Windows Container and Beyond

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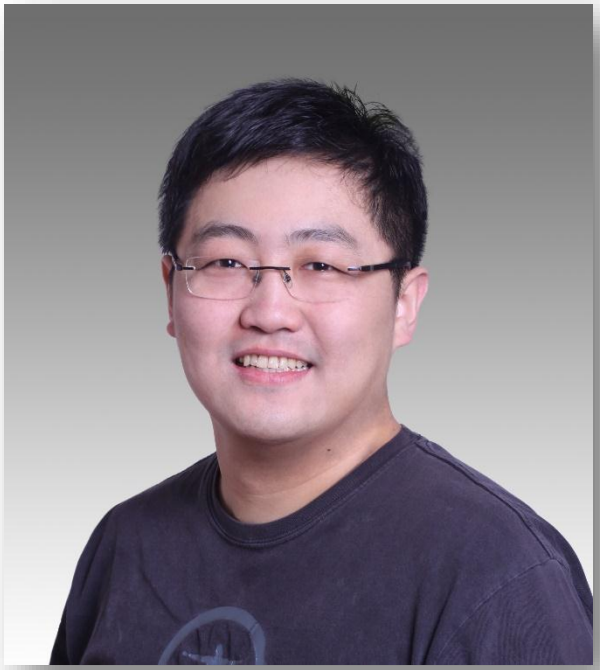
Introduction

左玥

- High Perf Computing / Grid Computing
- Microsoft
- Windows Kernel / Driver
- Azure - Virtualization
- Azure SDN - VSwitch
- Windows Container
- Alauda.cn (云雀科技)



Agenda

- Containers
- Drawbridge – precursor to Windows Containers
- Windows Server 2016

Two Aspects of Virtualization

Runtime environment	Packaging mechanism
• Density • Performance (Start-up) • Security • Isolation • Compatibility • …	• Generation • Distribution • Portability • App-centric or machine-centric • …

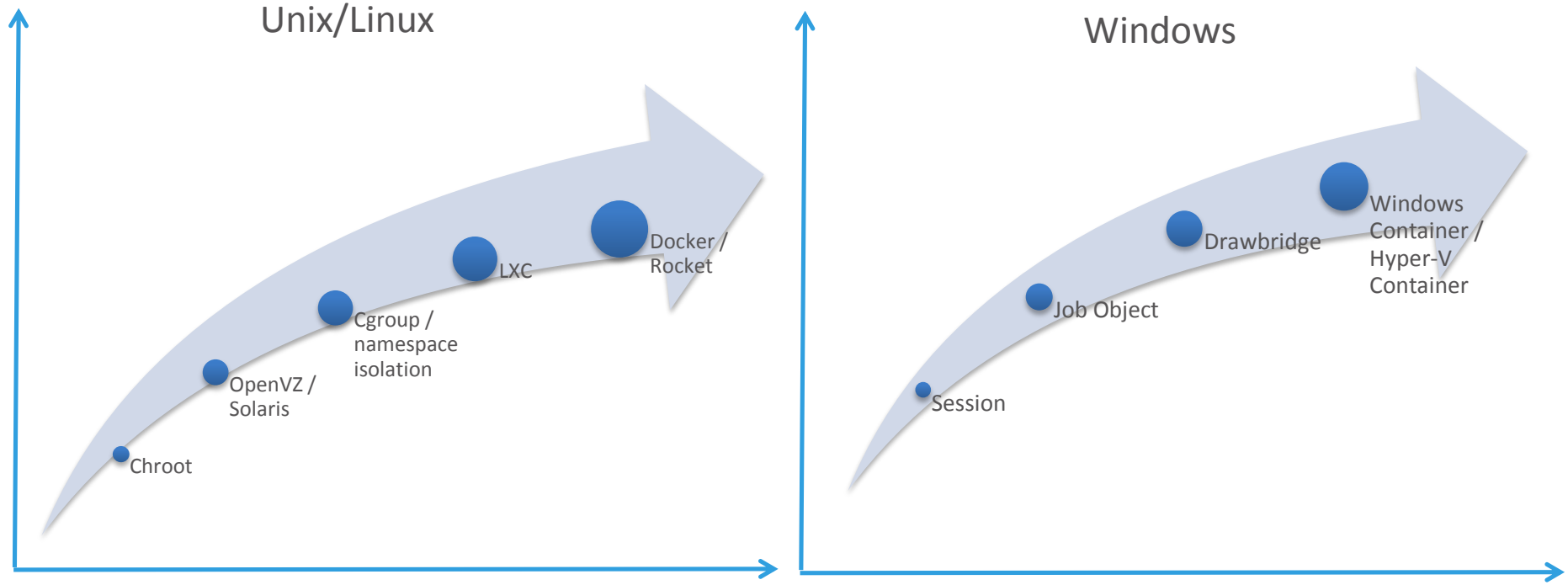
Container:
App-centric, High-density, Fast start up,
Easy to generate, Easy to distribute, High portability

