Xen And the Art of OCaml

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With thanks to Dave Scott and Richard Sharp.

CITRIX XenServer

Agenda

Xen and XenServer -

Experiences -

Statistics -

Futures -

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Timeline

2002: Xen Project starts at SRG, University of Cambridge

2005: Xen 3.0 released, with open-source Python toolstack

2005: XenSource founded in Cambridge and Palo Alto

2006: Commercial XenServer distribution begins

2006: Hit and run on the SRG resulted in new FP hackers

2007: XenSource acquired by Citrix for $500 million

2008: Dell / HP ship embedded XenServer, supported by MS

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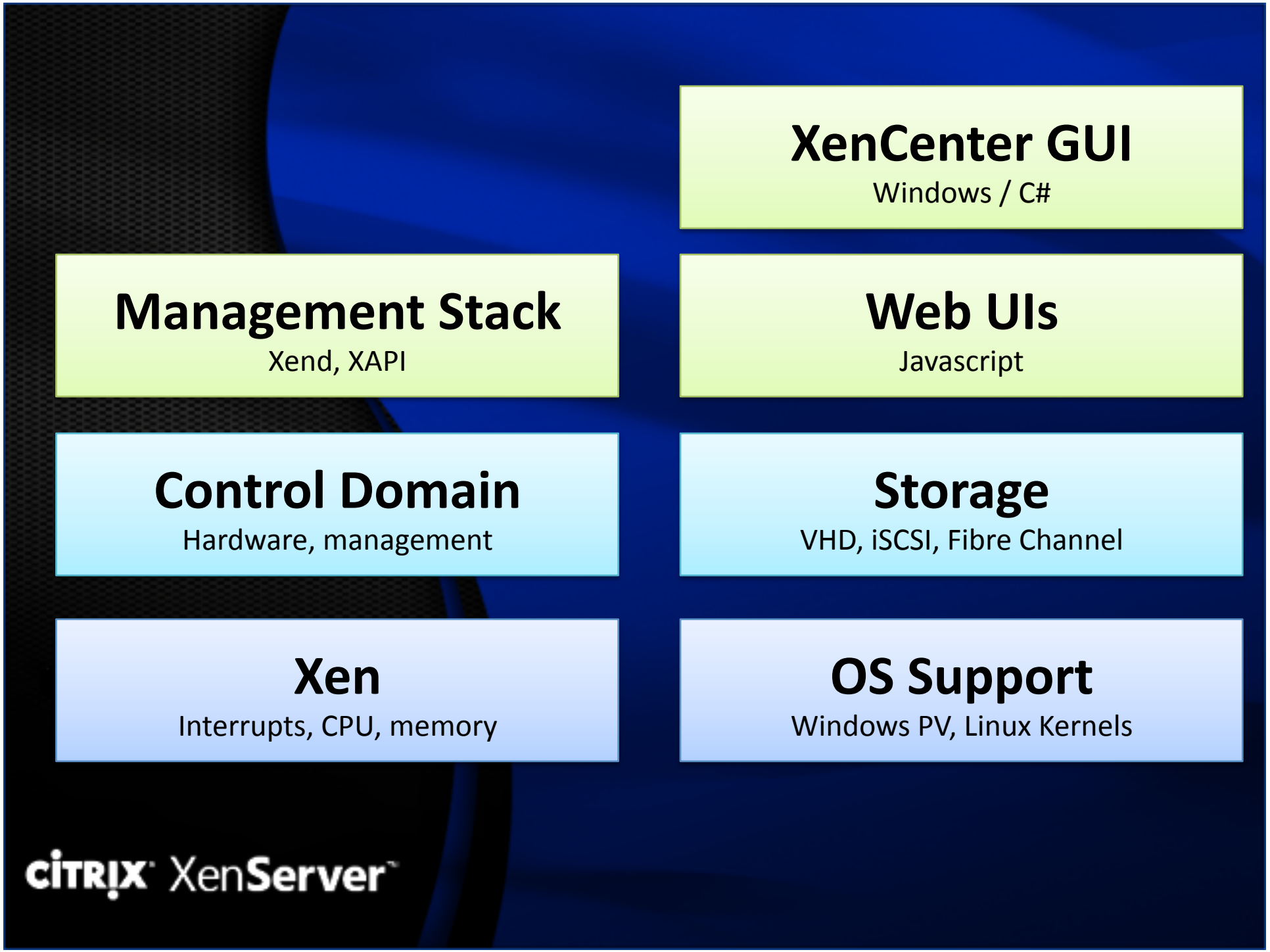
XenCenter GUI
Windows / C#
Management Stack
Xend, XAPI
Web UIs
Javascript
Control Domain
Hardware, management
Storage
VHD, iSCSI, Fibre Channel
Xen
Interrupts, CPU, memory
OS Support
Windows PV, Linux Kernels
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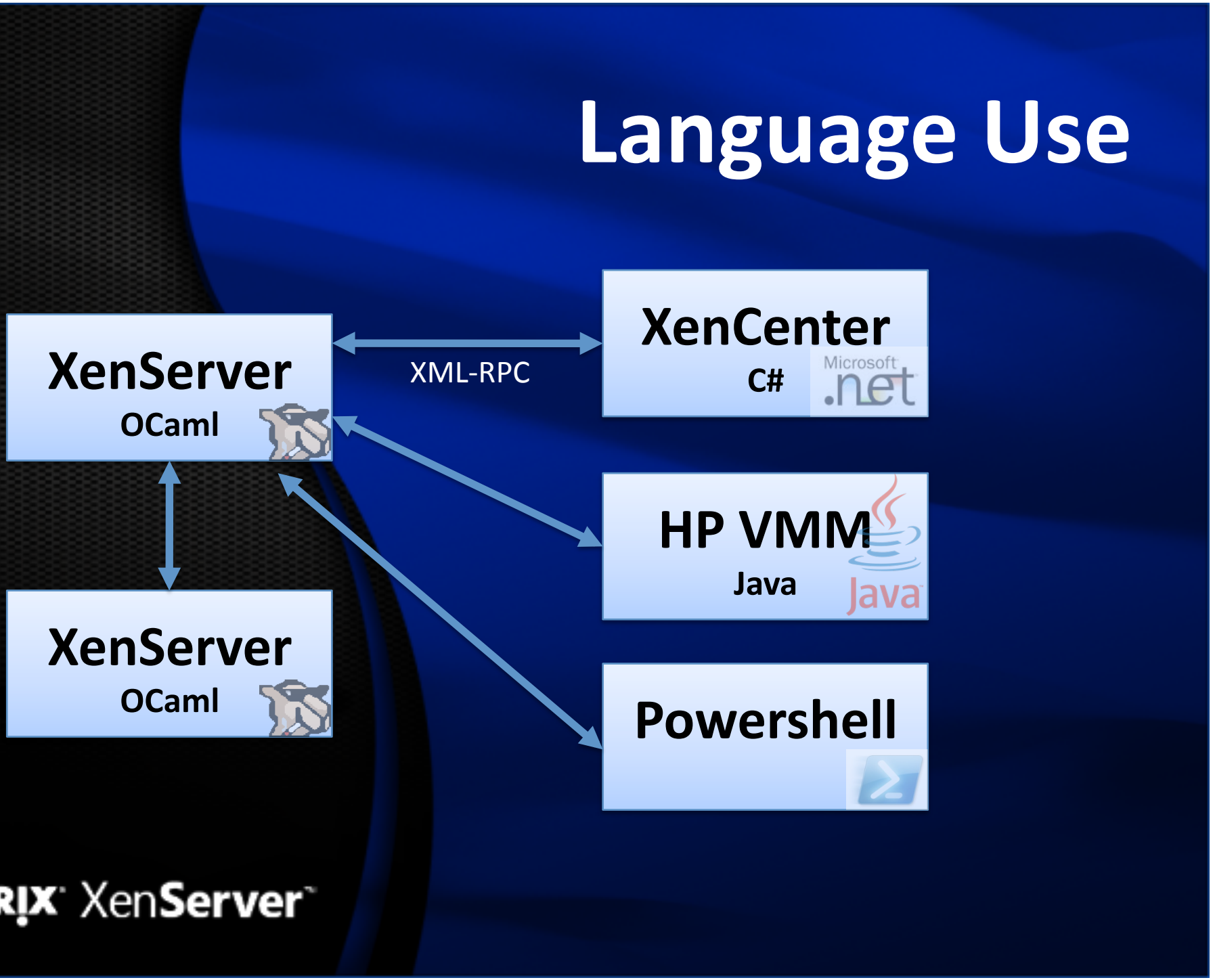
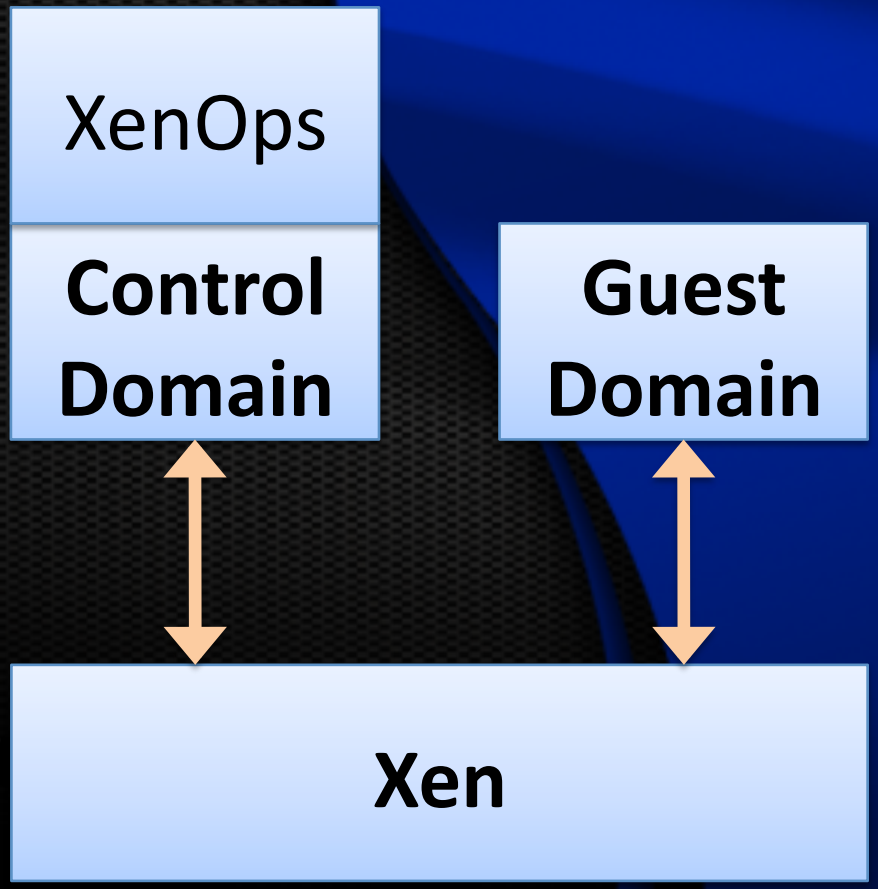
Language Use



