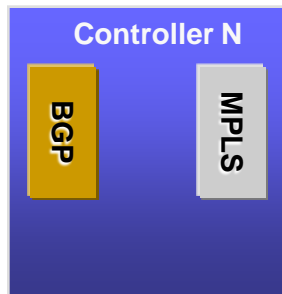
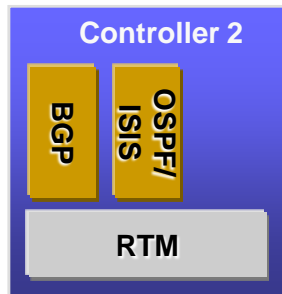
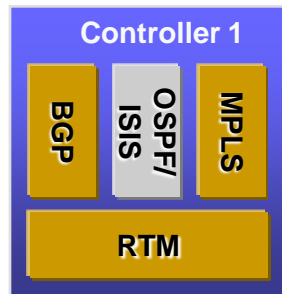




Carrier Class Foundation

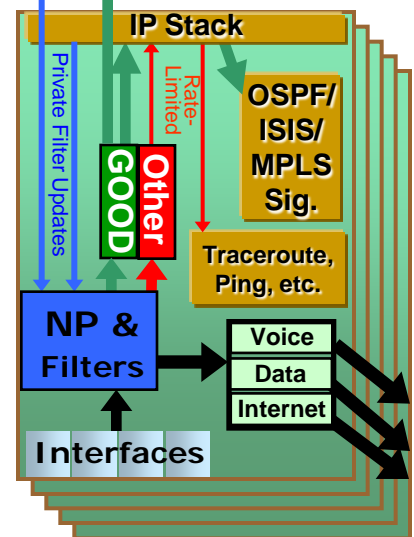
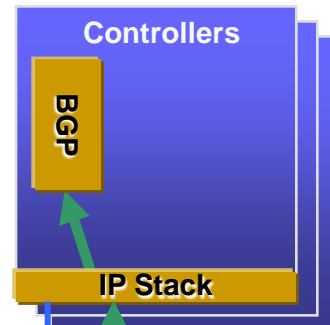
- Fully modular routing software, with task-specific resiliency
- Primary & backup modules can be assigned to any controllers
- Neighbor-specific IGP tasks distributed to Line Cards
- Control Plane in-service scalable - add controllers in any slot at any time, and replicate tasks
- Data plane is programmable, redundant, and in-service scalable



Active Backup

Carrier Class Resiliency

- Task replication and distribution eliminates single-point-of-failure
- Dual Protection Modes
 - ✓ Active/Backup
 - ✓ Standalone
- Task Monitoring
 - ✓ Operating system
 - ✓ Inter-task monitoring
- In-Service Upgrades
 - ✓ Upgrade backup tasks
 - ✓ Hitless per-task restart
 - ✓ Version-independence



Carrier Class Security

- Public plus Private Filters on each line card
- Control plane updates wire-speed filters to prioritize known-good control-plane traffic
- Pings, Traceroute, signaling, etc., handled by line cards.
- Unknown traffic rate-limited to prevent CPU exhaust
- Data plane protects total bandwidth for each service



System Differentiators

Carrier Class QoS

- ATM-grade results over IP
- Bandwidth Guarantees Per Service
- Bandwidth distributed fairly to ports

Carrier Class Logical Routers

- Physically independent multiple control planes
- Zero interconnect cost
- No change to administrative, routing or operations domains

Carrier Class Open Platform

- Open-platform control plane with 3rd-party extensibility
- Open-platform Data Plane with wire-speed 3rd-party extensibility



