Evolution of IT Infrastructure For Fusion Control Systems

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Tim Frazier

Chief Information Officer

NIF & Photon Science

Lawrence Livermore National Laboratory • National Ignition Facility & Photon Science

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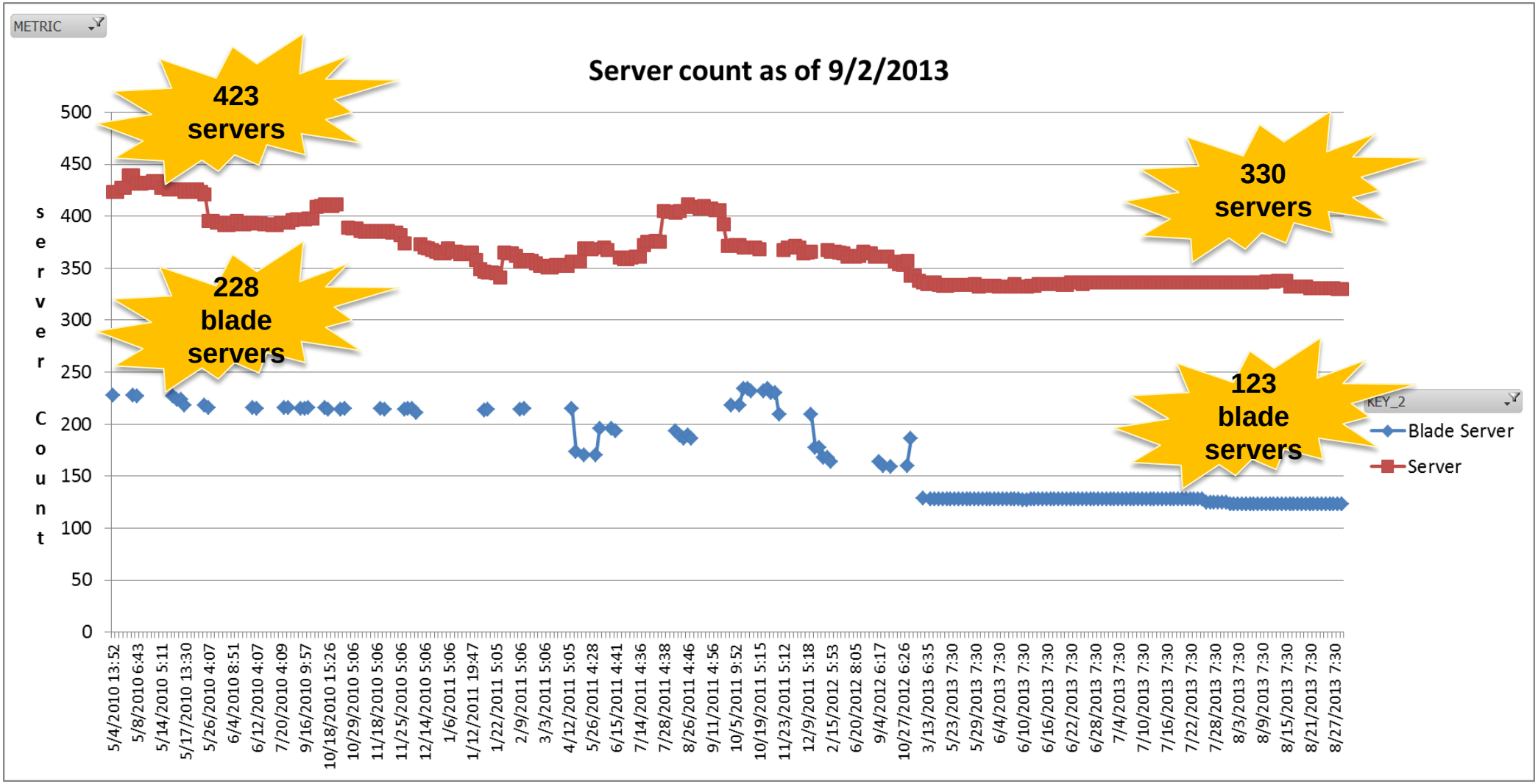
NIF's IT architecture is based on four principles

- Individual component failure should not cause infrastructure failure
  - Separate workloads & have more than one running at all times
- Technology should be easily replaceable
  - Avoid an attachment to physical things
- Achieving self-similarity should guide the selection of technology
  - Like model numbers wherever possible
- Use data to forecast resource consumption
  - Create repositories of long-term metrics for analysis

