We don't think about the road, unless it inhibits reaching our destination

Business Case for IPv6 on IoT

Joe Klein, CTO Disrupt6
Fellow, IPv6 Forum
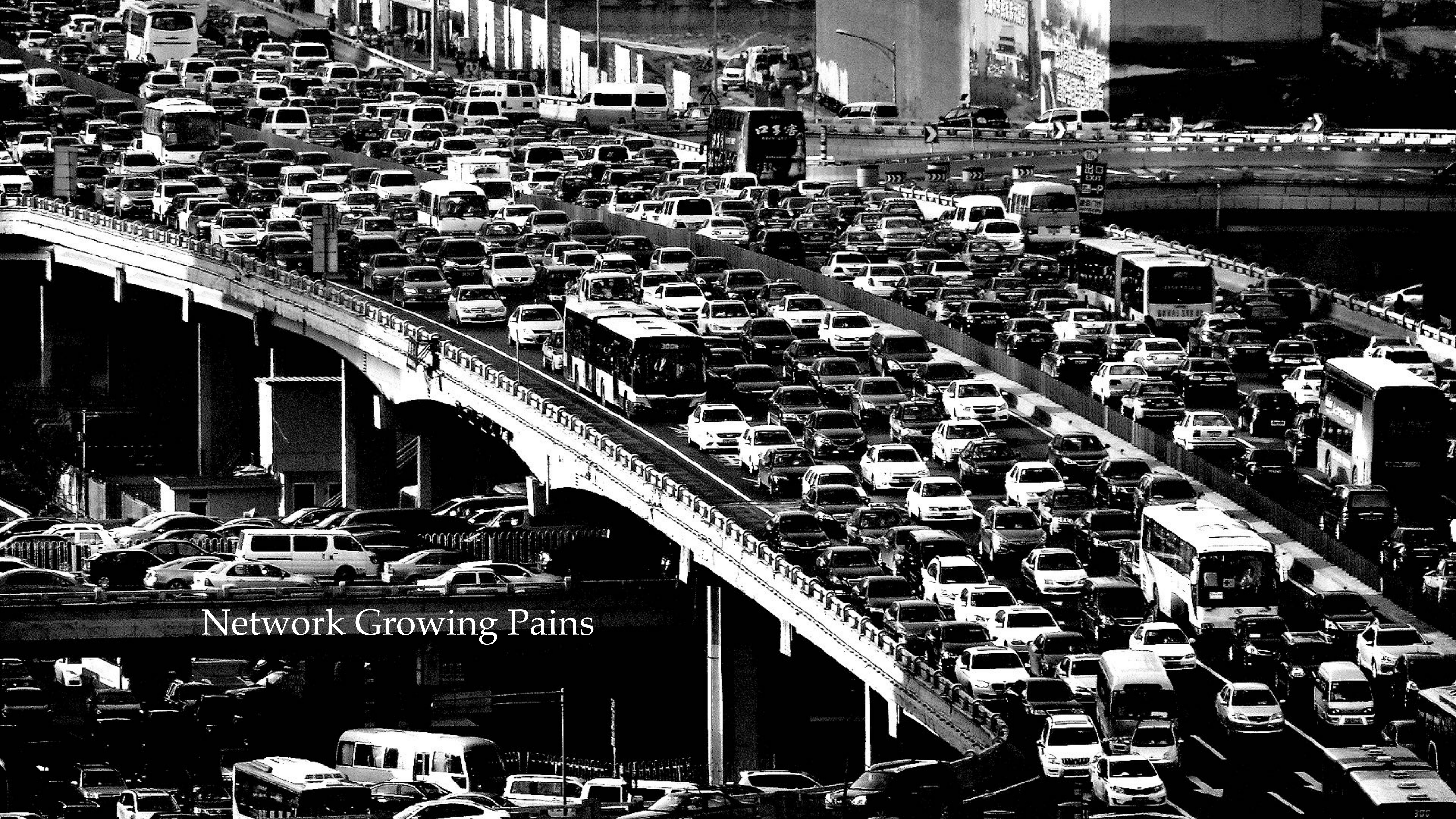#JoeKlein   joe.klein@disrupt6.com
+1.703.594.1419

