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CONVERGE TECHNOLOGY SOLUTIONS

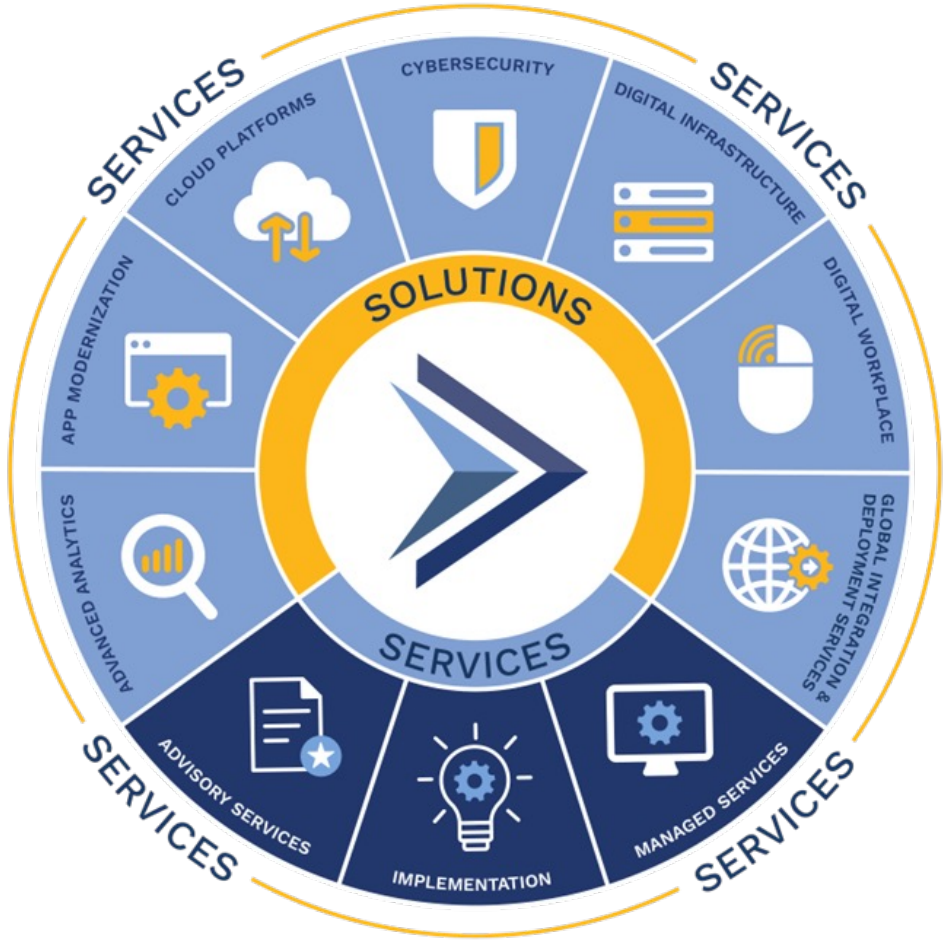
VICOM Infinity
A CONVERGE COMPANY

Commonwealth Center
For
Advanced Computing

Company Overview

Converge is a **services-led**, software-enabled, **IT & Cloud Solutions provider** focused on delivering industry-leading solutions.

Converge supports these solutions with **advisory**, **implementation**, and **managed services** expertise across all major IT vendors in the marketplace