NIF has consolidated its server footprint by 40%



Partnership with key technology providers has been integral to our success

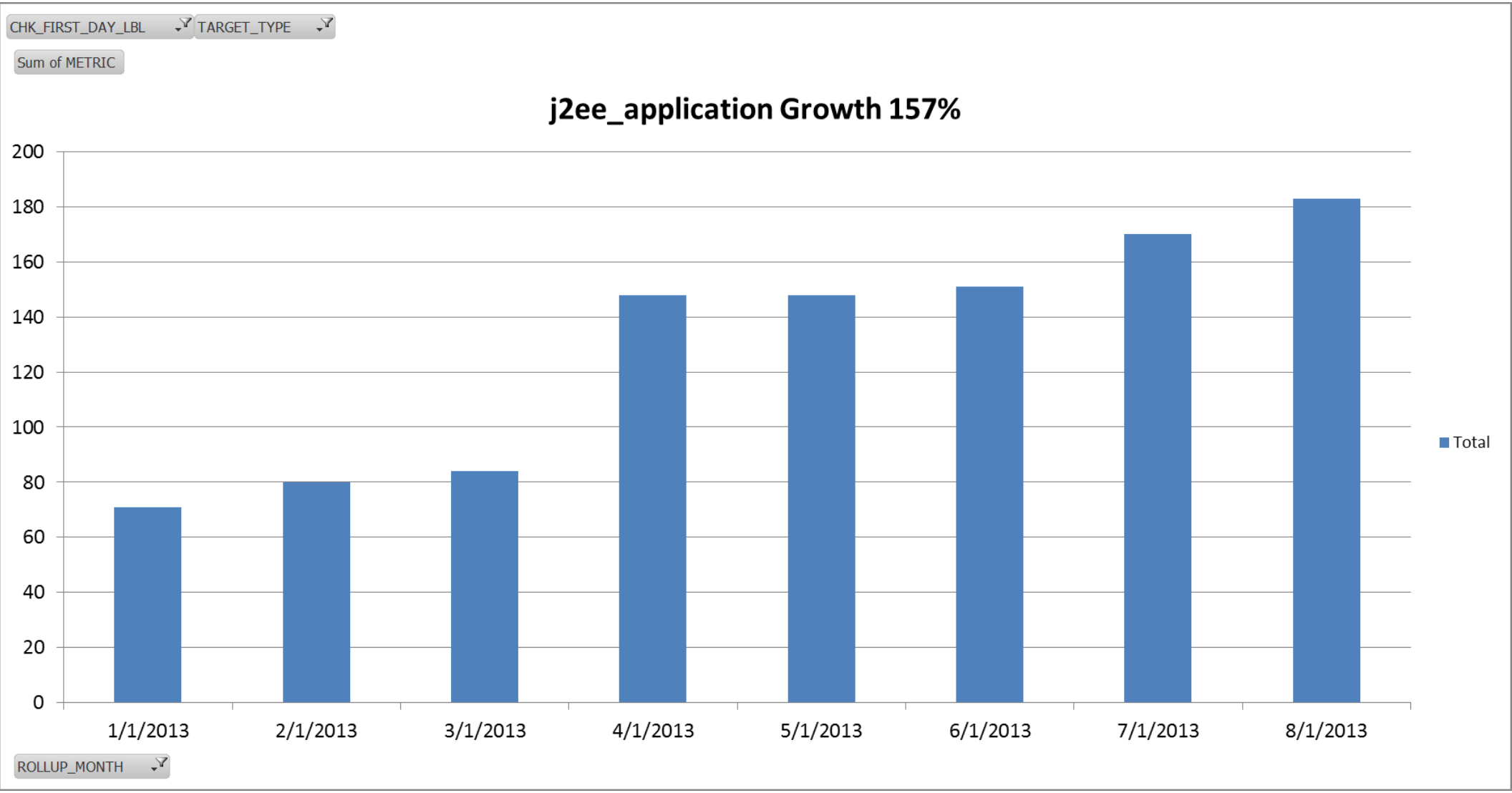
Our physical footprint has been reduced by 50%

SPARC-to-Intel migration made possible by port from Ada to Java

High-density, virtualized servers

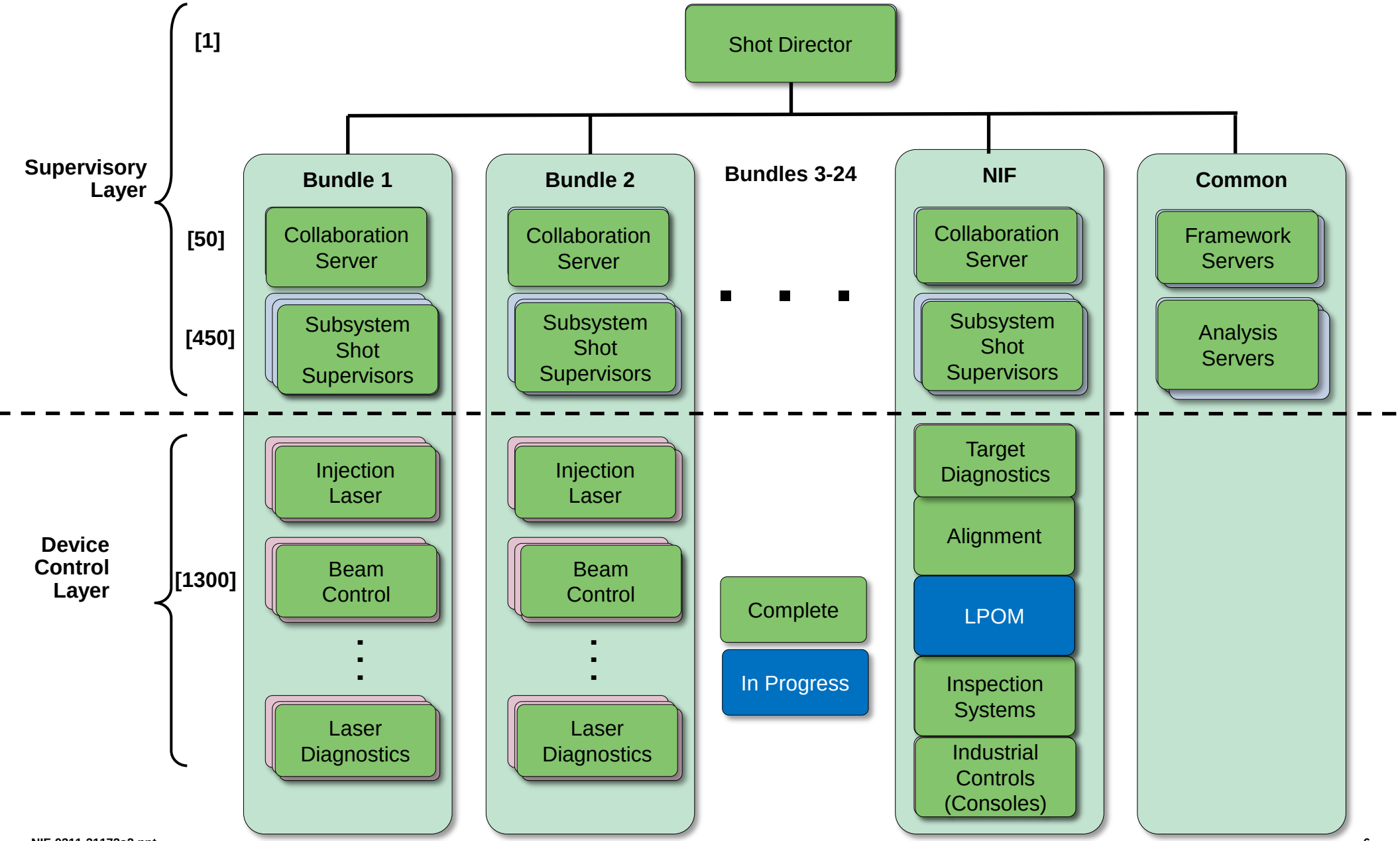
Single-purpose to multi-purpose servers made possible by Virtualization (Xen)

