ARCHITECTING FOR THE DIGITAL EDGE

IOA™ PLAYBOOK

FOUR FOUNDATIONAL STEPS TO BUILD YOUR DIGITAL PLATFORM

EQUINIX®

IOA Playbook

ABOUT INTERCONNECTION ORIENTED ARCHITECTURE™ (IOA)

What is IOA?

IOA is a proven, repeatable architectural framework, using industry best practices, that both enterprises and service providers leverage to directly and securely connect people, locations, clouds and data. IOA integrates the physical and virtual worlds where they meet.

IOA is used by more than 9,800 companies to accelerate digital transformation as the foundation for a global digital platform. The principles of IOA are to:

- Shorten the distance between your applications and data, and people (customers, employees and partners)
- Localize traffic and services across all the locations and markets you need to reach, and regionalize services globally
- Integrate and deliver via ecosystem exchanges, leveraging multiple clouds and SaaS providers to increase your rate of change while interconnecting with digital partners
- Locate data and analytics adjacent to users for improved response times and distributed scale, reducing the amount of data traversing the networks

IOA breaks the tired old assumption that you can't do anything about physical distance. In fact, you need to do exactly that to solve the problem of latency so that you can digitally engage users and integrate with clouds and digital business services.

By shortening the physical distance between global applications, data, clouds and people, IOA shifts the fundamental IT delivery architecture from siloed and centralized to interconnected and distributed.

What is the IOA Playbook?

This playbook is an introduction to IOA and a guide to using the IOA Knowledge Base. The knowledge base is a collection of detailed blueprints and design patterns to help architect for the digital edge and map your journey to becoming a digital enterprise.

Following these steps removes traditional architectural constraints and optimizes connectivity, leveraging ecosystems and placing IT back in control—in the center of an Interconnection Oriented Architecture.

Learn more at **www.IOAKB.com**

IOA Playbook

SETTING THE STAGE: DIGITAL DISRUPTION IS HERE

Digital disruption is the impact of digital technologies and new business models on a company's current value proposition and resulting market position.

The shift to digital is requiring firms to implement new commerce and collaboration models; to engage customers, partners and employees; and to support new connectivity and data models for analytics, IoT, digital payments and other digital services.

Digital disruption is not industry-specific. In 2015, the World Economic Forum launched DTI (Digital Transformation of Industries), an initiative to track the phenomenon, and found that it's unlike other economic revolutions in terms of its scope, with more than one-third of today's businesses expected to fail over the next 10 years if they do nothing.[1]

Competition can come from outside an industry and/or internationally, as digital companies can become global enterprises (e.g.,Uber's global disruption of the taxi industry).

As digital grows to 25% of the global economy (Figure 1), it is capturing a disproportionately larger share of global growth (upwards of 40%) than non-digital, which means that digital is seizing revenue growth. This is even more pronounced in the U.S. economy, where digital already makes up 37% of the economy, but is capturing more than 65% of the overall U.S. GDP growth.

Not only is the traditional way of doing business unsustainable, but 75% of the economy will be scrambling for market share and competing for a subset of the growth—putting extreme pressure on margins.

> "Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000."
>
> Pierre Nanterme, CEO, Accenture

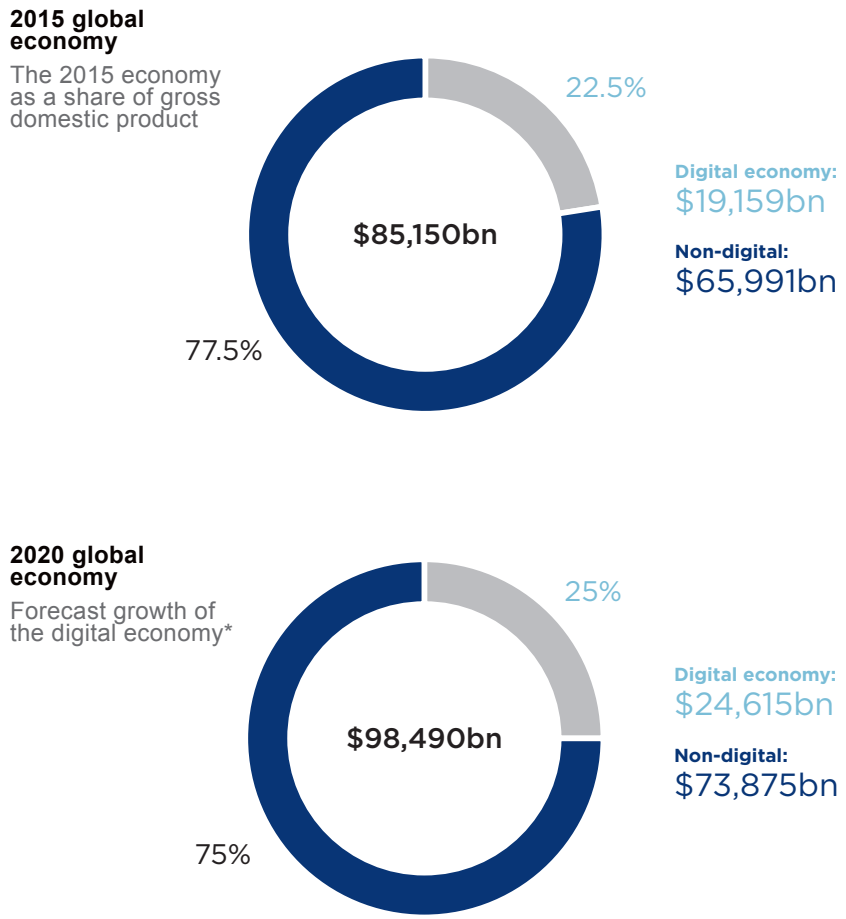


Figure 1: Global economy

Source: Accenture Strategy Group – https://www.accenture.com/us-en/insight-digital-disruption-growth-multiplier

