Dynamic Analytics Extended to all layers Utilizing P4

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This Talk is about Why P4 should be extended to other layers

- Interoperability - Utilizing common framework allows the development of a true networking language that is easy to learn
- Eliminates vendor dependence at all levels of the network, switches, Routers , NICs CPU
- Open Interfaces - **Following the P4 model allows the use of simple open interfaces such as custom actions-democratization of the data plane and open micro services**
- The P4/C extensions model should be very simple, and could exist across data plane while it **does not affect base data plane functionality**

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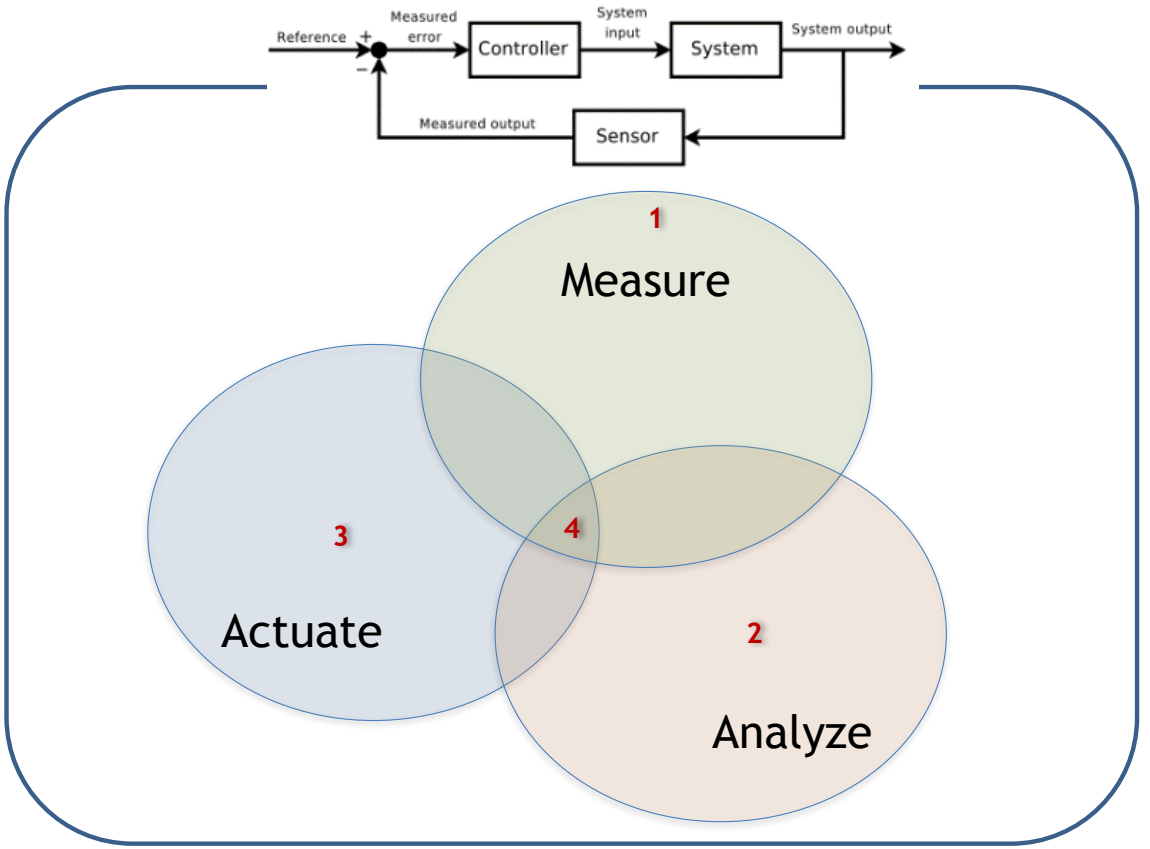
Autonomous Run Time Control and Reconfigure Observability blocks