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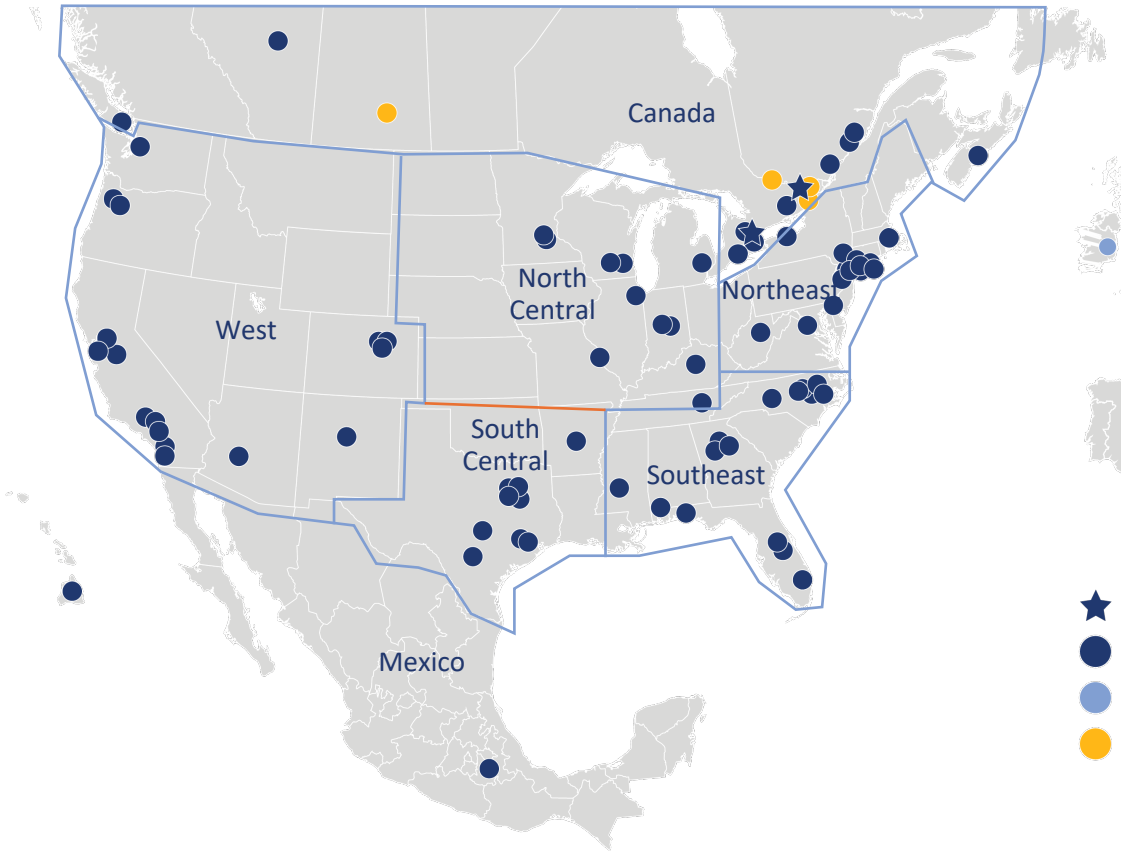
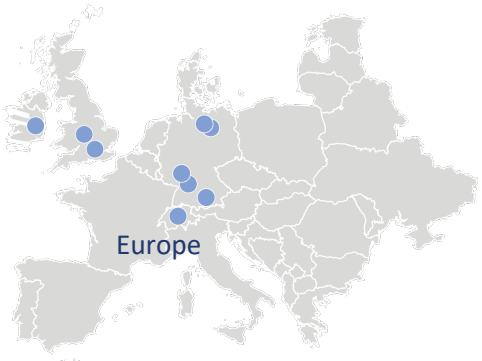
Converge Platform

- ***Scaled Footprint with Strong Partner Relationships and Capabilities***





- Converge HQ
- Converge North America
- Converge Europe
- Portage CyberTech

~3000 Employees Globally

incl.