Low-level Domains



C bindings

Makes Xen hypercalls

Deals with **domains**

Robust with (rigid) design patterns

Crashes are hard to track down

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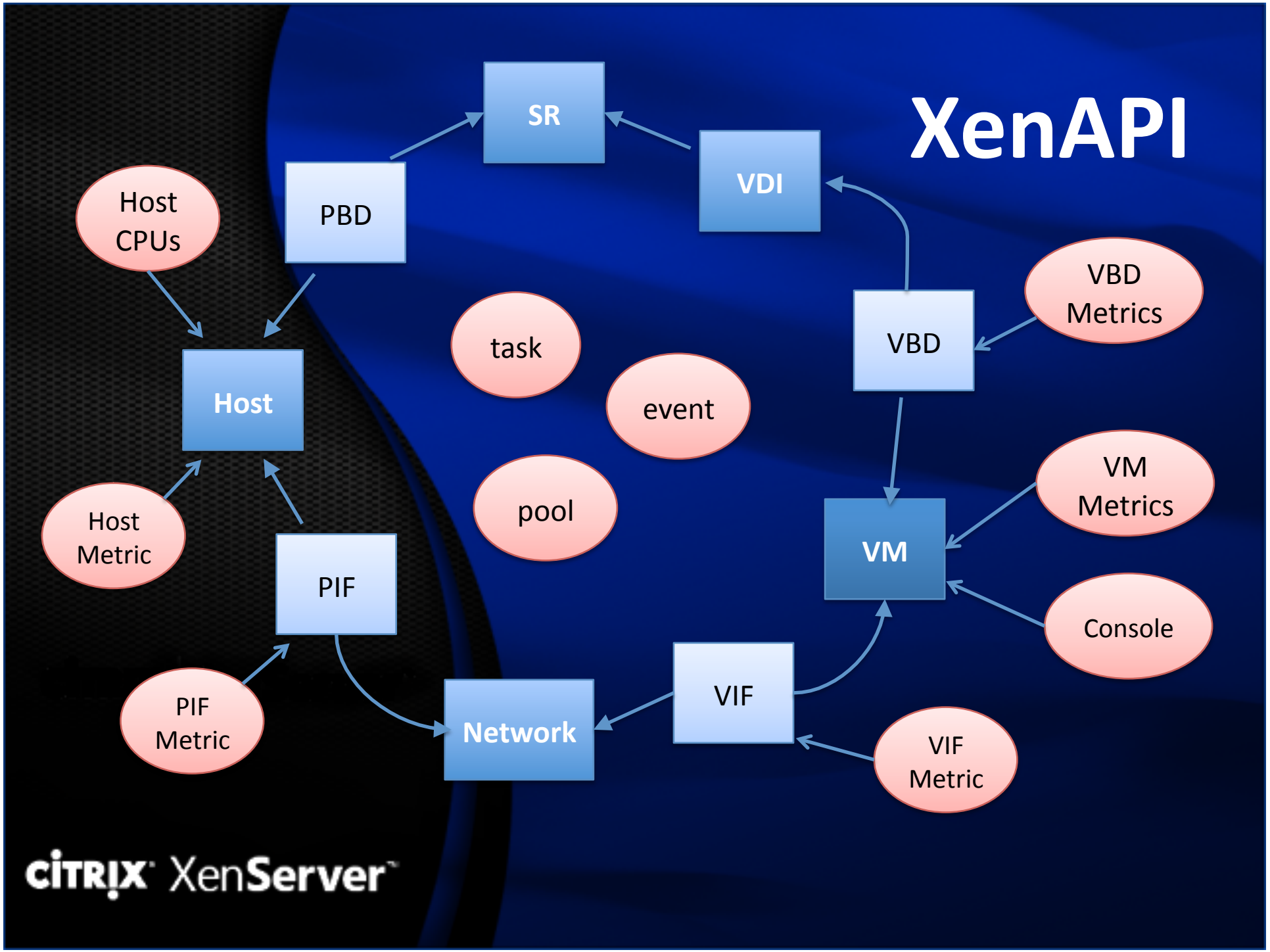
XenAPI
SR
VDI
PBD
Host CPUs
VBD Metrics
VBD
task
event
Host
pool
Host Metric
VM Metrics
VM
PIF
Console
PIF Metric
VIF
Network
VIF Metric