1- Programmable vProbe

2- Real time Instrumentation of probes

3- SDN based Actuation & Control

4- Real Time Feed back Loop



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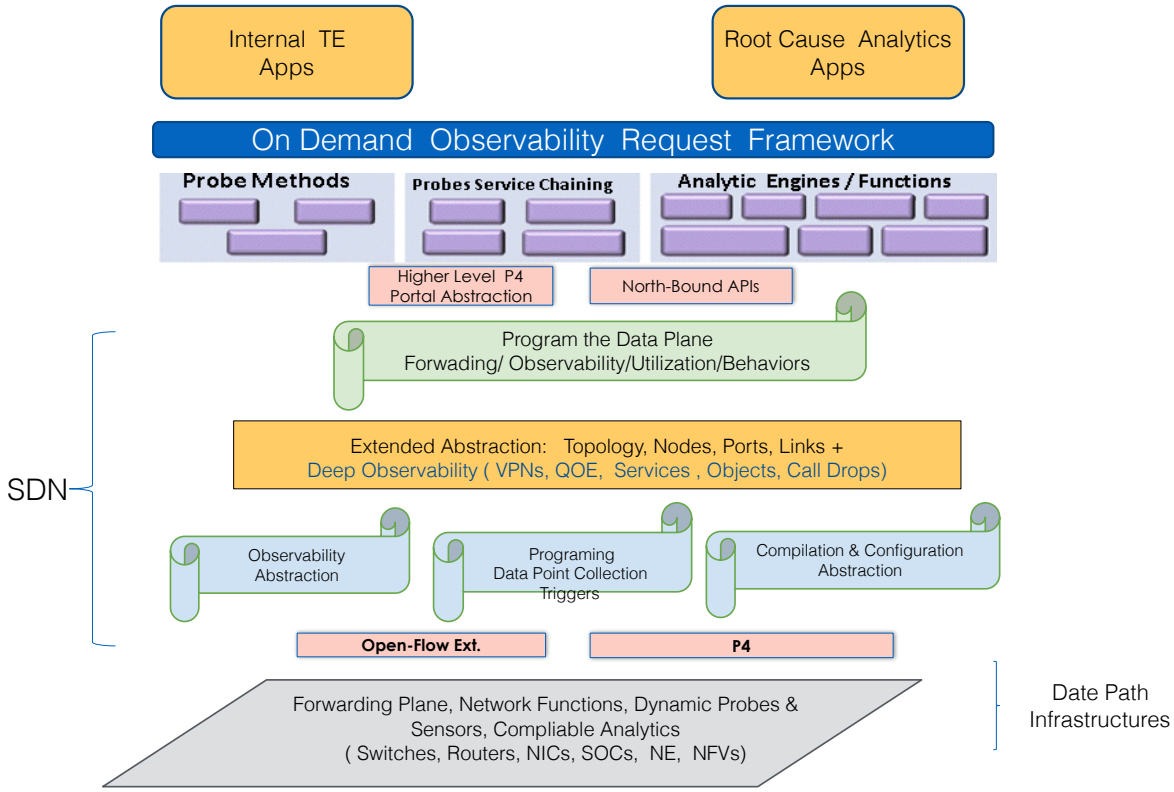
Why P4 should pay more Attention to Real time Observability

- Observability Abstraction
  - Resource state dissemination/collection
  - Ability to collect state of resources/elements
  - Ability to observe probes adaptively and on Demand
- Programming abstraction
  - Ability to program traffic forwarding rules/policies
  - Ability to program the Probes Control blocks
- Configuration abstraction
  - Ability to configure the resources bases on policies
  - Ability to configure the appropriate Probes for real time needs



