)
- [ ] Tools (4)

P4 FUNCTIONS

- [ ] BNG (9)
- [ ] INT (7)
- [ ] L2 switching (15)
- [ ] L3 routing (16)
- [ ] L4-7 application processing (10)
- [ ] Security / Filtering / ACL (13)
- [ ] UPF (9)

PRODUCT / PROJECT TYPES

- [ ] Hardware (20)
- [ ] Open Source (40)
- [ ] Research (9)
- [ ] Services (2)

MORE INFO

GÉANT

GÉANT ASSOCIATION – RARE/FREERTR

Category: Network Operating Systems

Product / Project Types: Open Source, Research, Software

Organization type: Non-Profit

P4 Functions: BNG, L2 switching, L3 routing, Security / Filtering / ACL

Overview: RARE/freeRtr is a software routing platform with a modular design that uses a message-based API between the control plane and data plane.

RARE
Router for Academia Research & Education

MORE INFO

Microsoft

MICROSOFT – SONIC

Category: Network Operating Systems

Product / Project Types: Open Source, Software

Organization type: Vendor

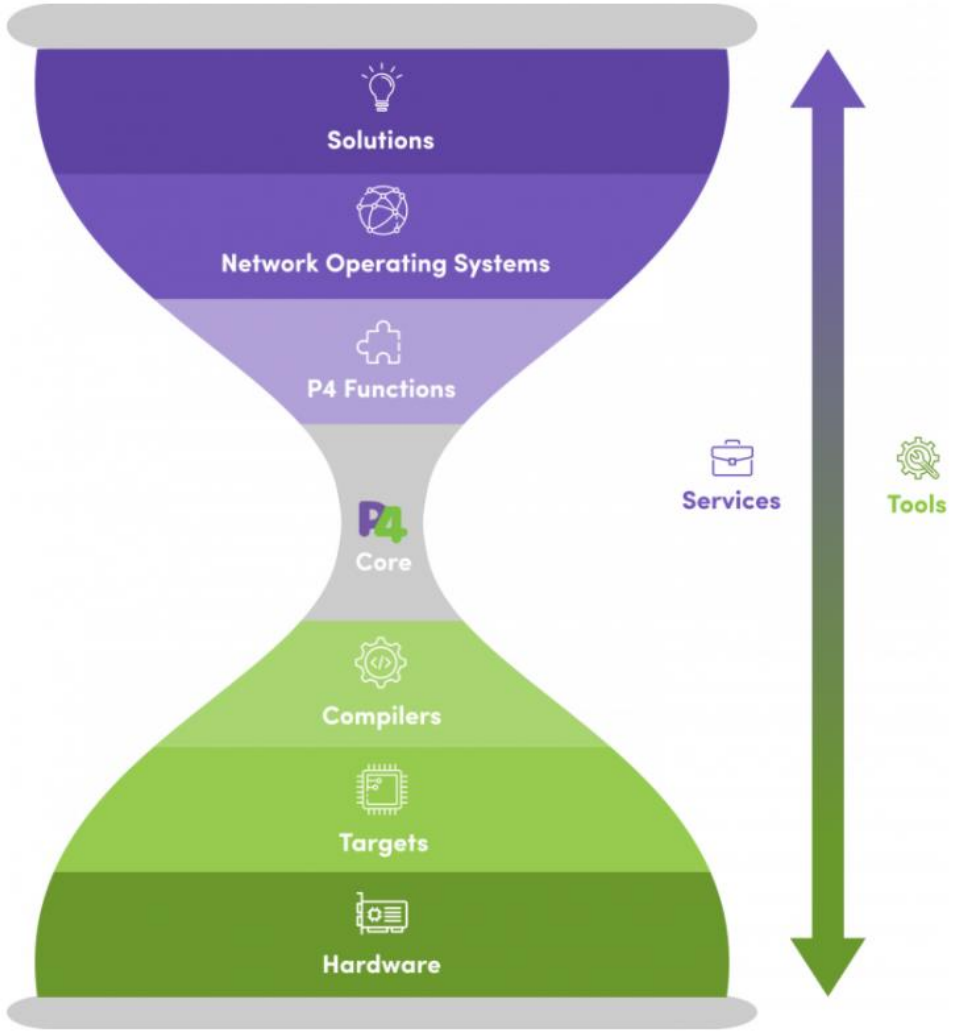
Overview: SONiC is an open source network operating system based on Linux that runs on switches from multiple vendors and ASICs. SONiC offers a full suite...