We have kept up with customer demand despite the 40% consolidation in footprint

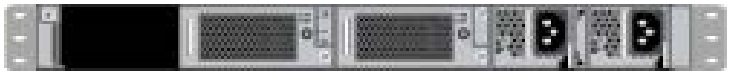


Low cost of ownership virtual machines enable single-purpose hosts

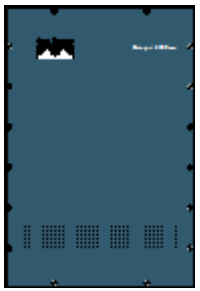
Virtualization of our Integrated Computer Control System (ICCS) is nearly complete



To build an infrastructure, you need building blocks

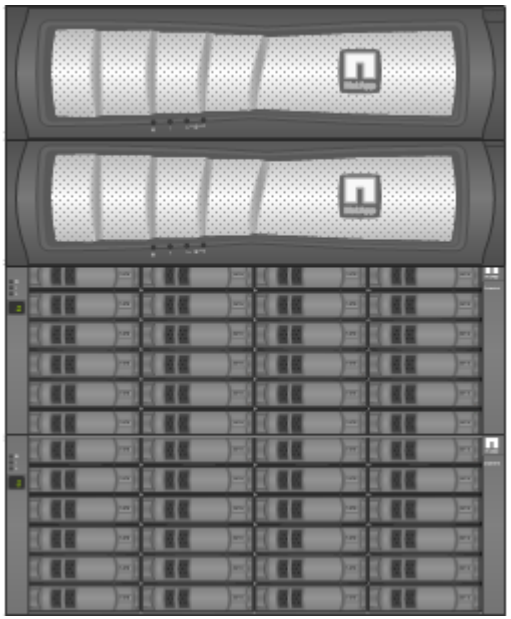


Ethernet Switch
Cisco 5548

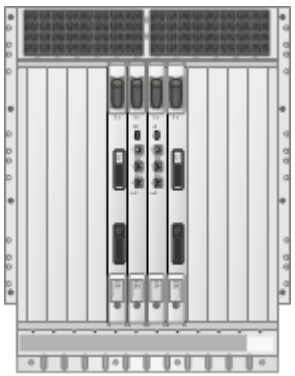


Ethernet Switch
Cisco 6509

Diskless Blade
