At the end of the day, Earth is a single point of failure…
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Gartner Conference

Why attend?
- Real-world take-aways
- Actionable insight and how-to advice across a broad range of technical topics
- Drill-down content and proactive guidance on vendor-neutral and cross-functional technology topics like cloud, DevOps, and big data.
- Considered “the” must-attend event for technical professionals by a plethora of technology publications and leaders throughout the U.S.

Recommended attendees
Architects, Managers, Analysts, Developers, and Planners.

<table>
<thead>
<tr>
<th>2,400+ attendees</th>
<th>70+ solution providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>430+ sessions</td>
<td>50+ exhibitors</td>
</tr>
</tbody>
</table>

Miscellaneous
Hottest topics requested in Gartner One-on-One Meetings

<table>
<thead>
<tr>
<th>Cloud Computing</th>
<th>Data Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet of Things (IoT)</td>
<td>Artificial Intelligence (AI)</td>
</tr>
<tr>
<td>Application Development Strategies for Digital Business</td>
<td></td>
</tr>
</tbody>
</table>

No need for the same person to attend yearly – recommend a different person attend every other year, or the same person attend every third year for maximum impact derived from the conference.

Ideas, statements, and notes in this VITA created report are derived from this Gartner Catalyst conference presentations attended, which explain in more detail the ideas contained within this report.
Gartner Opening Keynote

Architect Your Digital Ecosystem

Overview
Great opening presentation consisting of three Gartner leaders as seen pictured below in their presentation to us:

- Danny Brian – Gartner Vice President, Distinguished Analyst, and Gartner Fellow
- Lori Robinson – Gartner Research Vice President
- Kirk Knoernschild – Gartner Chief of Research Vice President and Conference Chair
They discussed topics such as:

**Infonomics**

How infosavvy are you? Take the quiz: [https://surveys.gartner.com/s/InfonomicsBook](https://surveys.gartner.com/s/InfonomicsBook)

| Infonomics | The emerging discipline of managing and accounting for information with the same or similar rigor and formality as other traditional assets (e.g., financial, physical, intangible, human capital). Infonomics posits that information itself meets all the criteria of formal company assets, and, although not yet recognized by generally accepted accounting practices, increasingly, it is incumbent on organizations to behave as if it were to optimize information's ability to generate business value. |

---

**The Three-Dimensional Challenges and Opportunities of Infonomics**

<table>
<thead>
<tr>
<th>Monetizing Information</th>
<th>Managing Information</th>
<th>Measuring Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generating measurable economic benefits from or attributable to available information assets</td>
<td>Applying traditional asset management principles and practices to information</td>
<td>Gauging and improving information's economic characteristics</td>
</tr>
</tbody>
</table>

---

**Placement on the Data Science Continuum**

We previously wrote about a concept we call the analytics continuum. The continuum provides organizations with a tool to understand their current data science capabilities and what they should consider for next steps. According to the continuum, organizations largely enter the data science market in the following pattern:
Drones

Drones appeared for the first time in the 2016 Gartner Hype Cycle for Emerging Technologies. Gartner’s 2017 graphic follows:

FAA registered drone operators surpassed number of manned aircraft in 2016.

Virginia is 9th out of the top ten drone states per FAA Part-107 licenses issued in 2017 – California is number 1 and Arizona is 10th.

Artificial Intelligence (AI) is driving advances for new intelligent things, such as autonomous vehicles, robots, and drones.
Digital Ecosystems

The Digital Ecosystem Surge

Old-style linear digital business  Participation in digital ecosystems

Top Performers are more likely to create or participate in digital ecosystems.

- Top Performers: 79%
- Typical Performers: 49%
- Trailing Performers: 24%

What is an ecosystem?

A digital ecosystem is an independent group of actors (enterprises, people, things) sharing standardized digital platforms to achieve a mutually beneficial purpose. Different ecosystems can coexist if separated by geography, market or category.
Ecosystems span multiple spheres of influence and concern spanning such areas as your industry, a grouping of industries, or even society in general.

Ecosystems benefit a lot of different people creating incentives to participate in an ecosystem where people cooperate because they have a mutually beneficial arrangement in addition to the monetary incentives that others will derive through participation.

By 2025, almost one-third of total global sales will come from ecosystems. (McKinsey Analysis 2017 Survey)

We’ve always had these ecosystems, but digital platforms have enabled creation of new ecosystems and support of existing ecosystems in a much more rapid way.

How do you create an ecosystem?

Used a story from the Genealogy industry to illustrate.

Nobody wants to be a genealogist, but people love to find out about their family history.

A whole multi-billion dollar industry has popped up only recently because it was a prominent past-time for a lot of people to find out what their family tree looks like.

The key to it all was answering how to get the records of the world to market, make them searchable, and where they’re able to connect them into trees where you can aggregate the data into a more useful state, where people can find the information they’re searching for.

The answer was the sharing of certain datasets between commercial organizations, non-profit organizations, and volunteer organizations – an ecosystem.

Other industries then popped up around this genealogy ecosystem that popped up because this scenario was mutually beneficial to all the participants.
The word Mr. Love identified for what transpired in this ecosystem is: Co-op-e-ti-pon.

Coopetition is an ecosystem in which competitors work together on some core and basic things like standards. You choose to compete in other areas, but you’re not competing to the point that you’re harming the industry. So everyone cooperates on some of the basics, where they’re building on common ground and benefitting, which then means this industry grows the opportunity significantly more than if everyone was fighting over every little piece.

~Ransom H. Love, Founder and former CEO of Caldera, and SVP of Strategic Relations for FamilySearch

The #1 barrier identified by CEO’s for creating digital ecosystems such as the aforementioned genealogy use case is culture, followed by resources and talent. Technology was not cited in the top three barriers.
Culture is not a top-down issue; we the people are the problem in our organizations. IT practitioners have more ability to influence the culture than any top-level leader can in their capacity.
To change your organization’s ecosystems, you must change your personal ecosystems.

Danny used the MX corporation example because they have been a huge disruptor in the banking industry and he has a friend, Ryan Moore (Engineer) that works there.

It’s a flat organization with 60 developers in a standup all working for the CTO.

There are no architects although the CTO did architect the overall flat organization ecosystem.

Ryan Moore describes it this way:

We all sit together, we have a single standup together. There’s never any red tape between taking on an issue or a project that goes outside of the team you are on. Last year I was really interested in developing the ability of our company to deploy features targeted at segments of users. I took a look at it and started taking on those tasks, got code reviews from more experienced server-side engineers without having to lobby for a backend engineer or a data engineer to do all that work. In the same way you don’t see an ant with an architect hat saying “I’ve designed the next colony!” Or a bee saying, “This is hive 2.0!” We’re
just down there making the hive work and expanding it the way that it should. An ecosystem is unmanaged in a top to bottom manner. That ecosystem performs in a way that a top-down managed system cannot.

Everyone in that ecosystem is working towards a common goal, which results in an empowering environment. If you can do it, just do it – take the initiative. It's an ecosystem of contributors.

This does not mean everyone everywhere needs to work in a flat organization; there are principles to take away here and apply to your organizations within your spheres of influence.

Change the vocabulary in your organization about how you talk about things. Use vocabulary that is freeing, not binding – avoid Buzzword Bingo.

Buzzword Bingo example:

If we fail to get funding for the proper metrics, the deliverables will suffer due to the lack of resources; projects will fail because we don't...
have team players; so we need better policies, more accurate timelines, and better communicated action items.

Organizational processes will focus you on what you know now and do now. But you’re more than that, better than that.

We must not let organizational dysfunction be the excuse for our not being the technologist we want to be and paid to be.

**Miscellaneous**

The biggest roadblock to achieving what is commonly called digital transformation isn’t the enabling technology, which can be difficult, rather it is the culture.

- In Gartner’s 2018 CIO Survey, 46% of respondents named culture as the biggest barrier to scaling digital transformation.

https://www.gartner.com/smarterwithgartner/learn-the-art-of-culture-hacking-for-culture-change/
The secret behind disruption and redefining analysis for the 21st century is… you:

<table>
<thead>
<tr>
<th>You detect</th>
<th>You connect</th>
<th>You learn</th>
</tr>
</thead>
<tbody>
<tr>
<td>You evaluate</td>
<td>You innovate</td>
<td>You optimize</td>
</tr>
<tr>
<td>You adapt</td>
<td>You dream</td>
<td>You solve</td>
</tr>
<tr>
<td>You transform</td>
<td>You lead</td>
<td>You…</td>
</tr>
</tbody>
</table>

Design programs to do only a single thing, but to do it well, and to work together well with other programs. ~Doug McKilroy circa 1990’s – Linux

Sounds a bit like microservices doesn’t it?

Linux was a major 1990’s disrupter – when including Android, Linux is currently the most widely deployed operating system in the world.

