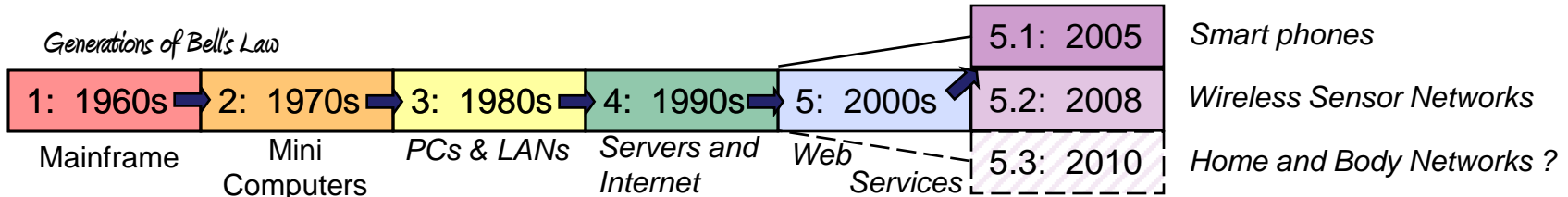*2009 Ground System Architectures Workshop*

A Multi-INT Ground System for Today and Tomorrow

Dr. Pete Rustan
March 24 – 26, 2009
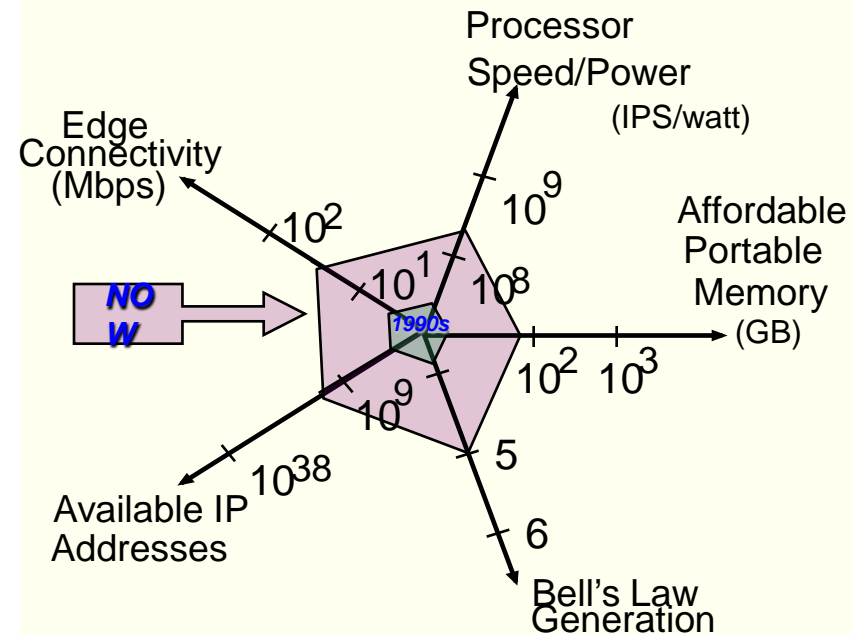
Leveraging Commercial IT Today

Generations of Bell's Law

1: 1960s	2: 1970s	3: 1980s	4: 1990s	5: 2000s	

5.1: 2005 — *Smart phones*

5.2: 2008 — *Wireless Sensor Networks*

5.3: 2010 — *Home and Body Networks ?*

Mainframe | Mini Computers | *PCs & LANs* | *Servers and Internet* | *Web Services*

Today's Capabilities:

✓ Significant IT capability is defined by combining the revolutionary expansion across each axis

✓ Common hardware infrastructure with tailored software for each mission

✓ Regardless of mission, ground system software has a great deal of commonality

- ❑ Processing: About 80% common
- ❑ C2: About 50% common
- ❑ Mission Planning: About 65% common