Servers
HP BL460c

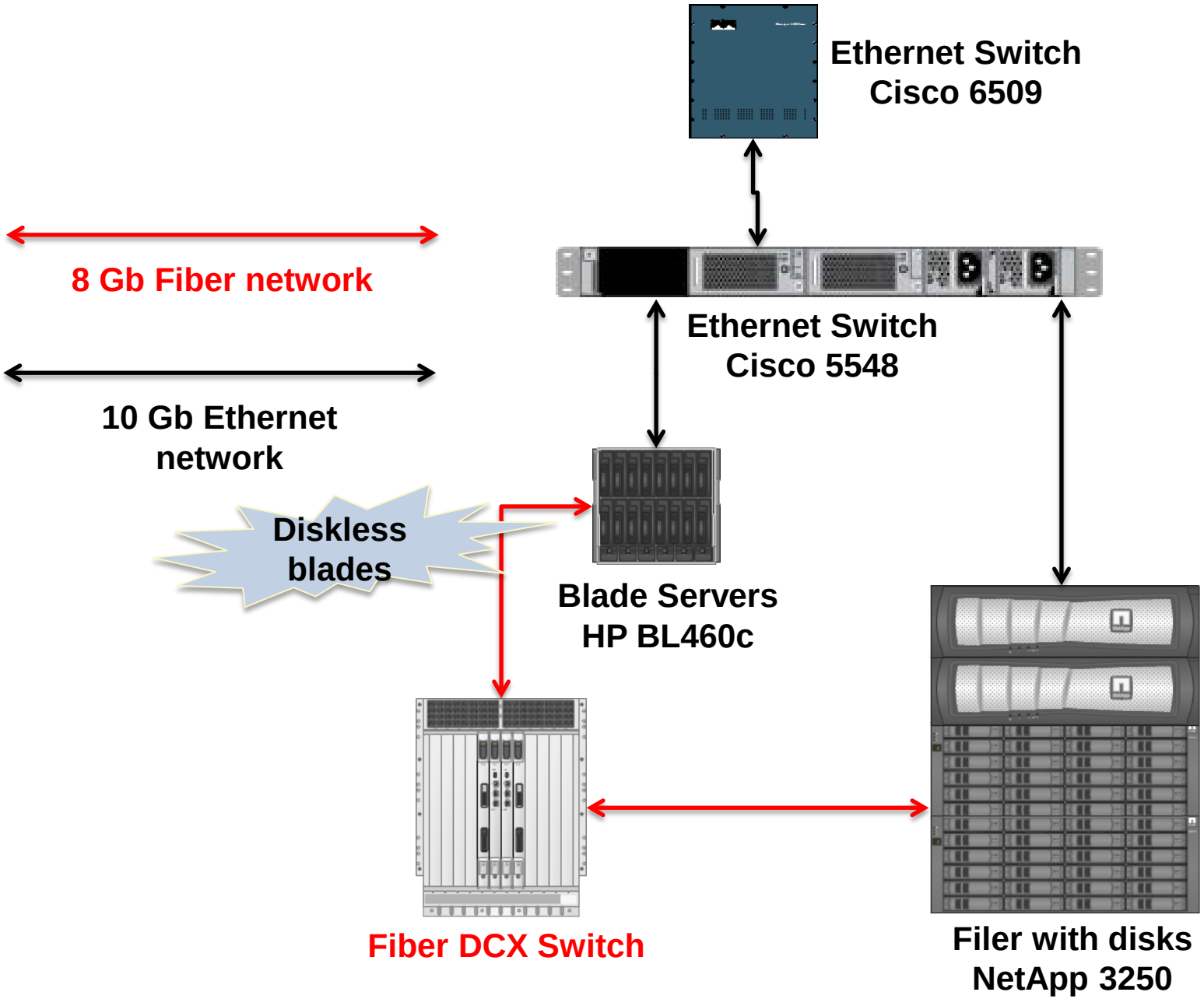


Filer with disks
NetApp 3250

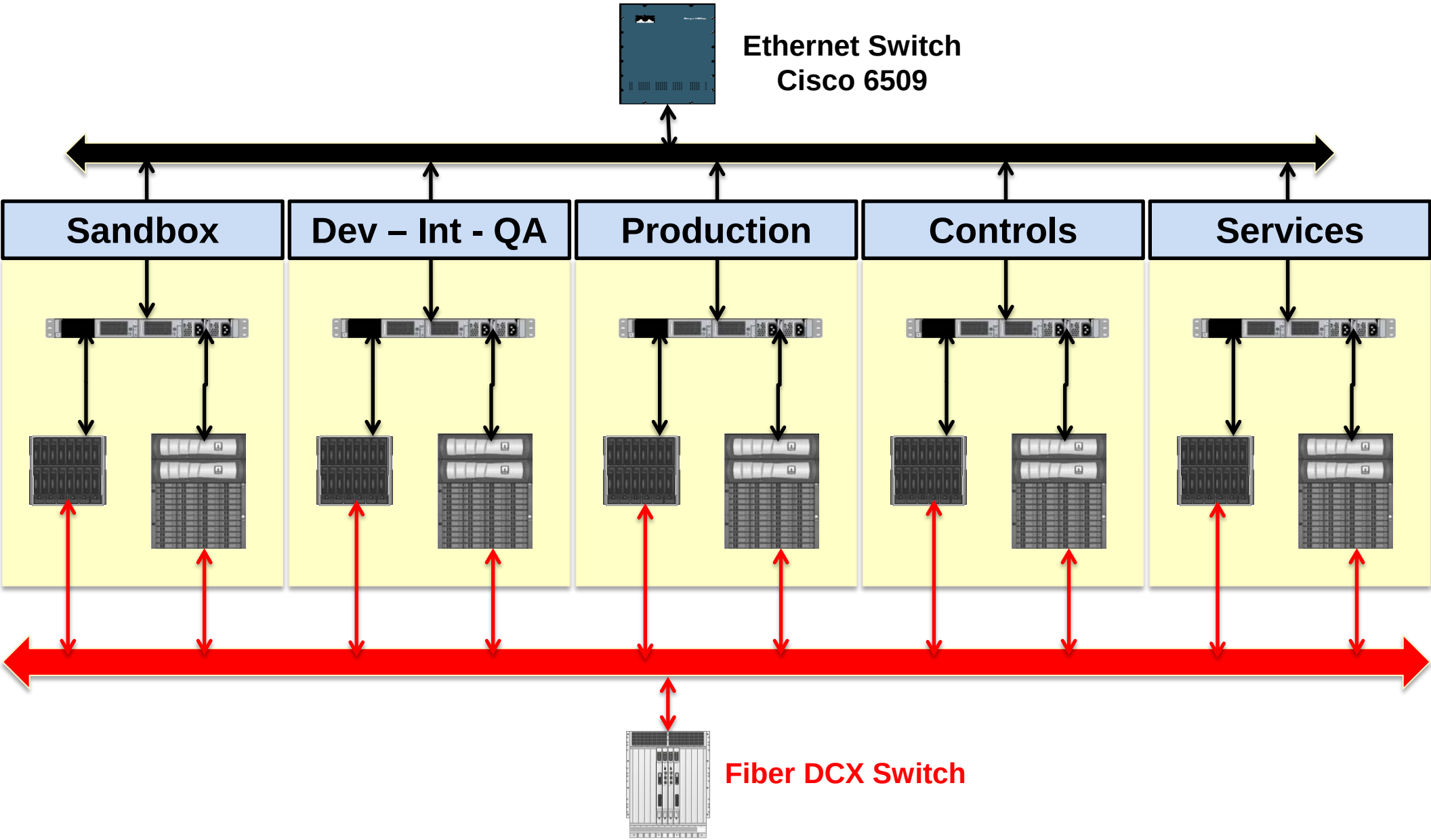


Fiber DCX Switch

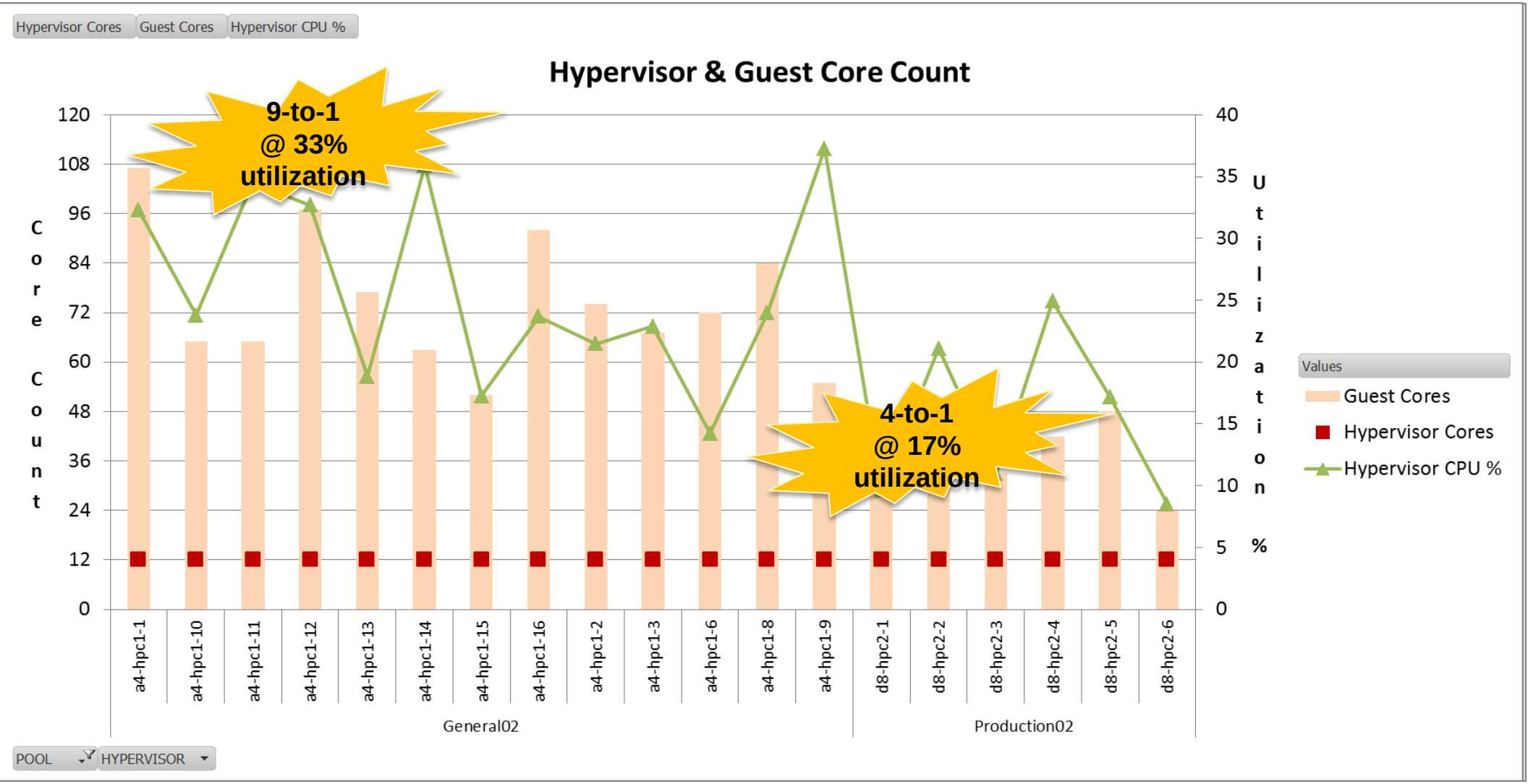
Proto-type a single environment



Create a segmented infrastructure