Networks Bridge Distance

Limitations of IPv4

Network Growing Pains
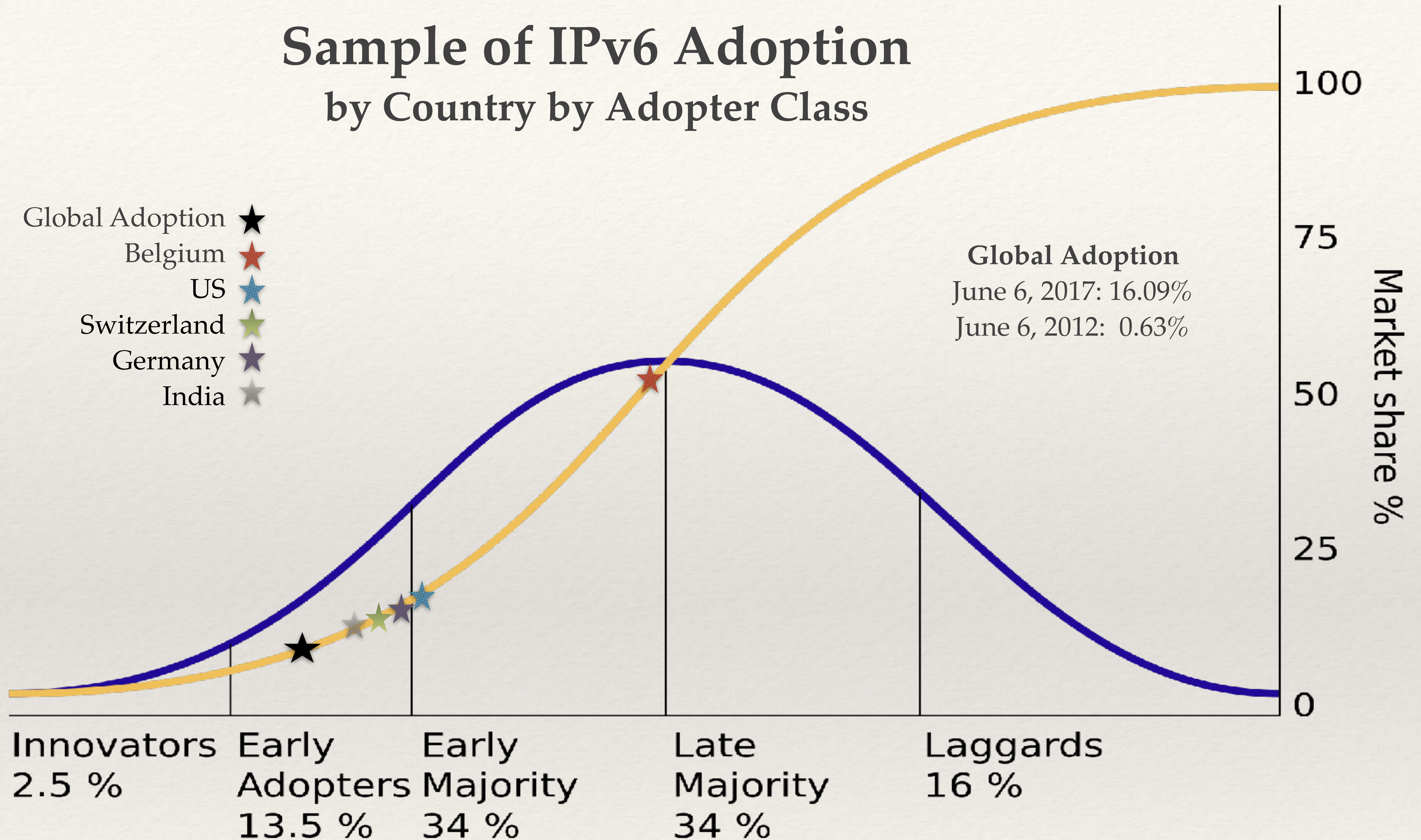
Short Term Decisions to Bridge the Distance