MORE INFO

ONF

OPEN NETWORKING FOUNDATION – STRATUM

Category: Network Operating Systems



Adaptado de: P4 Ecosystem

Iniciativas abertas em evidência

SONiC (Linux Foundation)

- Sistema Operacional de Rede aberto e multi-vendor focado em requisitos de datacenter
- Suporte a switches tradicionais (funções-fixas) e programáveis

PINS (Open Networking Foundation)

- Extensão ao SONiC para permitir um plano de controle híbrido (tradicional + opt-in SDN)
- Suporte a customizações e novas funcionalidades usando P4 (IN-band Telemetry...)

Comunidades de Redes Acadêmicas (GNA-G / RARE / RNTWG)

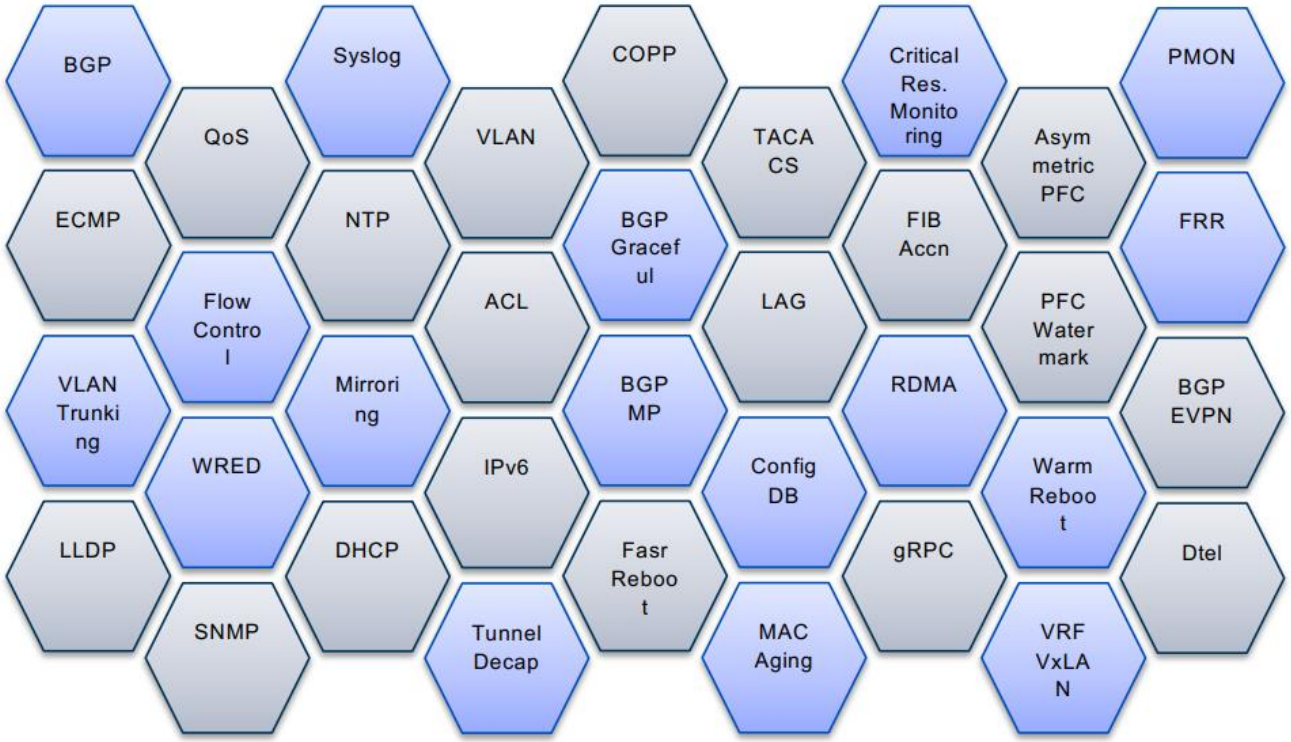
- Desenvolvimento de plataformas e protocolos com foco em transferências intensivas de dados
    - RARE/freeRtr, Packet Marking, PolKA (roteamento baseado na origem stateless)