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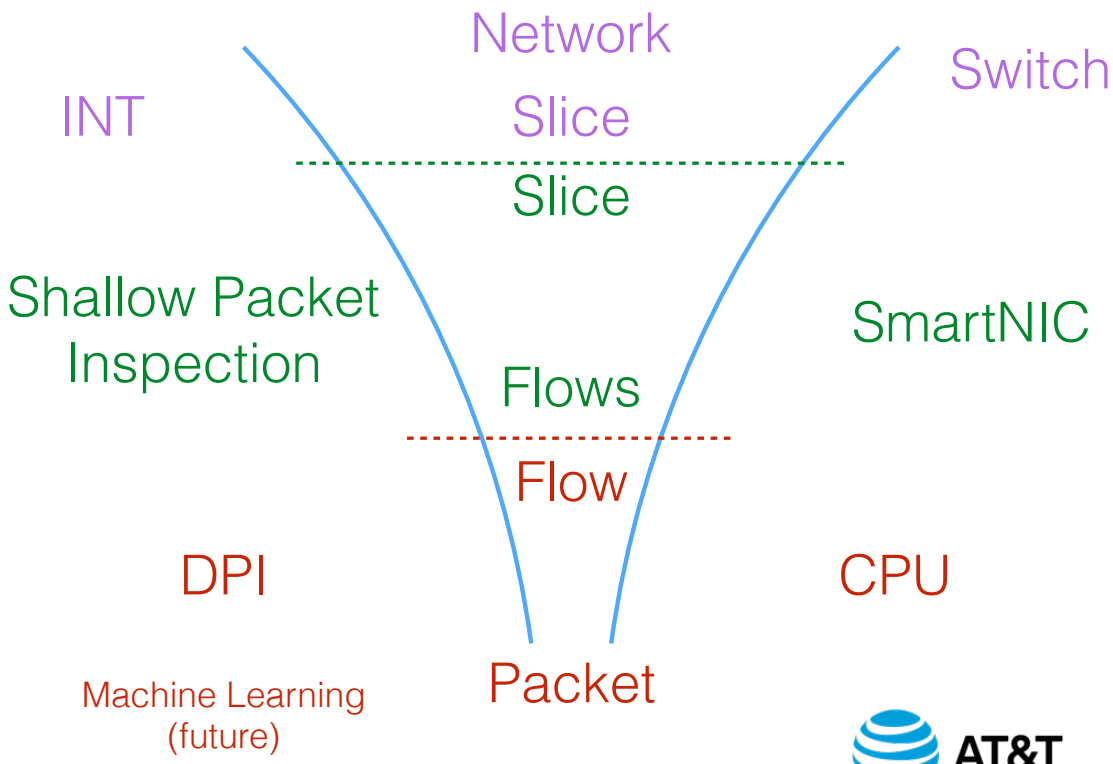
Data Plane Analytics / Monitoring for Network Slices

- Today's Monitoring platforms are mostly based on switches and compute nodes
  - (CPU)-limited processing, processing power (CPU)
  - Switch: INT, NAM etc…
  - Compute: DPI, TCPDUMP
- Emerging Open Platforms (disaggregated, sliced) effectively requires deep, broad, interconnected monitoring
- Require real time & closed feedback loop with Applications in Controls

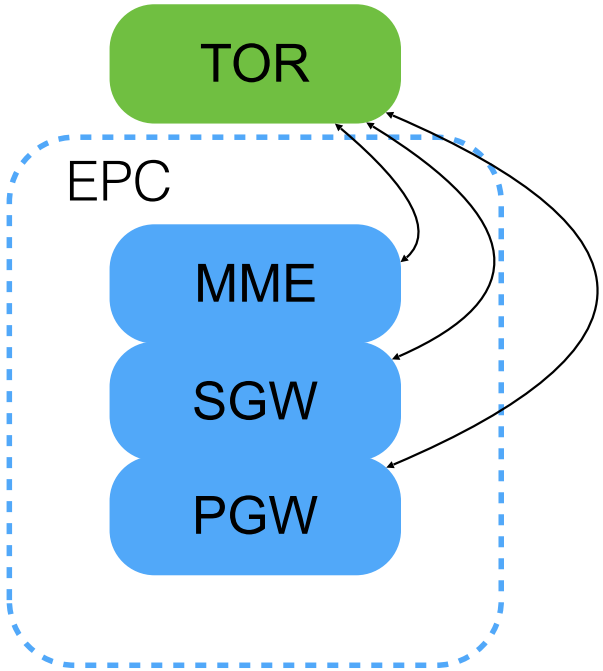


Example;
Extending P4 to SmartNIC to support Deeper Observability

- Next Generation Mobile Edge Networks will be both **disaggregated and sliced**
- CPU and NIC are only points able to monitor all flows
- CPU compute cycles are stretched
- SmartNIC could provide significant spare computational cycles and provide adjunct HW speed to the rest of the network functions
- Extending P4 to (L0-L7) could Drive unified customizable observability & Vendor Independence
- Could enable the service providers with **real time feedback loops** with controllers