IPv6 Only

Networking

Sample of IPv6 Adoption
by Country by Adopter Class

Global Adoption ★
Belgium ★
US ★
Switzerland ★
Germany ★
India ★

Global Adoption
June 6, 2017: 16.09%
June 6, 2012: 0.63%

Market share %

100

75

50

25

0

Innovators
2.5 %

Early
Adopters
13.5 %

Early
Majority
34 %

Late
Majority
34 %

Laggards
16 %

IPv4 End of Life

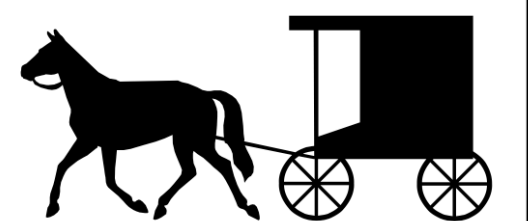**Internet Architecture Board**

Home   About   Activities   Documents   Liaisons   Appeals   IAB Mailing Lists

The IAB expects that the IETF will stop requiring IPv4 compatibility in new or extended protocols. Future IETF protocol work will then optimize for and depend on IPv6.
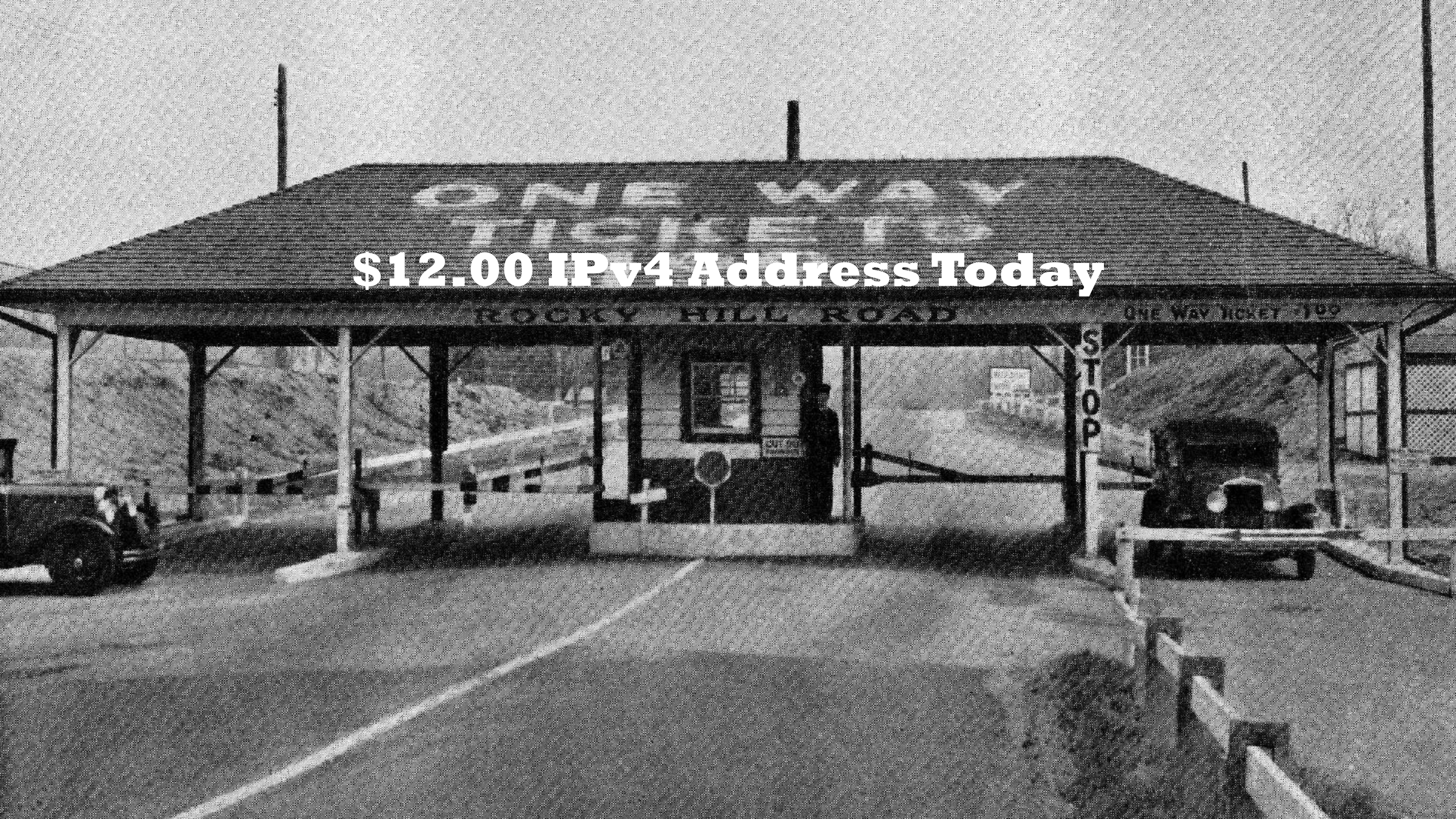
Posted on 2016-11-07
by Cindy Morgan

⚠ CAUTION

Legacy IP Only
This product does not support the current generation of the Internet Protocol, IPv6.

$12.00 IPv4 Address Today

Wells Fargo

- Greater space for growth
- Reduced requirement for readdressing duplicate address space in mergers/acquisitions
- Support for low-functionality end-points that may lack DHCP and static addressing capabilities (IoT, even Android devices)
- Reduce reliance on NAT (and associated logging complexity)
- More universally geo-locate address space (assuming ULA usage is reduced compared to RFC1918)
- Simplification of routing tables through improved summarization
- International Commerce