✓ IP addressing to uniquely deliver every product from any space asset

✓ Virtualization of processing and storage to reduce floor space from 500k ft^2 (Gen 4) to 50k ft^2(Gen 5)
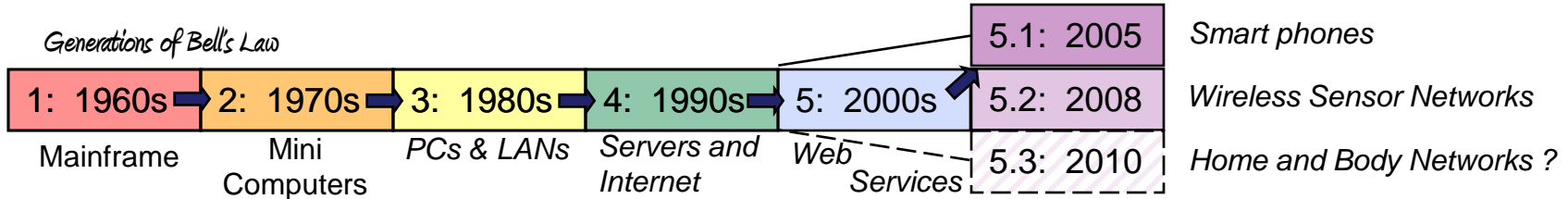
Edge Connectivity (Mbps)
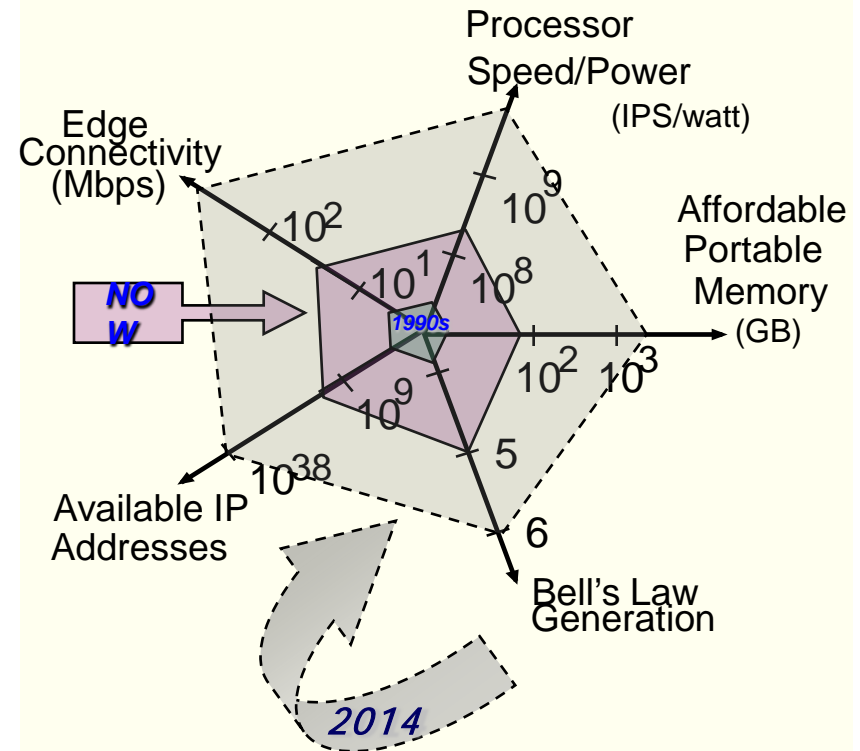
Processor Speed/Power (IPS/watt)

Affordable Portable Memory (GB)

Available IP Addresses

Bell's Law Generation

NOW

1990s

10^2 10^1 10^9 10^8 10^2 10^3 10^9 10^{38} 5 6

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Leveraging Commercial IT in 2014
Based on Predictable Trends

Generations of Bell's Law

1: 1960s	2: 1970s	3: 1980s	4: 1990s	5: 2000s

Mainframe — Mini Computers — *PCs & LANs* — *Servers and Internet* — *Web Services*

5.1: 2005 — *Smart phones*
5.2: 2008 — *Wireless Sensor Networks*
5.3: 2010 — *Home and Body Networks ?*

Capabilities in 2014:

✓ Smartphone capability doubles

✓ Number of applications increases exponentially

✓ Fully virtualized ground might mean the demise of large ground stations

❑ Processing in one or more locations based on floor space and affordable power

❑ C2 operators on base or commercial facility

❑ Centralized Mission Planning to better use all available assets (government and civilian)
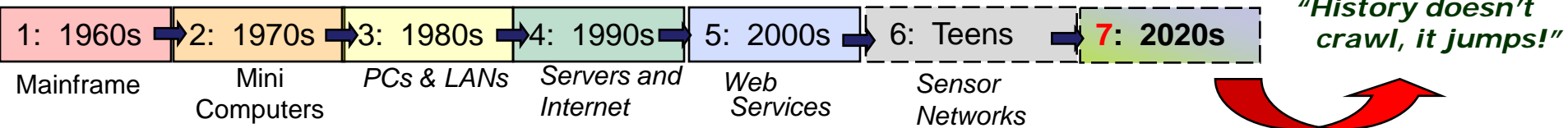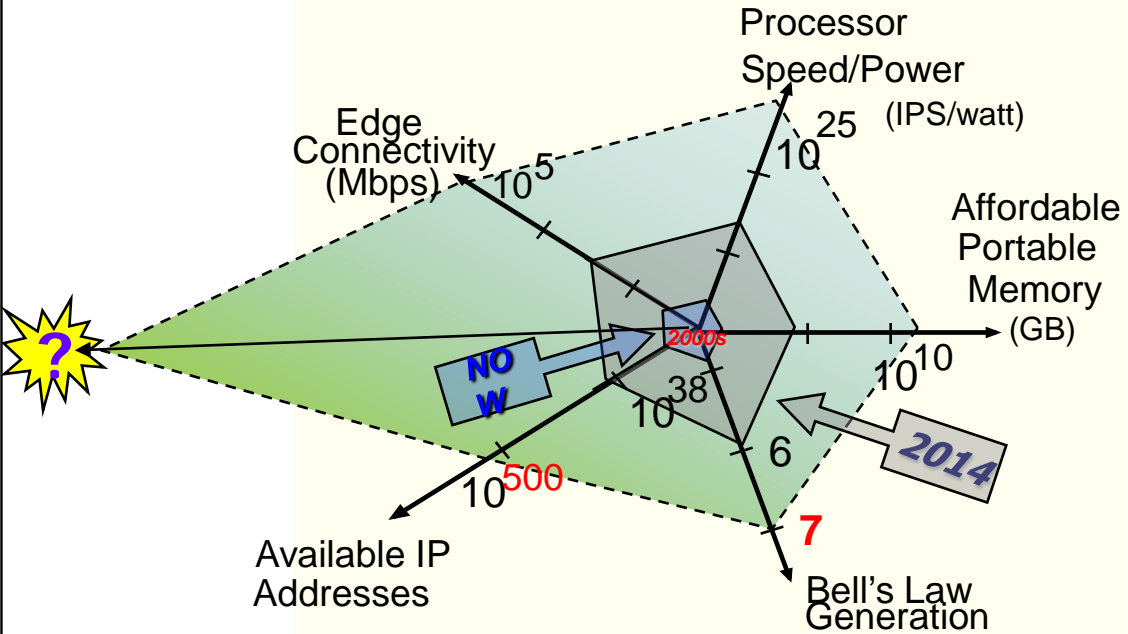
✓ Access to all space products from anywhere

Processor Speed/Power (IPS/watt)

Edge Connectivity (Mbps)

Affordable Portable Memory (GB)

NOW

1990s

Available IP Addresses

Bell's Law Generation

2014

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Leveraging Commercial IT in the 2020s
Unexpected, Unpredictable Trends

Generations of Bell's Law

1: 1960s	2: 1970s	3: 1980s	4: 1990s	5: 2000s	6: Teens	7: 2020s
Mainframe	Mini Computers	*PCs & LANs*	*Servers and Internet*	*Web Services*	*Sensor Networks*	

"History doesn't crawl, it jumps!"