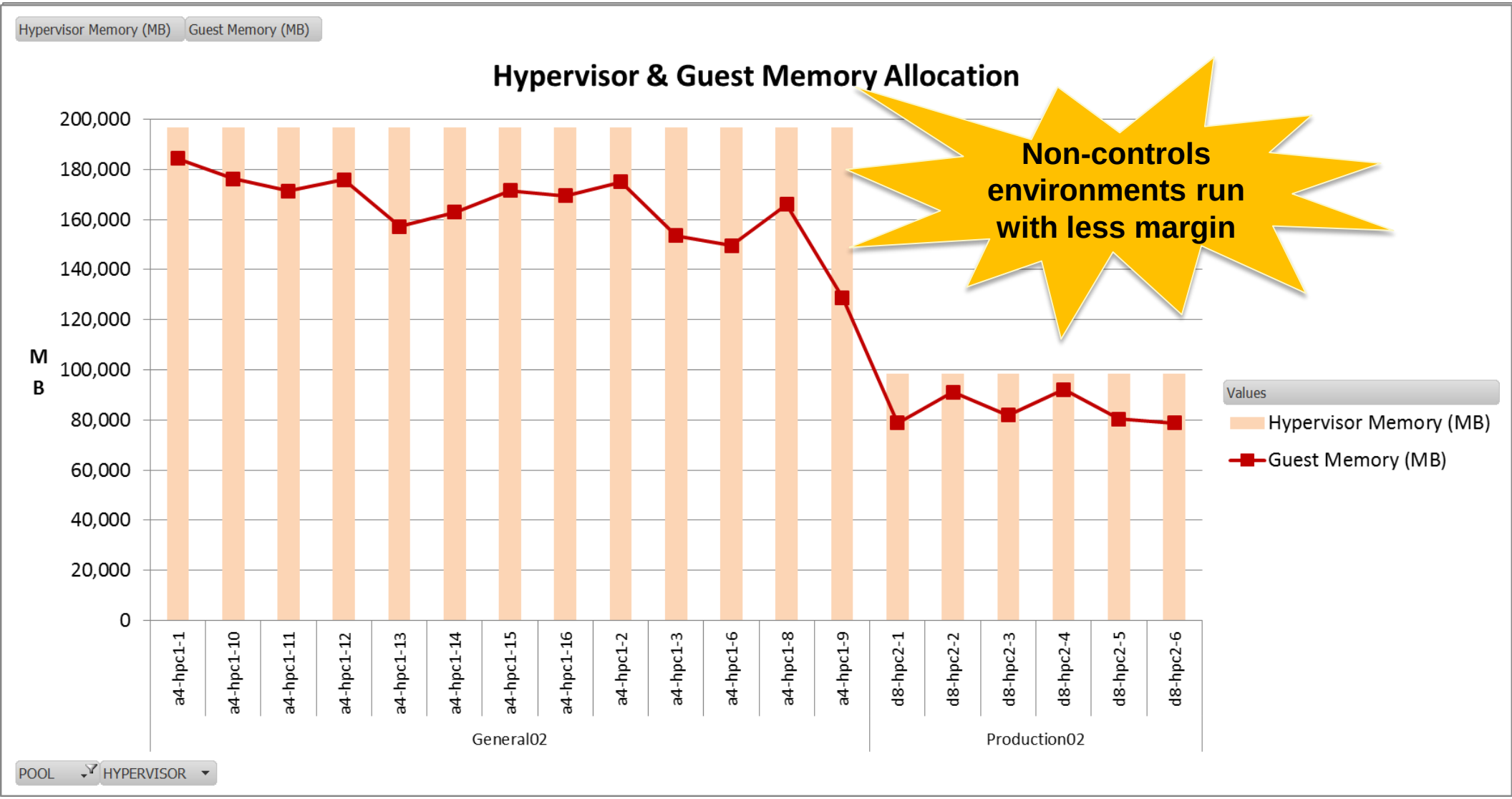


Computational workload is very densely packed onto hypervisors



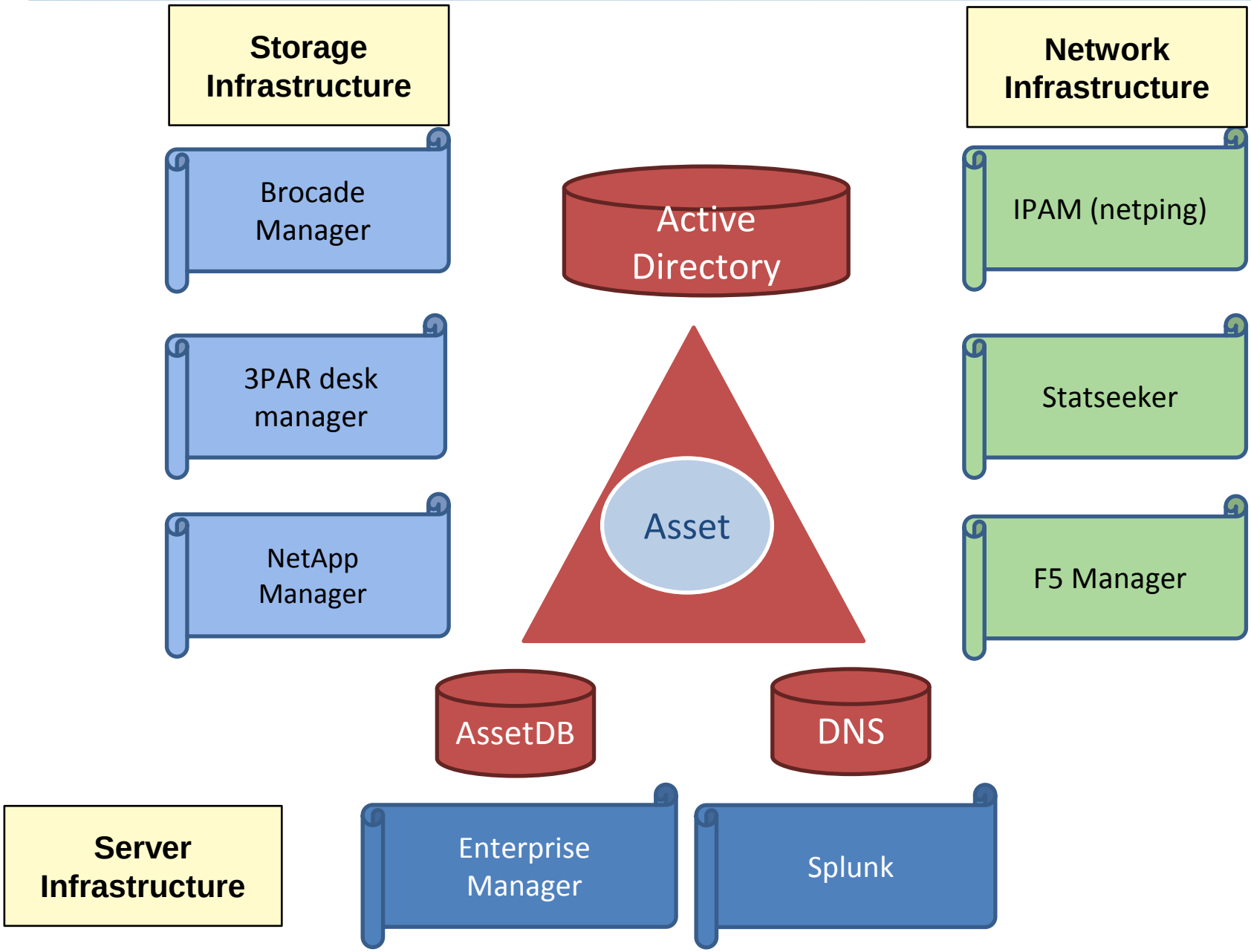
General02 : Development/Integration/QA virtual machines
Production02 : Production, non-control system virtual machines