IT practitioners must care about digital disruption; it will affect you, if it has not already.

Amazon is the quintessential example of digital disruption.

Built eCommerce platform that has changed the world.

Yearly apparel revenue added since 2005:

- Online stores led by Amazon – Up $27.8 Billion
- Department stores – Down $29.6 Billion

Example of Farmers Markets, which is a group of individuals, each with different and unique talents, products, and services that come together to create this ecosystem that is greater than the sum of its parts.
**Internet of Things (IoT) Architecture**

### Effective IoT Architecture and Design

#### Overview

Research and presentation by Mr. Erik T. Heidt of Gartner.

---

**IoT Core Workflow** – Gartner 2018

<table>
<thead>
<tr>
<th>Collect</th>
<th>Decide</th>
<th>Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor or Operational Data</td>
<td>Enterprise and Third-Party Systems’ Data</td>
<td>Orchestration Implements Decision</td>
</tr>
</tbody>
</table>

---

**Target Architecture is Our Focus Today.**

Target Architecture is the Focus Today – Gartner 2018

- Target architecture = (Business decisions) × (IoT architecture)

---

**Solution Path for Developing an Internet of Things Strategy**

1. Identify Team, Skills and Engagement Plan
   - Identify IoT Architect
   - Build CoE Team
   - Engage Business, OT, etc.
   - Open an IoT Lab
   - Track Risk and Security Issues

2. Define Target Architecture
   - Edge Architecture
   - Platform Architecture
   - Integration Strategy
   - Analytics Strategy
   - Technology Inventory

3. Govern the Delivery Process
   - Client Success Factors
   - Assurance Engagement
   - Review Risk and Security
   - Proof of Work
   - Meet Project Costs

4. Deliver Solutions
   - Delivery Process
   - Device Fabrication
   - Provider Evaluation
   - Testing
   - Monitoring
   - Maintenance

---

**IT is the digital business medium – IoT extends the digital business.**

IoT enables new decision models and capabilities by pulling edge enterprise and party data together.

Not all decisions are centralized, but the development of new, intelligent decision models are…
Begin IoT with the end in mind.

IoT is about business decisions.

Platform is the beating heart of IoT.

IoT moves from device focused into digital focused.

- Shorten time-to-IoT by leveraging existing edge data.
- The cloud is not moving to the edge.
- IoT platform is powerful because it is agile – it is the launchpad, not the rocket.
- IoT has many challenges such as the availability of IoT generalists.
  - Estimated there are currently only around 100 in the U.S.
- Most IoT today is data collection.
  - Embedded computing = microwave, sensors, compute bus; no communication.
- Untapped and silo’d IT is a great opportunity to install IoT.
  - Untapped = has network connection, but is not used.
- HPE has spent billions on edge computing in support of IoT – it’s coming.
- Your coding and equipment must be able to handle the meta data of IoT.
- IoT is continuous – not a one-time implementation.
- Enterprise is the “last mile” for IoT.
- IoT is mainly an open loop implementation.
- Business objectives are critical for IoT objectives.
Internet of Things (IoT) Architecture

IoT refers to a new form of software and service related to device communications. Here devices send across real time data which is analyzed in real time and necessary actions taken based on the analysis. These actions can be anything from email and mobile notifications, to triggering actions within other applications and back onto the devices. Given below is a high level architecture of IoT:

The architecture starts with your devices that will be sending across signals containing data. These signals can be in any form, and generally use binary based proprietary protocols that vary from device to device.

Internet of Things (IoT) by Syntel - Consider IT Done, 2015
Figure 4. Logical Architecture for an IoT Solution

Figure 2. Business Objectives for Current IoT Projects

Source: Gartner (October 2016)
Internet of Things (IoT) Architecture

Figure 3. IoT Value Spectrum

Source: Gartner (October 2016)

Figure 8. Three Parts of an IoT Solution

Source: Gartner (October 2016)
Because platform is the beating heart of IoT, Microsoft’s “88 Acres” code name was mentioned:
Revitalize Taiwan Industries with Internet of Things (IoT) by Cathy Yeh, Microsoft-Taiwan

Internet of Things Reference Model

Levels

7. Collaboration & Processes (Involving People & Business Processes)
6. Application (Reporting, Analytics, Control)
5. Data Abstraction (Aggregation & Access)
4. Data Accumulation (Storage)
3. Edge (Fog) Computing (Data Element: Analysis & Transformation)
2. Connectivity (Communication & Processing Units)
1. Physical Devices & Controllers (The ‘Things’ in IoT)

Data at Rest
Data in Motion

Internet of Things (IoT) Reference Model by Cisco
Summary

The Internet of Everything (IoT) Reference Model is a decisive first step toward standardizing the concept and terminology surrounding the IoT. From physical devices and controllers at Level 1 to the collaboration and processes at Level 7, the IoT Reference Model sets out the functionalities required and concerns that must be addressed before the industry can realize the value of the IoT. With the goal of enabling the IoT, this reference model provides a baseline for understanding its requirements and its potential.
Cloud Wars

Comparing Major Cloud Platform Providers

Overview

Research and presentation by Mr. Elias Khnaser of Gartner.

- The comparisons of the various cloud offerings were a result of months of research - @gartnercat
- A multi-cloud strategy is becoming increasingly important.
- AWS and Azure remain dominant in the cloud wars.
- [http://clouddecisions.gartner.com](http://clouddecisions.gartner.com)
- Some AWS does not have an SLA associated with them such as elastic beanstalk.
- IBM not a lot of change since 2015.
- Oracle cloud moving up infrastructure-wise.
- Alibaba focuses on the Asian market.
- Multi-cloud is inevitable.
Interestingly, AWS has no single instance availability SLA.

Amazon S3 availability SLA is 99.95%.

AWS has no backup service and no VM console access (basic access).
Azure excels in hybrid, identity and access management, and scale.

Azure has:

- limited availability per zone.
- no bare metal options.
- no provider offered Linux distribution
- no metrics driven load balancing.
- no regions and zones architectural transparency.

**Figure 3.** With purpose-built Microsoft Azure Stack integrated systems, powered by Intel technology, organizations quickly gain the power of cloud computing in the on-premises data center.
Google Cloud Platform (GCP) excels in security, technology and network, and financial incentives.

GCP has no:
~ LAN traffic encryption.
~ file storage support.
~ limited logging support for account management provisioning and security.
~ no regions and zones architectural transparency.
Oracle Cloud Infrastructure (OCI) excels in Oracle’s Suite of Services, networking, and compute.

OCI has:

~ limited geographic coverage.
~ no autoscaling service.
~ no cross-geography replication.
~ no backup service.
~ no directory services.
~ no network forensics, etc...

Figure 1: Oracle Cloud Infrastructure High-Level Architecture
Recommendations

✓ Create your own unique IaaS evaluation criteria set.
✓ Evaluate providers against your criteria.
✓ Forecast your future provider requirements:
  – Prioritize feature breadth and innovation?
  – Prioritize history, relationship and integration?
✓ Select a provider and begin using, but NEVER sit idle.
✓ Move from selection to provider management.
✓ Re-evaluate annually and prepare for a multicloud strategy.
State of the Web

The Critical Trends in Architecture, Platforms, and Frameworks

Overview
Research and presentation by Mr. Danny Brian of Gartner.

- Web traffic dominates

<table>
<thead>
<tr>
<th>Web Traffic by Platform, May 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile</td>
</tr>
<tr>
<td>Desktop</td>
</tr>
</tbody>
</table>

Which Browser to Support for Your Own Projects?

- Treat anything less than 3% of your user base as unsupported.
- Supporting a browser older than 5 years can incur a cost of +50% for development and testing.
- Supporting a browser older than three years can incur a cost of +30% for development and testing.
Always have a dual-browser strategy.

No investment in web expertise will be wasted.

Steer clear of more proprietary browsers.

Frameworks are for developer productivity.

- Suppliers should support all major browser versions.
- People don’t want to always install an app.
- Frameworks will remain to provide structure.
- Use a CSS preprocessor to reduce latency.
Recommendations

✔ Educate yourself and your teams on modern HTML5, JavaScript and CSS3 features. Don't skip the basics, and don't learn modern web technologies through the lens of a framework.

✔ Aggressively deprecate support for legacy browsers. Make this a matter of business cost-benefit, rather than developer preference.

✔ For most use cases, favor modern web app architecture, pushing more application logic to the client.

✔ Use web containers such as Cordova to leverage web code for packaged mobile and desktop applications.

✔ Test applications on multiple browsers, avoiding any proprietary browser features.
Quantum Computing

The “In Your Face” Disruption Few Understand and Some Fear

Overview
Research and presentation by Mr. Matthew Brisse of Gartner.