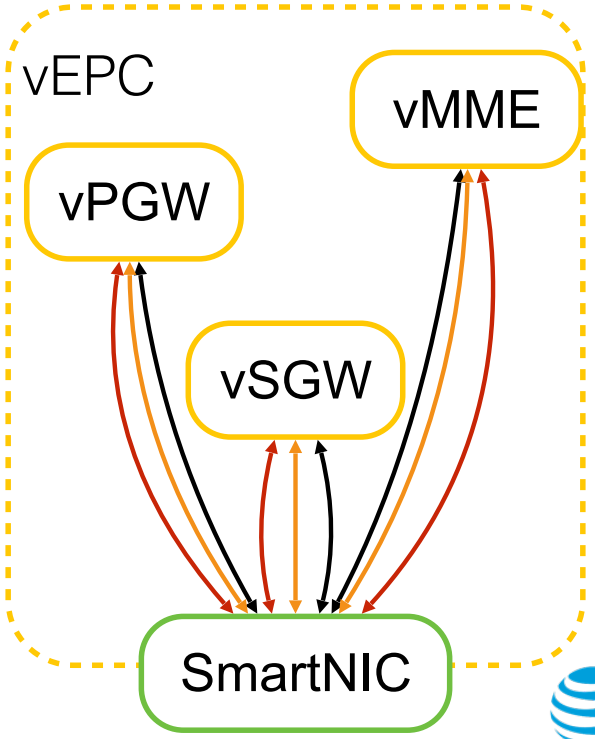
Disaggregation and Slicing Extending P4 to other Layers

Rack Based Middleboxes



Inter VM traffic highly significant

COTS Server Based Whitebox-with service based slicing



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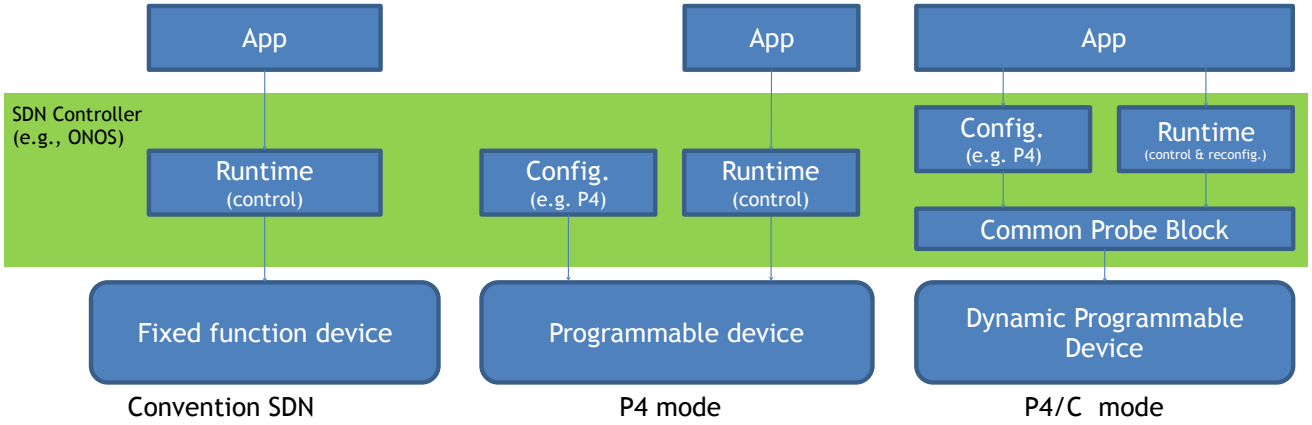
Observability in Real Time and On Demand

- Static Observability method doesn't work
  - Difficult to predict all probe & measurement tasks in advance at design time
  - Pre-allocate resources for all potential tasks in data path is prohibitively expensive
  - Data path full reconfiguration for new task is too slow and can cause service interrupt
- Dynamic incremental reconfigurations are needed moving towards 5G Networks
  - Anytime, anywhere, any action with dynamic resource allocation
  - Hitless data path modification
  - Allow multiple parallel tasks