Windows vs. Linux

Windows vs. Linux

- Broader API surface with Win32 sub-system (Win32k)
- Less componentization
- Less need for portability
- More enterprise-centric
- SKUs are big: 4G for Server Core

History of OS Virtualization



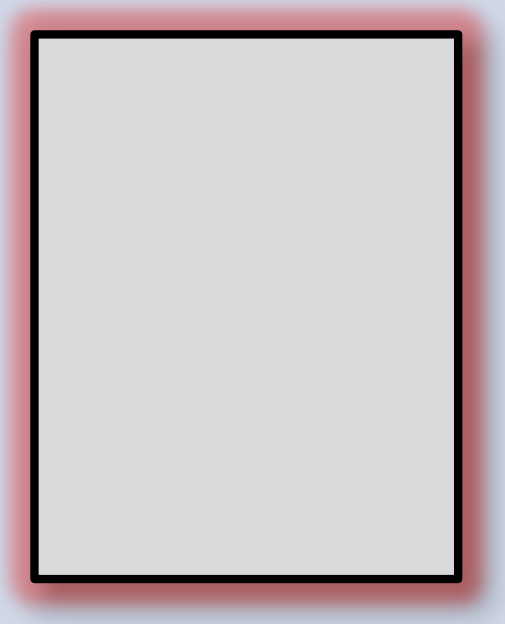
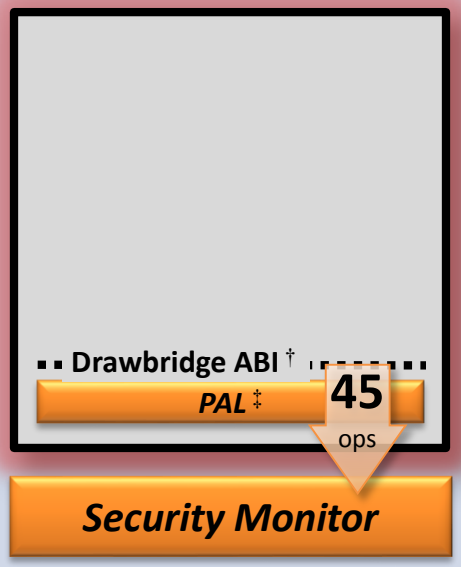
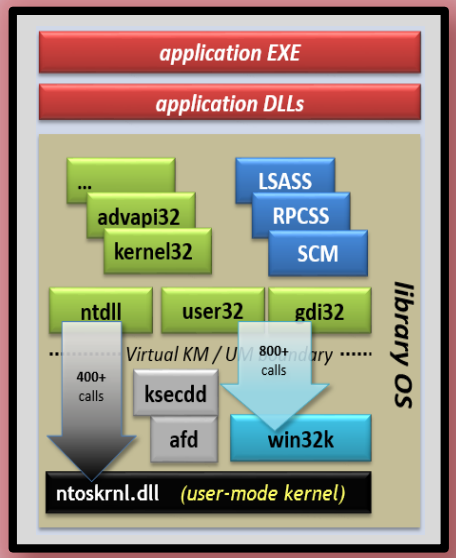
Drawbridge