*IMD Global Center for Digital Business Transformation

1. Retiring Cisco CEO delivers dire prediction: 40% of companies will be dead in 10 years, by Julie Bort, Business Insider, June 8, 2015. http://www.businessinsider.com/chambers-40-of-companies-are-dying-2015-6

SETTING THE STAGE: FORCING BUSINESS AND IT TO TRANSFORM

With disruption as a catalyst, digital transformation is driving the distribution of services and controls closer to customers, employees, partners and ecosystems. And, as the digital economy advances, revenues shift. The traditional economy struggles with revenue decline and must compete for what little growth remains. With greater commoditization and competition, digital impacts traditional margins, resulting in a focus on cost reduction and efficiency to minimize that impact. Therefore, to sustainably survive digital disruption, traditional organizations are transforming both their business architecture and IT delivery architecture together—from siloed and fixed to integrated and dynamic.

- **Traditional business ecosystems** (Figure 2) are serialized and haven't significantly changed, even while underlying technologies have increasingly changed
- **Traditional IT delivery** is heavily influenced by organizational boundaries, creating centralized silos of application systems and data on aging infrastructure, building IT debt
- **The challenge** is that traditional business and technology architecture investment—which likely contributed to a company's success—not only fails to address the new demands of digital, but will likely prohibit effectively competing in the digital economy
- **Established companies** have some advantages in capital, brand and existing customer base, but must disrupt themselves—and re-architect for continuous change—to compete
- **Digital business ecosystems** (Figure 3), in contrast, integrate business processes with partners to compound efficiencies and new capabilities
- **Digital IT delivery** starts with a digital platform that is both a business and technology platform. Businesses use it to digitally engage with customers, employees, partners and things—and to provide and subscribe to digital products and services within digital ecosystems
- **Digital companies** can innovate fast, fail fast and adapt to change—pushing items that are not mission-critical to integrated cloud services

From siloed and fixed…

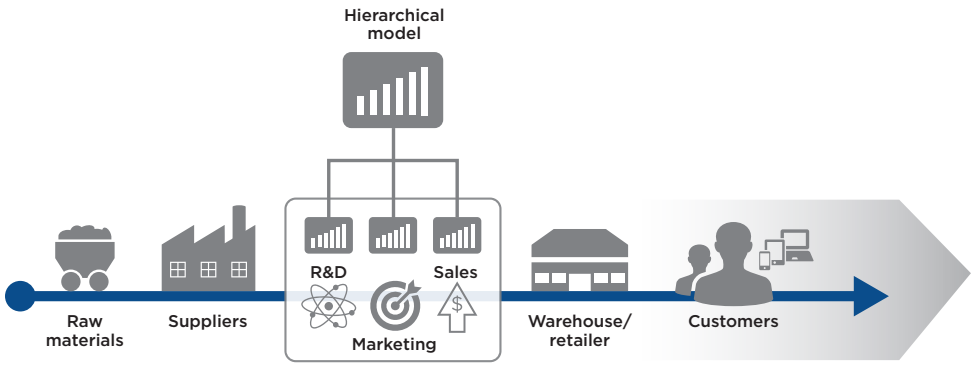


Figure 2: Traditional value chain

…to integrated and dynamic

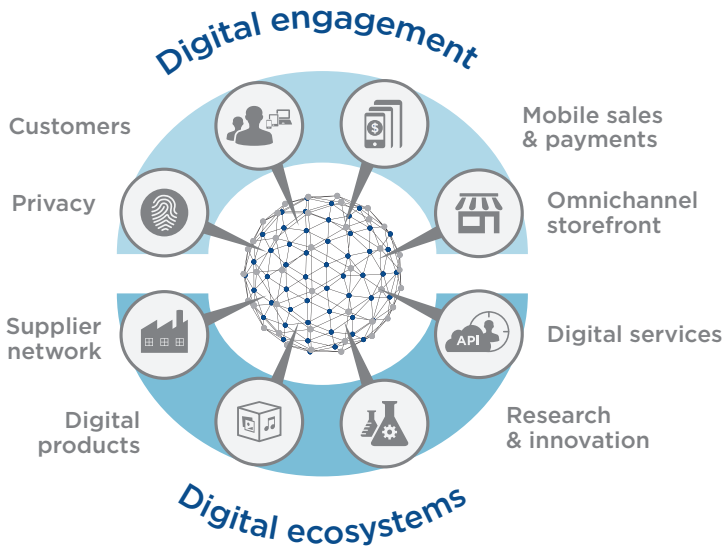


Figure 3: Digital integration

RE-ARCHITECT FOR THE DIGITAL EDGE

While digital engagement focuses on user experience, digital ecosystems center on application services, data exchange and new business processes such as productized APIs, digital payments, smart contracts and algorithms.

The result is the formation of multicloud, multi-partner, interactive workloads—where latency directly impacts business capabilities, and throughput diminishes scale as data volume increases. Applications are assembled to respond to changing business models, requiring components of interactive workloads to exist on both sides of the firewall (Figure 4).

Reducing latency between these components is a first step, since every millisecond of latency compounds the overall impact of the process. Even the simplified interactive workload in Figure 4 would result in thousands of packets transferred across dozens of permutations of the components. Using automation, the biggest limiting factor will always be throughput—bandwidth loss due to latency.