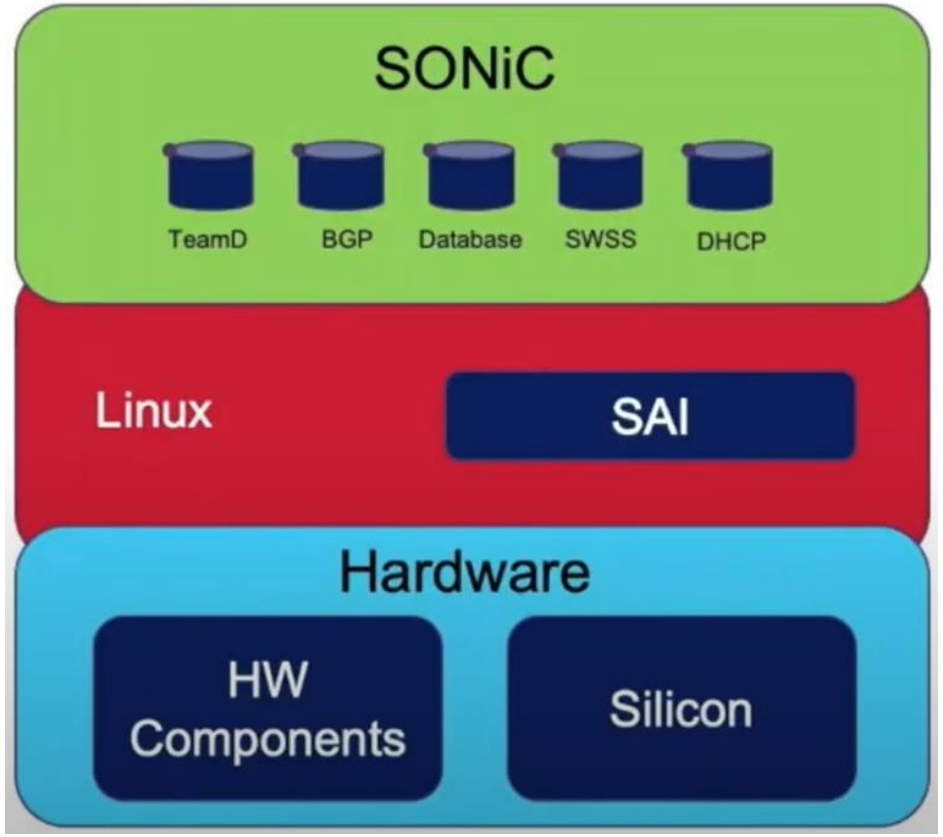
Disaggregated Open Router (TIP)

- Arquiteturas de referência para equipamentos (backbone, full-route) e implementações em software (SR-MPLS, SRv6)

Linux Foundation SONiC

- Open and multi-vendor Network Operating System focused on datacenter requirements/features
- Support for traditional (fixed-function) and programmable switches