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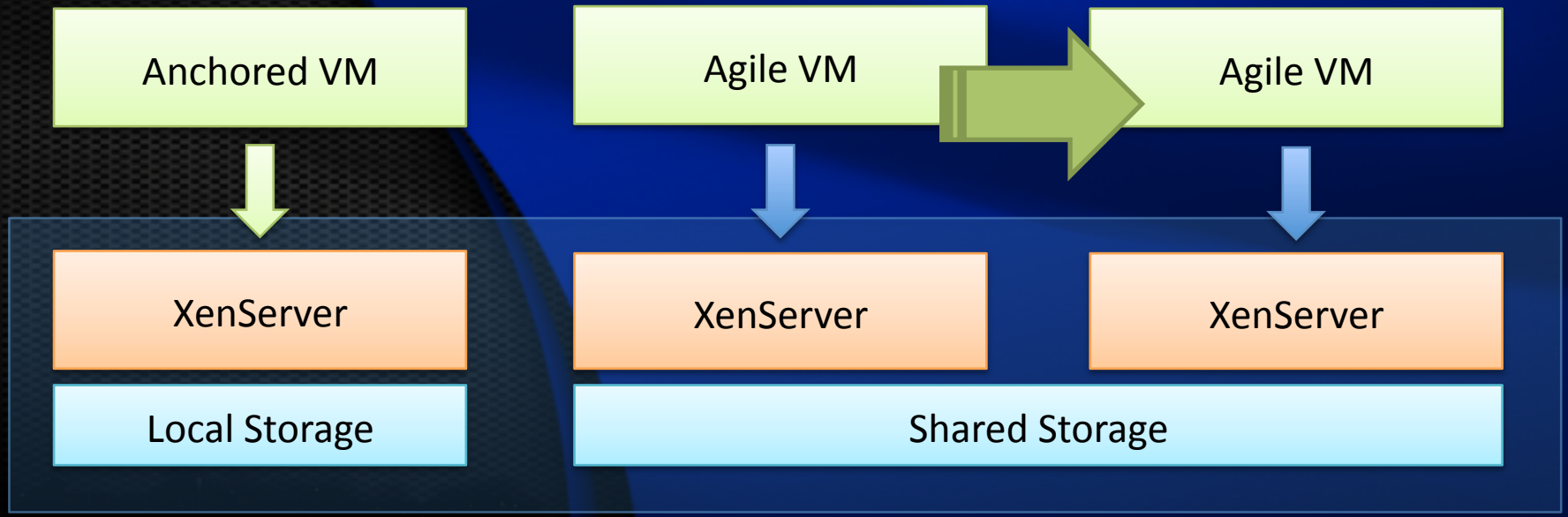
Resource Pools



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OCaml Experiences

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OCaml Features

Pleasure	Pain
Modules / Polymorphic Variants	Objects
Meta-programming	CamlP4
OMake	OCaml Build
Custom Standard Library	Community Libraries
Unix file descriptors	Channels
Private types … ?	