The physics involved in latency's compounding effects are not the only factors driving the need for intersection points at the digital edge. All of these services need to be integrated into one digital business platform. In addition, consistently preserving regulatory and compliance requirements is critical in the shift to digital (Figure 5).

Integrated digital business process on API-centric application workloads

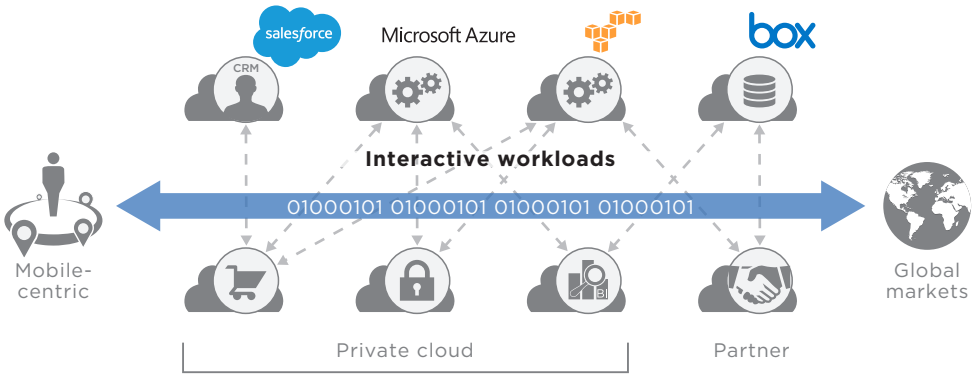


Figure 4: Interactive workloads

The digital edge is where to localize delivery of cloud-supported services to your customers, employees and partners

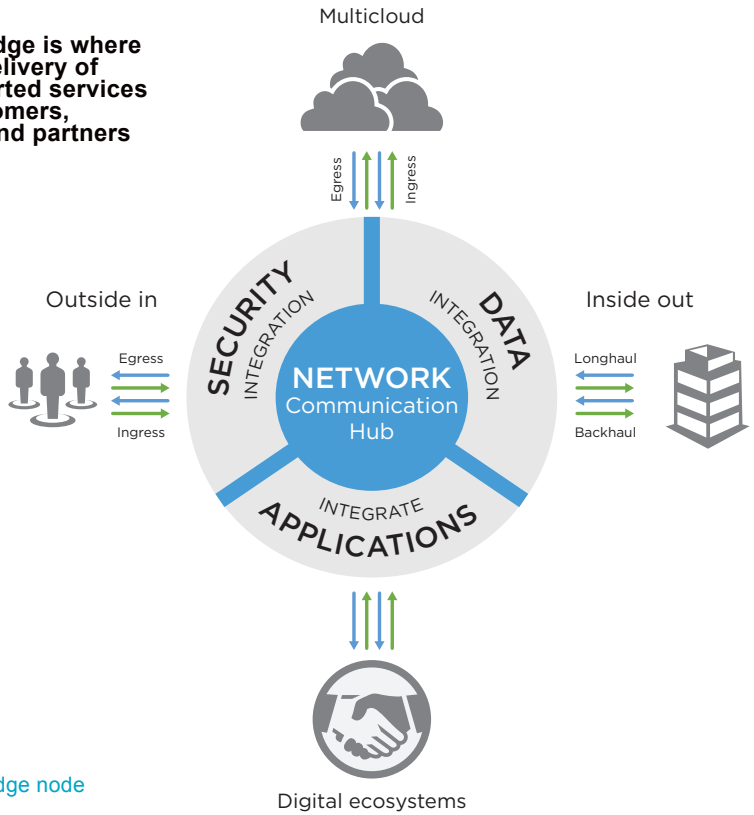


Figure 5: Edge node

SOLVE WITH AN INTERCONNECTION-FIRST STRATEGY

This shift in business and delivery architectures requires a digital edge strategy and placement of strategic control points next to users, clouds and networks. Build your digital edge alongside the largest industry ecosystems on Platform Equinix® to reach everywhere, interconnect everyone and integrate everything. Across our global interconnection platform, companies can scale their digital business, keep pace with shifting markets and find new growth opportunities by leveraging industry best practices of an IOA.

An Interconnection Oriented Architecture approach takes the fundamental delivery architecture of IT and turns it upside down. First, an IOA solves for the secure interconnection of people, devices, locations, clouds and business partners. Solving for interconnection first provides a foundation for information exchange, integration and digital commerce. Applications are then locally assembled to adapt to changing business models, which rely on a responsive critical infrastructure. Where you place these functions matters the most. Interconnecting multiple clouds and enabling data sources on both sides of the firewall is crucial (Figure 4).

Design the edge nodes based on the localized services and integration required, including industry regulatory or sovereignty requirements.

Deploy the edge nodes where business presence, population centers, high volumes of user traffic and points of data gravity are needed.

Tailor the edge nodes to localize business services to support the global digital business strategy.

The building blocks of a digital platform are not industry-specific. Everyone must solve the same architectural challenges. In multi-party digital exchanges, interconnection will be the most differentiating capability. The IOA Playbook outlines the edge node (Figure 6) as the point where the digital and physical meet and the optimal place to integrate.

The figures below illustrate how you can layer capabilities on top by adding functions to that node and/or by leveraging cloud ecosystems (or direct connections). As nodes are strategically placed in geographic locations, with optimized WAN connections between them, the result is the mesh of nodes depicted in Figure 7. As a digital platform, the firm decides which digital services to offer in each metro, and markets and tailors implementations with localized ecosystems (Figure 8).