Galen Hunt

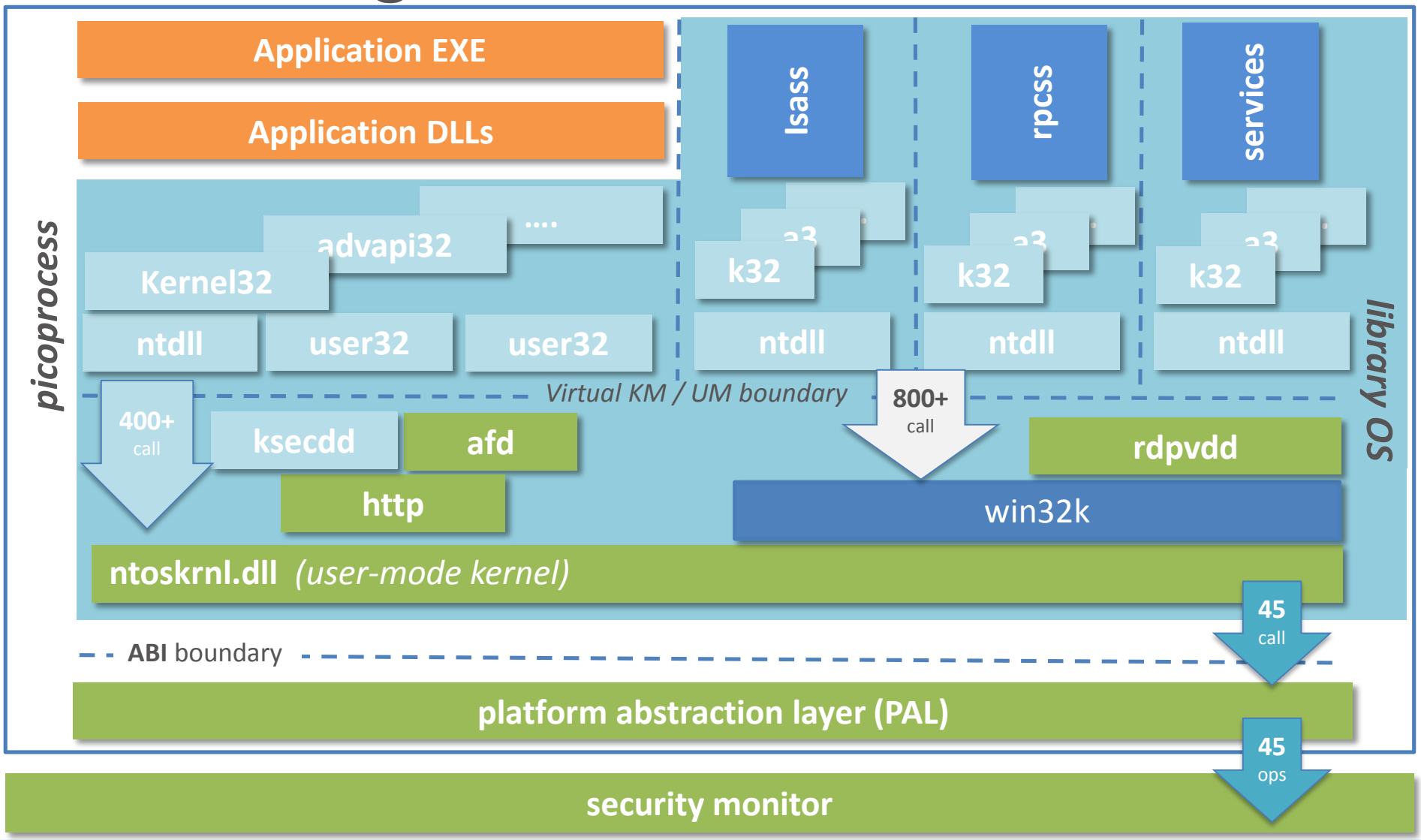
This paper revisits an old approach to operating system construction, the **library OS**, in a new context. **The idea of the library OS is that the personality of the OS on which an application depends runs in the address space of the application**. A small, fixed set of abstractions connects the library OS to the host OS kernel, offering the promise of better system security and more rapid independent evolution of OS components.

- Donald E. Porter, Silas Boyd-Wickizer, Jon Howell, Reuben Olinsky, and Galen Hunt, Rethinking the Library OS from the Top Down, in Proceedings of the 16th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), Association for Computing Machinery, Inc., March 2011.