Successes

Development Speed:

2 years: from nothing to enterprise tool-stack

Only one compiler bug

Hiring:

Easier to find talent!

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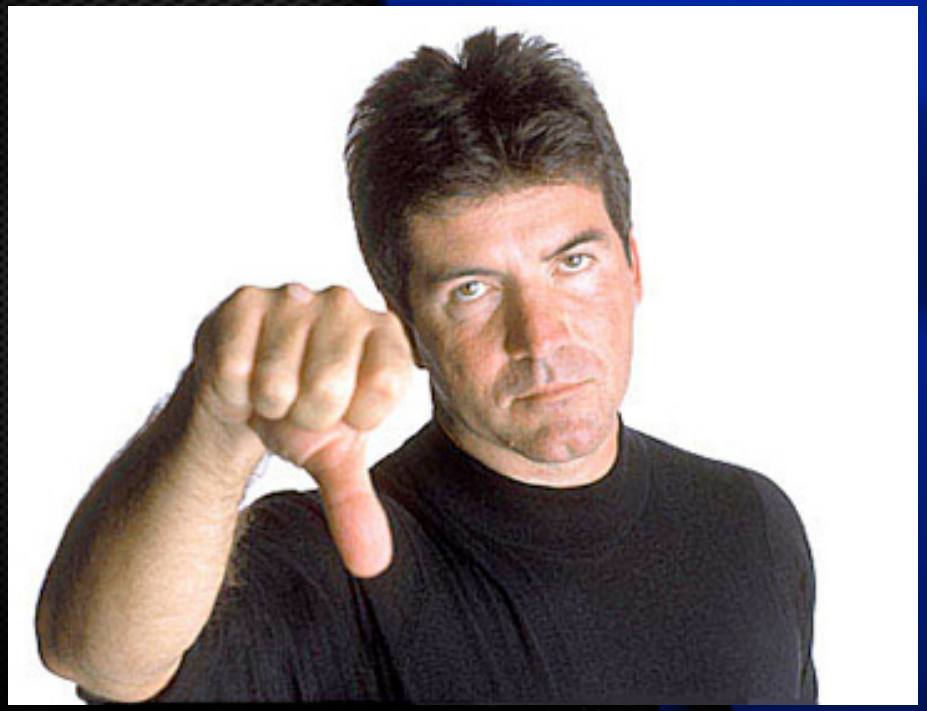
Challenges



Supportability:

Memory usage tracing

Exception Handling

Tracing and Logging

Development:

Windows portability

IDE Integration

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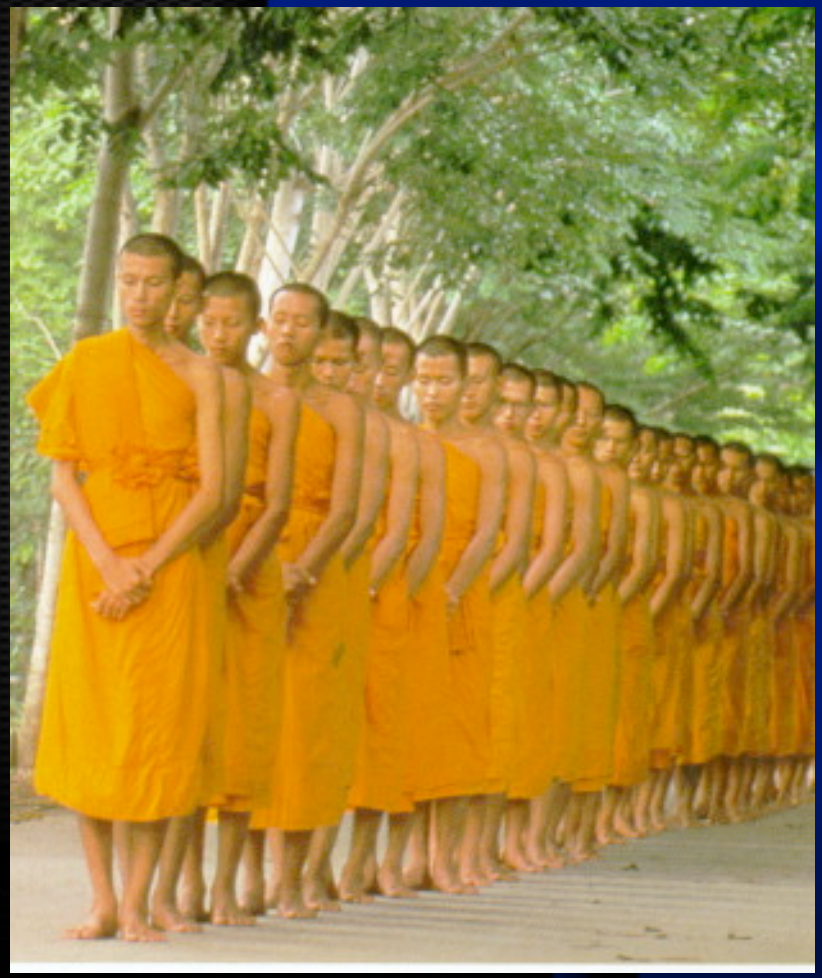