Decrease CAPEX
Increase Growth
Decrease OPEX
Competitive
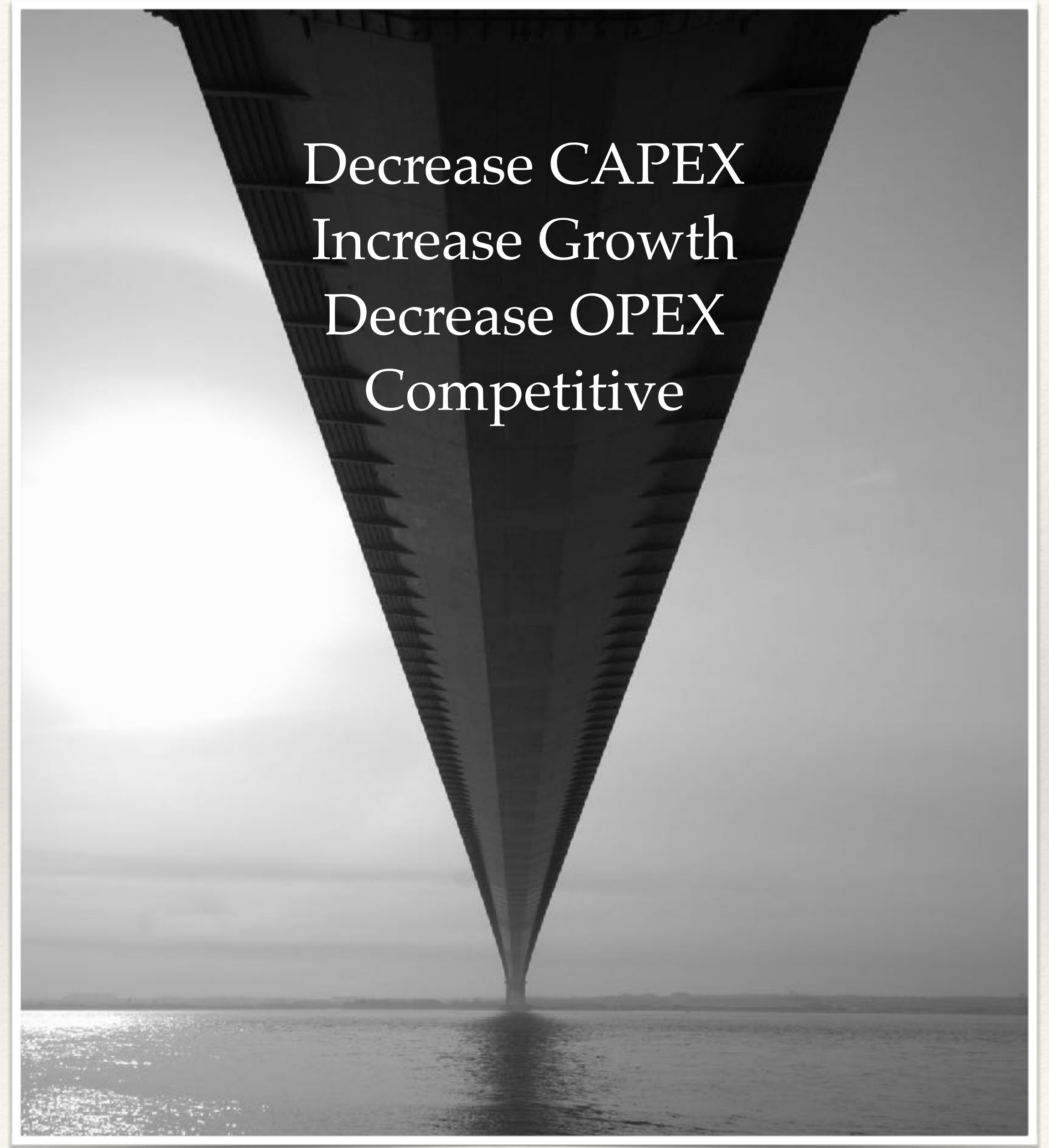
Microsoft

- Improved peer-to-peer networking for communications
- Personalized user experience using IP-based location services
- We see minor performance benefits as address translators are removed and implementations are improved NAT64 & NAT 444 (CGN) obscure location data, and cause service failures
- Market opportunities increase when customers mandate IPv6 support
- IPv6 allows faster infrastructure growth for services experiencing rapid customer usage
- *"Microsoft corporate IT efforts are based on a belief that IPv6 support is a cost of business, with returns on investment to be seen only over a very long time frame".*

User Experience

Decrease CAPEX

Increase Growth

Decrease OPEX

Performance

Competitive

Facebook

❖Easier management of networks

❖Flatter, simpler, and more manageable.

❖End-to-end connectivity integrity - Direct addressing is possible, due to vast address space, Shortest path, no additional latency (middle boxes)

❖Improved User Experience & Higher Engagement

❖ One address per user (or household), no additional latency (10-15% faster).