- Quantum computing will totally change the computing science landscape in higher education.
- Quantum computing is non-deterministic.
  - For example: 1+1 = 99.99% probability the solution is 2.
- Commercially viable for specific problems in six to ten years.
- Machine learning is the biggest quantum use case.
- Financial services planning on usage in 2027.

62 quantum computing companies currently.

Quantum computing is not ready today.

By 2023, 20% of organizations will be budgeting for quantum computing projects compared to less than 1% today.

Without hype there is no funding.

4IR = Fourth Industrial Revolution – Quantum, Artificial Intelligence (AI), Machine Learning, etc.
Gartner has received over 300 calls from CIO’s / CTO’s on Quantum through July 2018.

Quantum algorithms are coming first for use in machine learning.

All quantum chips are one off’s.
Quantum Computing

- Exponential speed up – $N^{300}$ instead of $N^2$ (1’s and 0’s).
- Computational scientist will take problems to quantum system for highest probability solutions.

Quantum impact on security — what is vulnerable?

<table>
<thead>
<tr>
<th>Cryptographic Algorithm</th>
<th>Type</th>
<th>Purpose</th>
<th>Impact when large-scale quantum computers are achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES-256</td>
<td>Symmetric key</td>
<td>Encryption</td>
<td>Probably okay</td>
</tr>
<tr>
<td>3DES</td>
<td>Symmetric key</td>
<td>Encryption</td>
<td>Must be deprecated</td>
</tr>
<tr>
<td>SHA-2, SHA-3</td>
<td>Hashing</td>
<td></td>
<td>Quantum safe algorithms</td>
</tr>
<tr>
<td>FIPS PUB 186-4</td>
<td>Digital signature standard</td>
<td>Signatures (public key + hashing)</td>
<td>No longer secure</td>
</tr>
<tr>
<td>SP 800-56A/B</td>
<td>Pairwise key establishment schemes</td>
<td>Key establishment</td>
<td>No longer secure</td>
</tr>
<tr>
<td>RSA</td>
<td>Public key</td>
<td>Signatures, key establishment</td>
<td>No longer secure</td>
</tr>
<tr>
<td>ECDSA, ECDH (Elliptic Curve Cryptography)</td>
<td>Public key</td>
<td>Signatures, key establishment</td>
<td>No longer secure</td>
</tr>
<tr>
<td>DSA (Finite Field Cryptography)</td>
<td>Public key</td>
<td>Signatures, key establishment</td>
<td>No longer secure</td>
</tr>
</tbody>
</table>

Source: Gartner
Banks have to be concerned about quantum.

---

**Quantum Computing**

**Prepare for Post Quantum — What Is Vulnerable?**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Application</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Key Infrastructure (PKI)</td>
<td>Certificates</td>
<td>PKI will need to be moved to quantum-safe cryptography Existing PKI will be deprecated Credentials will need to be renewed</td>
</tr>
<tr>
<td></td>
<td>Key management</td>
<td></td>
</tr>
<tr>
<td>Digital Signatures</td>
<td>(Contracts (mortgages, agreements) that extend beyond 2022 Secure email Timestamps Hash-based logs and records)</td>
<td>PKI-dependent Hash values will need to be lengthened</td>
</tr>
<tr>
<td>Cryptographic Hash Functions</td>
<td>Integrity checks Logs Password security</td>
<td>Hash values will need to be lengthened</td>
</tr>
<tr>
<td>Blockchain/Public Ledgers</td>
<td>Contracts Cryptocurrency Proof of work</td>
<td>PKI-dependent Credentials will need to be reissued Hashes lengthened Blockchains may need to be resigned</td>
</tr>
<tr>
<td>Data Security</td>
<td>Stored/Encrypted data S/SSL/TLS</td>
<td>Personal records where data needs to be secret for decades 70 years or more PKI-dependent Key storage and exchange will need new protocols</td>
</tr>
</tbody>
</table>

Move to quantum safe algorithms as providers make them available …

Source: NIST Guide

---

**Quantum Resistant: Future-Proof Now**

SecureRF’s methods are quantum-resistant to all known attacks

“The National Security Agency is advising US agencies and businesses to prepare for a time in the not-too-distant future when the cryptography protecting virtually all email, medical and financial records, and online transactions is rendered obsolete by quantum computing.”

Source: Ars Technica, August 21, 2015

“...We must begin now to prepare our information security systems to be able to resist quantum computing.”


Security Essentials for IoT Product Developers – SecureRF 2017
Quantum Computing

Quantum Resistance

- Two important quantum methods: Shor's Algorithm and Grover's Search Algorithm
- Grover's Search Algorithm reduces security level (e.g., AES-128 becomes 64-bit secure)
  - Doubling the security of GTC requires doubling the key size which only doubles the runtime
- Shor: Breaks ECC, RSA, and DH by quickly factoring/solving the discrete log problem
  - Requires the method's math be Finite, Cyclic, and Commutative
  - GTC is neither Cyclic nor Commutative, and the underlying group is Infinite - Shor does not apply

Quantum computing positions the qubits and then reads them.

Qubit = electrons.

Need 150-300 qubits to do meaningful work.

Need an oscilloscope to read qubits.
Quantum computers are different from the digital computing that drives today’s data centers, cloud environments, PCs and other devices. Digital computation requires data to be encoded into binary digits (bits), each of which is always in one of two definite states (0 or 1). However, quantum computation uses quantum bits (qubits), which can be in multiple states simultaneously. As a result, operations on qubits can amount to a large number of calculations in parallel. It has been shown that in theory, some specific problems should be solvable in much less time on a quantum computer than using the best known algorithms for a conventional computer. Here are four key concepts that are the foundation of quantum computing.

1. **SUPERPOSITION**
   Think of classical physics as a coin. It can be either heads or tails. If it were a bit, it would be 0 or 1. In quantum physics, this coin is best thought of as a constantly spinning coin. It represents heads and tails simultaneously. As a result, a qubit would be both 0 and 1 and spin simultaneously up and down.

2. **ENTANGLEMENT**
   Entanglement gives quantum computing the ability to scale exponentially. If one qubit simultaneously represents two states, two qubits represent four states when coupled together. They can no longer be treated independently; they now form a coupled, or entangled, super state. As more qubits link together, the number of states exponentially increase, which could lead to a computer with astronomically large computing power.
3 **FRAGILITY**

Quantum states are quite fragile. If you measure, observe, touch, or perturb any of these states, they collapse to a classical state. The states don't stick around for very long, which is why quantum computers are currently hard to build.

4 **NO CLONING**

A corollary to fragility is the 'No Cloning Theorem.' In classical physics, if two bits are represented by the coins below, one can copy or eavesdrop and recreate the information. In contrast, the information entangled within a set of qubits will be lost if someone tries to observe or copy them. A quantum state cannot be copied without the sender or receiver realizing this. This concept serves as the basis of quantum communications.

Quantum computing holds a credible promise of radically enhanced performance, with the potential to solve specific complex problems that are practically unsolvable by today's computers. Development of actual quantum computers is still in its infancy, but quantum computing has the potential to solve complex simulations such as large-scale financial analysis and more effective drug development.

- Free quantum computing is available on the web today.
Don’t ignore quantum computing!

![Quantum computer system stack](image)

**Figure 2.7: Quantum computer system stack [16]**

---

**Recommendations**

- Learn all you can about quantum computing now while you have time.
- Increasing awareness of across research and application teams.
- Minimize risk by utilizing quantum as a service (QCaaS) techniques to start becoming familiar with quantum algorithms — still experimental.
- Begin by selecting quantum programming approaches that are supported across cloud and QC platforms.
- Focus on quantum algorithms that could potentially solve real world problems.
Mobile Security Strategy

How to Evolve Your Mobile Security Strategy in 2018

Overview
Research and presentation by Mr. Eric Maiwald of Gartner.
Mobile Security Strategy

Phase 1 — Prework
1.1 Gather Data Requirements for Mobile Devices
1.2 Gather Business Requirements (Mobile Applications, Mobile OS, and Customer Specifications)
1.3 Build Out Mobile Security Education and Awareness Training

Phase 2 — Mobile Strategy
2.1 Mobile Security Strategy Compute
2.2 Define Mobile Security Policies and Rules
2.3 Define Mobile Security Communications
2.4 Define Mobile Security Requirements
2.5 Define Mobile Security Enforcement
2.6 Define Mobile Security Operations
2.7 Define Mobile Security Requirements

Mobile Threat Defense Architecture

Cloud-Based Protection
- Behavioral Anomaly & Config. Change
- Network Control (UTM/VPN)
- Mobile Telemetry
- Mobile HW versions
- Mobile OS/Security Vulnerabilities
- Wireless Network Database
- Mobile App Risk Database
- Crowdsourced TI

On-Device Protection
- Application Protection
- Network Protection
- Device Protection

MTD Vendors
- SYMANTEC
- ZIMPERIUM
- LOOKOUT

MTD Integration to UEM/EMM

UEM/EMM Controls
- Network Control (VPN)
- Application Deployment & Control
- Access Control (Conditional Access)
- Device & Config. Management
Corporate Managed Security Strategy Recommendations

✓ Evaluate the risks and new tactics being leveraged on mobile devices by malware by keeping current with mobile threat reports.
✓ Set minimum mobile OS and device standards.
✓ Enforce applications are installed only from trusted sources (Google Play, Apple Store, Windows Store or Enterprise Apps Store).
✓ Evaluate mobile threat defense (MTD) solutions with cloud-based application reputation services with EMM enforcement.
✓ Deliver training to drive user awareness of which permissions mobile applications are requesting. This approach can help reduce unwanted applications from being installed.