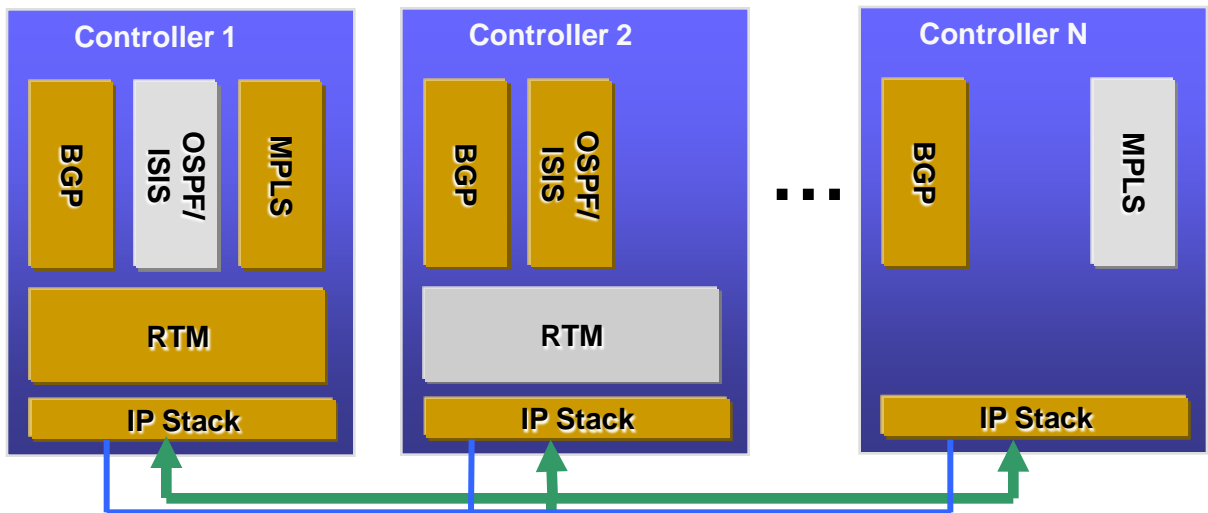
- Resilient control plane, Fully-distributed, with Scaled Routing Protocols
- Dynamic Filtering Protects control plane(s) against attacks
- Programmable Logic for unlimited flexibility
- Multi-chassis scaling, In-service

29 Patents Issued & Pending

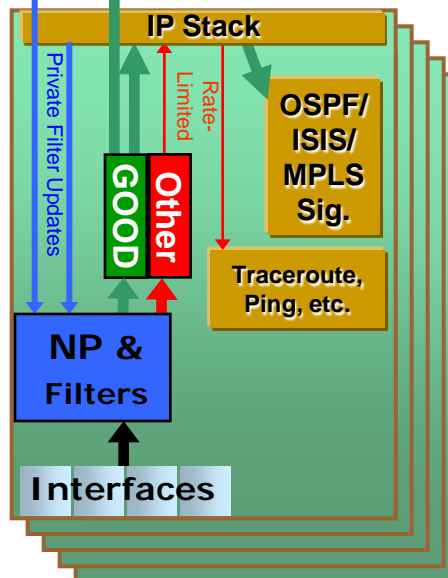
Control Plane Differentiators

- Fully-Modular Routing Software
 - ✓ Task resiliency
 - ✓ Distribution
 - ✓ No single point-of-failure
- In-Service Upgrades
 - ✓ Module-by-module
 - ✓ Version Independent
 - ✓ Hitless
- In-Service Scalable
 - ✓ Add active controllers
 - ✓ Any slot and any time
 - ✓ Replicate tasks to scale control plane

Carrier Class Control Plane



- Control Plane Updates Private Filters
 - ✓ On each line card
 - ✓ Prioritizing known-good control-plane traffic
 - ✓ Rate-limiting other traffic to prevent CPU exhaust



- Line Cards Offload Controllers
 - ✓ Pings
 - ✓ Traceroute
 - ✓ Signaling, etc.



