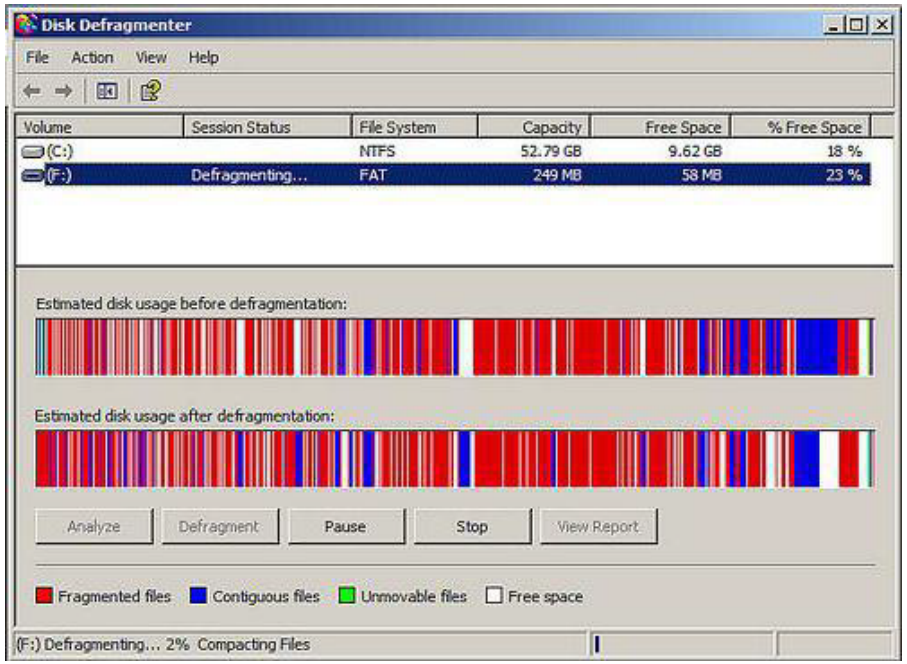
CONCURRENT TECHNOLOGIES

SOSA and the Ethernet Pipe Dream

Nigel Forrester
Director of Strategy

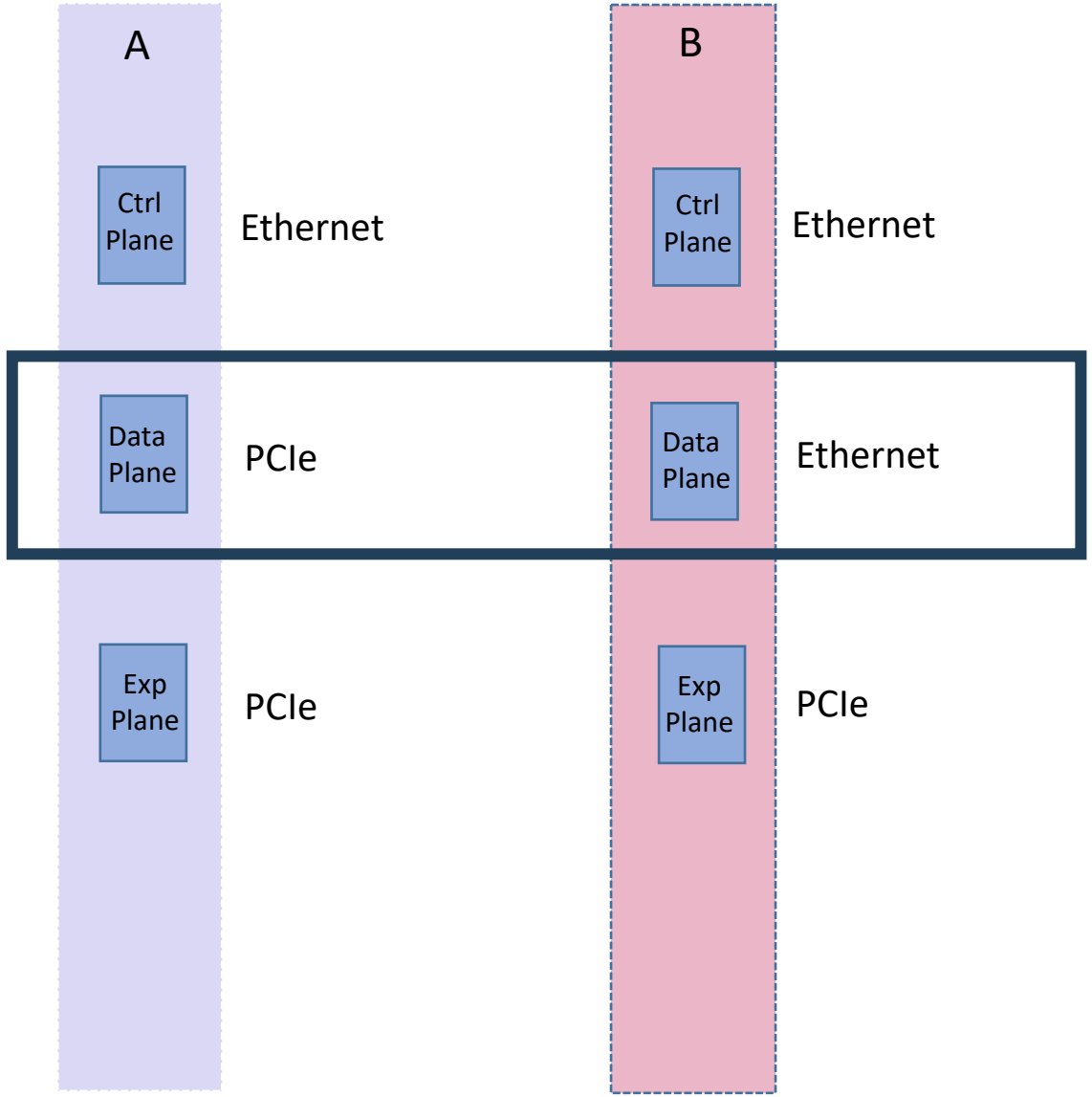
The importance of Ethernet