BYOD Security Strategy Recommendations

✓ Evaluate the risks and new tactics being leveraged on mobile devices by malware by keeping current with mobile threat reports.
✓ Set minimum mobile OS and device standards.
✓ Verify applications are installed only from trusted sources (Google Play, Apple Store, Windows Store or Enterprise Apps Store).
✓ Evaluate mobile threat defense solutions with cloud-based application reputation services.
✓ Enforce adaptive access based on the state of the device.
✓ Deliver training to drive user awareness of which permissions mobile applications are requesting. This approach can help reduce unwanted applications from being installed.
Innovation Culture

Overview
Research and presentation by Mr. Jake Knapp – New York Times Best Selling Author.

- Best individual keynote of the conference.
  - Very engaging presentation.
Mentioned the problem we all have with current methods where he would start putting appointments on his calendar and it was looking good and doable:

But then he was slammed all week and it was getting complicated and crammed and becoming unmanageable:

His calendar then got so stuffed he had to color code it to better track stuff:
Finally with multiple back-to-back appointments and overbookings, the calendar started to make him feel like the frog in the Frogger Game where it was all he could do to just start each day (bottom of game) and try to reach the end of the day (top of the game) alive:

- There has GOT to be a better way. So he decided on a new approach.
• On Monday, make a map for the week and design your time.
  ○ Generally the default for the week is to do everything at once in a multi-tasking world, but how about instead focus on one key moment and completing it?

  ○ Decide what needs to be accomplished:

  ○ Then target specifically what you want to finish this week – what is doable:
• On Tuesday, sketch out a solution:

• Base solution on the groups ideas:
  o Default is to brainstorm, but that wasn't working for a variety of reasons.
  o How about with a sprint, have each person come up with an idea on their own at the group desk, or their own desk, or wherever is comfortable for them. Each person identifies a solution for that idea in good detail using whatever necessary research method they are comfortable with and at their pace:
Then that same day everyone meets back as a group, and everyone presents their idea and their solution so all are equally valued by being given time to voice and explain their solution. Now instead of just brainstorming ideas where extroverts take over, there are a bunch of ideas with solutions from each member of the group, and everyone can think about each solution.

- On Wednesday, the group decides which solution(s) is the best:

  Default with deciding on an appropriate solution is generally endless discussion, but in a sprint environment, it’s fast and decisive through a structured decision process that allows the decider to decide:
On Thursday a prototype is developed:
On Friday test your developed prototype:

- Quit wasting time on:
  - Ideas that suck
  - Arguments
  - Politics
  - Meetings
  - Playing it safe

  Default behavior is to play it safe, but with sprint it is to take big risks.

  Default behavior is one bet, but with sprint it is parallel universes.
• For years, people have told us group brainstorms don’t work. Here are well-written articles on the topic from 2010, 2011, 2012, 2013, 2014, and 2015. And this isn’t some recent trend—half of those articles cite a 1958 Yale study which found that individuals working on their own are emphatically better at problem-solving than teams of brainstormers. And yet, we keep right on brainstorming. We have a problem to solve, we have a group of people, and somebody says, “Let’s brainstorm a few ideas.” We can’t resist.

• The best ideas – the solutions that teams actually executed – came from individual work.

http://jakenapp.com/sandiego
Multi-Cloud Playbook

Your Multi-Cloud Playbook: Strategy, Architecture, Use Cases, and Deciding Which Application to Migrate to Which Cloud

Overview

Research and presentation by Mr. Elias Khnaser of Gartner.

Lock-in is a concern in the cloud, but you can’t eliminate it entirely.

For instance, unexpected lock-in with a cloud provider may occur through the sheer mass of data you have at one provider.

Multi-cloud computing refers to the use of cloud services from multiple public cloud providers for the same purpose. It is a special case of hybrid cloud computing.

- Multi-cloud is a special hybrid cloud case.
- Difficult to figure out if an application should be in Azure, AWS, etc., because the main cloud suppliers are at feature parity.
- Production scenarios are good with redundant multi-cloud.
- Most multi-cloud today is redundant multi-cloud.
- Azure is good for system of record.
- Gartner says that every single inquiry call they receive ends in a multi-cloud conversation.
- What is driving multi-cloud?
- The biggest pull to Microsoft's Azure cloud is Office-365.

- AWS is great for DR.
- High performance computing (HPC) is popular with multi-cloud.
- Cloud providers must allow connections to other data centers.
- VDI can be a challenge in a multi-cloud environment.
- 3rd party PaaS is interesting, difficult, and attractive, but not always possible.
- Continuous multi-cloud that is far away from native communications is very expensive – financial institutions are trying it.
- Workload placement can be generally with either Azure or AWS.
  - Azure is rolling out more availability zones, but currently AWS is better.
- High performance computing (HPC) on spot instances is best with AWS.
- For SMB on CIFS shares go with Azure.
- AWS is more automated with objects.
- SLA’s with Azure are better.
- Multi-cloud architectures are:
  - Redundant Multi-cloud:
  - Composite Multi-cloud:
Multi-cloud Use Case Examples:
Cloud Computing Governance

Adaptive Governance: Coping with the Challenges of Cloud Computing

Overview

Research and presentation by Mr. Douglas Toombs of Gartner.

- Shadow operations expose organizations to unnecessary risks.

- Principle statements should always be:
  - Relevant – grounded in specific contexts relative to the organization.
  - Actionable – readers must be able to grasp what might be required of them.
  - Clear Implications – noncompliance to core principle should have consequences that are practically self-evident.

![IT Spending by Funding Source, 2017](chart)

![Examples of Principles](chart)
Cloud Computing Governance

- Implementing programmatic controls to enable governance:
  - Five key approaches:
    1. Use native tools and capabilities of the cloud provider(s).
    2. Use third-party software.
    3. Use provider native tools + third-party software.
    4. Use provider native tools + in-house developed tooling.
    5. Use provider native tools + third-party software + in-house developed tooling.
  - Most organizations will end up at #5.

Example of Using Provider-Native Capabilities

**Amazon Web Services Identity & Access Management Policy**

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "ec2:*",
      "Resource": "*",
      "Effect": "Allow",
      "Condition": {
        "StringEquals": {
          "ec2:Region": [
            "eu-central-1",
            "eu-west-1",
            "eu-west-2",
            "eu-west-3"
          ]
        }
      }
    }
  ]
}
```

**Microsoft Azure Resource Group Policy**