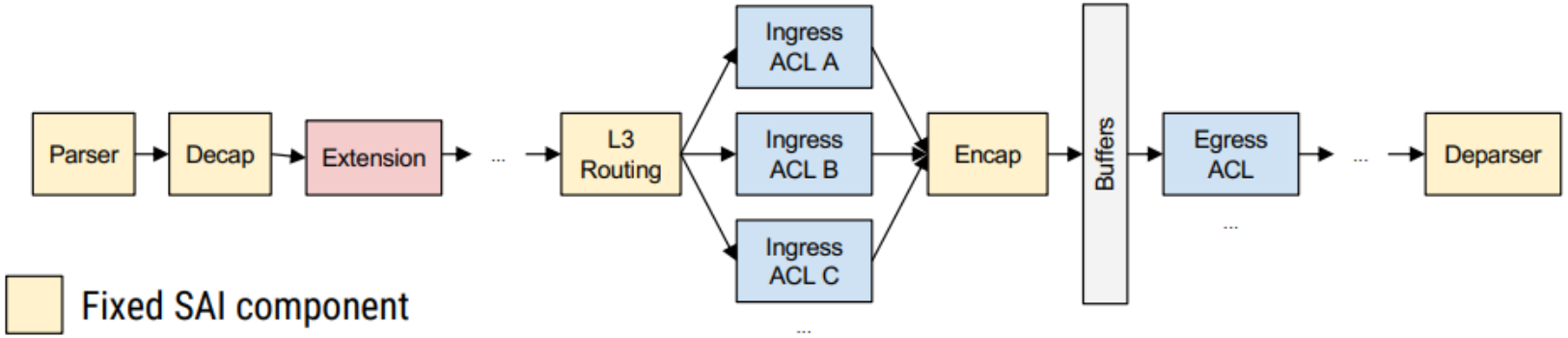


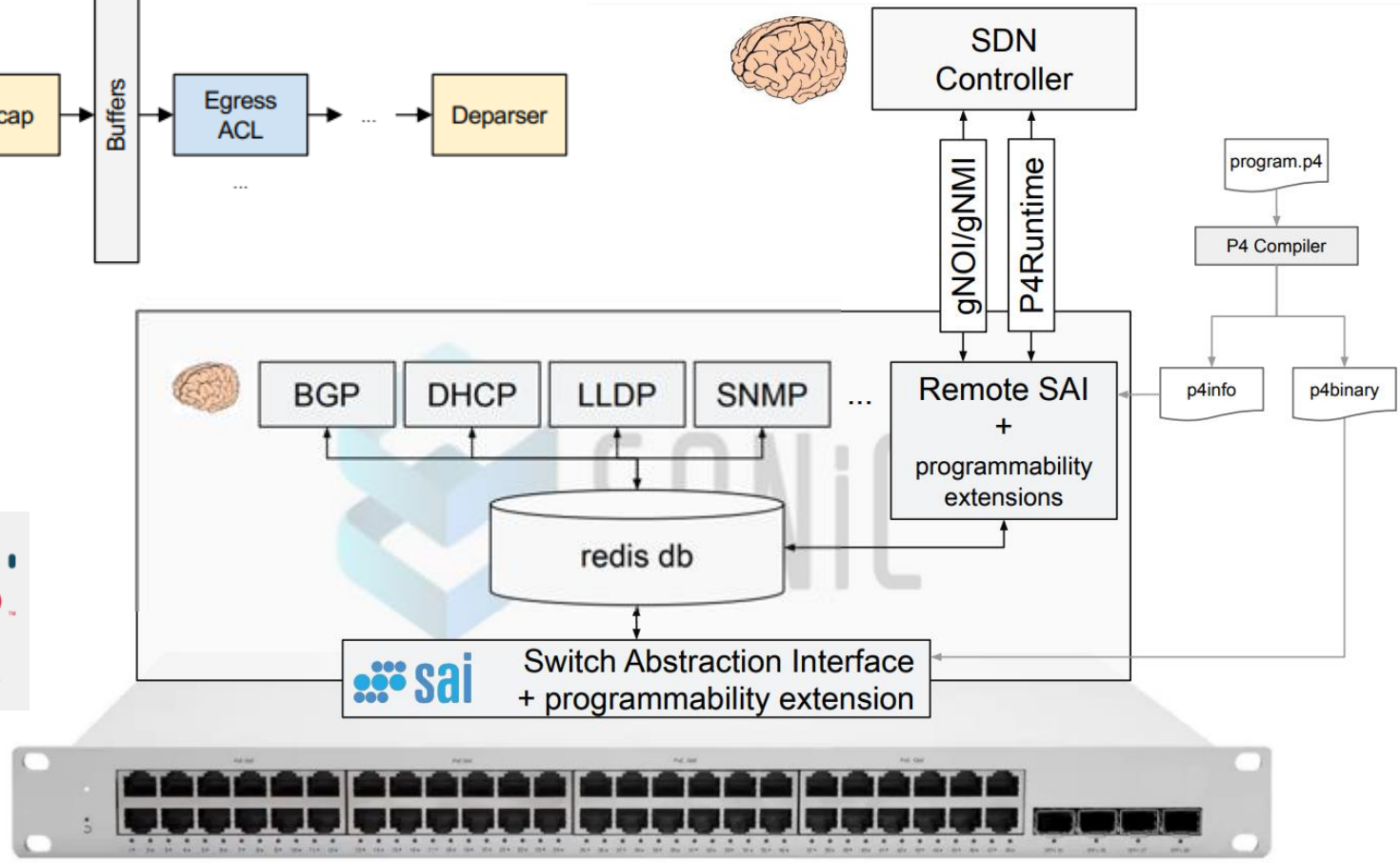
Fonte: SONiC: Open Source NOS in Data Center