Capabilities in 2020:

o Biological computing

    o Access times similar to brain recollections

    o Storage based on biological models

o Quantum computing

    o 100s of times faster than our best processors today

    o Quantum Key Distribution for unbreakable crypto

Processor Speed/Power (IPS/watt)

Edge Connectivity (Mbps)

Affordable Portable Memory (GB)

NOW

2000s

2014

Available IP Addresses

Bell's Law Generation

Most people _over_estimate what they can do in a year and _under_estimate what they can do in a decade!
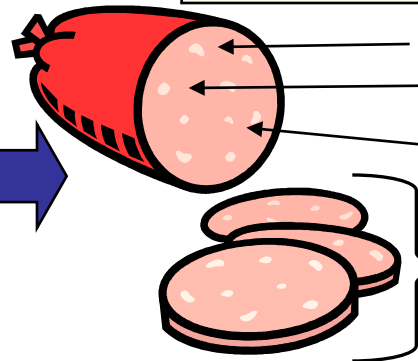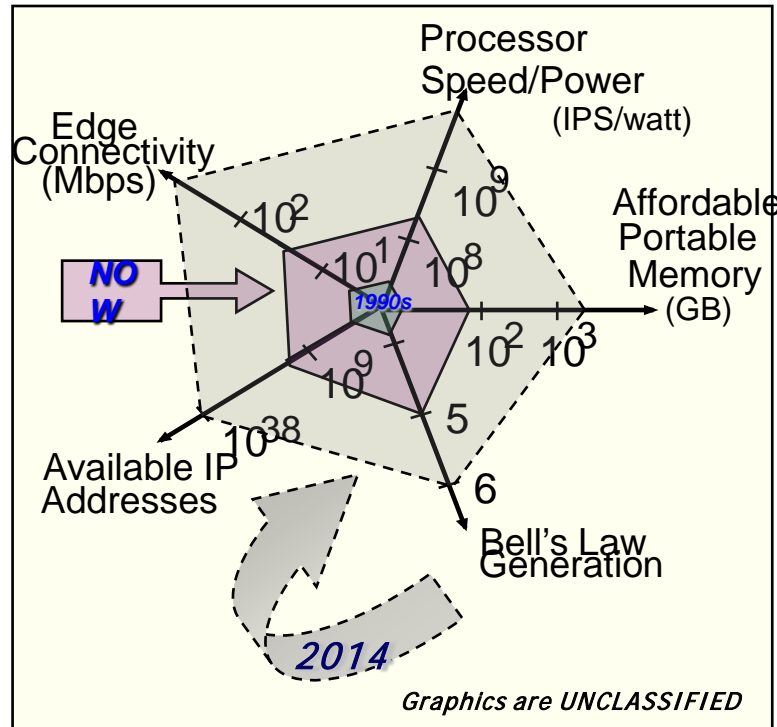
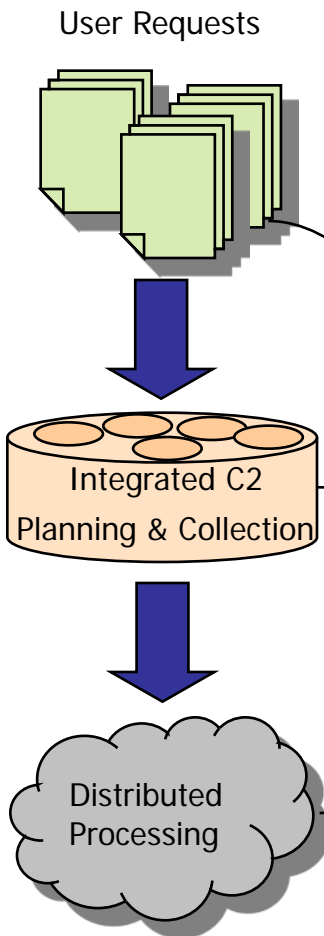*Tony Robbins*

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Leveraging IT Innovations for Multi-INT capability

By using IT Innovations

✓ Integrate Planning & Collection based on focused areas of interest

✓ Virtualize Processing & Storage

✓ Deliver software-based services

User Requests

Integrated C2 Planning & Collection

Distributed Processing

Improve all our products to every customer, regardless of discipline!

Processor Speed/Power (IPS/watt)

Edge Connectivity (Mbps)

Affordable Portable Memory (GB)

10^2 10^9 10^1 10^8 $1990s$ 10^2 10^3

NOW

10^9 10^{38} 5 6

Available IP Addresses

Bell's Law Generation

2014

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IMINT

SIGINT

HUMINT

Each slice is a different service, made up of ALL SOURCES!