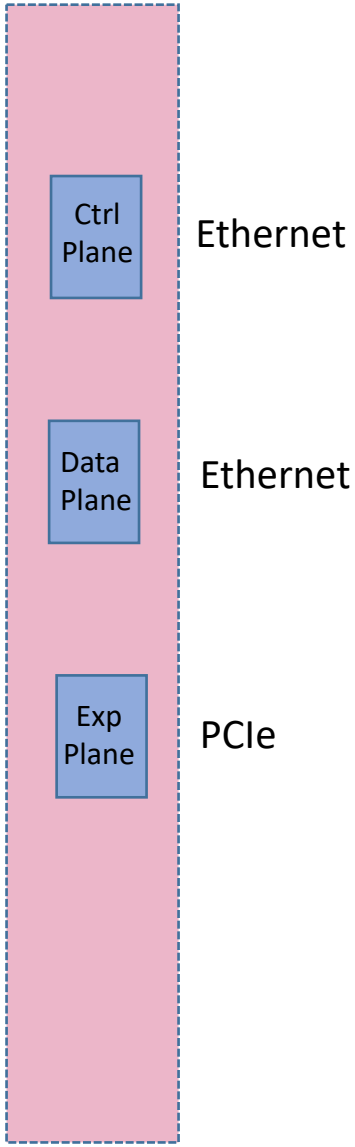


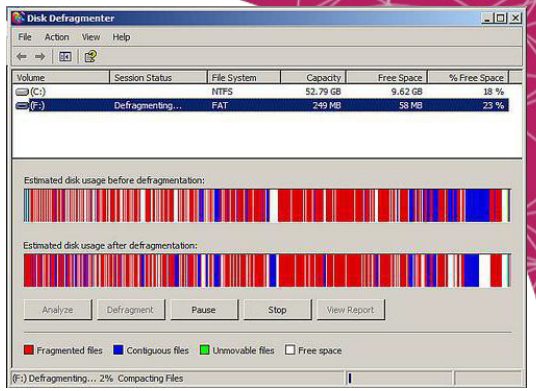
REAL TIME

Future Proof

Data Plane Defragmentation

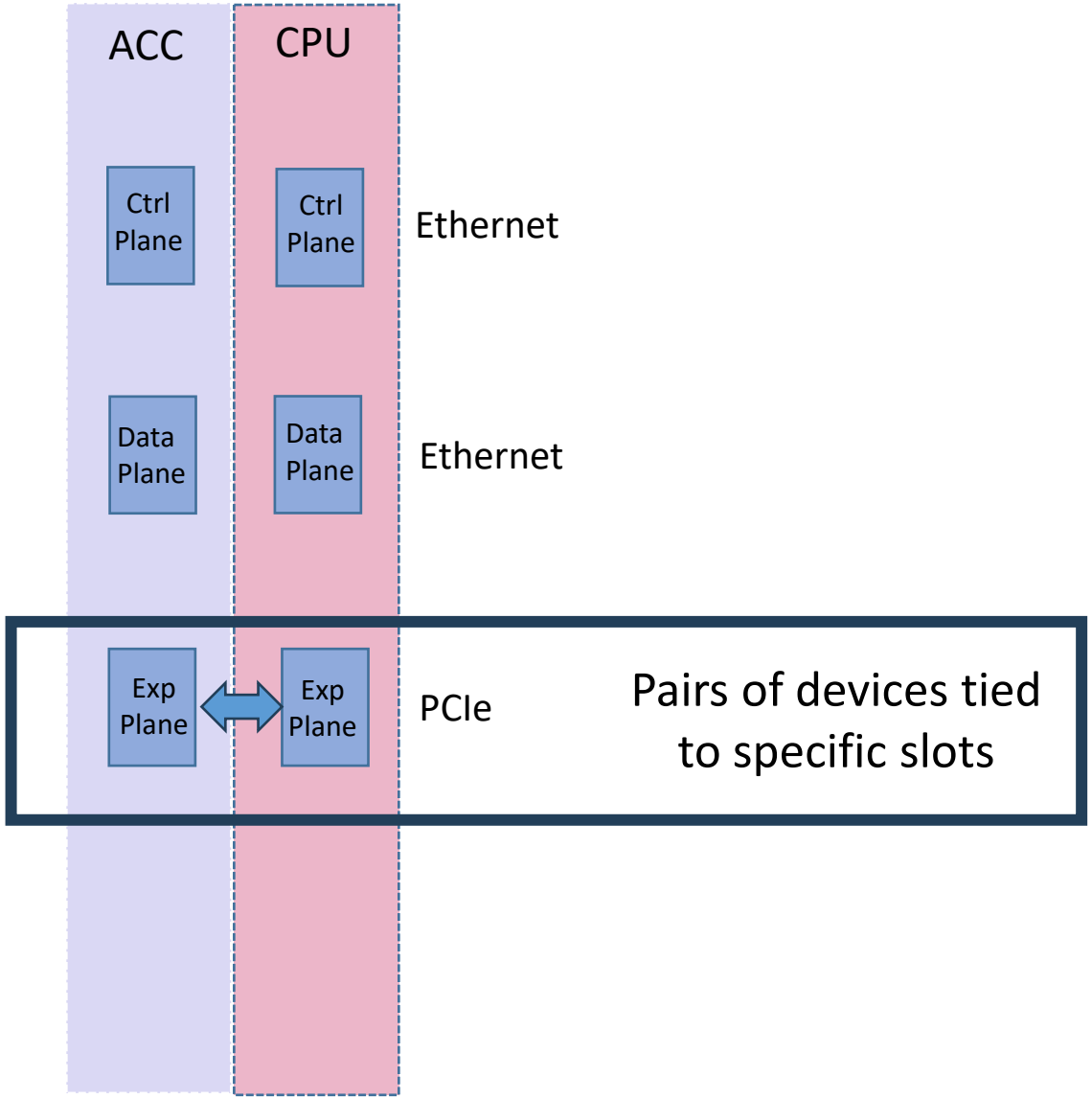