60+ Office Locations

400+ NA Sales Personnel

1,200+ NA Technical Resources

400+ UK Personnel

300+ Germany Personnel

350+ EU Technical Resources

with

1,000+ Certifications

4,000+ Customers

10 Key Partner Relationships

1,000+ Total Partner Relationships

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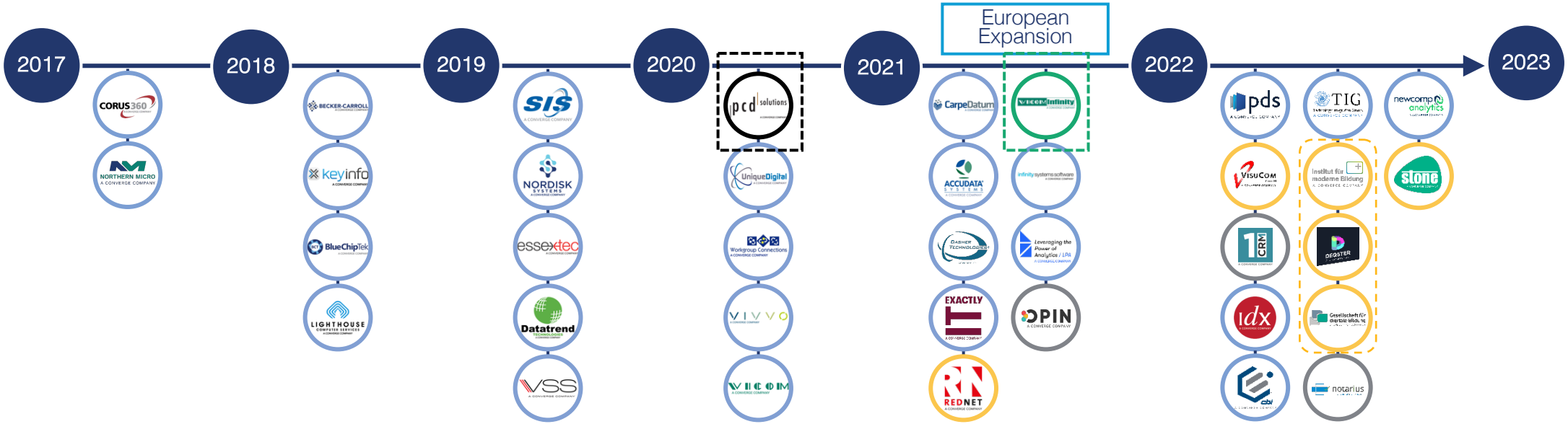
Acquisition Overview

M&A Strategic Pillars

- Culture
- Skills
- Clients
- Partnerships



European Expansion Portage Focused Collectively GfdB

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Fully Integrated Set of Solutions & Services

A Full Suite of Solutions…

Advanced Analytics
- AI/ML
- Business Analytics
- Data Visualization
- Data Platforming & Integration
- Financial & Operational Mgmt.
- Robotic Process Automation

Application Modernization
- Application Development & Migrations
- DevOps
- Containers Services & Kubernetes
- Automation & Orchestration
- Observability & Intelligent Ops
- Integration & Middleware

Cloud Platforms
- Cloud Foundations & Landing Zones
- Cloud Migrations
- IBM Power on Cloud
- VMware on Cloud
- Infrastructure as Code & Automation
- Cloud Governance & Operations
- FinOps & Cost Optimization

Cybersecurity
- Threat Assessments
- Risk & Compliance
- Identity & Access
- Data Protection
- Security Intelligence & Analytics
- Response, Remediation & Maturity

Digital Infrastructure
- Datacenter & Compute
- Intelligent Networking
- Customer Experience
- Multi-site Deployment
- Configuration Centers
- Infrastructure Security

Digital Workplace
- Voice & Unified Communications
- Workplace Productivity Solutions
- Endpoint Management Solutions
- Virtual Desktop Solution
- End User Compute

Global Integration & Deployment
- Planning/Acquisition
- Configuration
- Deployment
- Support
- Management
- Retirement/Disposal

…Delivered through End-to-End Service Offerings

Advise
- Architecture Planning & Insights
- Roadmap Design & Prioritization
- Software Asset Management
- Strategic Transformation Workshops & Assessments

Implement
- Agile Methodology & DevSecOps
- Build & Design
- Integration & Support
- Program & Project Management
- Talent Services

Manage
- Service Desk & Managed ITSM
- Managed Applications (AMS)
- Security Operations Center (SOC)
- Infrastructure Operations Center (IOC)

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Vicom Infinity Historical and Current Mainframe Capabilities

- **Since Our Founding / Late 1990's**
  - Major Account Presence
  - Value-added Reseller of IBM Hardware, Maintenance, and Software
  - Trusted Vendor Source for IBM Z Mainframe and Associated Storage and Network I/O
- **Long-Term Trusted IBM Relationships**
  - IBM Champion Program
  - IBM Z Academic Initiative Program
  - IBM Certified Platinum Level Business Partner and VAR
  - IBM Authorized Tier One Services Provider
  - IBM Participant Alpha/Beta Tests
  - IBM Software Migration Project Office (SMPO) Staffing Partner