Ecossistema SONiC

Fonte: SONiC – open than ever

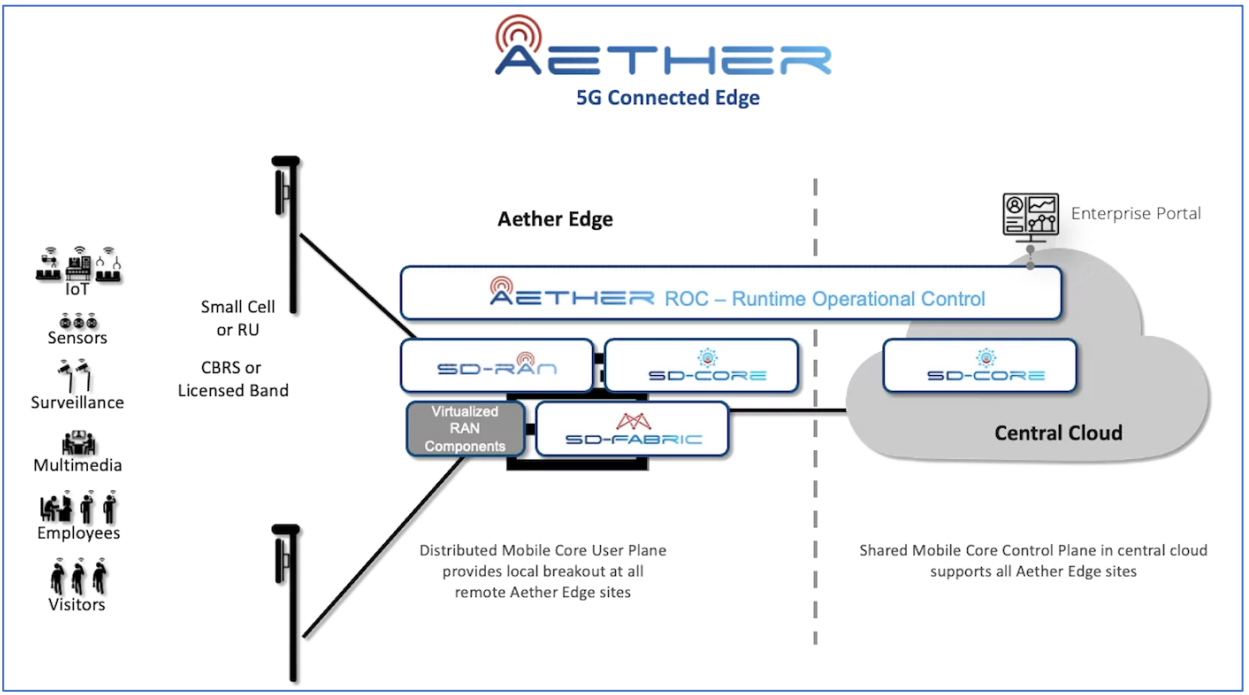
ONF P4 Integrated Network Stack (PINS)