Drawbridge Concepts

Picoprocess	Security Monitor	Library OS
		
provides a secure container for code	provides primitive OS services to picoprocesses	provides Windows compatibility

Drawbridge Architecture



Drawbridge vs Docker

	Docker	Drawbridge
Kernel	Same with host	Independent
Security	Enterprise multi-tenancy	Hostile multi-tenancy
Density	High	Medium
Start-up	< 1 sec	~ 1 sec
Namespace Isolation	Partial	Full
Union FS	Layered and COW	Layered and COW
Block-based	Supported	Not supported
Multi-inheritance	Not supported	Supported (Registry)

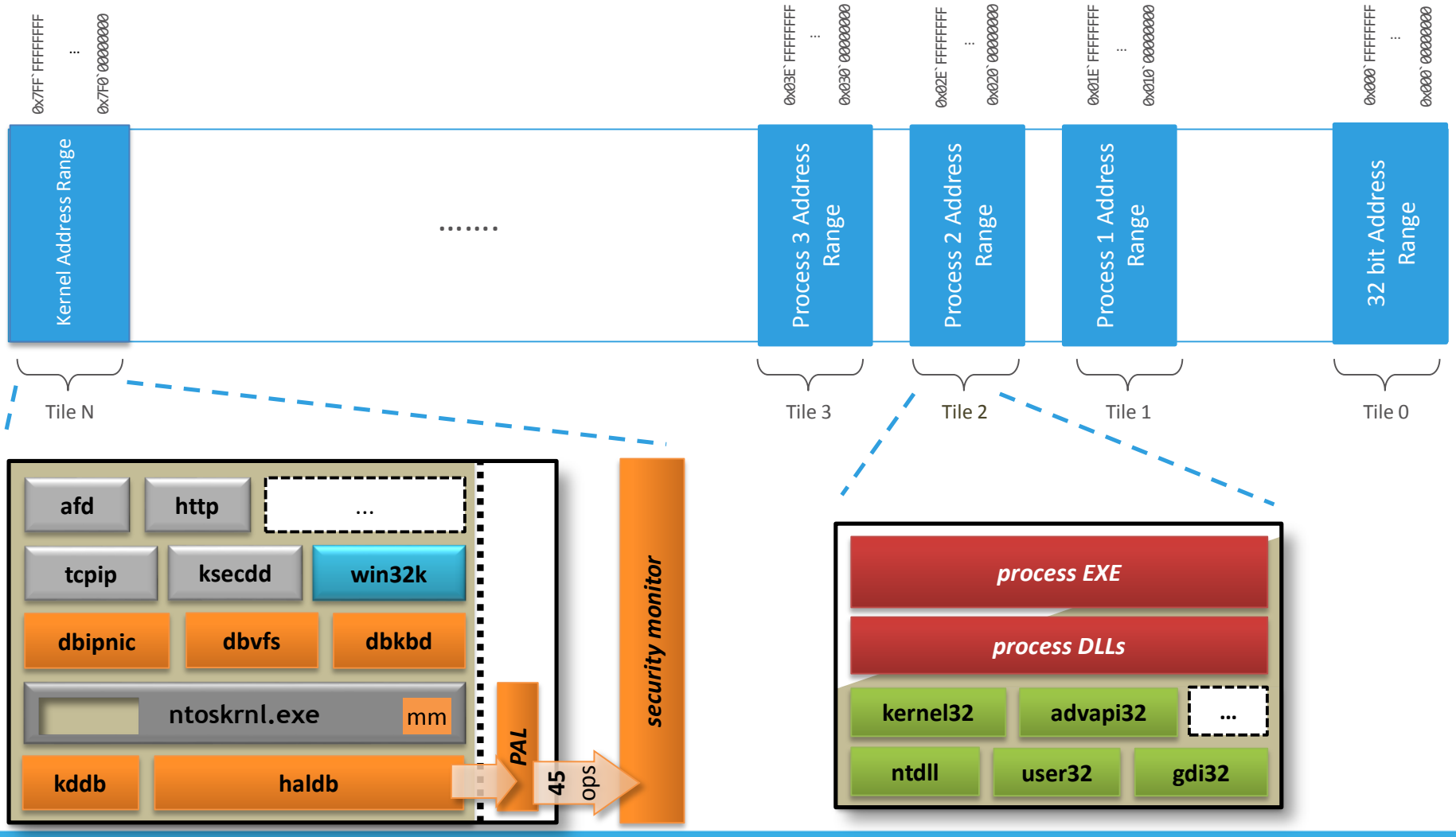
Drawbridge ABI (45)