❖Improved interoperability and mobility capabilities (which are already widely embedded in network devices)

User Experience
Decrease CAPEX
Increase Growth
Decrease OPEX
Performance
Competitive

Internet Service Provider

Comcast

- ❖Reduce costs based on depleted IPv4 addresses
- ❖USD 9.50/IPv4 address (In Bulk) – USD 35.00/IPv4 address in cloud
- ❖Reduce operational complexity
- ❖One IPv6 address per user/household   sensor/floor
- ❖Increase service offerings and become more competitive
- ❖IoT wireless and analytics

User Experience
Decrease CAPEX
Cost Containment
Decrease OPEX
Performance
Innovation

Layer 1 - Physical Layer Connections

Wired & Wireless

- ❖ 4G LTE NG Wireless & 5G Wireless
- ❖ Cognitive radio (TV Whitespace) & IoT Networks (LoRaWan)
- ❖ IoT & IoTT (Internet of Trusted Things)
- ❖ 6LowPan (IPv6 for low power systems)
- ❖ Car-toCar/Car-to-Infrastructure Communications
- ❖ Cellular infrastructure does not exist
- ❖ Many international 'smart cites', 'smart buildings', 'smart transportation system'

Bluetooth
Wifi
4G
5G
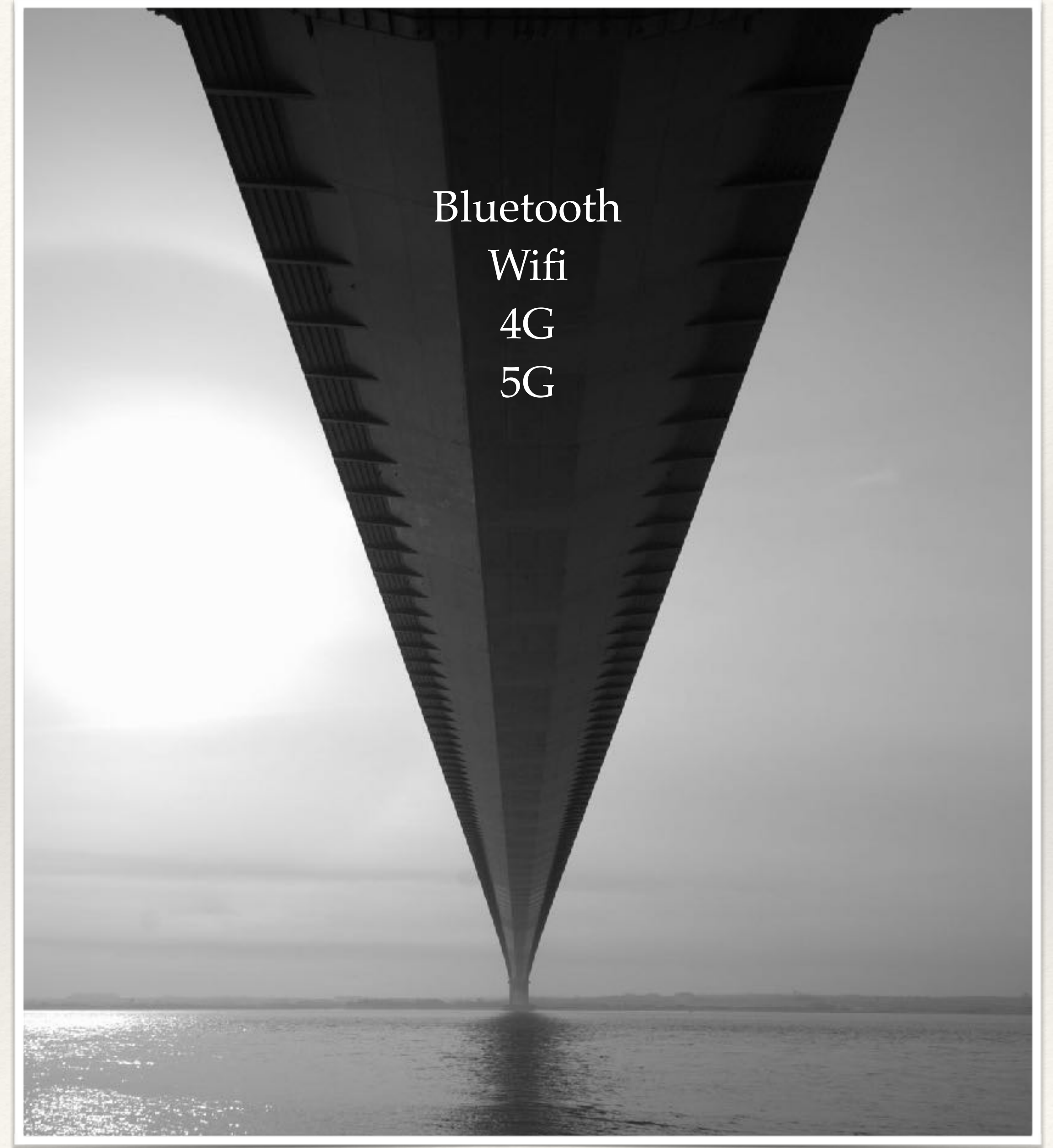
Decrease Power Utilization