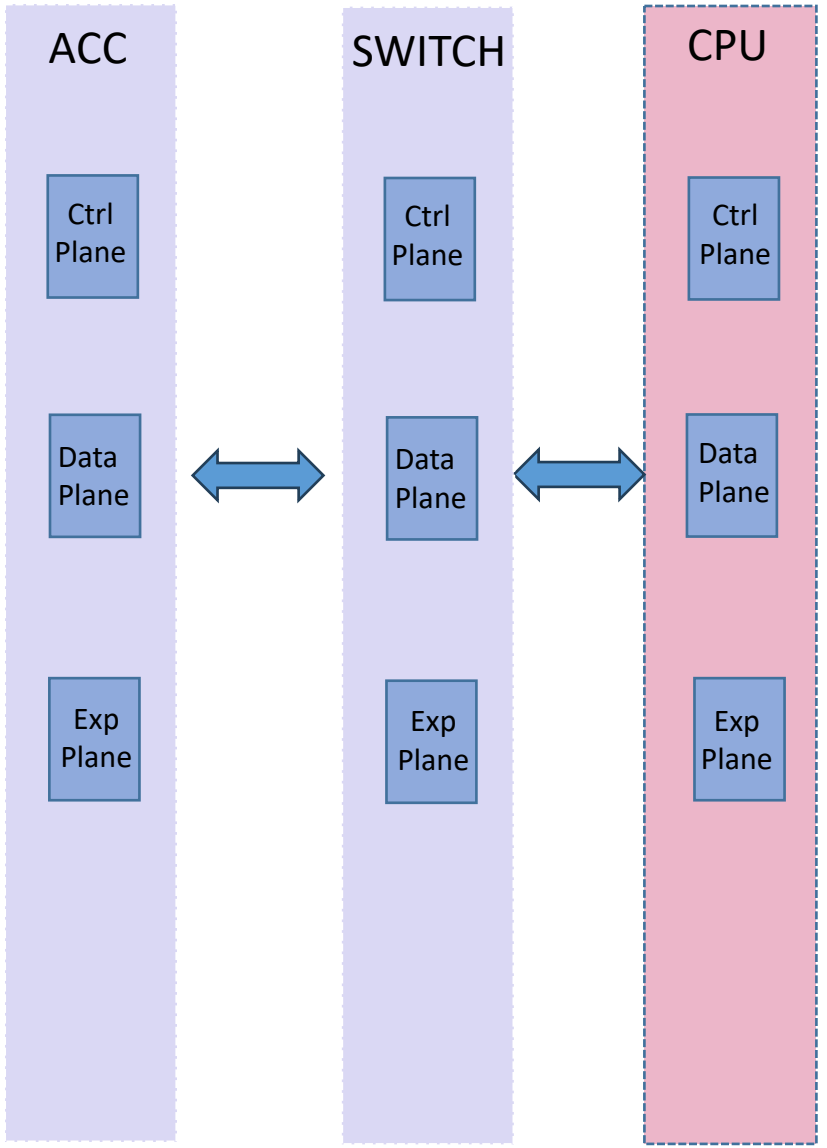


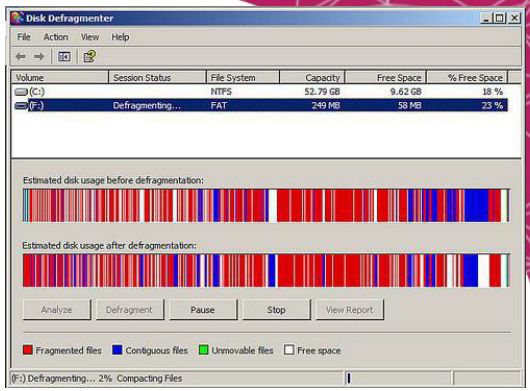


CONCURRENT TECHNOLOGIES

Defragmentation and Independence

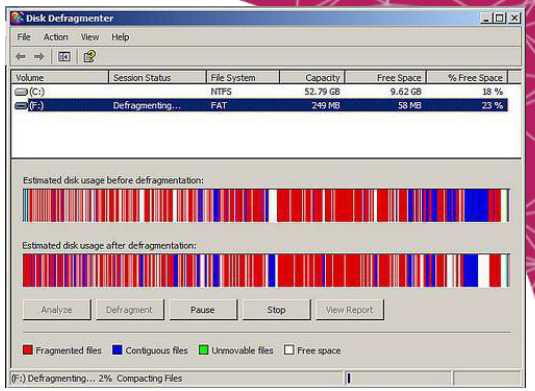