Memory limits the packing factor for hypervisors

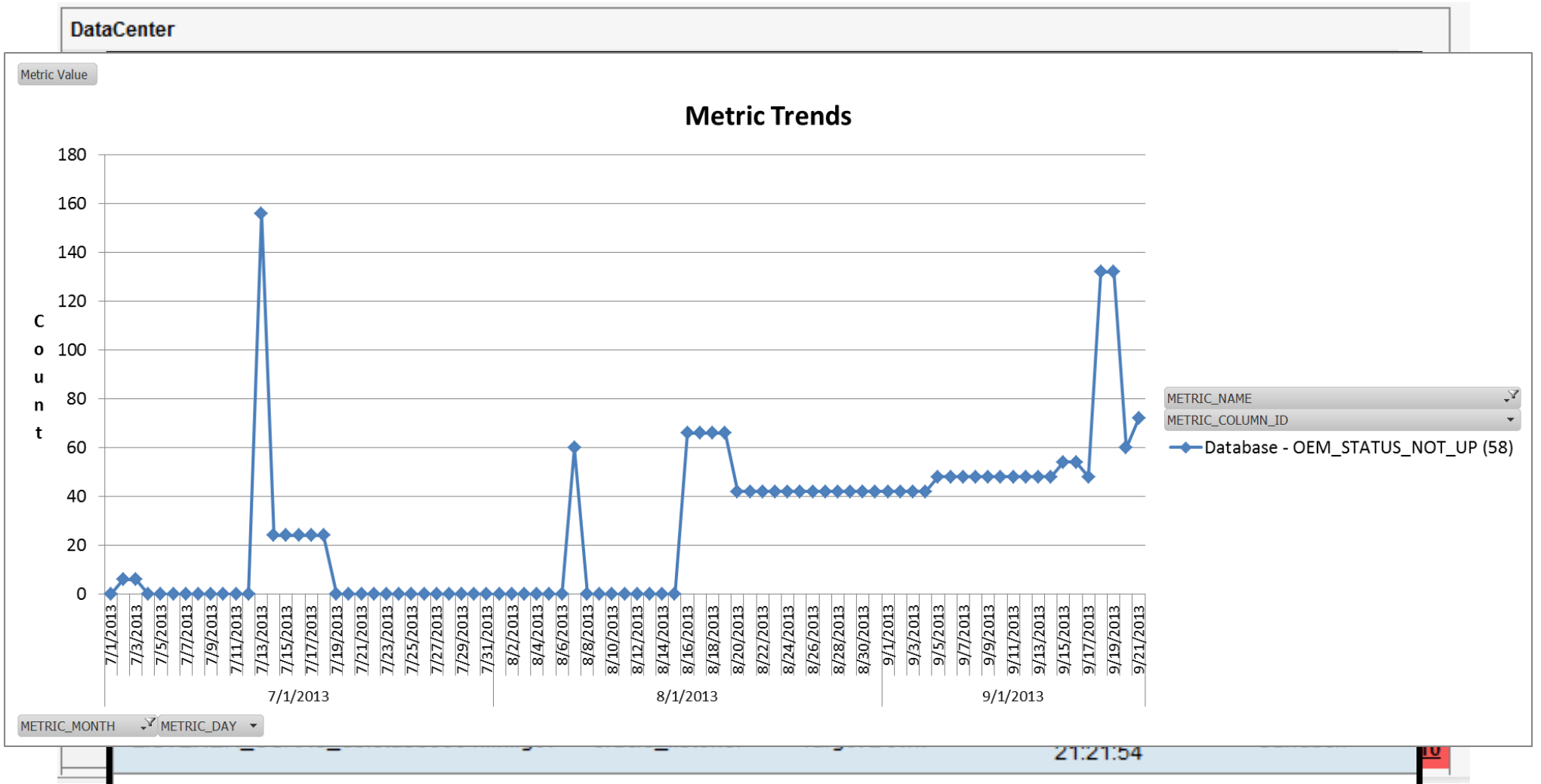


General02 : Development/Integration/QA virtual machines
Production02 : Production, non-control system virtual machines