This design can be achieved one location at a time, with minimal up-front investment, leveraging technologies already used by enterprises and providers today.

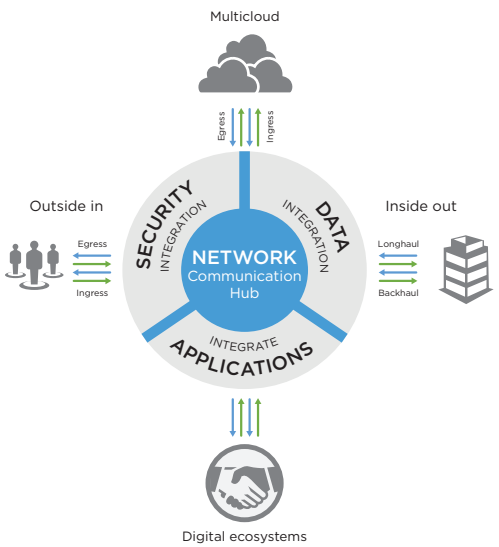


Figure 6: Edge node

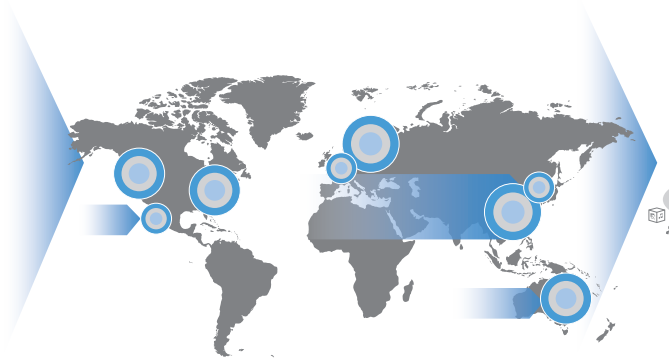


Figure 7: Edge of mesh nodes

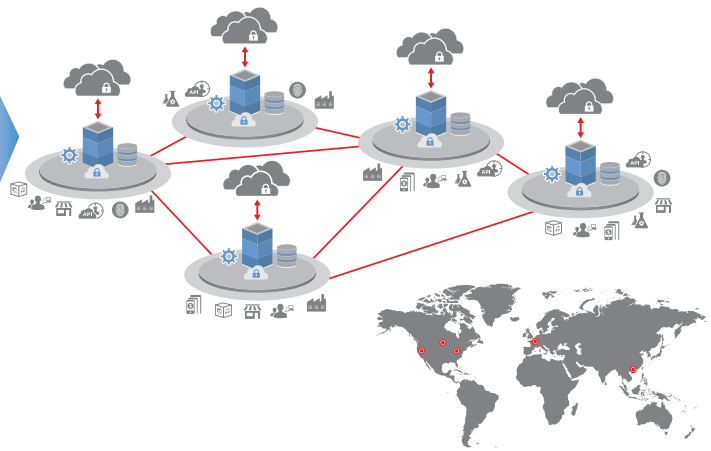
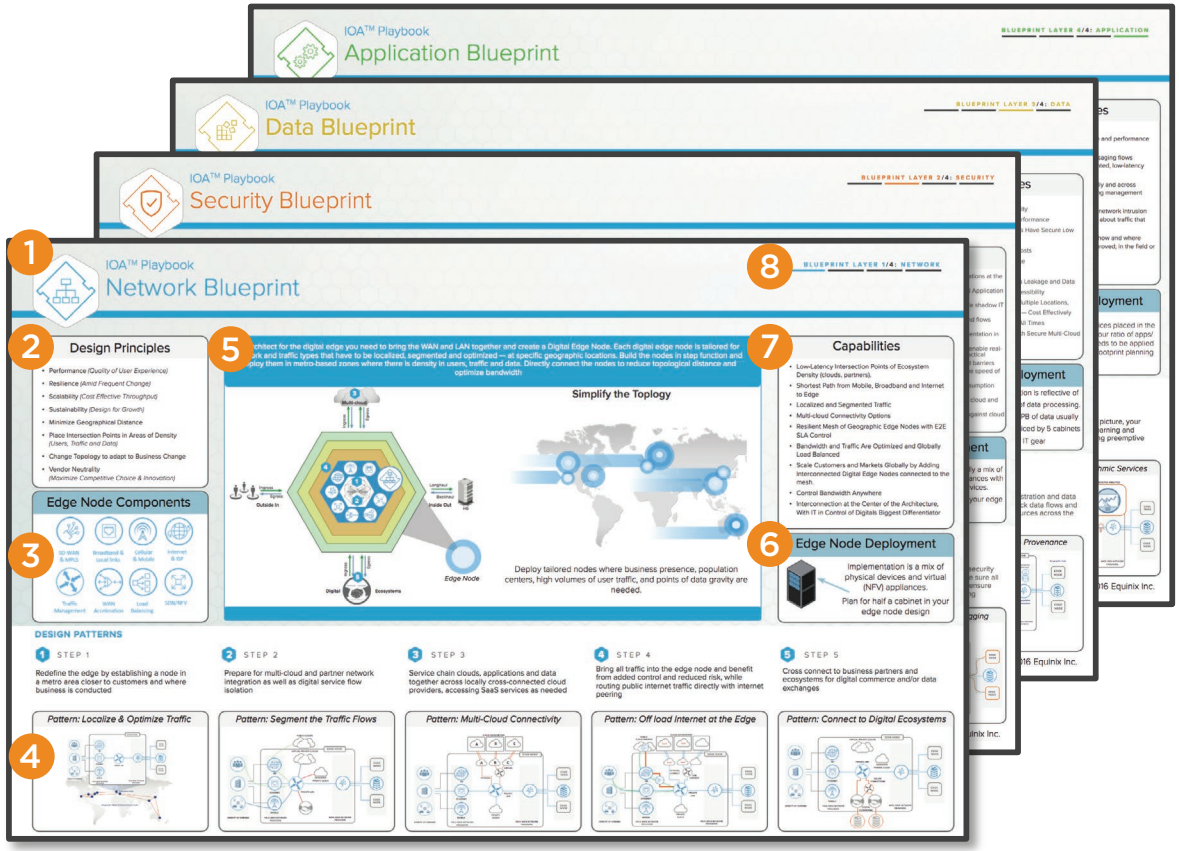