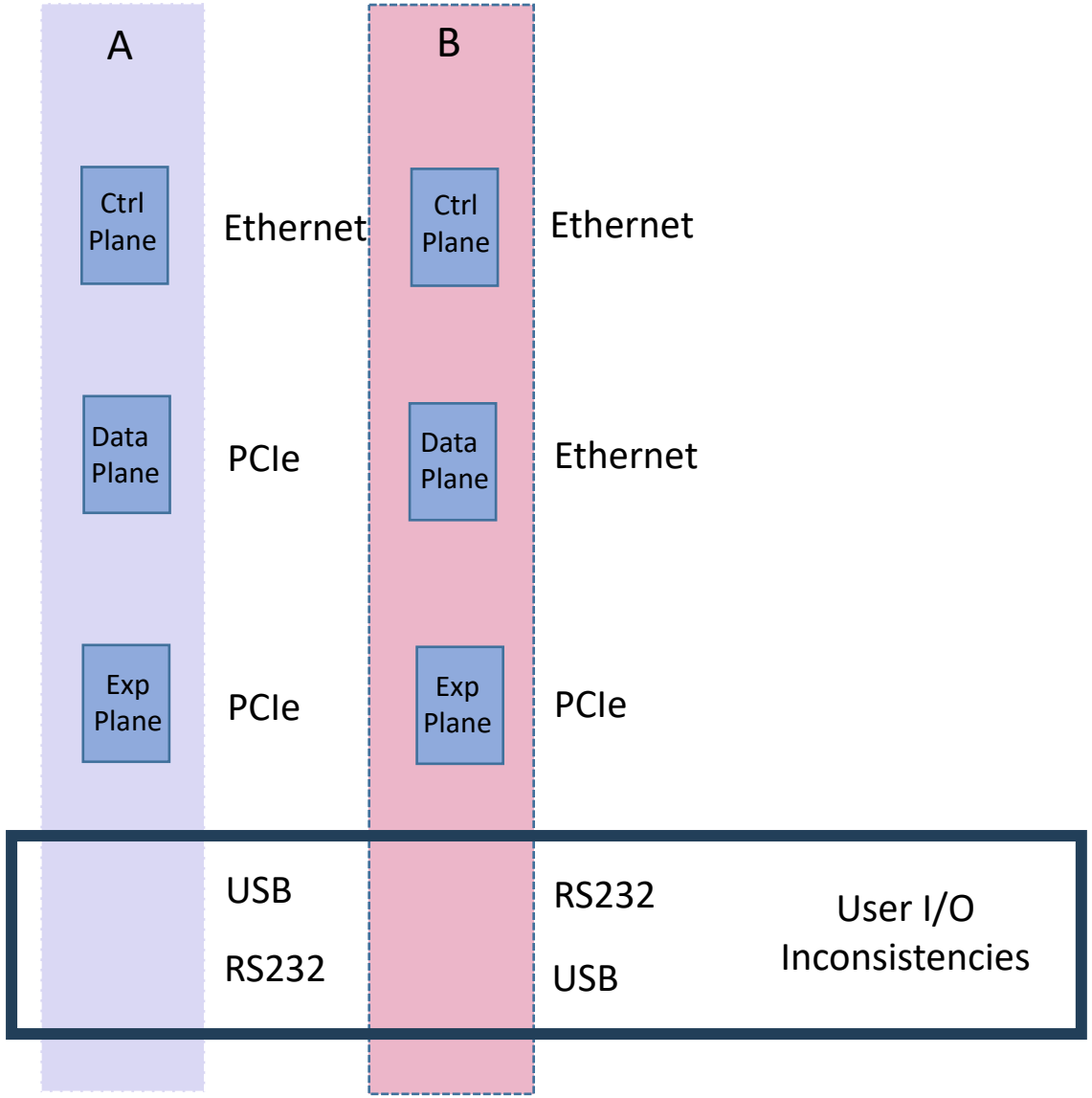




CONCURRENT TECHNOLOGIES

Defragmentation User I/O





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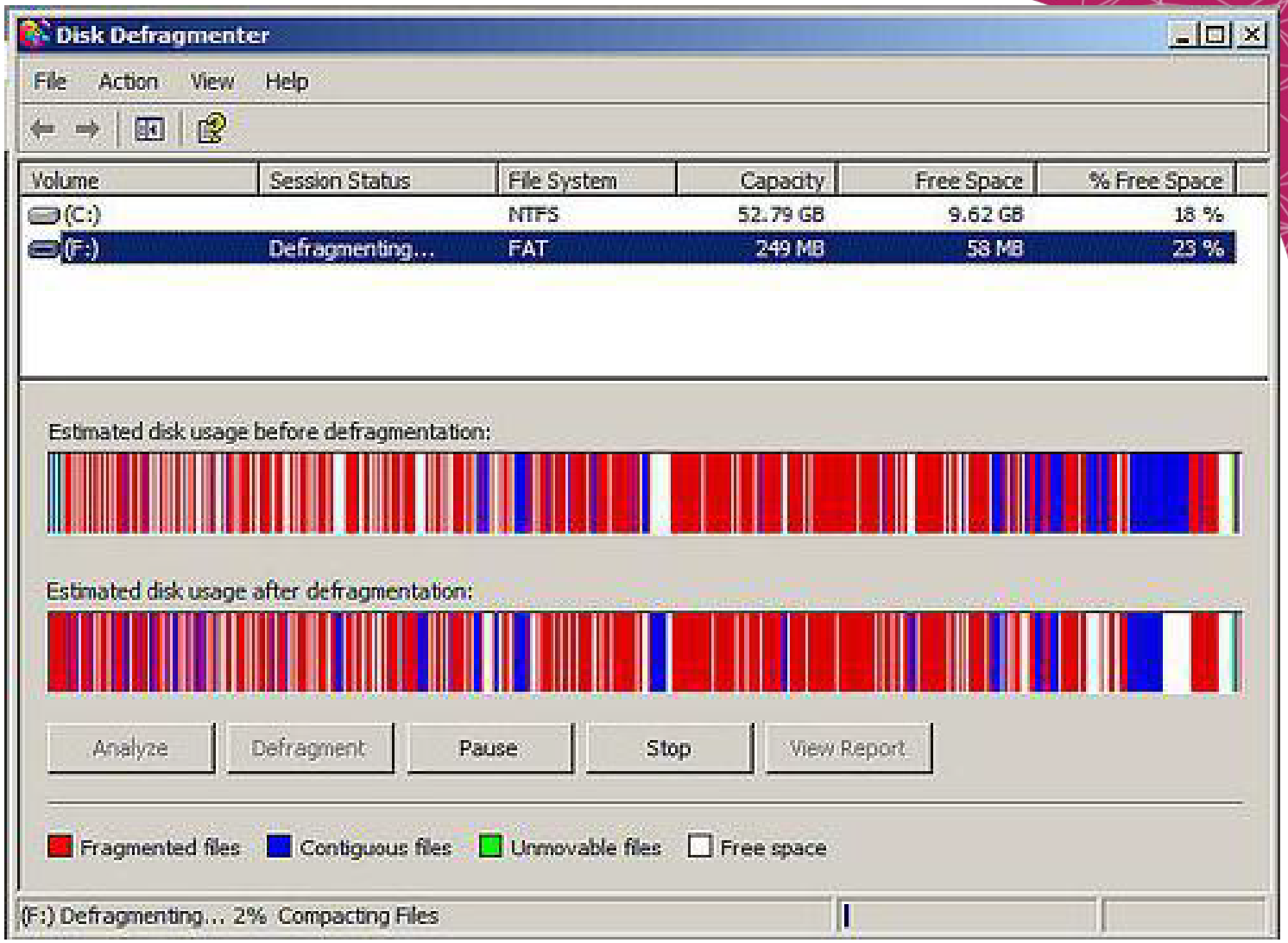
Defragmentation Summary