```json
{
  "if": {
    "not": {
      "field": "location",
      "in": [
        "germanycentral",
        "germanynortheast",
        "germanywestcentral",
        "germanynorth",
        "ukwest",
        "uksouth",
        "westeurope",
        "northeurope",
        "switzerlandnorth",
        "switzerlandwest",
        "francecentral",
        "francesouth"
      ]
    }
  },
  "then": {
    "effect": "deny"
  }
}
```
• IT $$$ is moving outside IT to the business (for VITA that would mean to the agency).

*We need to move away from delivering information technology to the business, to helping deliver information technology through the business …*
Cloud Computing Governance

- Principles, Programmatic Controls and Policies:

**Principles, Programmatic Controls and Policies: An Example**

**Principle**: All organization systems and data should only be accessed by employees or verified subcontractors.

**Programmatic Control**: LDAP or Microsoft Active Directory will be used to maintain a list of active employees and contractors, and systems shall validate access against this prior to allowing access.

**Policy**: Business units self-managing solutions that can not integrate with LDAP/AD will be responsible for disabling accounts for terminated employees in a timely fashion. IT will routinely audit for compliance against this policy.

---

**Guardrails**: Implemented to stop a bad outcome

**Guidelines**: Clearly communicates a risk boundary

---

**PROGRAMMATIC CONTROLS**

---

**POLICIES**
• Solution Path for Enabling Governance of Public Cloud Computing:
Cloud Computing Governance

- Gartner Cloud Adoption Framework:

- Gartner Multi-cloud Governance Framework:
Application Delivery

Application Delivery Showstoppers with a Modern Ecosystem

Overview
Research and presentation by Mr. Jason Dover of KEMP Technologies.

- Three common showstoppers.
  - #1 = Workload Migration to cloud
    - Cloud native, stateless, loose coupling.
    - 50/50 by 2020 in cloud.
    - Cloud apps / On-prem apps.
  - #2 = Evolved Application Architecture (Microservices)
  - #3 = Aligning ADC multi-tenancy to cloud
    - Tighter coupling at physical layer makes it difficult for loose coupling at logical layer.

- ADC scaling = Application Delivery Controller.
- Need a PER-App ADC fabric.
- How your multi-app VM environment might look ahhhhh.
- But apps and VM’s easily multiply, along with the addition of container architecture, or even micro-services architecture, and then you end up with this:
And you end up with...

Why You Now Need a "Per-App" ADC Fabric

- Provision in minutes/hours
- Make instant changes to App Infrastructure
- Dynamically adjust capacity and functionality
- Gain visibility on multi-vendor ADC environment
- Enable hybrid and multi-cloud deployments
- Scale-out / scale-in

Hypervisor

Application Server VMs
ADC licensing:

**How You Pay And License Today**

Cost-per-ADC = Max License Capacity + Hardware Resources

- How many instances & HA Clusters will we need?
- How do we “size” each instance per App?

**How Modern ADC Licensing SHOULD Work?**

...ACTUAL aggregate peak usage – Not # of instances used

Only Pay for What You Use!
90% of the data present in the world today was created in the last two years alone!

Data Visualization

The Future of Data Visualization

Overview

Research and presentation by Mr. Daren Bradham of Gartner.

- Visualization that is already here:
  - A plethora of beautiful charts and graphs.
There are growing capabilities and culture around self-service business intelligence.

- Ability to deploy data visualization techniques throughout the architecture.

Three frontiers for tomorrow’s data visualization:

- New avenues for sensing data.
  - Smell
  - Sound Sculpting
    - Non-contact tactile feedback for feel-able 3D shapes.
    - Exploring volumetric slices through tactile shapes.
  - Touch
    - Render a large number of control points in real-time.
    - Increase tactile strength through optimizations.
    - Perform technical and user evaluations.
Good visualization can empower, spark invention, and initiate discoveries.

- New exploratory tools.
- Data visualization to make breakthroughs.

- Challenges implementing big data analytics in a better way include:
  - Tools are hard to master.
  - Scalability.
    - Companies find it difficult to scale up resources and human capital to meet big data projects that have grown exponentially.
  - Actionable insights.
    - Difficult to directly correlate higher volume of big data with better insights.
      - Primary issue is lack of cohesiveness amongst stakeholders and data scientists.

ABOUT
This visualization displays a live 3D terrain made up of every stock in the U.S. stock market with a market cap at or above one billion dollars. Each box shows a single stock. Stocks are grouped together into industries.

Double-tap to reposition the graphic. Swipe with one finger to rotate or tilt vertically. Pinch to scale.
Augmented Reality (AR) helps to overcome the problems of limited human perception and limitations from dimensions and screen sizes when analyzing big data.

- The problem of scaling for actionable insights is solved effectively by AR.
Data visualization means making data more digestible and actionable for people.

- Keep in mind that sometimes a 3D graphic is not the best visualization for some aspect of data.
- Sensing = More than eyesight – includes sound, touch, etc.
- http://biynabogosian.com/research

Get inspired with visualizing data!
Multi-Cloud Resiliency

Resiliency for Every State of Your Multi-Cloud Journey

Overview
Research and presentation by Mr. Andrew Stone and Girish Dadge of Sungard Availability Services.

- Took the hierarchy of needs and applied it to multi-cloud resiliency.

- Use GitHub for CloudFormation and DataDog for Amazon CloudWatch for integration and scalability.
Multi-Cloud Resiliency

- CloudChecker and Spotinst to check in cost optimization in production.

- Questions to ask for cloud-based recovery:

  ![Cloud Based Recovery Diagram](image-url)

  - How confident are we?
  - Can my stakeholders function?
  - Can we execute without chaos?
  - Can I stay in sync with production?

  - Tested Recovery Time Objective SLA
  - Business Application / Outcome Focused
  - Automated & Orchestrated Recovery
  - Evolving with Production Updates

  - What is cost of downtime?
**Cloud Storage**

Comparing Cloud Storage – Amazon, Google, and Microsoft.

**Overview**

Research and presentation by Ms. Angelina C. Troy of Gartner.

- Cloud storage services:
  - Used for compute storage with EC2, GCE, Azure VMs; primarily single 0-VM
  - Used for compatibility and multi-VM/instance connectivity
  - Used for API-addressable mass storage

- What block storage services are available?

<table>
<thead>
<tr>
<th>Block Storage Services</th>
<th>Amazon Web Services</th>
<th>Microsoft Azure</th>
<th>Google Cloud Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent SSD</td>
<td>EBS gp2 – General Purpose</td>
<td>Premium Managed Disk</td>
<td>Persistent Disk (SSD)</td>
</tr>
<tr>
<td>Persistent HDD</td>
<td>EBS st1 – Throughput Opt.</td>
<td>Standard Managed Disk</td>
<td>Persistent Disk (HDD)</td>
</tr>
<tr>
<td>Ephemeral Storage</td>
<td>EC2 Instance Store</td>
<td>VM Local Storage</td>
<td>GCE Local SSD</td>
</tr>
</tbody>
</table>
Cloud Storage

- Google Cloud Platform (GCP) has the largest volumes and highest noncached IOPS.
- Microsoft Standard has the highest latency, but supports caching.
  - Also has a new SSD option called “Standard SSD” that should contribute to reduced latency
  - Caching can make up for higher latencies and lower throughput using persistent HDD.
- Block storage availability statistics:

![Gartner Cloud Decisions — Availability Statistics (Compute)](image)

- Persistent HDD has considerably lower capacity cost than persistent SSD.
- Leverage Gartner’s data and methods for testing.
- Balance compute and storage resources:
  - Compute instance selection is every bit as important as storage selection.
- Do not oversize volumes or select compute instances that are too small.
  - Volumes have performance maximums, but so do compute instances.
- Select persistent HDD services where possible:
  - Many workload do not require SSD performance.
  - This is an opportunity for significant cost savings.
- Set up snapshot management through serverless functions.
Data is your responsibility not theirs – if it gets lost in the cloud then it’s on you, so plan accordingly...

- What object storage services are available?

### Object Storage Services

<table>
<thead>
<tr>
<th>Vendor Platform</th>
<th>Amazon Web Services</th>
<th>Microsoft Azure</th>
<th>Google Cloud Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Usage Services</td>
<td>Amazon Simple Storage Service (S3)</td>
<td>Hot Storage (LRS, ZRS, GRS, RA-GRS)</td>
<td>Google Cloud Storage (GCS)</td>
</tr>
<tr>
<td>Mid-Usage Services</td>
<td>Amazon S3 Standard Infrequent Access (S-IA)</td>
<td>Cool Storage (LRS, ZRS, GRS, RA-GRS)</td>
<td>GCS Nearline</td>
</tr>
<tr>
<td>Low-Usage Services</td>
<td>Amazon Glacier</td>
<td>Archive Storage (LRS, GRS, RA-GRS)</td>
<td>GCS Coldline</td>
</tr>
</tbody>
</table>

- Data distribution design in object storage:

- Data distribution in object storage:

<table>
<thead>
<tr>
<th>Provider</th>
<th>Multiple Zone</th>
<th>Single Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS</td>
<td>S3 Glacier</td>