Figure 8: Tailored localized services deployed globally

IOA KNOWLEDGE BASE: ANATOMY OF A BLUEPRINT

The IOA Knowledge Base contains integration blueprints and design patterns developed from studying more than 400 customer deployments and ongoing learning from key advanced enterprises and providers.

1. Icon and name (edge node integration layer)
2. Design principles
3. Typical components involved
4. Design pattern steps
5. Quick context with objective depiction
6. Sizing guide
7. Capabilities achieved
8. Reference index



IOA PLAYBOOK: MAPPING THE JOURNEY

Start your journey with the blueprints and design patterns in the IOA Knowledge Base

IOA LAYER	PATH	CHECKLIST
NETWORK		✔ Simplify the topology
SECURITY		✔ Create security guardrails
DATA		✔ Establish a data fabric
APPLICATIONS		✔ Integrate via intersection points

IOA NETWORK BLUEPRINT

To architect for the digital edge, you need to bring the WAN and LAN together, and create a digital edge node. Each node is tailored for the network and traffic types that must be localized, segmented and optimized at that geographic location. Build the nodes in a stepped-function way, and deploy them in metro-based zones where there is density in users, traffic and data. Directly connect the nodes to reduce topological distance (number of hops) and optimize bandwidth (throughput).

To simplify the topology, follow these steps:

1. Localize and optimize the traffic
2. Segment the traffic flows
3. Establish multicloud connectivity
4. Offload internet at the edge
5. Connect to digital ecosystems

Establishing a communications gateway in strategic population centers—or areas of IoT device connection density—allows you to consolidate access across the field area networks (ISP, Ethernet and mobile) to localize the traffic. This creates the optimal path for outside-in connectivity.

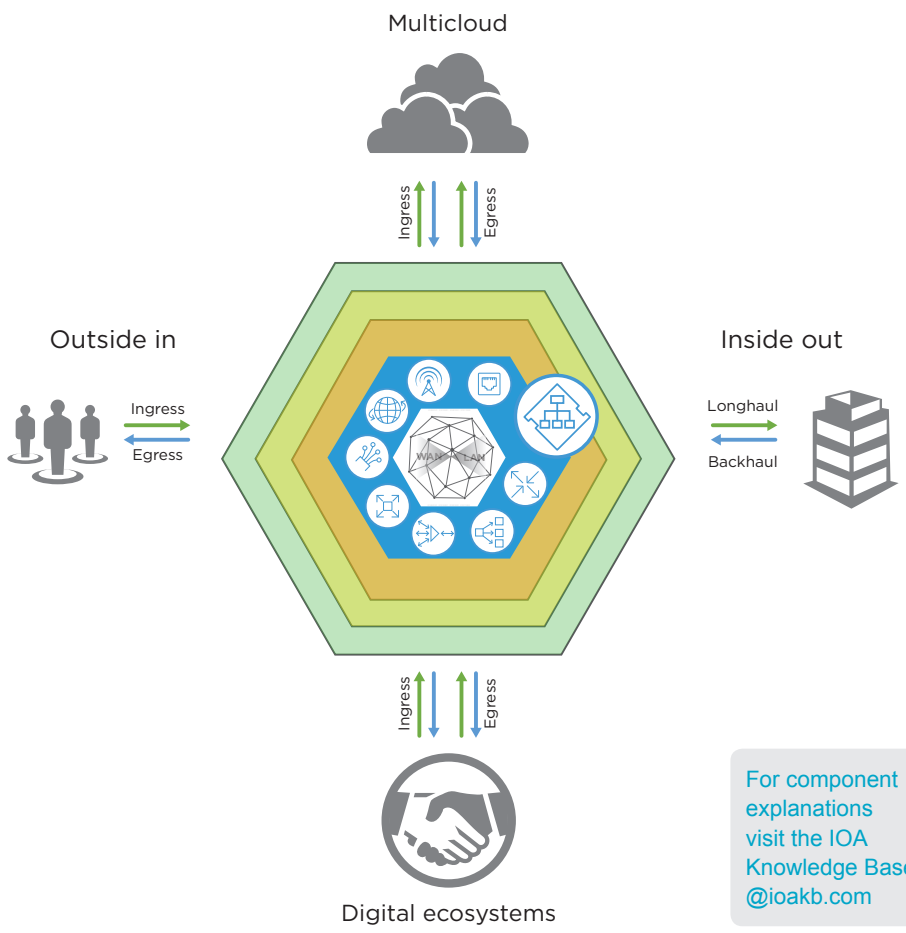
Leverage choice in competitive connectivity between these geographic hubs, or edge nodes, to create a mesh that maximizes bandwidth and balances load in the most cost-effective way (reducing longhaul and backhaul). This creates the optimal path for inside-out connectivity.

Directly connect to multiple clouds locally at the edge (Layer 2 or 3) to create the shortest distance to users and maximize efficiency. Directly connect to the internet as well, to optimize access to personal or lower-risk application services. This solves for multicloud interconnection efficiency.