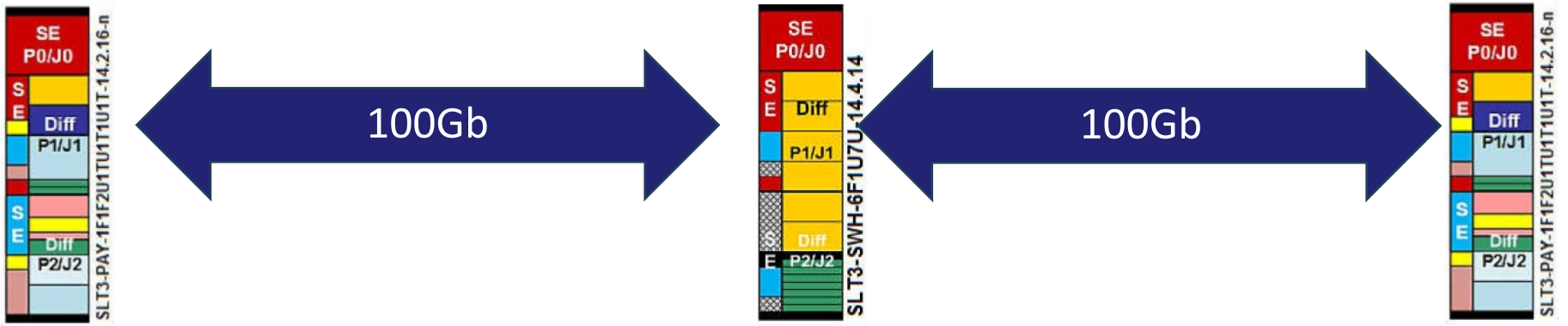
- 3U VPX before 2020:
  - 25 Designs
  - 112 Variants
- 3U VPX Aligned to SOSA:
  - 13 Designs
  - 36 Variants



Ethernet Test Setup

Future Proof

- Completed by using a pair of SOSA Aligned processor cards linked by a 100G Ethernet Switch
- Each card was running Ubuntu 22.04.1 (kernel version 5.15.0-43) and the MTU was set to 9000
- iPerf3 used to measure the maximum available bandwidth



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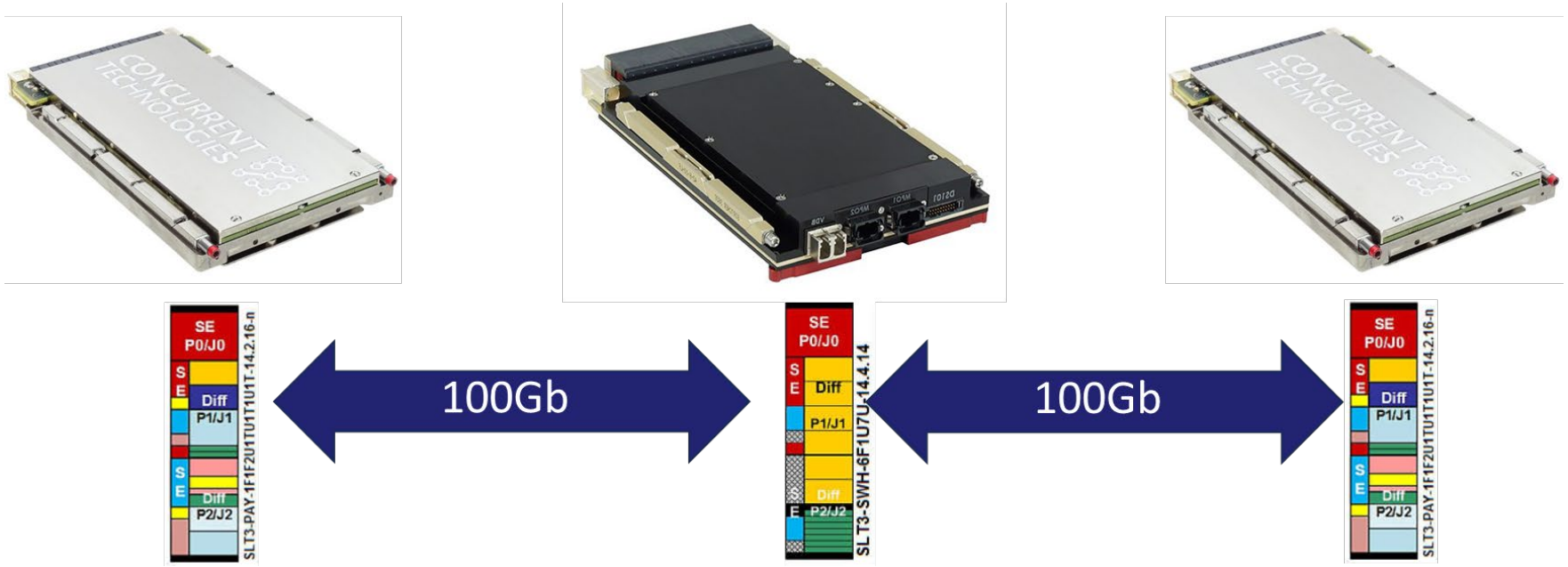
Ethernet Benchmarks

Future Proof

- Running iPerf3 on both the server and client:
  - The total bit rate achieved was 94.3Gbps
  - After installing the Linux preempt_rt Real Time kernel, the bit rate was 92.6Gbps
- Using RDMA/ROCE
  - We achieved 88.2Gbps



Future Proof?