<td>S3 Z-IA</td>
</tr>
<tr>
<td>Google</td>
<td>Multi-Regional* Regional</td>
<td>N/A</td>
</tr>
<tr>
<td>Microsoft</td>
<td>ZRS GRS/RA-GRS**</td>
<td>LRS</td>
</tr>
</tbody>
</table>
- Eleven-9’s durability although no durability SLA.
- Options are available for multiple regions:
  - CRR for AWS
  - Multi-regional for Google
  - GRS for Microsoft
- Versioning for AWS and Google.
- Snapshots for Microsoft.

  o Object storage availability statistics:

  ![Gartner Cloud Decisions — Availability Statistics](image)

  o Performance depends on the instance accessing data:
    - Larger instances generally have more throughput.
    - Google allows higher throughput for small instances.
    - Latency is under 1ms (often 0.5ms) for high- and mid-usage.
      - Low-usage is measured in minutes or hours (except Google).
    - AWS has the most consistent throughput.
    - Google has the highest small instance performance, but a lower large instance performance.
    - Microsoft has the highest potential throughput but also highest variability:
      - Note: Latency had to be measure between VMs due to testing method.

  o Object Performance Statistics:
Object storage cost is more than just capacity pricing...

### Cloud Storage

<table>
<thead>
<tr>
<th>Provider</th>
<th>Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS</td>
<td>0.301 ms</td>
</tr>
<tr>
<td>Google</td>
<td>0.355 ms</td>
</tr>
<tr>
<td>Microsoft</td>
<td>N/A*</td>
</tr>
</tbody>
</table>

#### Object Storage Highlights

- **AWS**
  - Amazon S3 and Amazon Glacier use different APIs.
  - Amazon Glacier does not have an availability SLA.
  - Amazon Macie can detect sensitive data in S3 / Glacier.
  - S3 Select and Glacier Select can return a subset of an object.

- **Google**
  - Multi-regional does not expose the regions it uses.
  - Public objects are automatically cached on the edge network.

#### Object Storage Costs:

<table>
<thead>
<tr>
<th>Service Class</th>
<th>Capacity Cost per GB per Month</th>
<th>PUTs/Month</th>
<th>GETs/Month</th>
<th>Data Retrieval</th>
<th>Egress</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Usage</td>
<td>First nonfree tier</td>
<td>250</td>
<td>1,000</td>
<td>1 GB</td>
<td>100 MB of first nonfree tier</td>
</tr>
<tr>
<td>Mid-Usage</td>
<td>First nonfree tier</td>
<td>500</td>
<td>500</td>
<td>500 MB</td>
<td>50 MB of first nonfree tier</td>
</tr>
<tr>
<td>Low-Usage</td>
<td>First nonfree tier</td>
<td>100</td>
<td>10</td>
<td>10 MB</td>
<td>1 MB of first nonfree tier</td>
</tr>
</tbody>
</table>

Source: "Includes Object Storage with In-Depth Information"

*Testing methodology not possible in Microsoft Azure

AWS instances: G5, G5i, G5ad
Google instances: n1-standard-2 and n1-standard-8
Microsoft instances: D2v2 and D4v2
- GCS Coldline latency is the same as high- and mid-usage.
- Small instance performance is quiet good by comparison
- Transfer Service can pull data from arbitrary HTTP/HTTPS locations into GCS buckets.

- **Microsoft**
  - Not S3 API compatible by default (must use workarounds)
  - Archive Storage does not have ZRS or an availability SLA
  - Archive Storage early deletion fee is 180 days, no 90 days
  - Can update portions of an object rather than in whole
  - Azure Stack has interesting future potential for distribution and tiering capability.

- **Recommendations for Object Storage:**
  - While the standard service class has the lowest operational cost, a large percentage of the typical organization’s data isn’t operated on so be sure to align the use case to the appropriate service class.
  - Control storage sprawl to avoid sticker shock
    - Focus on timely data deletion and data life cycle.
    - Determine when and if data should be deleted.
  - Focus on operational aspects to differentiate services:
    - How can the service simplify your life and data management?
    - Determine the full cost including operations, retrievals, and egress.

- What File storage services are available?

---

### File Storage Services

<table>
<thead>
<tr>
<th>Vendor Platform</th>
<th>Amazon Web Services</th>
<th>Microsoft Azure</th>
<th>Google Cloud Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFS Storage</td>
<td>Amazon Elastic File System (EFS)</td>
<td>N/A*</td>
<td>Google Filestore (preview)</td>
</tr>
<tr>
<td>SMB Storage</td>
<td>N/A</td>
<td>Azure Files</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Cloud Storage

Recommendations for Cloud Storage in General:
- No provider or service is the best overall.
- Don’t forget to encrypt your data – no significant performance hit doing so.
- Remember that your data is your responsibility.

These File Services Are Quite Different

<table>
<thead>
<tr>
<th>File Protocol</th>
<th>Amazon EFS</th>
<th>Google EFS</th>
<th>Microsoft Azure Files</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing per Month*</td>
<td>$0.30 per GB</td>
<td>$0.20 per GB (standard)</td>
<td>LRS: $0.06 per GB</td>
</tr>
<tr>
<td></td>
<td>$0.30 per GB (premium)</td>
<td>ZRS: $0.075 per GB</td>
<td>GRS: $0.10 per GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>plus operations cost***</td>
</tr>
<tr>
<td>Data Distribution</td>
<td>Across AZs</td>
<td>Within one AZ</td>
<td>Within one AZ (LRS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Across AZs (ZRS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Across Regions</td>
</tr>
<tr>
<td>Max Capacity (per share)</td>
<td>PBs+</td>
<td>64 TB</td>
<td>5 TB</td>
</tr>
<tr>
<td>Max IOPS (per share)</td>
<td>Performance based on throughput</td>
<td>5,000 (standard)</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30,000 (premium)</td>
<td></td>
</tr>
<tr>
<td>Maximum Throughput (per share)</td>
<td>1 GB/s or 3 GB/s (depends on region)</td>
<td>180 MB/s (standard)</td>
<td>60 MB/s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700 MB/s (premium)</td>
<td></td>
</tr>
</tbody>
</table>

*Based on U.S. $, 2024
**Based on current pricing
***10,000 operations vs. 10,000 operations depending on type of operation

Each Hits a Different Cross-Section of Use Cases

- Amazon EFS has a mechanism to move data into Amazon EFS as needed
- Microsoft can cache Azure Files data into on-prem Windows Servers
- EFS-to-EFS Backup and Azure Files Snapshots can provide data protection

Recommendations for Cloud Storage in General:
- No provider or service is the best overall.
- Don’t forget to encrypt your data – no significant performance hit doing so.
- Remember that your data is your responsibility.
Multiple Cloud Networking

Networking Across Multiple Regions and Clouds

Overview

Research and presentation by Mr. Simon Richard of Gartner.
VPC Peering and VNet Peering

$0.01 per GB transfer rate within region

VPC-peering and VNet-peering is now the preferred connectivity across regions for AWS and Azure. In Google, global VPC are preferred.

The WAN Topology Spectrum

- All Internet
- Hybrid MPLS
- All MPLS

= Remote or Corporate Sites
= Data Center
### Multiple Cloud Networking

<table>
<thead>
<tr>
<th></th>
<th>AWS</th>
<th>Azure</th>
<th>Google</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internet Egress</strong></td>
<td>Cost depends on the region and the bandwidth used per month.</td>
<td>Cost depends on the source region and the bandwidth used.</td>
<td>Cost depends on the source region and the bandwidth used.</td>
</tr>
<tr>
<td></td>
<td>Updated pricing is available <a href="#">here</a></td>
<td>Updated pricing is available <a href="#">here</a></td>
<td>Updated pricing is available <a href="#">here</a></td>
</tr>
<tr>
<td><strong>Cross-Region Traffic</strong></td>
<td>Cost depends on the egress region. $0.02/GB in North America and Europe. Special pricing between U.S. East (N. Virginia) and U.S. East west/central7/Ohio at $0.01/GB.</td>
<td>Same as Internet egress cost.</td>
<td>Egress with region in the U.S. at $0.01/GB.</td>
</tr>
<tr>
<td></td>
<td>Updated pricing is available <a href="#">here</a></td>
<td></td>
<td>Egress outside the U.S. at Internet egress rates.</td>
</tr>
<tr>
<td><strong>Inter-region VPC and VNet Peering</strong></td>
<td>Same cost as Inter-region cross-region traffic.</td>
<td>VNet ingress and egress costs are charged on both sides of the connection, based on the region.</td>
<td>Same as Internet egress cost.</td>
</tr>
<tr>
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<td>Updated pricing is available <a href="#">here</a></td>
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</tr>
<tr>
<td><strong>Private Interconnect Data Transfer Cost</strong></td>
<td>Depends on the source AWS Region and AWS and Direct Connect location. Varies from 2$/GB within U.S. to 1$/GB from Australia to South Africa.</td>
<td>Egress traffic charges only. Varies from 2.5$/GB from North America to where? Also offers unlimited data plans.</td>
<td>Egress traffic charges only. Depends on the source region. Varies from $0.5/GB from within the US to 4$/GB in Australia.</td>
</tr>
<tr>
<td></td>
<td>Updated pricing is available <a href="#">here</a></td>
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</tr>
</tbody>
</table>

### Recommendations

- ✓ Create VPC and VNet transit network, managed by NetOps, to connect regions and providers.
- ✓ Leverage VPC and VNet peering for region to region connectivity within a provider.
- ✓ Build a cloud edge leveraging a colocation hub when using more than one MPLS network carrier. Once built, decide which functions to centralize in the cloud edge instead of duplicating them in each of the cloud providers.