- **Our Full Range of IBM Mainframe Lifecycle Services**
  - Architect and Design Assistance
  - Capacity Planning & Modeling
  - Disaster Recovery Planning & Implementation
  - Installation Planning & Implementation
  - Software Migration & Installation
  - Application Modernization and Migration
  - System Upgrade, Migration, & Conversion Services
  - Pervasive Encryption
  - Parallel Sysplex Training
  - End User New Technology Training
  - Staff Augmentation / Contingent Workforce
  - Key Personnel Risk (KPR) Program Management
  - Mainframe Managed Services - Remote / On-Prem / Hybrid

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Notable Mainframe Clients, and many more

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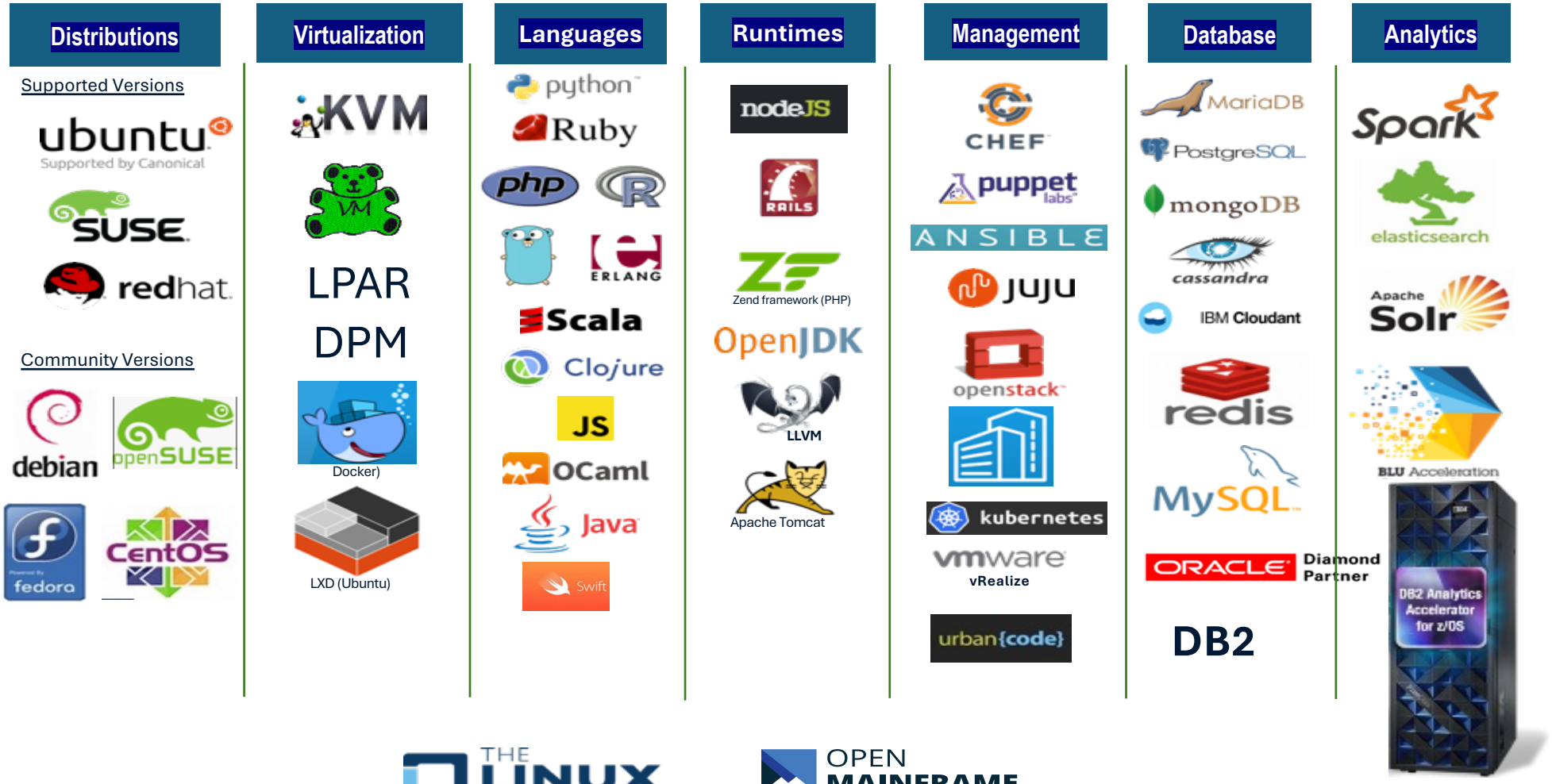
Our Legacy and Continuing Drive of Mainframe Innovation