- Always a Pipe Dream
- 100/200/400G Ethernet
- PCIe Gen 5 & Gen 6

- Easy to transition payloads
- Difficult to upgrade backplanes

Looking Beyond Ethernet Bandwidth Performance Metrics

- Ethernet is the de facto control and data fabric
- SOSA Aligned processors have no ‘user I/O’ making it more challenging to implement legacy real time serial protocols such as ARINC 429, CANBus and MIL-STD-1553
- Traditional Ethernet fabric has gaps around “determinism” and “reliability”
- Time Sensitive Networking (TSN) separates out the real-time traffic from other less critical systems traffic to provide a viable converged Ethernet solution

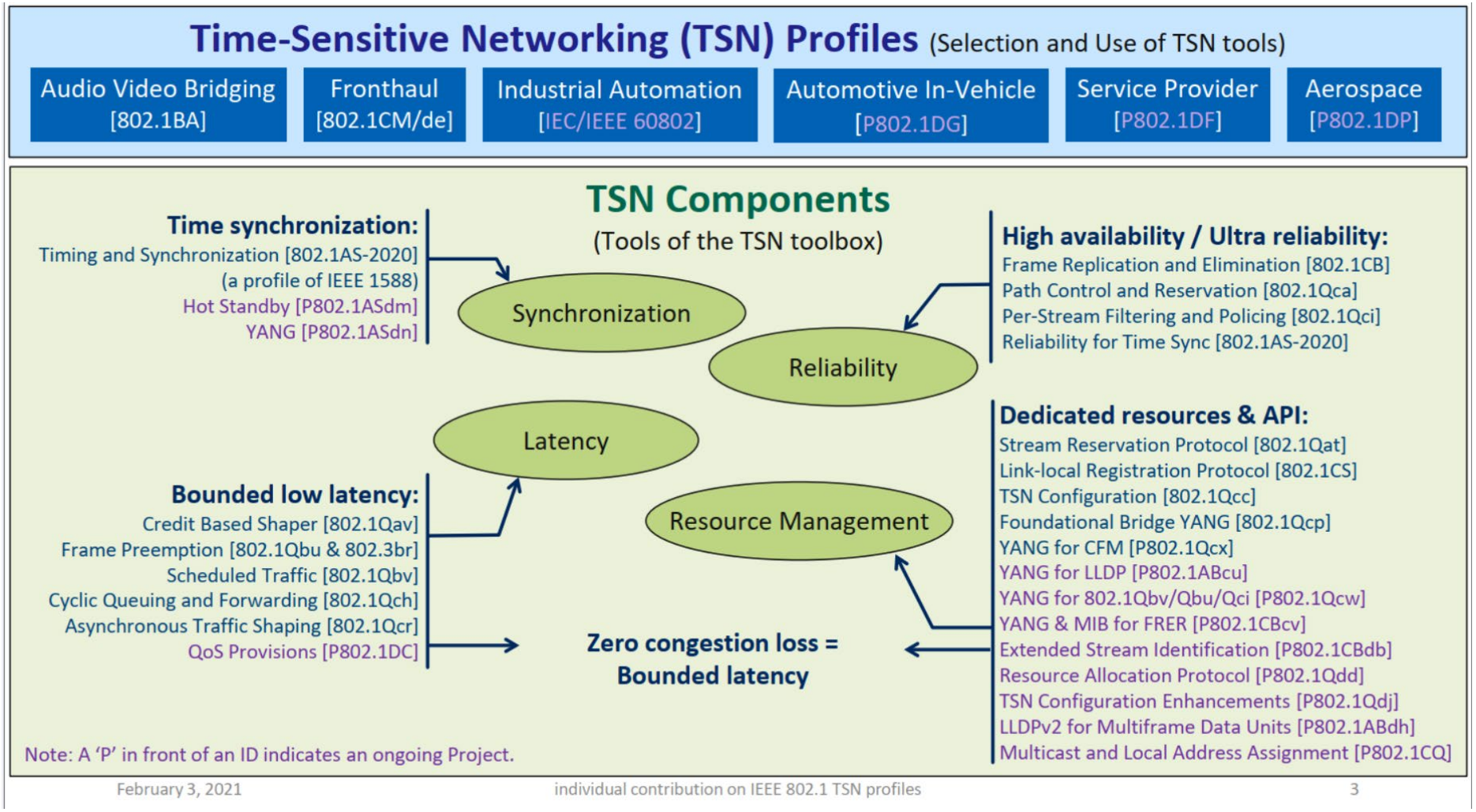
Time Sensitive Networking (TSN) – the Basics

- TSN is a collection of IEEE Standards providing real-time behavior in systems utilizing Ethernet by Time Synchronization, Traffic Shaping and Scheduling, Reliability and Resource management
- TSN grew out of the IEEE 802.1 standard working groups on Audio Video Bridging (AVB) to make sure that independent networks streams for audio and video data arrive at the correct times to ensure synchronization

Time Sensitive Networking Profiles

- TSN uses a profiles approach that defines:
  - Features
  - Configurations
  - Protocols
- Some profiles are well defined, while others are still works in progress
- For example, work is currently underway by SAE and IEEE on the Aerospace profiles (P802.1DP), which are being defined in SAE AS6675 Working Group as IEEE 802.1DP; these will focus on security, high availability and reliability, maintainability, and bounded latency for deterministic networks that range in Design Assurance Levels (DALs)