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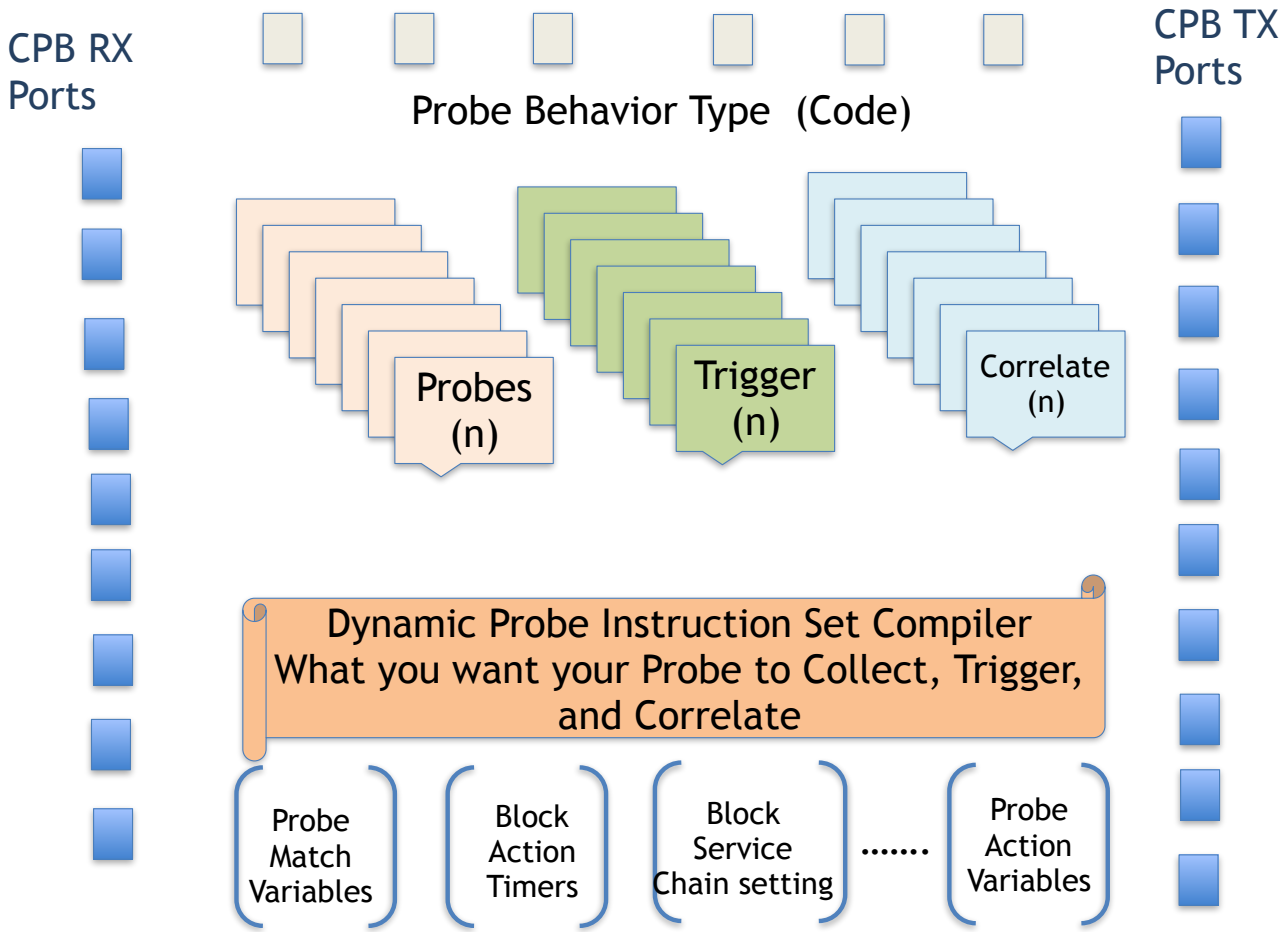
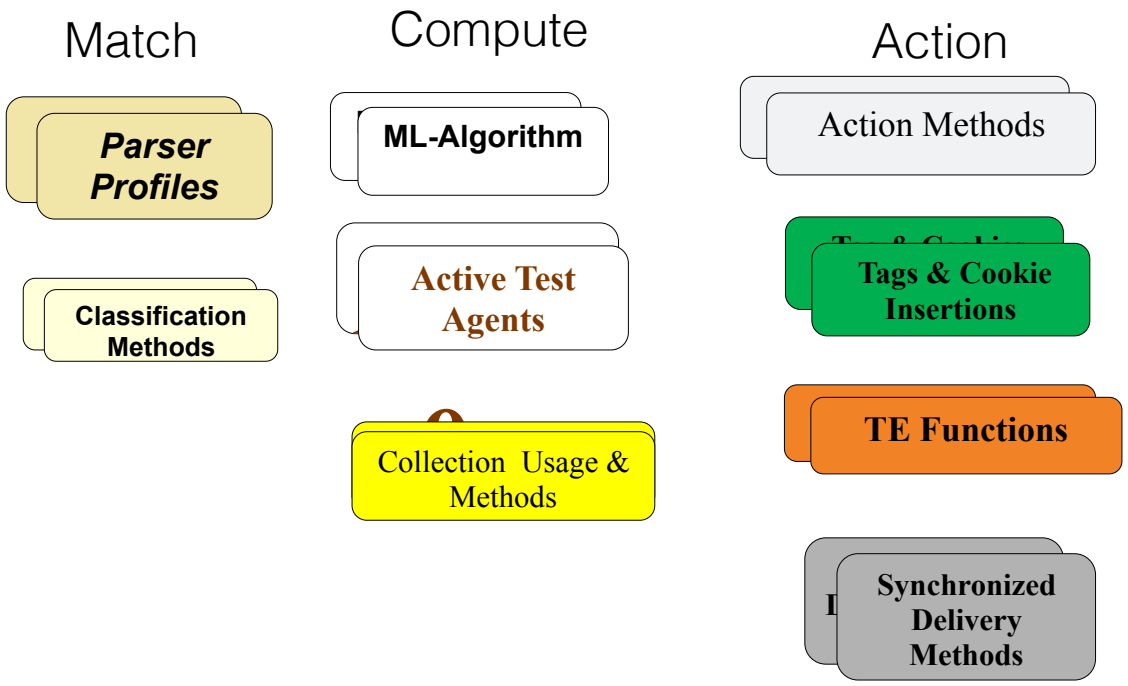
Common Probe Block (CPB) - Conceptual