- Example:
  - DkThreadCreate, DkThreadDelayExecution, DkThreadResume, DkThreadExit
- Application:
  - Snapshot
  - High availability
    - Jacob R. Lorch, Andrew Baumann, Lisa Glendenning, Dutch T. Meyer, and Andrew Warfield, **Tardigrade: Leveraging Lightweight Virtual Machines to Easily and Efficiently Construct Fault-Tolerant Services**, in 12th USENIX Symposium on Networked Systems Design and Implementation (NSDI'15), USENIX – Advanced Computing Systems Association, 4 May 2015.
  - Secure enclave (SGX) – R|G
    - Andrew Baumann, Marcus Peinado, and Galen Hunt, **Shielding applications from an untrusted cloud with Haven**, in 11th USENIX Symposium on Operating Systems Design and Implementation (OSDI '14), USENIX – Advanced Computing Systems Association, 6 October 2014.
  - Time-travel debugging

Challenges

- Maintenance
  - NT Kernel from scratch
- Compatibility
  - Implementation divergence
  - Missing functionality
  - Privileged operations
  - Single application process
- Extensibility

Drawbridge ++

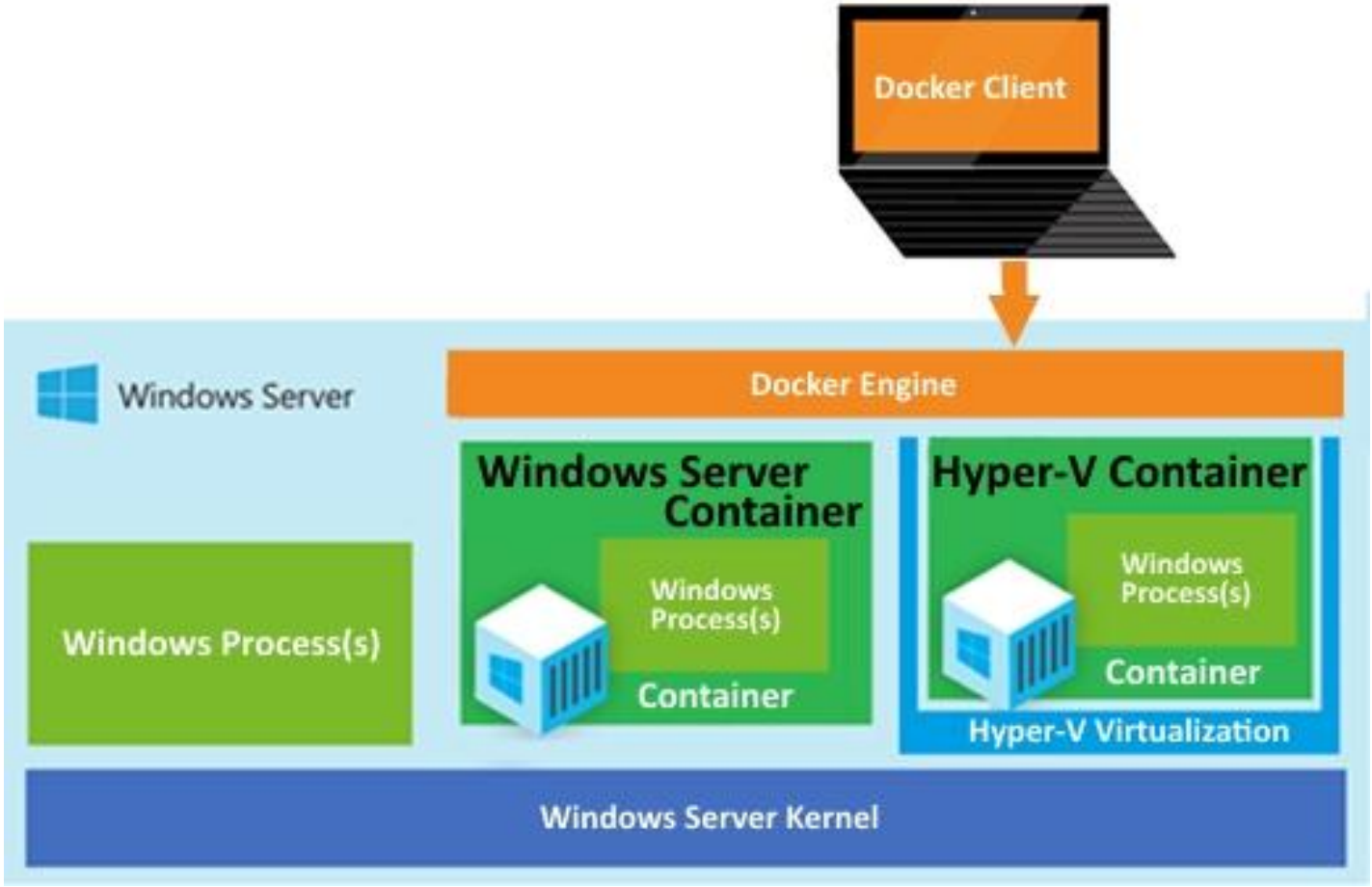


Drawbridge Use-Cases

Azure Machine Learning

Azure Automation

Containers in Windows Server 2016

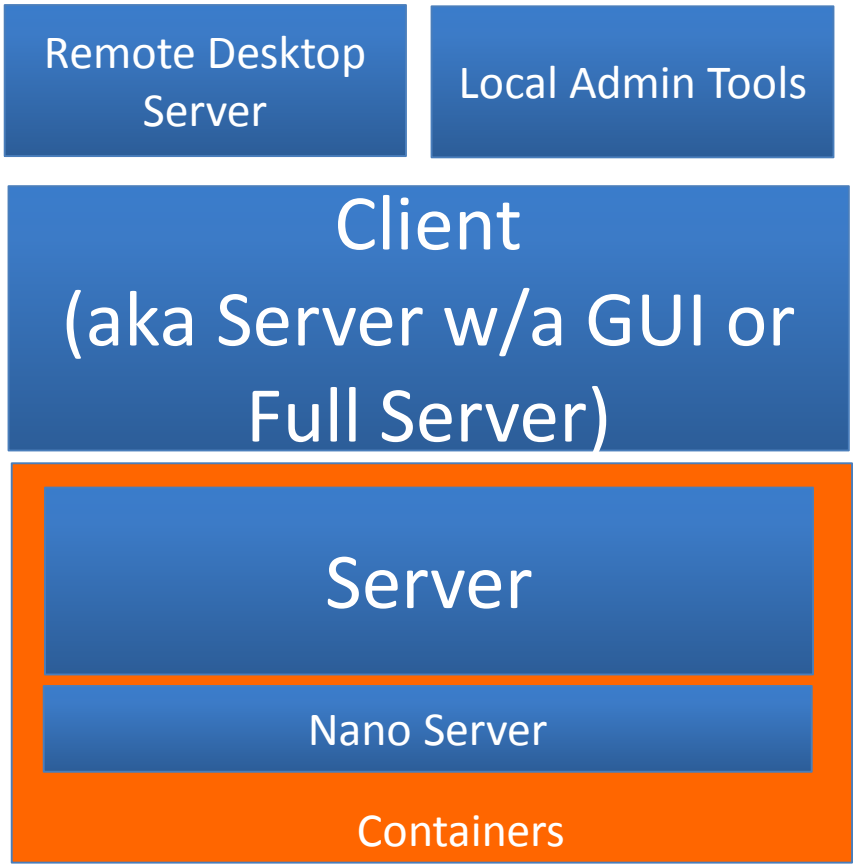


Windows Server Container vs Hyper-V Container vs Docker

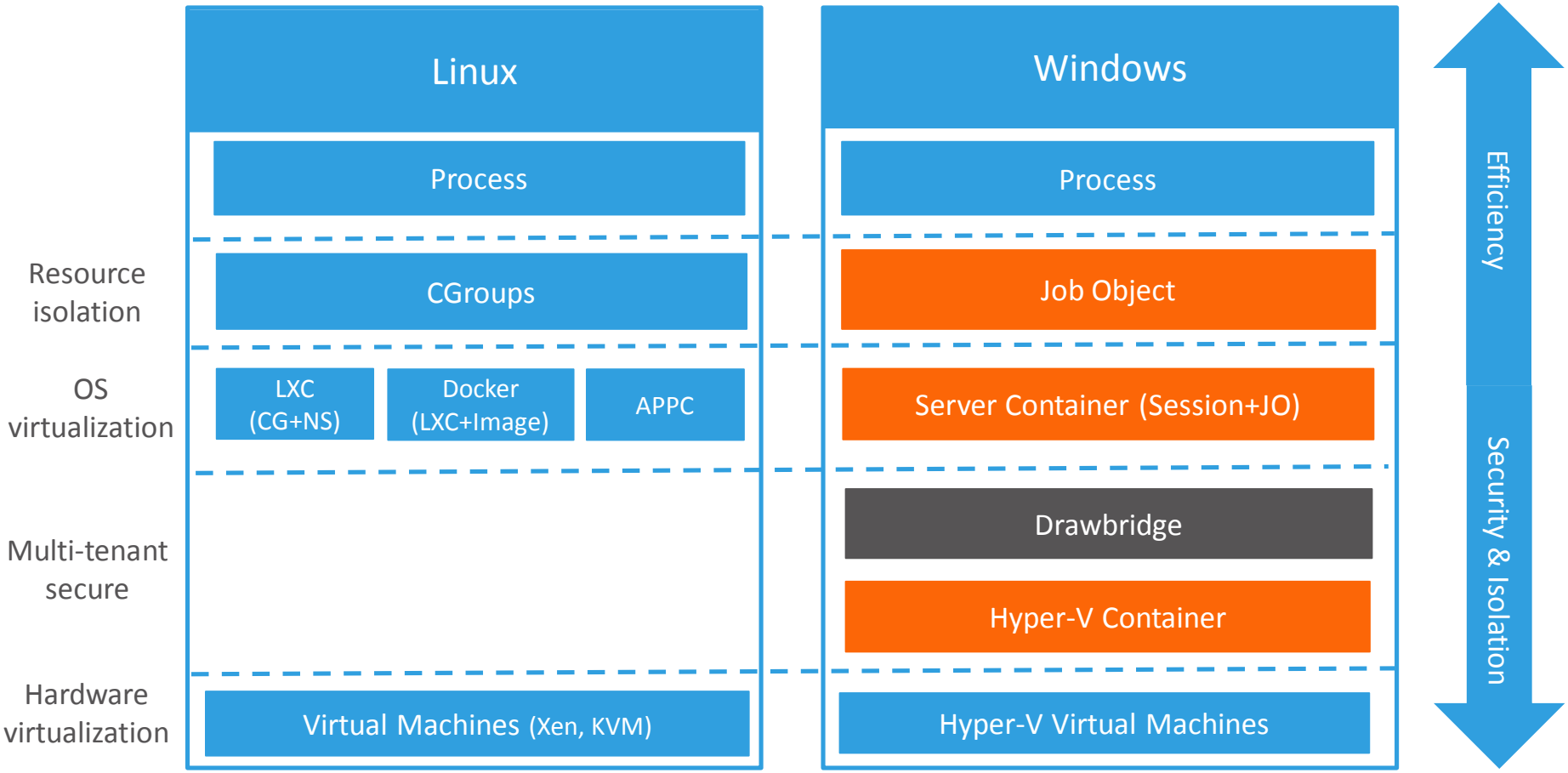
	Docker	Windows Container	Hyper-V Container
Kernel	Same with host	Same with host	Independent
Security	Enterprise multi-tenancy	Enterprise multi-tenancy	Hostile multi-tenancy
Density	High	High	Medium
Start-up	< 1 sec	??	??
Namespace Iso.	Partial	??	Full
System services	Not shared	Some sharing	Not shared
Union FS	Layered and COW	Layered and COW	Layered and COW
Block-based	Supported	Not supported	Not supported
Multi-inheritance	No	??	??

Nano Server

- Server Roadmap
  - Deep factoring
  - Client/Server clarity
  - Containers
- Nano Server
  - Zero foot-print model
  - Hyper-V, storage and clustering
  - Full Windows driver support
  - Core CLR, ASP.NET & PaaS
  - Core PowerShell
  - Cloud-centric management



Virtualization Spectrum



What’s Next

- Will be available in 2016
- Target your server app to Nano server
- Will change the way Windows apps are packaged and delivered

Q&A

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