Chassis ROI Differentiators

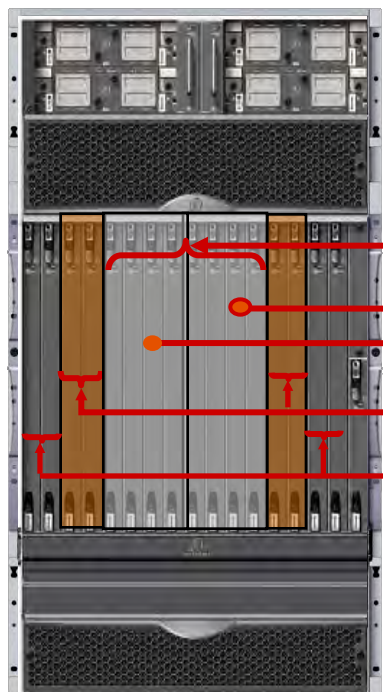


Front

- **Control cards in any slot**
 - ✓ Line cards in any slot
- **32 slots per rack**
 - ✓ 2 Chassis per rack
- **Multi-Chassis Scaling**
 - ✓ In-Service
 - ✓ Half-chassis granularity
 - ✓ No central switch chassis
 - ✓ One-Click™ connectors



Pay-As-You-Grow



Back

- 1st Stage Fabric
 - Switch fabric for slots 1-8
 - Switch fabric for slots 9-16
- 2nd Stage Fabric for chassis 2-8
- Fabric for beyond 8 chassis
 - ✓ 10-15 year in-service scalability



Data Plane Differentiators

iNP

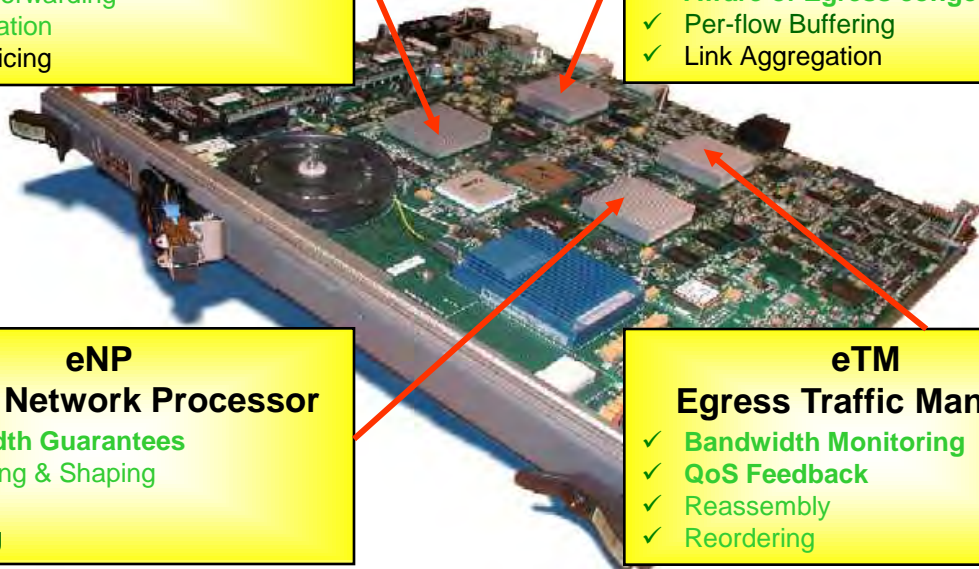
Ingress Network Processor

- ✓ Control-plane protection
- ✓ Logical Routers
- ✓ Packet Forwarding
- ✓ Classification
- ✓ Flow Policing

iTM

Ingress Traffic Manager

- ✓ QoS Guarantees
- ✓ Bandwidth Guarantees
- ✓ Aware of Egress congestion
- ✓ Per-flow Buffering
- ✓ Link Aggregation