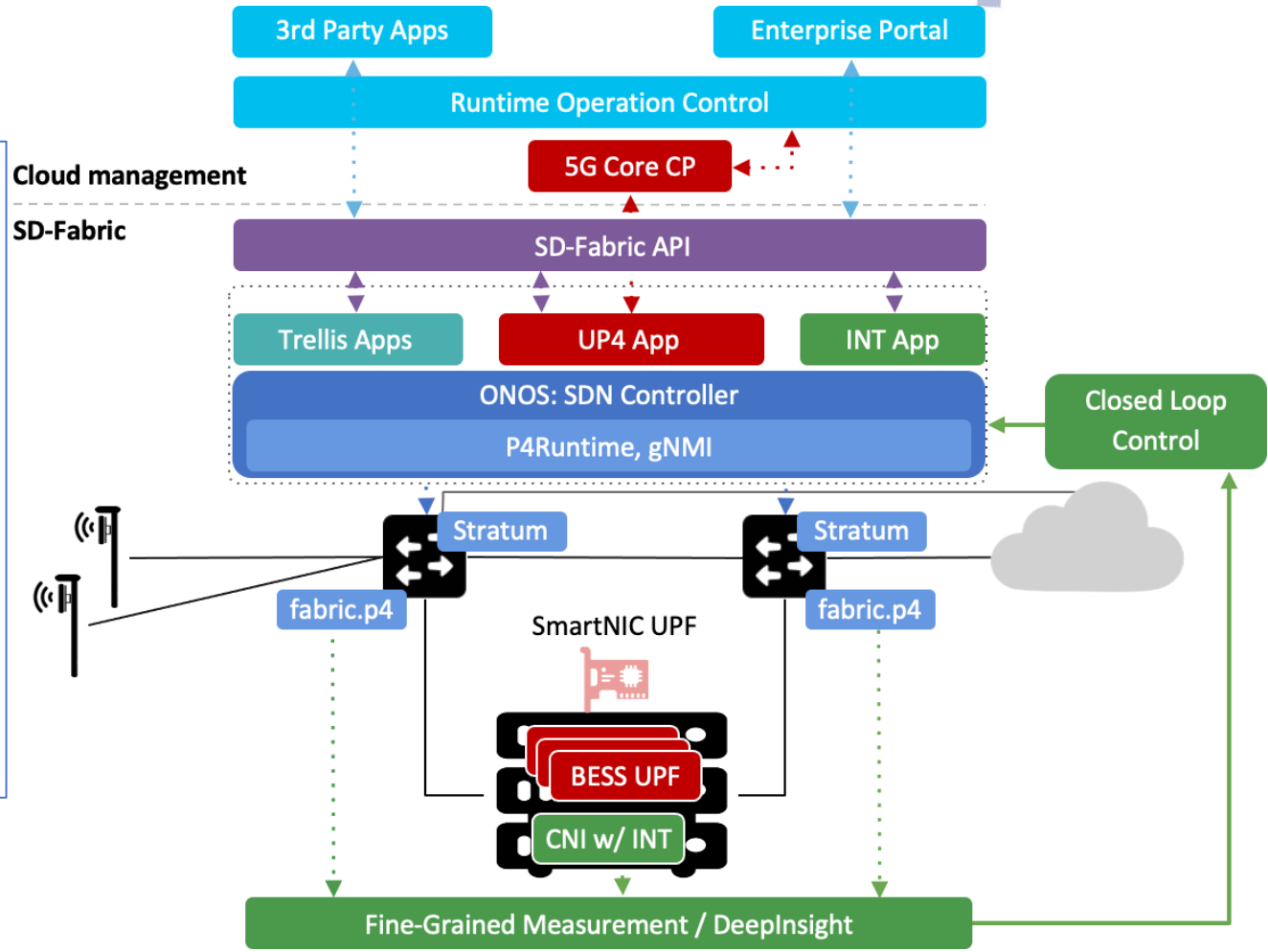




Adapted from: [PINS - Extending SDN and P4 Programmability]

ONF Stratum / SD-FABRIC / Aether





Fonte: Stratum Techinar - July 2021

GEANT RARE/freeRTR

Suporte a múltiplas plataformas: Tofino/P4, DPDK, eBPF/XDP

Desing modular e amplo feature set:

- **forwarding**: ipv4, ipv6, ipx, mpls, nsh, layer2, irb, atom, eompls, vpls, evpn
- **routing protocols**: ospf, isis, bgp, rip, eigrp, babel, olsr, pim, msdp
- **lsp support**: p2p, p2mp, mp2mp built by bgp, ldp, rsvp-te, sr, sr-te, bier, polka
- **crypto**: macsec, ipsec, ikev1, ikev2, tls, dtls, ssh, openvpn, wireguard, sgt
- **tunnel**: gre, ipip, l2tp, pptp, lisp, geneve, nvgre, vxlan, etherip, amt
- **encapsulation**: ethernet, vlan, ppp, framerelay, pwether, virtppp, hairpin
- **misc**: acl, qos, nat, pbr, srv6, vrrp, hsrp, inspect, 6to4, rpl, tunnel, vpdn, pcep