IPv4 + NAT

❖ Keep Alive - State on all devices
  end-to-end

IPv6

❖ No NAT

❖ 3-14% decrease in battery life and
  power utilization end-to-end

Battery Savings
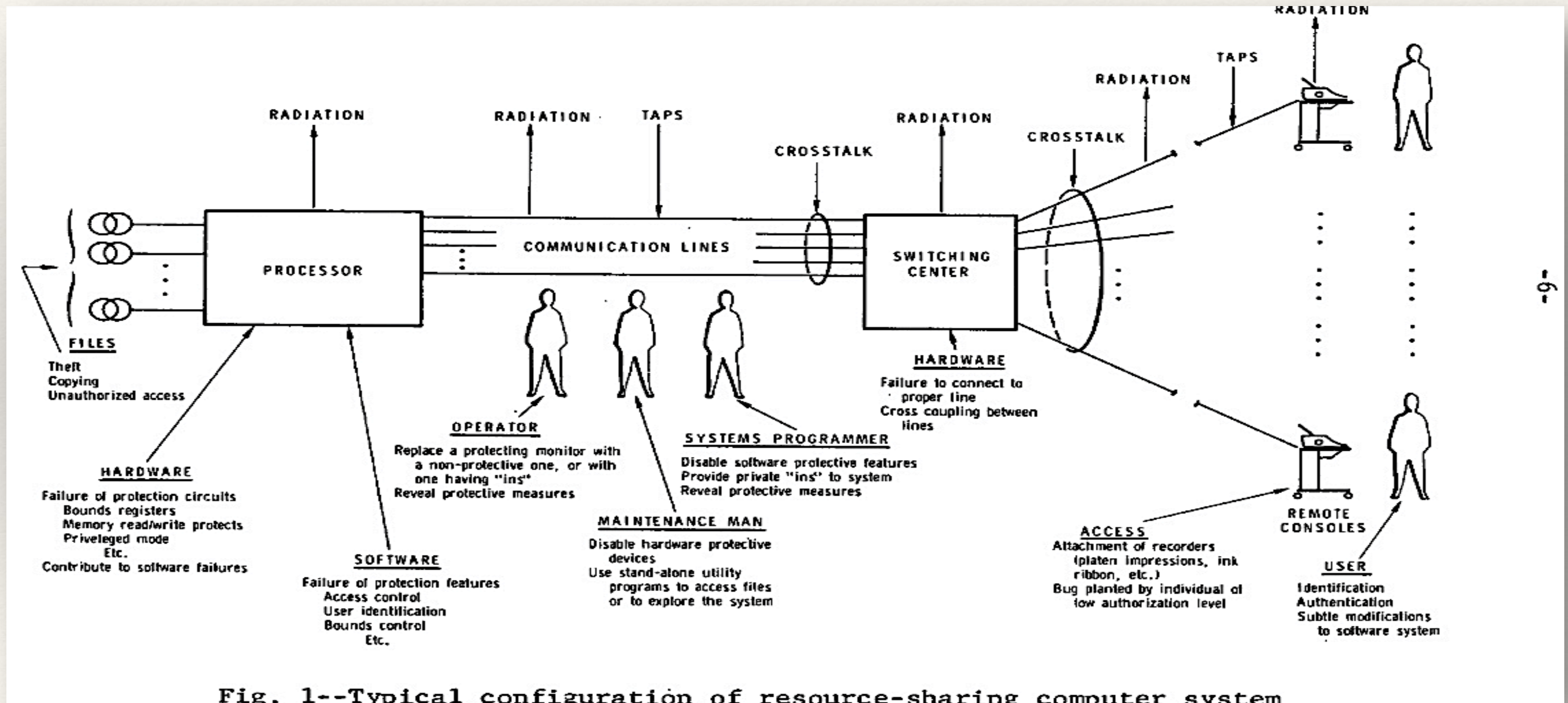Power Savings
Less Cooling
Longer Life