Higher Level P4 Programming Abstraction for Deep Observability

P4 Control

P4 programmable Blocks / Primitives



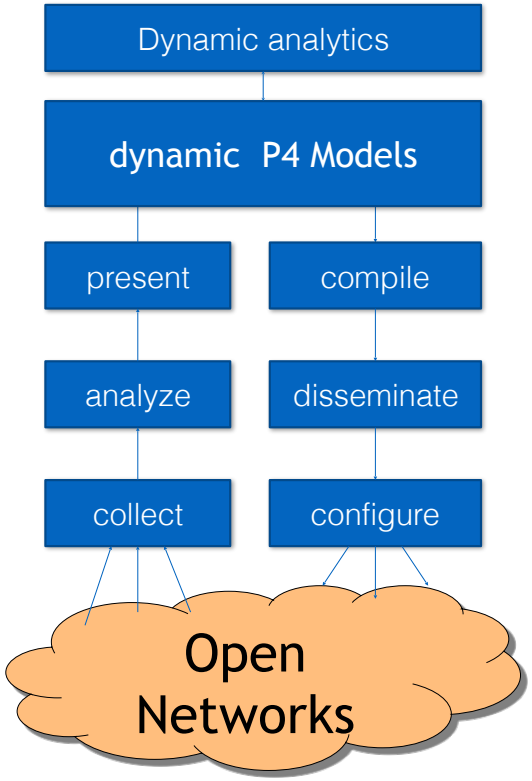
P4 can play a key role for deep observability at all layers of network stacks

QoE
- Flow jitter, latency measurement
- Packet drop rate
- Root Cause Analysis

Security
- DDoS detection
- Deep packet inspection
- Stateful flow monitoring

Customer Care
- Custom Observability
- Flow tracing
- Root cause analysis

Optimization
- Load estimation
- Traffic matrix calculation
- Elephant flow identification