To support secure digital business, cross connect to partners at the edge in a meet-me fashion (peering traffic). Doing this shortens the distance between multi-organizational digital business flows and leverages the advantages of digital ecosystems.

The benefits of aggregating connectivity at a colocation edge node, as well as securely cross connecting segmented flows, are dramatic. Both can result in sustainable cost reduction and performance improvement. In digital, network flows are business flows, so performance translates to revenue, and these hubs give you back control over the flows. Improving network performance has traditionally required reducing distance (and number of hops) and/or reducing the payload (requiring less throughput). By implementing this mesh of edge nodes, the following results can be achieved:

- An 84% drop in throughput, over a 100Mbps cable, at 30ms
- Up to an 85% reduction in WAN latency (MPLS) and the ability to completely bypass the internet



For component explanations visit the IOA Knowledge Base @ioakb.com

IOA SECURITY BLUEPRINT

To architect for the digital edge, you need to localize security services in the digital edge node and govern multi-party flows. Each node is tailored for the traffic and digital services at that geographic location, placing you back in control of your business flows. Redefine the edge by implementing boundary control for the field area networks, placing an inspection zone (modern DMZ) to observe activity across multiple clouds and organizations and automating traffic policing within affinity groups.

To create security guardrails, follow these IOA security blueprint steps:

1. Establish boundary control
2. Create an inspection zone
3. Apply policy administration and enforcement
4. Locate identity and key management
5. Integrate security analytics and logging

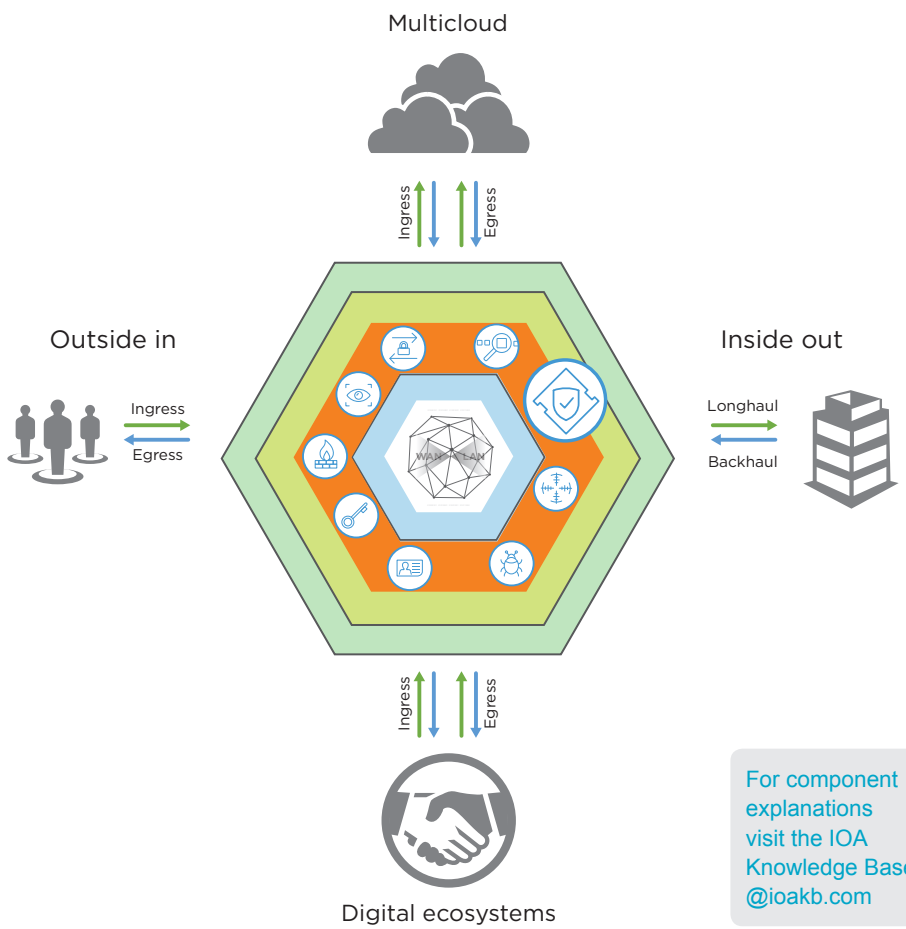
The digital edge must be prepared for multicloud application and data flows, servicing people, employees and partners across multiple networks. It's no longer just a gate—it's akin to airport security with domestic and international traffic and different classes of service.

Boundary control is about security checkpoints at the edge with localized firewall, SSL termination (VPN) and other protection for malware and DDOS. Likewise, it's crucial to contain threats at the edge, reduce the attack surface of cyber threats and get traffic onto the dedicated private network quickly.

The next step is to create an inspection zone. This is to provide transparency (deep packet inspection) to enable other security services (such as those scanning for vulnerabilities or lawful interception for data leakage, etc.), as well as monitoring and logging (i.e., for security analytics).

Policy management (PEP/PDP) is applied, in line with the traffic segmentation strategy, to detect rogue traffic or unauthorized activity, or to catch mistakes made by users or developers—effectively creating guardrails.

Place latency-sensitive security services with high traffic volumes, like identity and key management, close to multiple clouds and population centers. This helps improve overall performance to all dependent services.