Code Statistics

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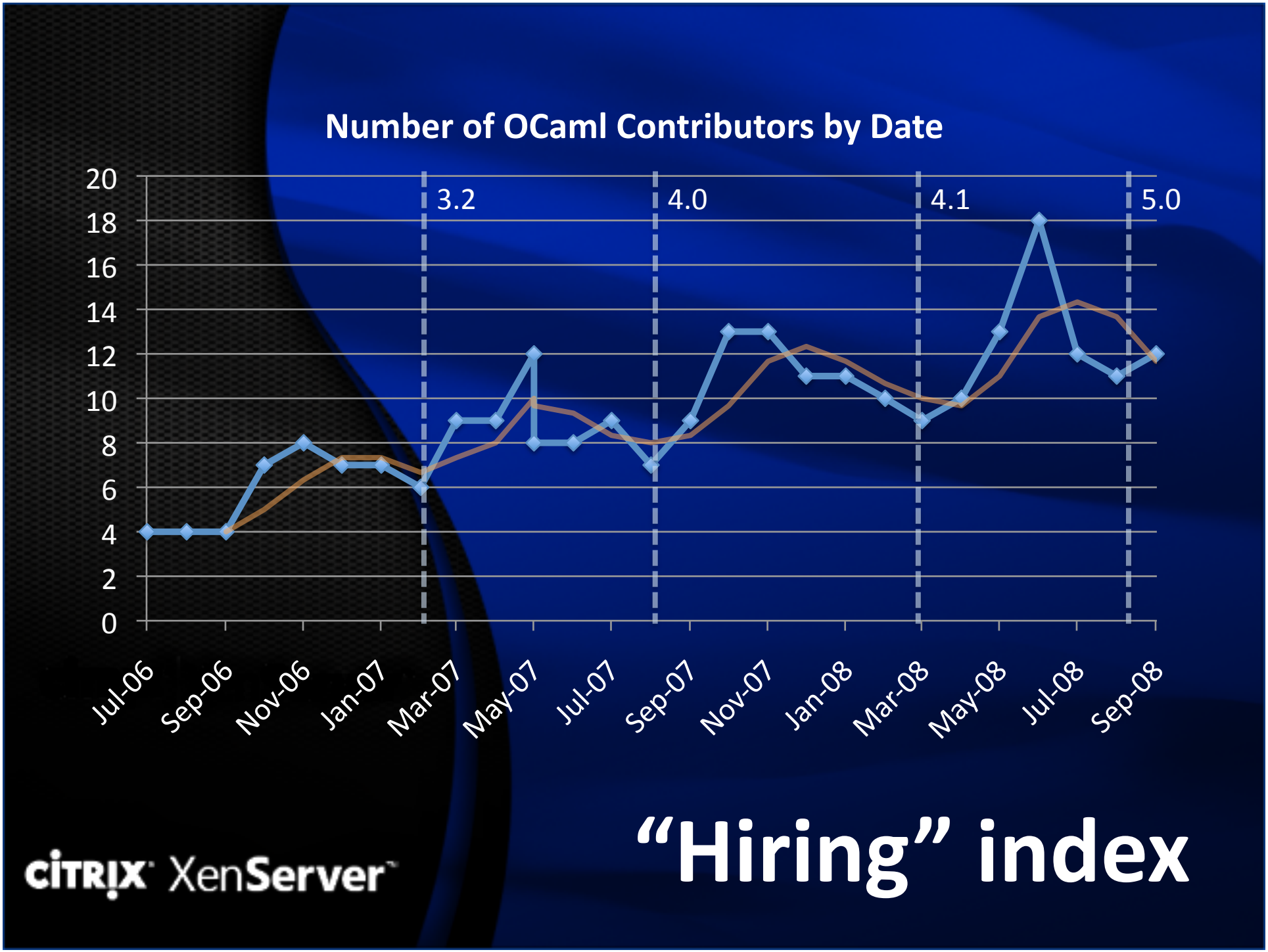
Number of OCaml Contributors by Date
20
18
16
14
12
10
8
6
4
2
0
3.2
4.0
4.1
5.0
Jul-06
Sep-06