THE LINUX FOUNDATION

OPEN MAINFRAME PROJECT

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Introducing CCAC

“Commonwealth Center for Advanced Computing”

- Multi-tenant Multi-Hybrid Cloud Service Provider
- “Domains” (tenants) – Each a Hybrid Cloud unto themselves
    - Teaching – Workforce development certifications
    - Academic Research
    - Medical Research
    - Business Partners - $
    - Cyber Range - $
    - Economic Development – (Business startups)
    - System Infrastructure - (Control Plane)
- Foster consolidation of grant-based resources
- Provide resources for academic access

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Introducing CCAC

“Commonwealth Center for Advanced Computing”

- An amalgamation of diverse Hybrid Clouds
- Multi-platform, multi-vendor
- A “Cloud of Clouds”

  - Storm, Pageant, Swath, Flock, Cluster, Veil, Movement, Nye, Plump, Ring, Riot, Rope, Sky, Soar, Streak, Superfluity, Swirl, Threatening, Tuft, Wisp, **Bank**, Formation, Scurry, Sea, Cling, Menagerie, **Billow**, **Cuddle**
  - **“Gestalt Cloud”**
    - **“**something that is made of many parts and yet is somehow greater than or different from the combination of its parts**”**
  - **“Emergent Cloud”**
    - “Emergence occurs when individual parts interact and organize themselves in a way that gives rise to new properties or behaviors at a higher level of complexity. “

      Reference: https://www.physicsforums.com/threads/can-something-be-more-than-the-sum-of-its-parts.109953/

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Introducing CCAC

- IBM z16
- IBM ESS 3500
- IBM FlashSystem 5200
- IBM DS8910
- IBM Power 10 (3)
- x86
- Cisco routers, VPN

“Work In Progress”

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CCAC Objectives

Hybrid Multi-cloud

- Single ~~Glass of Pain~~ Pane of Glass
- “Lego bricks” (added to Service Catalog as they are developed/demanded)
  - Includes Data Catalogs (AI training), maybe even Skills Catalogs???
- Multiple hardware architectures (IBM Z series, IBM Power 10, x86, others)
- Foster Cyber Security, Commercial, Academic & Medical collaboration
- COTS and Open-Source software
  - “Showcase”
  - Testbed (Develop & Sell software/solutions) – incubation
- Re-invent industry/academic collaboration
  - Interns => Collaborators => Partners => Employees => Employers!!!

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Cloudscape Considerations

Identity Management/Access Control
(authentication/authorization, lifecycle, North/South or omnidirectional)

- Accept local institution credentials (federated)
    - At least at VPN & Control Pane tiers
- Establish access lifecycle
- Define resource allotments
- (Ideas?)

Solution: IBM Security Verify Access & IBM Security Verify Privilege Vault

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Cloudscape Considerations

Resource management/Governance

(allocations, lifecycle, throttling? Chargeback? SLAs?)

- Who gets what?
- And, for how long?
- How do we enforce allotments?
- Do we need Service Level Agreements?