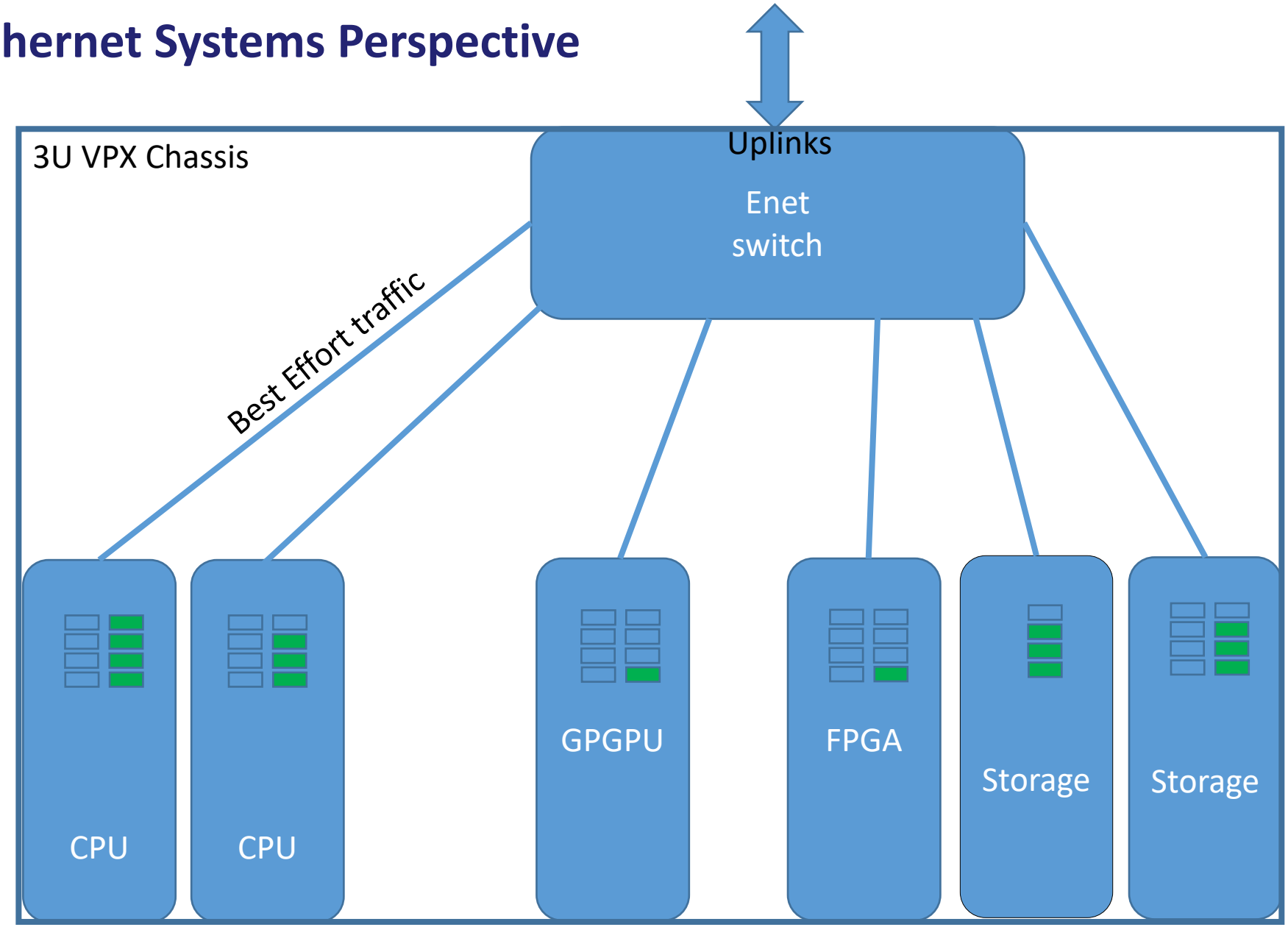
TSN Profiles and Grouping



Time Sensitive Networking (TSN)

- Time Synchronization
  - IEEE 802.1AS gPTP
- Traffic Shaping
  - IEEE 802.1Qbv – Time aware Shaper (TAS)
  - IEEE 802.1Qav – Credit Based Shaper (CBS)
- High Availability
  - IEEE 802.1CB – Frame Redundancy and Elimination for Reliability (FRER)
- Configuration of the network
  - IEEE802.1Qcc - Centralized Network Configuration(CNC)
- Traffic Types
  - Hard Real-Time (i.e. Control)
  - Soft Real-Time (User experience i.e. Video display)
  - Best Effort (General traffic)