Validado em vários casos de uso: SOHO, BNG/LNS, LSR/LER, BGP RR,

Fonte: RARE/freeRtr documentation

Testbed Persistente Multi-Recurso

Rede programável pré-produção para validar/integrar novos serviços

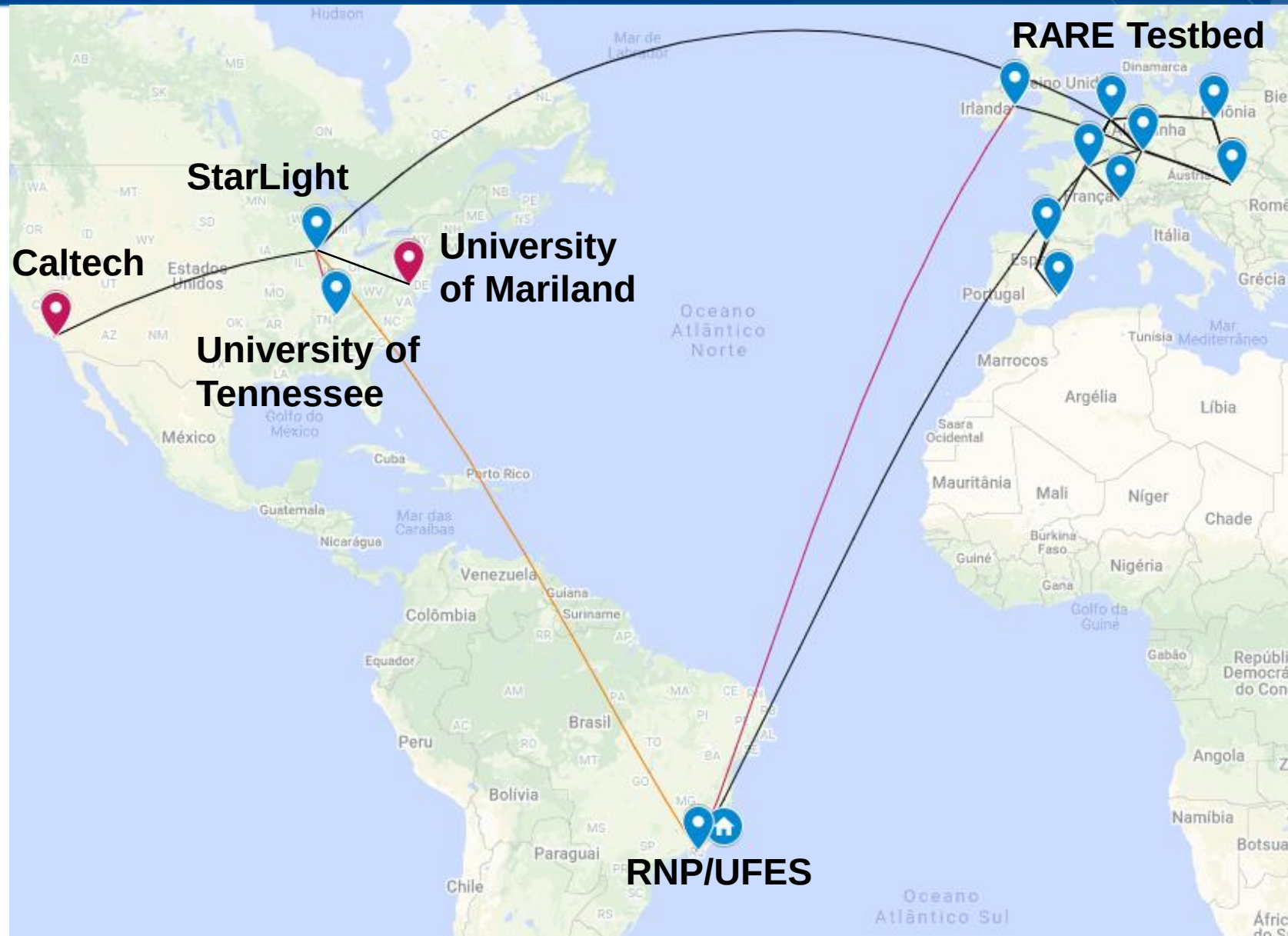
- Packet Marking
- INT based Congestion Detection
- Traffic Engineering (SR, PolKA)

Iniciativa internacional conjunta

- GNA-G Data Intensive Science
- GNA-G AutoGOLE / SENSE
- RARE project

Recursos

- Servidores 100G, Switches P4
  Circuitos Dinâmicos



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