Solution: IBM CloudPak for Watson AIOps Infrastructure Automation

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Cloudscape Considerations

Security/Compliance

(multi-tenant, liabilities, North/South as well as East/West, GDPR, HIPAA)

- “Stay in your lane” – doesn’t work for most circumstances
- Tenants have privacy concerns
- Verify compliance to policies
- Pervasive encryption (Quantum safe)

Solution: IBM CloudPak for Watson AIOps Infrastructure Automation

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Cloudscape Considerations

Analytics/Performance

(measure “Goodness” and “Badness”, audit trail, telemetry, capacity planning)

- “How well are we doing?”
- Can we prove it?
- Where are the resources being consumed?
- Do we need more resources?
- How do you quantify “Success”?

Solution: IBM CloudPak for Watson AIOps Infrastructure Management

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Cloudscape Considerations

APIs & Services

(diversity [non-linear], interoperability, data management, C&C)

- As you combine multiple cloud services, API differences increase exponentially
- API overlap is the “sweet spot”
- Data governance is an issue
- Seamless Command and Control abstraction is crucial to the illusion

Solution: IBM CloudPak for Watson AIOps Infrastructure Automation

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Cloudscape Considerations

Risks

- How much liability?
- Breaches
- Data loss/recovery
- Service Level Agreements
- ”Media Management”
    - ”Free” press is not necessarily “Good” press
- Availability

Solution: ???

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Basic needs

How do you build a CCAC?

- What are the infrastructure requirements?
  - Need specific z/VM configuration to support ICIC
  - Need a Linux server to install ICIC and friends
  - Need a laundry list of additional servers/services to support Identity Management, IP management, DNS
- Can we self-host our infrastructure requirements?

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z/VM Architecture

- TCPIP
  - SSL (still harder than it needs to be)
  - ~~LDAP (can be made easier)~~
  - SNMP (simple)
  - FTP (simple)
  - SMTP (simple)
- RACF (shared RACF database using Alan Altmark's refined RACF tips)
- DIRMAINT (simple enough)
- SMAPI (so much harder than it needs to be)
- RSCS (simple-ish)
- ZVPS (simple)
  - ZALERT, ZMAP, ZMON, ZOPER, ZPORTAL, ZPRO, ZTCP, ZVIEW, ZVWS, ZWRITE

z/VM Architecture

- Networking
  - Layer 2 VSWITCHes for TCPIP & Linux
  - Layer 3 VSWITCHes for z/OS

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Basic needs

- General purpose Linux server
- FTP server (vsftpd) – (pod)
- WEB server (apache/nginx/ZVWS) – (pod)
- DNS server (Bind) – (pod or InfoBlox)
- IPAM server (Open Source) – (pod or InfoBlox)
- DHCP server (ISC dhcpd or Kea) – (pod or InfoBlox)
- NTP server (ntpd) – (InfoBlox)
- Certificate Authority (OpenSSL) – (pod)
- Radius server (FreeRadius) – (pod)
- LDAP server (OpenLDAP, phpLDAPadmin) – (pod)

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General purpose Linux server

- ”Just Enough” Linux
  - Minimal footprint
- Cloneable by design
- Extensible (LVM)
- Mild synergy with z/VM (SMSG, VMLINK, RSCS, etc.)
- Support CONMODE 3270 (for laughs)
- Free
- Can be XAUTOLOGged
- Basis for creating Linux server machines?

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General purpose Linux server (nuts & bolts)

- 3 CMS files
  - RC LOCAL
  - HALT LINUX
  - PROFILE LINUX

- All created and modified using XEDIT
- All live on 191 disk

General purpose Linux server (nuts & bolts)

Minor Linux “customization”

- Change ”timeout” in /etc/zipl.conf (from 10 to 2 seconds)
- Add “quiet” to boot parameters in /etc/zipl.conf
- Implement RC LOCAL:
  - chccwdev -e 0.0.0191
  - dasd=$(lsdasd | grep '0.0.0191' | awk '{print $3}')
  - # Mount the 191 disk at /mnt (ensure square backets are translated):
  - cmsfs-fuse -a --from=CP037 /dev/${dasd} /mnt
  - cp /mnt/RC.LOCAL /etc/rc.local
  - chmod +x /etc/rc.local
  - systemctl daemon-reload
  - systemctl enable rc-local
  - systemctl start rc-local
  - # Un-mount the 191 disk:
  - fusermount -u /mnt
  - # Bring the 191 disk "offline" (and suppress the output):
  - chccwdev --offline 0.0.0191 2>&1 > /dev/null