For component explanations visit the IOA Knowledge Base @ioakb.com

The benefits of localizing security services at the edge extend from the capabilities granted by access aggregation, cloud integration and digital business segmentation. They include:

- Localizing controls and extending your security posture to where you do business. This capability can expand, scale and change as fast as digital business changes
- Gaining insight into use of cloud and SaaS services consumption, with the ability to apply dynamic and real-time policy controls that govern their use, as well as detecting packet-level anomalies
- Capitalizing on latency advantages to implement security, governance and controls that would have otherwise negatively impacted user experience or scale

IOA DATA BLUEPRINT

To architect for the digital edge, you need to localize some data requirements in the digital edge node; balance protection with accessibility; and govern data movement and placement. Each node is tailored for the local or shared data services at that geographic location, placing you in control of your data and performance.

To establish a data fabric, follow these IOA data blueprint steps:

1. Establish a distributed data repository
2. Solve data cache and edge placement
3. Situate edge analytics and streaming flows
4. Build for data exchanges and data integration
5. Apply data pipelines and maintain provenance

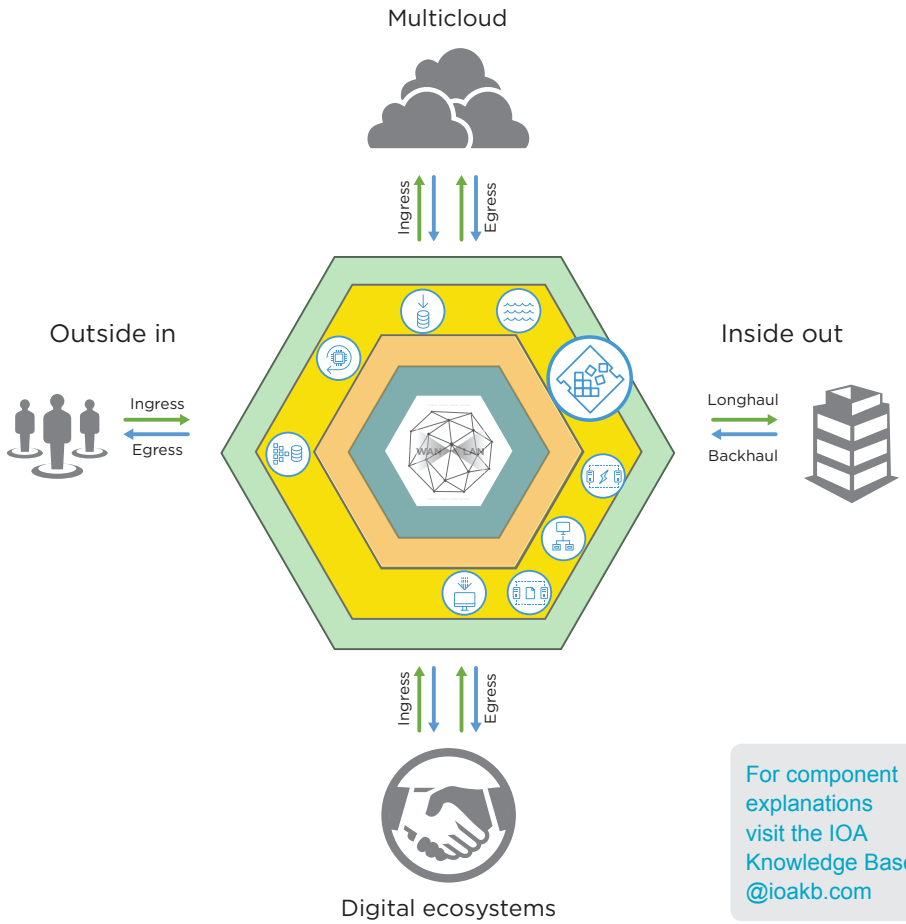
The first step is to deploy a scalable distributed data repository that is consistent and geographically dispersed by design. Configured to leverage both private and public cloud capacity as a single distributed pool, it becomes a default tier of data service available everywhere (with both file system and API interfaces).

Latency-sensitive data should be strategically placed in proximity to the services that require it and on a faster local cache repository. Establish this cache/copy at the edge to make it securely accessible to multiple clouds and business partners, or to services running locally in the node. Placement at the edge also satisfies data sovereignty or sensitivity requirements that require data containment in the node or region/location.

Data analytics services, either standalone with large data sets or real-time, event processing-based, should be placed at the edge. In addition, streaming data can be aggregated at the edge from multiple sources at an intersection point, and made available as flows to multiple destinations, to many sources and subscribers.

As data is monetized, secure access to it must be established between multiple parties in proximity to networks and partners for lower latency.

Data sources will need to be dynamically connected because in analytical processing, a greater number of data sources directly translates to a richer experience. Data integration is needed for batch or real-time orchestration, servicing requests or moving and/or translating data.



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Finally, since data is delivered across a set of distributed data systems, inventory and meta information must be centrally managed, covering both data-at-rest and in-motion (data pipelines). It's important to optimize data placement while retaining federated governance.

The benefits of localizing data at the edge start with accessibility, security and control—without compromising the value propositions of clouds and digital ecosystems. Running multicloud application workloads doesn't require moving data—just accessing the data locally in the edge node over secure, low-latency connectivity. This will minimize the risks of data loss, data leakage and data theft. In addition, it will optimize business value, enforce regulatory controls and help you remain in control of the data at all times.

IOA APPLICATION BLUEPRINT

To architect for the digital edge, you need to localize application services in the digital edge node as a multicloud, multi-party business integration point. The shift to digital is trading complicated silos for interactive systems of digital services. This transforms application development to an API-centric approach in building internetworked components. Each edge node is an application communication gateway, as well as a place to colocate application functions that have latency- or volume-driven workloads (i.e., improving user experience).