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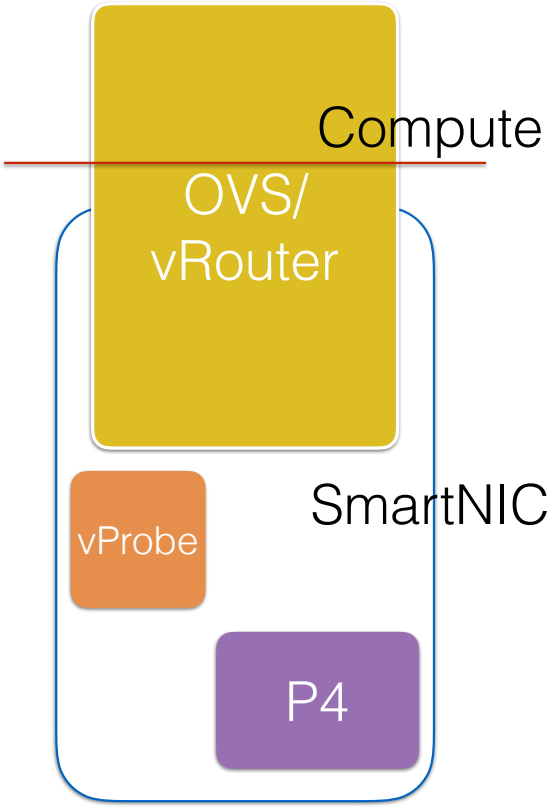
Dynamic Analytics in SmartNICs Utilizing P4-Implementation

Monitoring Network Slices

The SmartNIC

- Fully Programmable
  - Allows for total flexibility in the Dataplane-P4 for flexible data plane elements or custom tagging, probes for monitoring and OVS (or vRouter) as well.
  - All of this can be done through the use of a many threaded many core architecture that allows effective partition
- Why P4
  - P4 is incredibly flexible and allows innovation in the data plane- SmartNICs and switches can communicate in a distributed fashion
  - A unifying language by which network elements can interact is very powerful
  - Combining this with custom blocks allows for innovation to be harnessed



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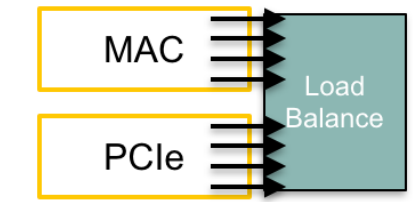
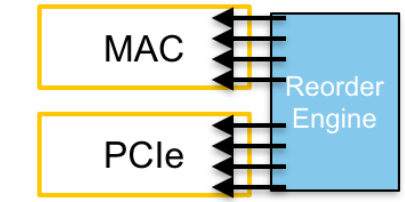
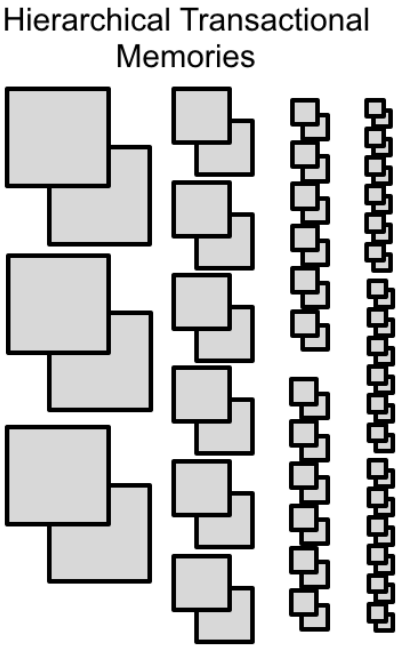
The Netronome Approach-500+ Threads