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General purpose Linux server (nuts & bolts)

Install required packages:

- apt install -y fuse autofs make gcc bind9-dnsutils traceroute dbus xxd snmp snmpd git perl curl podman podman-docker

Install FUNET NJE:

- cd /usr/src
- git clone https://github.com/moshix/linuxNJE.git
- groupadd funetnje
- useradd -g funetnje funetnje
- cd /usr/src/linuxNJE
- make
- make install
- mkdir /etc/funetnje
- cp /usr/local/etc/ucp /usr/local/bin/
- chmod 755 /usr/local/bin/ucp

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General purpose Linux server (nuts & bolts)

Install smaclient:

- cd /usr/src
- git clone https://github.com/lllucius/smaclient.git
- cp smaclient/smaclient /usr/local/bin/

General purpose Linux server (nuts & bolts)

RC LOCAL

- Saves CP TERMINAL settings
- Sets TERMINAL BREAKIN GUESTCTL if needed, turns off edit characters
- Updates /usr/local/bin/halt.linux
- Copies halt.linux to appropriate “shutdown” directory
- Executes PROFILE LINUX

General purpose Linux server (nuts & bolts)

HALT LINUX

- Restores TERMINAL settings
- Tears down RSCS link (if needed)
- IPL CMS PARM AUTOCR
- Called by “halt”, “poweroff” and “shutdown” (NEVER use “shutdown”!!!)

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General purpose Linux server (nuts & bolts)

PROFILE LINUX

- Define VSWITCH name (optional)
- Define VNIC address (optional)
- Define IPv4 address (IPv6 would be just as easy)
- Define CIDR
- Define IP gateway
- Define DNS server IP address (optional)
- Define hostname (optional)

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General purpose Linux server (nuts & bolts)

PROFILE LINUX

- Define domain name
- Define Linux network adapter (“link”) name (optional)
- Define RSCS node name (optional)
- Enable auto-login to console as root
- Enable SSH to root
- Enable SMSG support

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PROFILE LINUX

```
#!/bin/bash
########################## Customize these ##########################
# Virtual NIC device address
myNIC="0900"

# IPv4 address (must NOT be blank)
myIP="10.0.0.14"

# CIDR (number of bits in your subnet mask) (must NOT be blank)
myCIDR="24"

# IPv4 address of GATEWAY (must NOT be blank)
myGATEWAY="10.0.0.1"

# DNS server IP address (leave blank to use "1.1.1.1")
myDNSIP=""
```

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General purpose Linux server – uses

- FTP/WEB server for ICIC installation material
- SMAPI testing platform (thank you Leland Lucius for smaclient)
- Run DATAPUMP/VSIPUMP pods
- Run other pods?

Plugging and Playing

How does everything fit together?

- VPN
  - Radius server
    - LDAP server
  - IBM Verify Access?
- Control Plane
  - AIOps
    - ICIC
    - PowerVM
    - DNS updates?
    - Certificates?

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Plugging and Playing

- IBM CloudPak for Watson AIOps Infrastructure Automation (Provisioning)
  - Integrates with:
    - ICIC running under z/VM on Systems Z
    - PowerVC on Power 10s
    - HiperV on x86
    - Public clouds

- IBM CloudPak for Watson AIOps Infrastructure Management (Reporting)
  - Same integrations

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Typical flow

- User “applies” for CCAC access
  - Need: Web portal, on a DMZ, workflow
- User receives a Welcome e-mail
- User navigates to WebVPN URL and uses their local site credentials
  - Need: WebVPN gear
- User navigates to AIOps portal

-or-

- User interacts with their servers using standard protocols

Need: Resource Control, LifeCycle Management, Alerting, Data Governance (AIOps?)

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Summary and observations

- Collaboration is key
- Allow for “fluidity”
- Adopt a “Documentation First” attitude
- Opportunity to train students & provide career opportunities
- Opportunity to re-envision industry/academic collaboration

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Stay tuned…

Special
Thank You
To
The VCU Team

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