Nov-06
Jan-07
Mar-07
May-07
Jul-07
Sep-07
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
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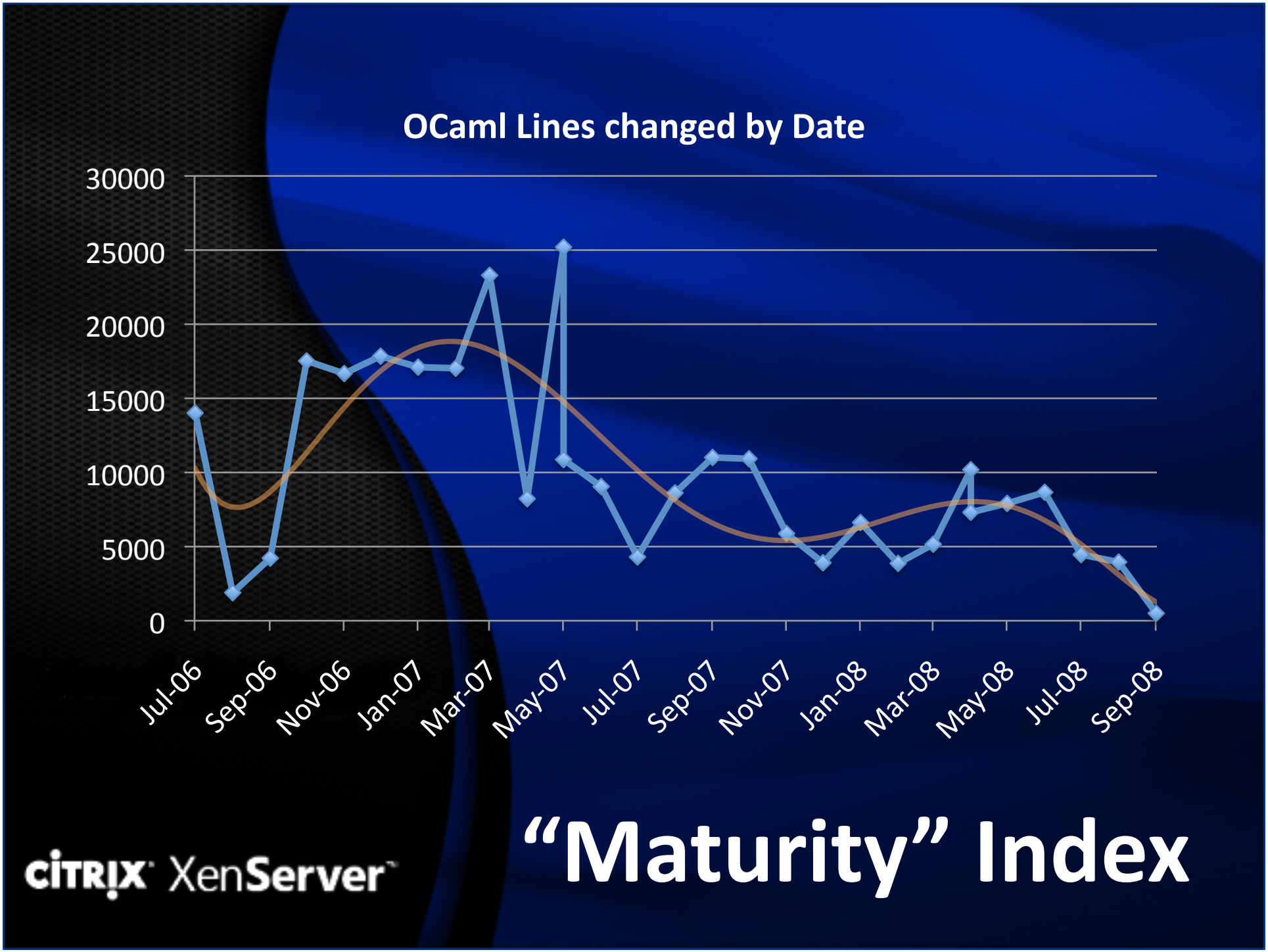
"Hiring" index