We rely on many tools to manage our infrastructure

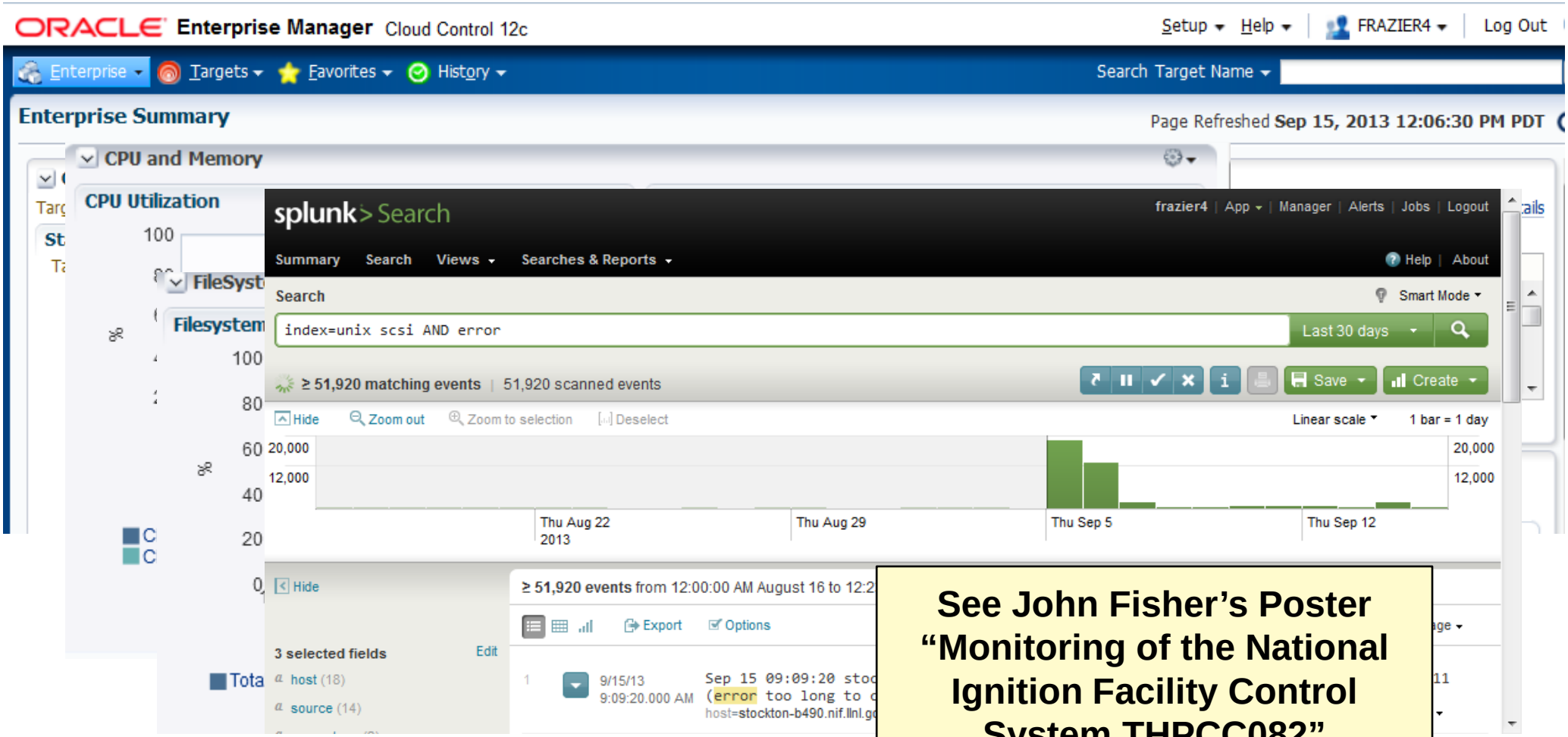


We have developed metrics to measure discrepancies between tools & performance outliers



Systemic problems can be revealed by trending metrics over time

Two tools are used monitor & manage our server infrastructure



See John Fisher's Poster "Monitoring of the National Ignition Facility Control System THPCC082"

Oracle Enterprise Manager Performance, Configuration Management & Incident Management

Splunk
Log file mining & alerting

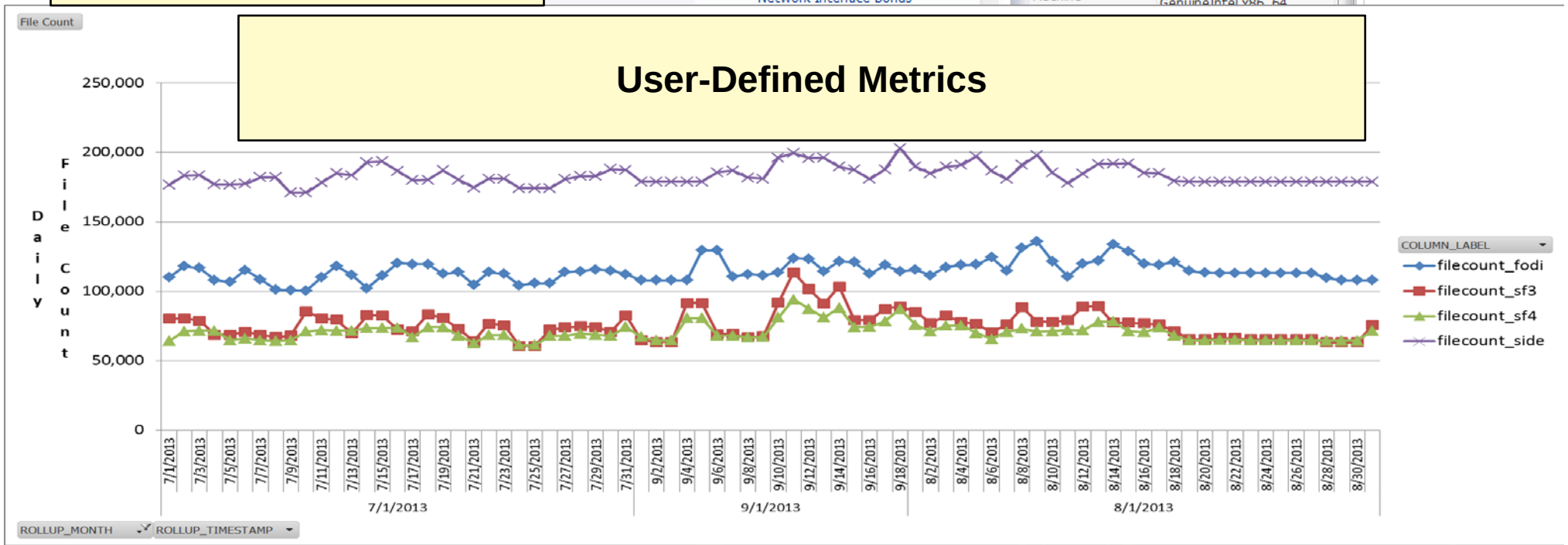
Agent-based monitoring provides a wealth of information beyond host performance management

Configuration Management

Application metrics

Database metrics

User-Defined Metrics



Final thoughts

- **Self-similarity, more than any other quality, has enabled us to grow our infrastructure by 100% without a corresponding increase in staff**
- **Segmentation, more than any other design principle, has enabled us to increase reliability by isolating performance degradation & component failures**
- **Virtualization, more than any other technology, has enabled us to grow our infrastructure by 100% while at the same time consolidating our physical footprint by 50%**
- **Data provided by tools, specifically agent-based collection, more than any other asset, have provided the knowledge needed to manage our infrastructure**
- **It is time for your questions!**

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