eNP

Egress Network Processor

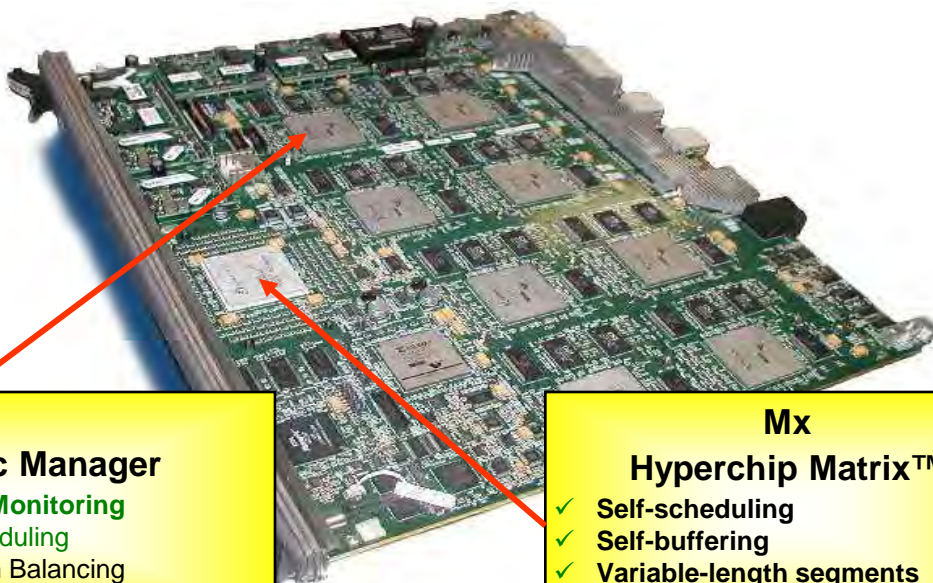
- ✓ Bandwidth Guarantees
- ✓ Scheduling & Shaping
- ✓ Filtering
- ✓ Buffering

eTM

Egress Traffic Manager

- ✓ Bandwidth Monitoring
- ✓ QoS Feedback
- ✓ Reassembly
- ✓ Reordering

15 Patents Issued & Pending



xTM

Fabric Traffic Manager

- ✓ Congestion Monitoring
- ✓ Per-flow Scheduling
- ✓ Per-Flow Path Balancing
- ✓ Resiliency

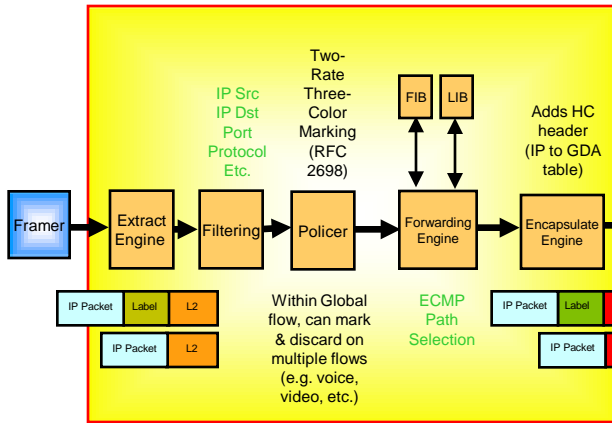
Mx

Hyperchip Matrix™

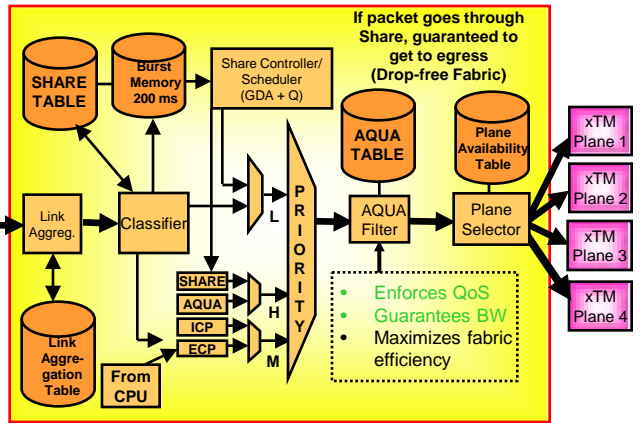
- ✓ Self-scheduling
- ✓ Self-buffering
- ✓ Variable-length segments
- ✓ Scales to 64K ports