OCaml Lines changed by Date
30000
25000
20000
15000
10000
5000
0
Jul-06
Sep-06
Nov-06
Jan-07
Mar-07
May-07
Jul-07
Sep-07
Nov-07
Jan-08
Mar-08
May-08
Jul-08
Sep-08
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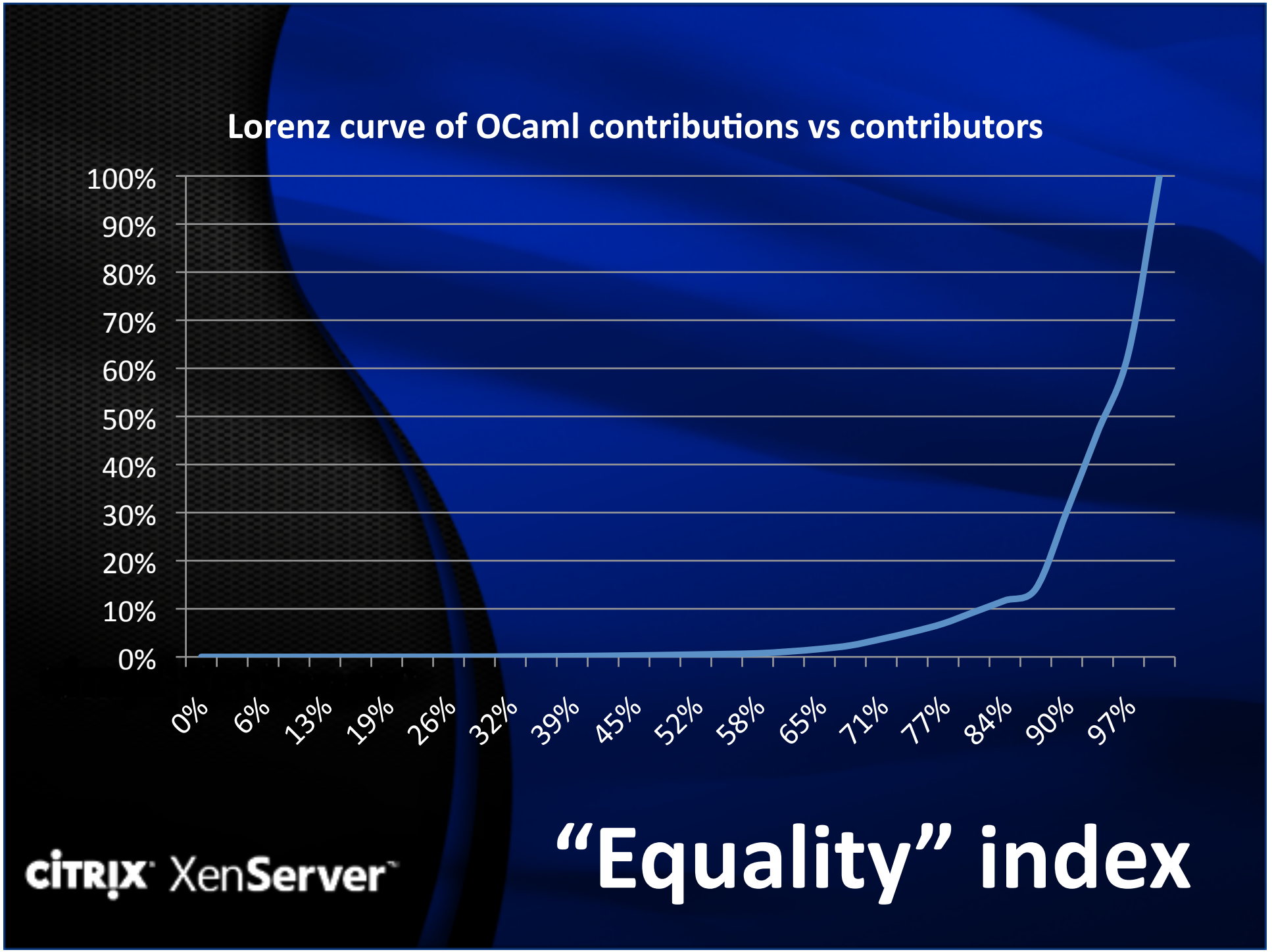
"Maturity" Index


Lorenz curve of OCaml contributions vs contributors
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
6%
13%
19%
26%
32%
39%
45%
52%
58%
65%
71%
77%
84%
90%
97%
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"Equality" index

Futures

Low-Level:

OCaml secure domains

Xenstore, Melange

OEM Embedded

High-Level:

Declarative Data Centres

SLA “compilers”

F# / SCVMM integration?

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