Changing the Security Game

Security Source Document

- Earliest Document on Security and Privacy
- Risk to Distributed System
- Analysis of Technology and People
- Influenced
  - "Wargames",
  - "NSA Rainbow Series,
  - "Security Assessments",
  - "Defense in Depth"
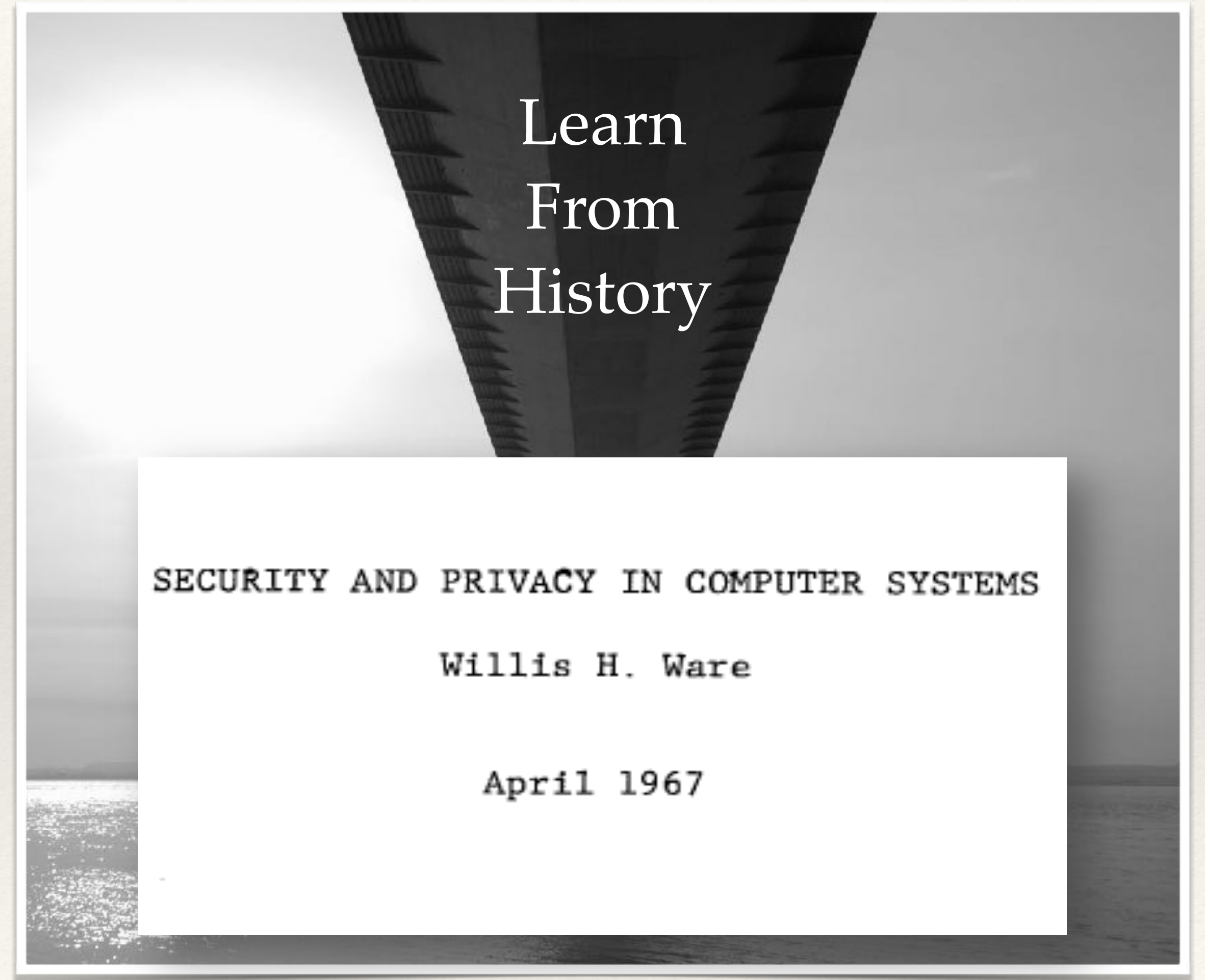
Learn From History

SECURITY AND PRIVACY IN COMPUTER SYSTEMS

Willis H. Ware

April 1967

Security and Privacy in Computer Systems

Fig. 1--Typical configuration of resource-sharing computer system

#1 - Remove the IPv4 Warts

❖ Re-Architect improved Operations & Security!

❖ Remove IPv4 Only Devices & Applications

❖ Update existing products, only if they

  support IPv6 only operation - https://ip6.nl/

❖ Engineer to the newest RFC's and standards,

  and demand products support them

Remove IPv4 Technical Process and Security Workaround

#2 - Defeat SPAM/Phishing - Improved Trust

Basic Level

  Trust between email servers (MTA)

    Associate IP address and valid domain (FCrDNS)

    Validate email is from expected domain (SPF)

  Trust email sent between servers

    Source Validates trust before sent (DKIM)

    E-Mail Authentication (DMARC)

  Block bad domains not IP addresses

    Spamhaus Domain Block List (SURBL) or Newly Observed

    Domains (NOD)

Advanced Level

  Encrypt all email (TLS/valid certificate)

  Validate Certificate (DNSSEC)

  User Validating E-Mail Server (DANE)

  Scanning Detection (use /118 from a /64)

  Allow connections from only registered blocks (BOGON List)

Defeat
SPAM
Phishing

#3 - Defeat Information Brokers & Targeting

Information Broker

- **Active**
  - Scans your system, looking for open ports, vulnerabilities, location
- **Passive**
  - Reduce external Connections
    - ntp, DNS, Patch Management, CGN, location
  - Decrease RF power
- **Passive - Active**
  - Cloud Providers, CGN