To integrate via intersection points, follow these IOA application blueprint steps:

1. Implement API management
2. Plumb for messaging
3. Apply distributed coordination
4. Leverage complex event processing
5. Introduce predictive algorithmic services

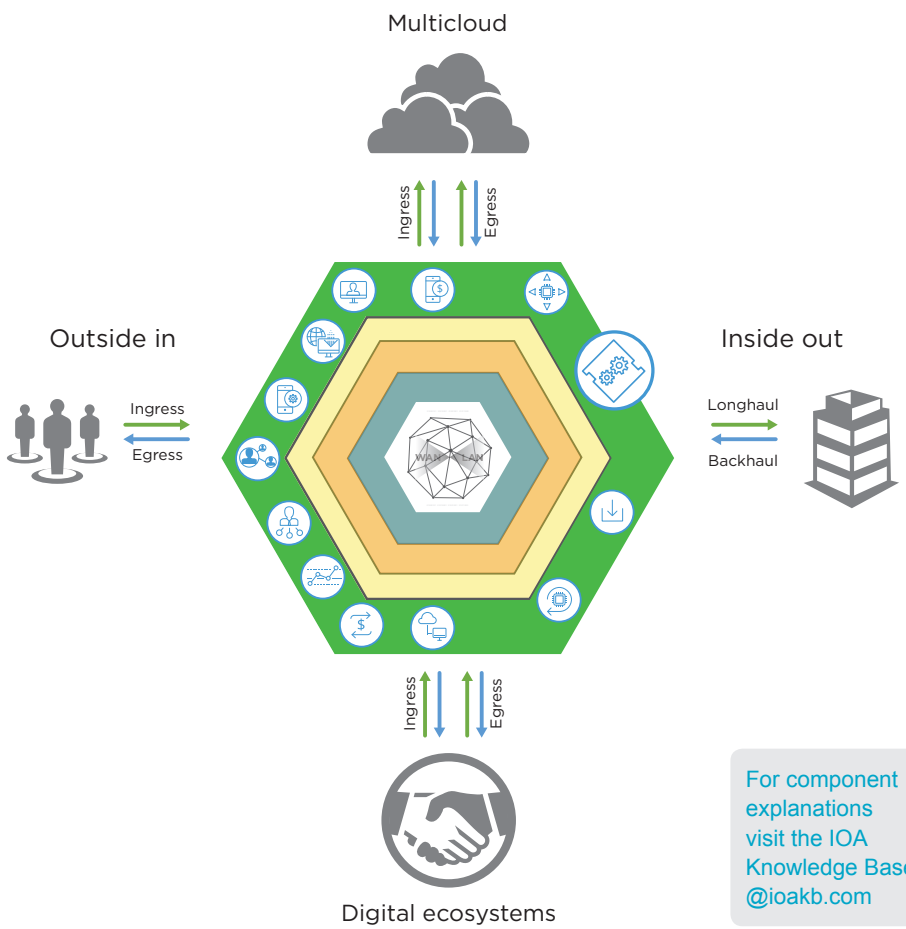
Implement API management first to get in front of the world of digital services—create APIs, manage partner APIs, choreograph traffic, productize APIs, apply usage analytics and establish controls. APIs will be the building blocks of application assembly and lifecycle management.

Digital services will have a mix of synchronous and asynchronous behaviors, and messaging pipelines will be needed to bring contextual cohesion to the flow (across the disparate services). Also, in the mash-up of clouds, networks and application architectures, failures will occur. The edge nodes will maintain the messaging (and process) state.

Flipping the architecture and distributing components out to the edge means that coordination and configuration, including distributed governance, must be included as foundational components of the platform.

Beyond analytics, which previously focused on detecting anomalies, the platform must be able to infer complex events based on multiple data sources. This will become a crucial capability for digital business.

Predictive capabilities are the next logical extension. Having already determined that complex events are occurring, analytics will be expected to trigger the appropriate automated actions. These capabilities need to be commoditized and readily available throughout your organization.



For component explanations visit the IOA Knowledge Base @ioakb.com

The benefits of localizing application services at the edge and building them into the communication fabric are not only about digital advantage, but also about reducing risk and improving control.

- With API management, messaging and coordination implemented on top of a secure high-speed data fabric with low-latency access to clouds and digital partners, you have successfully eliminated all barriers to digital business success
- The mesh of edge nodes now acts as a distributed application bus and becomes your enterprise neural network—putting control back in the center of the architecture

IOA DIGITAL PLATFORM

The IOA Playbook outlines the foundational steps toward building your digital platform to support digital transformation. Accelerate your journey to that transformation by removing traditional architectural constraints, optimizing connectivity, leveraging ecosystems and placing IT back in control in the center of an Interconnection Oriented Architecture.

Platform Equinix—where everything you need to create your digital future is within reach

This combination of technology, interconnection, critical-mass communities and industry expertise comes together in the form of Platform Equinix, a global interconnection platform for the world's leading businesses that facilitates speed, global scale and security while mitigating risk.

Equinix is home to thousands of companies in dozens of industries that come to us for the power of interconnection. Our global platform for success includes:

- Access to 1,700+ networks and 2,900+ cloud and IT service providers (including AWS, Cisco, Google, IBM and Microsoft)
- 270,000+ cross connects between our customers
- 200 data centers in 52 metros, all interconnected through the world's largest internet exchanges—lowering the barrier to foreign markets and regional services

Our interconnection solutions can empower your business to quickly and dynamically respond to change. Take control of your digital strategy, and innovate at the edge with Equinix.

Learn more at **www.IOAKB.com**

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