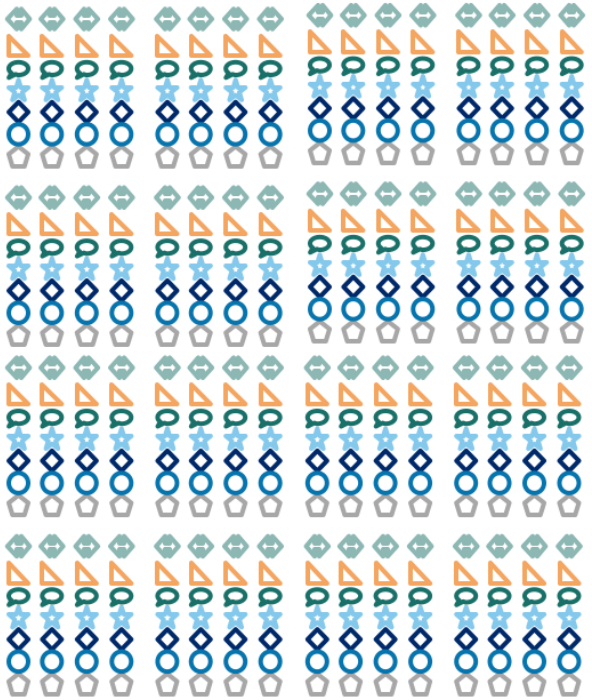


Multi-Threaded (8x) cores





Reorder Engine is Key Feature due to the use of ~1000 simultaneous threads



Many Multi-Threaded NPUs with specialised hardware offload

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Use Case: Classifying and Monitoring Network Slices

- Isolating Slices
  - No longer can one simply isolate a problem to a specific ‘box’-There are multiple VNFs within one COTS server
  - Therefore it is essential to be able to monitor by VNF and by slice
- Flexible/Dynamic Monitoring
  - Different Slices require different monitoring at different locations in the network
  - Being able to dynamically change how different flows/slices are monitored will allow a significant improvement in the granularity of monitoring
- Predictive Reaction:
  - Improved Monitoring may allow networks to react to problems before they are readily apparent
  - Aim for general reactive loop of <12s (for latency sensitive slices such as mission critical IoT)

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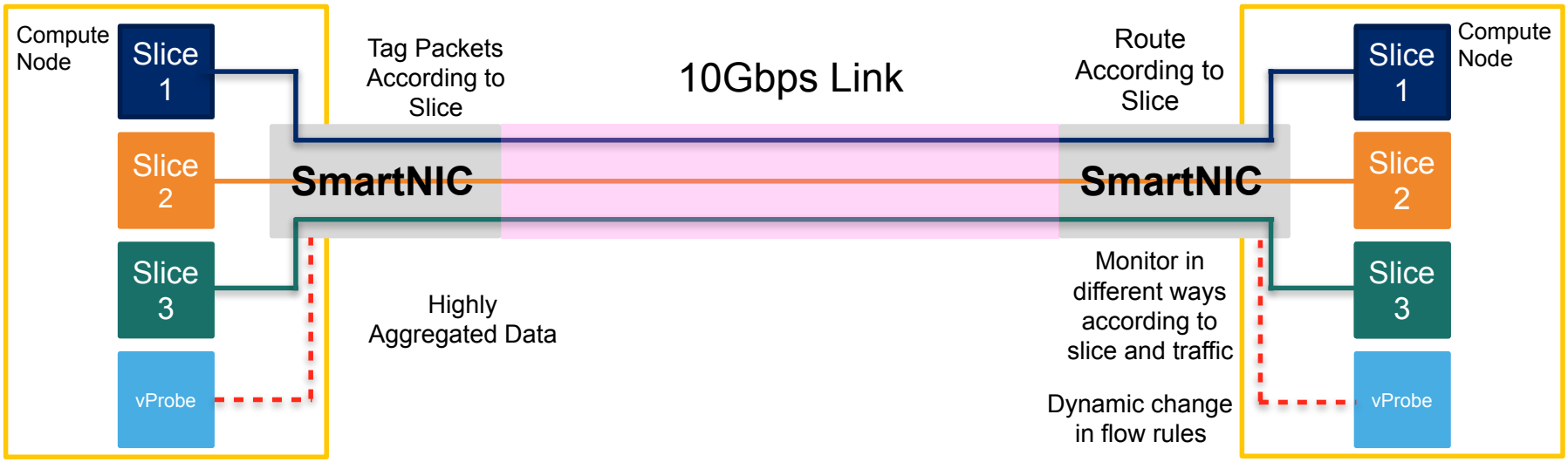
Demo Setup



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Final Remarks

- SmartNICs are not a replacement for other types of monitoring/P4 data plane elements
- Rather, they compliment and target other types of monitoring and applications
- This is an example of the power of a fully programmable SmartNIC in the data plane allowing for flexible adaptation to new concepts

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