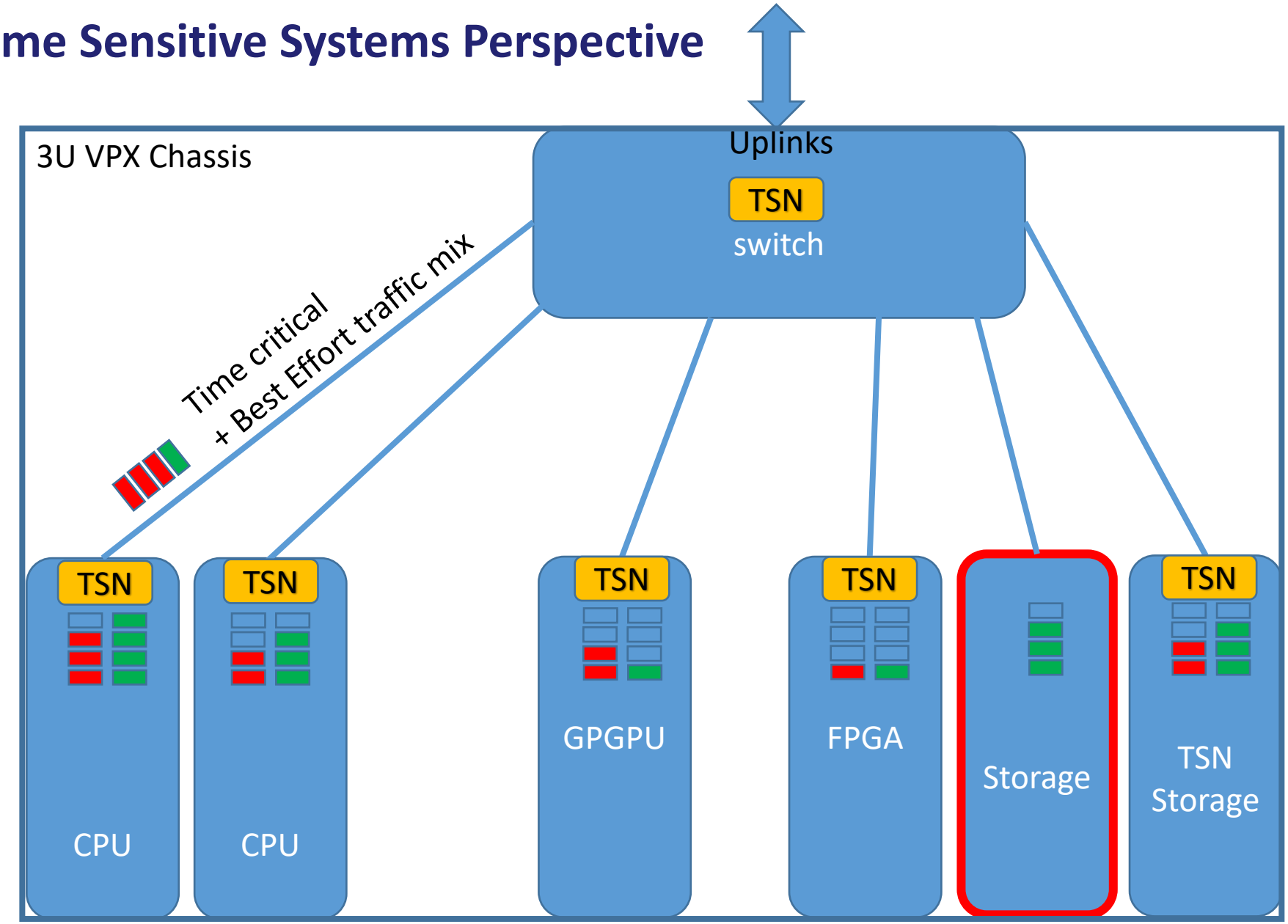
Ethernet Systems Perspective



Green = Packets

Common Time Base
across system w/ 802.1AS

Time Sensitive Systems Perspective

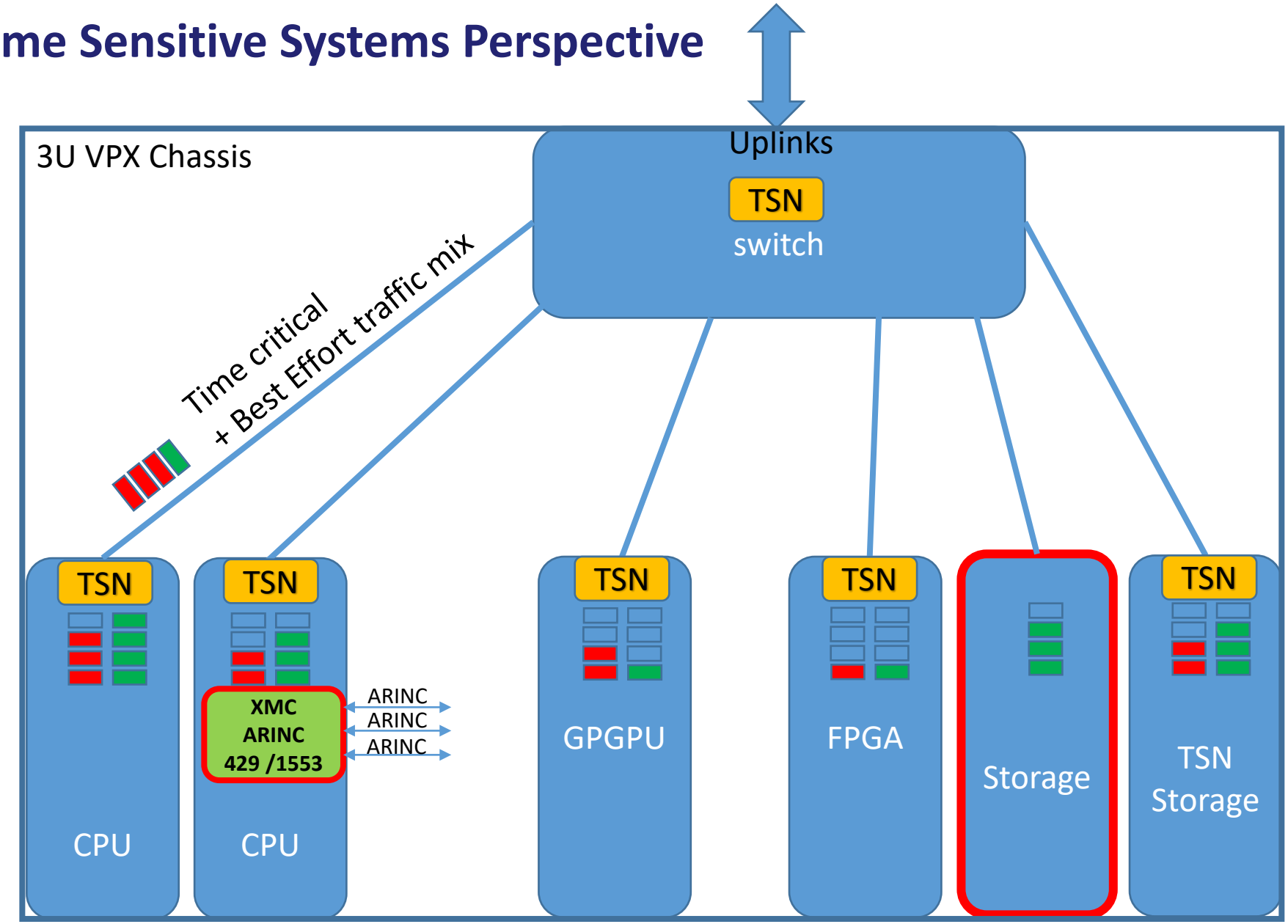


Key

Red = High Priority queue
Green = Low Priority queue

Common Time Base
across system w/ 802.1AS

Time Sensitive Systems Perspective



Key

Red = High Priority queue
Green = Low Priority queue

Common Time Base
across system w/ 802.1AS

CONCURRENT TECHNOLOGIES

Real Time Summary

- TSN is driving another change in architectures
- Early days but has significant momentum

CONCURRENT TECHNOLOGIES

Thank You

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Director of Strategy