Virtual Desktops

**VDI, DaaS, or Hybrid? The Best Virtual Desktop Approach for Your Business**

**Overview**

Research and presentation by Mr. Mark Lockwood of Gartner.

- **VDI** = On-premises hosted
  - On-premises-hosted infrastructure and virtual desktops, control plane in cloud or on-premises – designed by you and managed by you.

- **DaaS** = Cloud-hosted
  - Desktop-as-a-Service cloud-hosted infrastructure and virtual desktops, control plane in cloud – designed by cloud vendor, managed by cloud vendor and you.

- **Hybrid** = On-premises-hosted and cloud-hosted
  - On-premises and cloud-hosted infrastructure, control plane in cloud – designed and managed in both ways.

- Need to ask yourself five questions for VDI:
  - What are you trying to accomplish?

Implementing virtual desktops where they don't belong will guarantee failure and user distrust.
Virtual Desktops

- What are my use-cases?
- Where are my users?
- Where is my data?
- What is the cost?

- Managing the performance of VDI is tricky and is the most sensitive to change.
- There is no magic number for a VDI implementation in an organization – could be 10% or could be 100%.
- VDI and DaaS is highly susceptible to a user breakage.
- Have to segment user base on how they use their desktops when figuring out what would be the best deployment of a VDI solution throughout the organization.
- Really have to watch graphics with VDI and DaaS.
- What are you trying to accomplish?
  - Server virtualization does not equal VDI success.
  - Cloud IaaS success does not equal Desktop-as-a-Service (DaaS) success.
  - Common reasons to implement VDI:
    - Overcoming distance
    - Enhanced data security
    - Centralization
    - Non-persistence
  - Common reasons to implement DaaS:
    - Overcoming distance
    - Proximity to cloud apps
    - Elimination of complexity of VDI
    - Move to OPEX cost model
    - Elasticity

- What are my use cases?
  - What use cases fit?

---

The Two Aspects of Virtual Desktop Use Cases

Understand your applications

Understand user workstyles
- Where are my users?
  - User location determines use experience.
    - Further away user is from the data location, then higher latencies incurred resulting in lower user productivity, and negative experiences
- Where is my data?
  - Data needs to follow your users
What is the cost?

- VDI does not save money over physical deployments – 15%-20% more than physical desktop deployments.
- Must be able to explain the value that virtual desktops bring that makes additional cost worthwhile.
- Choose DaaS to reduce upfront capital costs and management costs, and to allow for elasticity and highly distributed workforce.
- Choose VDI for greater data access speed, a larger ecosystem, and more control over your virtual desktop environment.
- Centralization is a great use case for VDI.
- Non-persistence is a huge value for VDI.
- Choose a hybrid solution (VDI and/or DaaS) when you have significant use cases for both VDI and DaaS.
- Choose to remain on physical systems if neither DaaS nor VDI offer obvious productivity and security enhancements.
- Do not rush! There are many, many ways to fail with desktop virtualization; slow and steady... wins!

No one answer is right for all scenarios.

Remember that physical could be the right choice.

The best desktop for IT may be a total failure for users.
- DaaS (Desktop as a Service) is managing to an SLA.
- Elasticity = pay for desktops needed only when used.
  - For example, tax preparation occurs five months out of the year then no need to pay for idle resources for the rest of the year.
- Data for DaaS = Data users manipulate.
Agile Skills and Practices

Become an Agile Superhero: Skills and Practices to Succeed

Overview
Research and presentation by Mr. Bill Holz of Gartner.

- Team is accountable.
- SME will hinder agility – all have to be the "expert" / multi-skilled.

- Mature agile team may not need a full time scrum master.
- 90% are doing scrum if they’re doing agile.

Perfection is the enemy of done.
• Two people coding together has been shown to be quicker.
• No bigger waste than delivering the wrong thing.
• Rework is waste.
• Amazon is a DevOps company.

"I have experienced many instances of being obliged by better information, or fuller consideration, to change opinions even on important subjects, which I once thought right, but found to be otherwise."
Operational Databases

Choosing the Right Cloud Platform for the Next Generation of Operational Databases

Overview

Research and presentation by Ms. Lyn Robinson of Gartner.

Comparing On-Premises and Cloud Database Platforms

- CosmoDB (Azure) is used in speed and persistence layer.
- A noSQL database is different than an on-premise database.
- DynamoDB for AWS is preferred.
- Data consistency is problematic for both CosmoDB and DynamoDB.
- Cloud databases are not perfectly elastic – you have to preprovision their capacity and watch to see if you have provisioned enough.
- Hot pathing = speed path.
- Cold path = persistence path.
- AWS setup function = overall program logic.
- API-in-the-sky is like pie-in-the-skyyyyy.
- LA = Logic App.
- Use strategic vendor approach for database cloud choices.
- Homogeneous = moving from Oracle on-premise to Oracle cloud.

- Database tools in the cloud scale bigger.
Cloud Database Pricing

- Can be difficult to predict, but is efficient once established:
  - Amazon DynamoDB and Azure Cosmos DB are priced based on preprovisioned throughput for reads and writes.
  - Relational database servers are based on storage and compute


The Benefits of dbPaaS

AWS

Azure

(Database software major version upgrades)
Managed Private Cloud

- Azure on-premises offerings:
  - SQL Server Stretch Database
  - SQL Server Data Files in Azure
  - Azure Stack with SQL Server
- Oracle Cloud on-premises offerings:
  - Oracle Cloud at Customer with Oracle Database
- AWS and Google:
  - No similar offerings

Migrating Databases From On-Premises to the Cloud

- Amazon RDS databases are not 100% compatible with their on-premises counterparts:
  - No access to server one which the database is running, no access to certain system tables.
- Azure SQL Database is not 100% compatible with Microsoft SQL Server:
  - SQL Server Managed Instance, when it is released, will provide a smoother option, and will be suitable for many but not all migrations.
- Hence, every database migration is a project.
Operational Databases

Migrating Databases From On-Premises to the Cloud

- Oracle has database offerings on Oracle Cloud that are 100% compatible with their on-premises counterparts:
  - Oracle Database Cloud Service — Bare Metal.
  - Oracle Database Exadata Cloud Service.
  - Oracle Database Exadata Cloud at Customer.
- Oracle is currently building out their cloud platform.

- Gartner recommends making cloud the default deployment option for enterprise database systems.
  - Justify any databases that remain on-premise
  - Perform new development in the cloud
  - Migrate legacy on-premises databases to dbPaaS where feasible
- Focus DBA’s on:
  - Solution architecture
  - Performance optimization
  - Database DevOps
  - Security and compliance
  - Researching and development with new data-related technologies
- Adopt a multi-vendor approach to mitigate concerns of cloud vendor lock-in
  - Use a primary cloud vendor for a majority of workloads
  - Use a second cloud vendor as an alternative
  - Consider Azure if yours is primarily a Microsoft shop
  - Explore AWS for moving diverse technology to the cloud
Identity Analytics

How Analytics, Machine Learning, and Artificial Intelligence (AI) are shaping the Future of IAM

Overview

Research and presentation by Ms. Lori Robinson of Gartner.

- Unable to keep up with the attacks.
- 90% of breaches are thru privileged access.

Analytics, ML, and AI bridge the gap between access controls and user activity and provide for continuous, contextual risk-aware IAM.

Identity Analytics Capabilities ...

- Data Mining and Aggregation
- Dynamic Risk Evaluation
- Identity Correlation and Profiling
- Data Presentation and Visualization
- Machine Learning, Behavioral Analytics, AI
- Continuous Monitoring, Alerting and Remediation
Most IAM innovation is coming from machine learning and behavioral analysis.
Orthodox Authentication Methods (FIPS Pub 41)

Type 1: Something (only) the person *knows*
- Costly to Support
- Easily Compromised
- Frustrating
- Privacy Concerns
- Presentation Attacks
- Enrolment

Type 2: Something (only) the person *has*
- Costly to Acquire
- Costly to Provision
- Inconvenient

Type 3: Something (only) the person *is*

Trusted Identity Capabilities Model (TICM)

Third-Party Credentials:
- Physical:
  - National ID Card
  - Driving License
  - Payment Card
- Digital:
  - Social Login
  - Bank ID
  - GSMA Mobile Connect

Curated Credentials:
- Orthodox Authentication Methods:
  - Passwords
  - Tokens
  - Active Biometric Models

Familiarity Signals:
- Trusted Device, Location
- Entity Link Analysis
- Social Footprint
- Normal Behaviors
- Passive Biometric Models

Risk Signals:
- Malware Detection
- Short Phone/Email Lifetime
- Anonymity
- Location Mismatch

Anomalies:
- Other Deviations From Normal Behaviors

Attack Signs:
- Device Spoofing
- Nonhuman Behavior
- Attacker-Like Behavior
- Probing

Identity Corroboration

Identity Dissonance
Analytics help achieve effective and continuous IAM.