Defeating Targeting

#4 - Consider Anti-Fragile Model
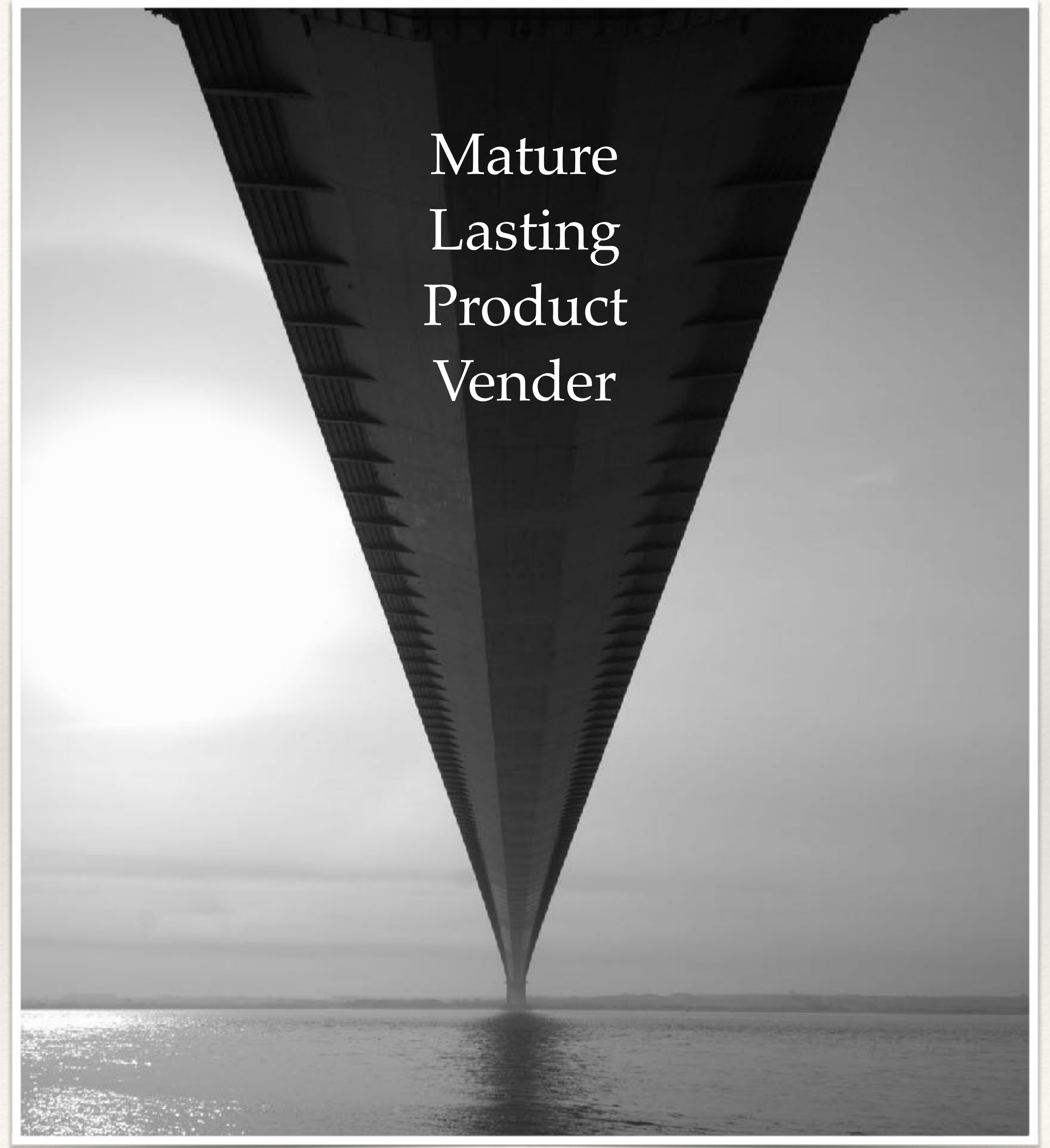
What	Why	How
Encryption	Manage Keys Not Data	Key Management, Remote Attestation
Tokenization	Reduce Value of Data	Data Sovereignty/Residency/Privacy
Containment	Block movement	Decomposition into Containers & Firewalls
Immutability	Avoid Changes to code	Power up, power cycle, Secure Boot
Flux	"Make it moving"	IP/Application/Reboots/Patching
Speed	"The New Stealth"	DevOps, "Serverless computing"
Diversity	Increases effort	Processors
Decentralization	Decrease value in any one location (Cloud!)	P2P networks, Analytics at the edge
Disinformation	Slows attackers	Deception Systems

#5 Vender Security

Address vulnerability in systems
- Bug Bounty
- Vulnerability Handeling

Mature
Lasting
Product
Vender

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