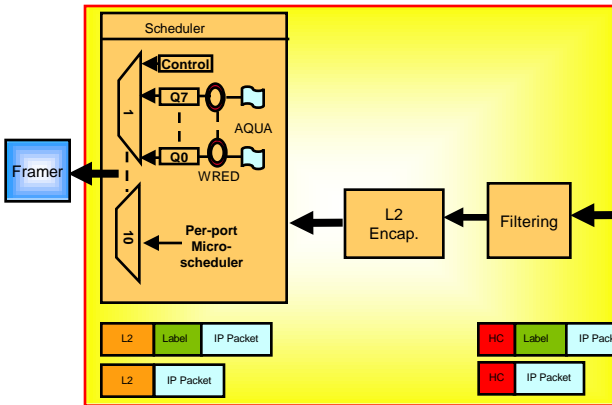
Chip Differentiators



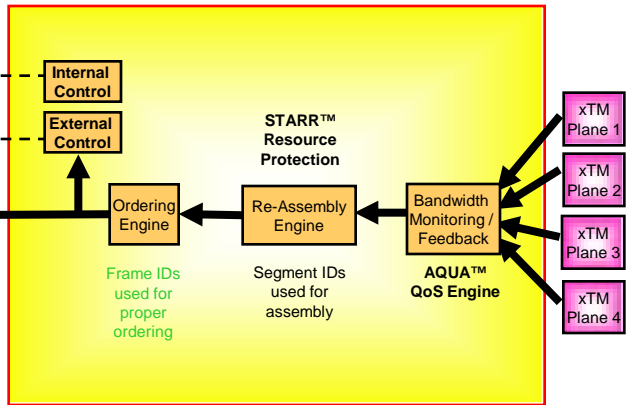
iNP Ingress Network Processor



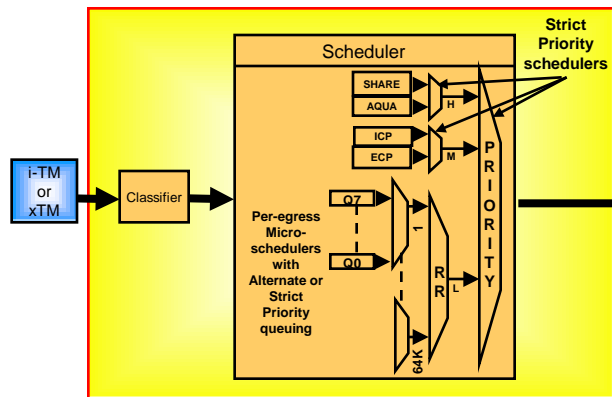
iTM Ingress Traffic Manager



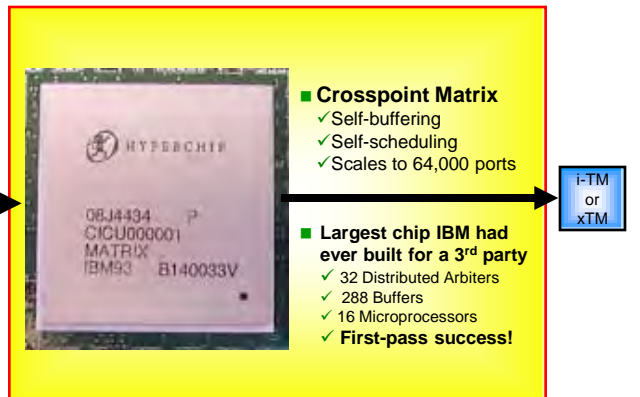
eNP Egress Network Processor



eTM Egress Traffic Manager



Fabric Traffic Manager (xTM)



Hyperchip Matrix™