*Give strong consideration to implementing identity analytics if your organization meets one or more of the following criteria:

- Is a large, regulated organization that has embraced a risk-based approach to IAM.
- Relies on one-time allow/deny gating for user authentication.
- Understands that advanced IAM reporting is insufficient and desires risk-aware, continuous monitoring.
- Experiences access certification fatigue.
- Encounters widespread assignment of excessive privileges.
- Has high usage of privileged access.
- Suspects the presence of abandoned or orphaned accounts.
- Has general gaps in security analytic infrastructure and experience with analytic tools.

- Document use cases before selecting a vendor.
- Look for vendors that incorporate machine learning / behavior analytics.
- Analytics is bridging the gap between ID and access controls.
- Real power of IAM is aggregation from other sources.
- Analytics methods are emerging.
- IAM = Admin, Author, and Assurance groups/disciplines – analytics spans all three.

### Vendor Landscape

<table>
<thead>
<tr>
<th>Adaptive Access</th>
<th>IGA</th>
<th>PAM</th>
<th>CIAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainwave GRC, CA Technologies, Certifly, IBM, RSA (FortiScale), Guruul, Okta, Oracle, Ping Identity or Entr熙am, RSA, Securonix</td>
<td>Brainwave GRC, CA Technologies, SecureAuth + Core Security, Guruul, Hitachi ID, IBM, Micro Focus, One Identity, Oracle, SailPoint, Savvynt, Securonix</td>
<td>BeyondTrust, CA Technologies, Centrify, CyberArk, Guruul, One Identity, Thycotic, Savvynt, Securonix</td>
<td>Jamrath, ForgeRock, SAP (Shyva), jWelcome, Microsoft, Oracle, Ping Identity, Salesforce</td>
</tr>
</tbody>
</table>

*Not an exhaustive list of vendors, rather a sampling of vendors in each segment.

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Gartner.®
- Adaptive access is the most mature IAM area.
- ID proofing hard in a digital world.
- Governance = Develop policy and verify policies are followed.
Cloud Native Strategies

Developing Cloud Native Strategies and Architectures

Overview

Research and presentation by Mr. Simon Richard of Gartner.

- What it looked like when first heading to the cloud:

- What the road to cloud looks like today:

- Develop cloud strategy: Assess applications based on risk, benefits, and effort, then balance all three against the feasibility.
- Expect disruption caused by cloud analytics.
Establish cloud skill sets: Develop the IT brokering function
By 2020, organizations that lack cost optimization processes will average 40% overspend in the public cloud.
Cloud Native Strategies

Architect for availability in the cloud.

Compare and Select Providers Based on Technical Capabilities

<table>
<thead>
<tr>
<th>IaaS Provider</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Web Services</td>
<td>92%</td>
<td>94%</td>
<td>93%</td>
</tr>
<tr>
<td>Microsoft Azure</td>
<td>88%</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>Google Cloud Platform</td>
<td>70%</td>
<td>80%</td>
<td>85%</td>
</tr>
</tbody>
</table>

Integration Happens at Different Levels

- Management
  - Cost Control
  - Monitoring/Reporting
  - Intelligent Placement
  - Security Governance
  - Capacity Management
- Applications
  - API, Service Bus
  - Application Integration
  - Stretched Database
  - Data Integration
- Cloud/Virtualization
  - Cross-Silo Orchestration
  - VM Mobility
  - Container Mobility
  - Workload Bursting
- Infrastructure
  - Network Connectivity
  - Identity/Access
  - Backup and DR
  - Storage Gateways
  - Colo Storage
Cloud Native Strategies

Why Must We Design for Multicloud?

- Risk Mitigation
- Reduced Lock-in
- Availability
- Unique Innovation by Providers
- Mergers and Acquisitions
- Use-Case-Driven — e.g., Office 365

Architect to Secure and Mitigate Risks

Authorize

- Control who has access to cloud services

Protect

- Leverage CSP security controls

Audit

- Establish an audit process
Automating broken processes only breaks things faster!

Cloud Native Strategies

Find the low-hanging fruit

Enable Self-Service

User Self-Service

Workloads/Service Catalog


Data Center Vm. Private IaaS No. 1 Public IaaS No. 2 SaaS No. 1 SaaS No. 2
Five Self-Service Approaches

01 Provisioning Individual Resources
02 Provisioning Preapproved Templates
03 Provisioning User-Supplied Templates
04 Cloud Provider Access with Guardrails
05 DevOps Enablement with Guardrails

The Automation and Orchestration Cycle
Cloud Native Strategies

Embrace AIOps

The Cloud Management Wheel

Gartner
Architect the Internet of Things (IoT) Using the Gartner Reference Model

Overview

Research and presentation by Mr. Kyle Hilgendorf of Gartner.

The Gartner IoT Reference Model: Layers, Tiers and Interfaces

- **Tiers** define where a component, function or process operates in the IoT architecture.
- **Layers** define what behavior an IoT component, function or process must possess.
- **Interfaces** define how data and control flow into, out of and through the system.

Reference Model Tiers Define Logical Deployment Locations

<table>
<thead>
<tr>
<th>Edge Tier</th>
<th>Platform Tier</th>
<th>Enterprise Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical/Digital interface</td>
<td>Global ingestion/analysis</td>
<td>Business systems</td>
</tr>
<tr>
<td>Local ingestion/analysis</td>
<td>Event processing</td>
<td>Workflow processes</td>
</tr>
<tr>
<td>Local/Distributed</td>
<td>Policy and orchestration</td>
<td>IT services</td>
</tr>
<tr>
<td>Sensors and actuators</td>
<td>Algorithms and applications</td>
<td>Operations</td>
</tr>
</tbody>
</table>

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Architect your IoT system using the Gartner IoT reference model – decompose complexity using layers, tiers, and interfaces.
Finance Team Collaboration

Outcome: Analysis of how the IoT cloud platform will impact operational cost.

Security Team Collaboration

Outcome: Increased awareness, communication and analysis of security risks.
IoT and Gartner Reference Model

Application Development Team Collaboration

Outcome: Improved software integration with end-to-end architecture.

Operations and Governance Teams Collaboration

Outcome: Better system operation and project governance.
Use your cloud model/blueprint to collaborate with stakeholders while iteratively refining the blueprint based upon stakeholder feedback.

- Edge tier is where physical meets digital.

Outcome: Enhanced overall experience and improved business outcomes.

**Basic Premises**

- **Devices**
  - send and receive data interacting with the
- **Network**
  - where the data is transmitted, normalized, and filtered using
- **Edge Computing**
  - before landing in
- **Data storage / Databases**
  - accessible by
- **Applications**
  - which process it and provide it to people who will
- **Act and Collaborate**

Building the Internet of Things (IoT) – Cisco
Internet of Things (IoT) Conceptual Architecture Model – Microsoft
Self service capability is a huge driver.

UTO – Digital Transformation

Driving Digital Transformation with Intelligent Technologies

Overview
Research and presentation by Ms. Joanne Fletcher of the City of San Diego.

Unable to obtain (UTO) presentation deck through reasonable efforts.
Microstrategy helps to turn the culture in an organization.

--

UTO – Disparate Data

Rubber Meets the Road: Driving Insights from Disparate Data

Overview

Research and presentation by Mr. Cameron Forbes of Falken Tire.

Unable to obtain (UTO) presentation deck through reasonable efforts.
Security is still high on delaying to cloud.

Do not necessarily get rid of your on-premise solution.

There is risk for data in motion to/from the cloud, and on data at rest in the cloud.

**UTO – Hybrid Governance**

**Hybrid Governance Demands Hybrid Execution**

**Overview**

Research and presentation by One Identity.

Unable to obtain (UTO) presentation deck through reasonable efforts.

There is risk for data in motion to/from the cloud, and on data at rest in the cloud.
She believes the solution for the IT talent shortage is more women.

She identified herself several times as a feminist with a capital “F”.

Just because you failed does not mean you should not try anymore.
How do you monitor / manage microservices when they're up for less than a minute?

30% of microservices fit this situation…
Report Contact Information

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Enterprise Architect
robert.kowalke@vita.virginia.gov

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11751 Meadowville Lane, #1W-E1, Chester, VA 23836

Signature Series spotlight

Top 10 Strategic Technology Trends for 2018

- Intelligent
  - AI Foundations
  - Intelligent Apps and Analytics
  - Intelligent Things
- Digital
  - Digital Twins
  - Cloud to the Edge
  - Conversational Platform
  - Immersive Experience
- Mesh
  - Blockchain
  - Event-Driven Model
  - Continuous Adaptive Risk and Trust

Gartner Top Strategic Predictions for 2018 and Beyond

1. Consumers Favor Visual and Voice Search
2. Digital Giants Self-Disrupt
3. Legitimized Cryptocurrencies
4. Increased Fake News
5. Counterfeit Reality Overtakes Reality
6. Bots Take Over
7. Versatility Wins Over Specialization
8. AI Creates More Jobs Than It Takes
9. IoT in Everything
10. Assume IoT Security Vulnerabilities

Gartner Predicts: By 2020, 85% of CIOs will be piloting AI programs through a combination of buy, build and outsource efforts.