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Elliptical Mobile Solutions

Advantages of Micro-container-based Data Center Infrastructure

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This paper shows the advantages of interconnecting self-contained and robust micro-containerized data center modules (data center in a box) packaged inside an inexpensive shell building. Using data provided by Uptime Institute's research and published papers, this paper compares typical "legacy" data center construction costs with a typical Elliptical Mobile Solutions micro-container deployment.

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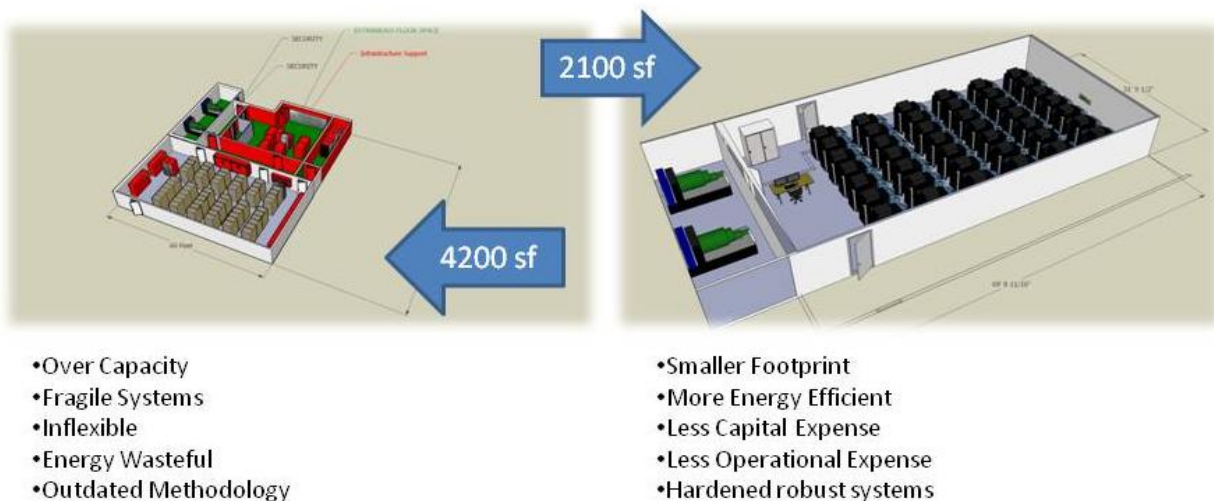
Introduction

This paper compares one megaWatt of IT capacity deployed in two different ways. Using Uptime Institute’s “True TCO (total cost of ownership) Calculator” (Kooimey, ©2007, Uptime Institute),¹ Elliptical Mobile Solutions (EMS) has contrasted a traditional or “legacy” datacenter facility to a micro data center-based build (including a metal shell building). The purpose of this comparison is to show the savings potential afforded by a micro-container-based infrastructure. The recent Uptime Institute study reveals that the TCO of a Tier 3 or Tier 4 (referring to Uptime Institute’s Tier Classification System for determining a data center facility’s availability and resiliency) datacenter is \$25,000/ft². The Institute has determined that each 42U rack of Tier 4 equipment requires 100ft² of raised floor *including support equipment* allocated per rack. The micro data center has 20ft² allocated for floor space/ergonomic considerations despite its actual physical foot print of 14ft² with all physical support equipment is onboard.

Features, Benefits of Micro-Container-Based Infrastructure

- Enables rapid deployment of a fully functional cost, space, and energy-efficient data center
- Affordable, scalable infrastructure allows data center operator to automatically micromanage power consumption, cooling delivery and temperature setpoints
- Technology transfer of enterprise computing to the small to medium business market place
- Flexible data centers open new market locations
- Scales to meet changing business needs with “pay-as-you-go” infrastructure
- Delivers highly granular, vendor-specific, and optimized server, network, storage, and telecommunications environments

Figure 1. Micro-container-based data center versus standard design



¹ [True TCO Calculator](#)

- Typically enables 50 percent lower operating costs than traditional datacenter design and build
- Provides a high-quality, complete turnkey solution for data center deployment
- Smaller footprint, higher density 300-800W/ft² vs. legacy 150W-200W/ft² datacenter
- Vertically increases data center compute density without increasing overall facility footprint
- Merges facilities infrastructure and IT equipment into one easy-to-manage appliance
- Modularity and scalability increase efficiency 10 to 15 percent by preventing “over-” or “under-builds” – each ultimately more expensive than “just-the-right-capacity” builds
- Single-user datacenter relocation
- Turnkey solution for Health Insurance Portability and Accountability Act (HIPAA) and Sarbanes-Oxley Act (SarbOx) data security compliance
- Relocatable Adaptive Suspension Equipment Rack (RASER) is transported with pallet jack or forklift with all rack-mounted equipment in place; Self-Propelled Electronic Armored Rack (SPEAR) unit is compact enough to pass through open doorways
Earthquake resistant
- Disaster tolerant
- Future-proof infrastructure

“Infrastructure systems are expected to represent about 90 percent of the energy use of IT equipment in 2011”

EPA Report to Congress 2007

“Data center facilities spend (CapEx and OpEx) is a large, quickly growing and very inefficient portion of the total IT budget in many technology intensive industries such as financial services and telecommunications. Some intensive data center users will face meaningfully reduced profitability if current trends continue.”

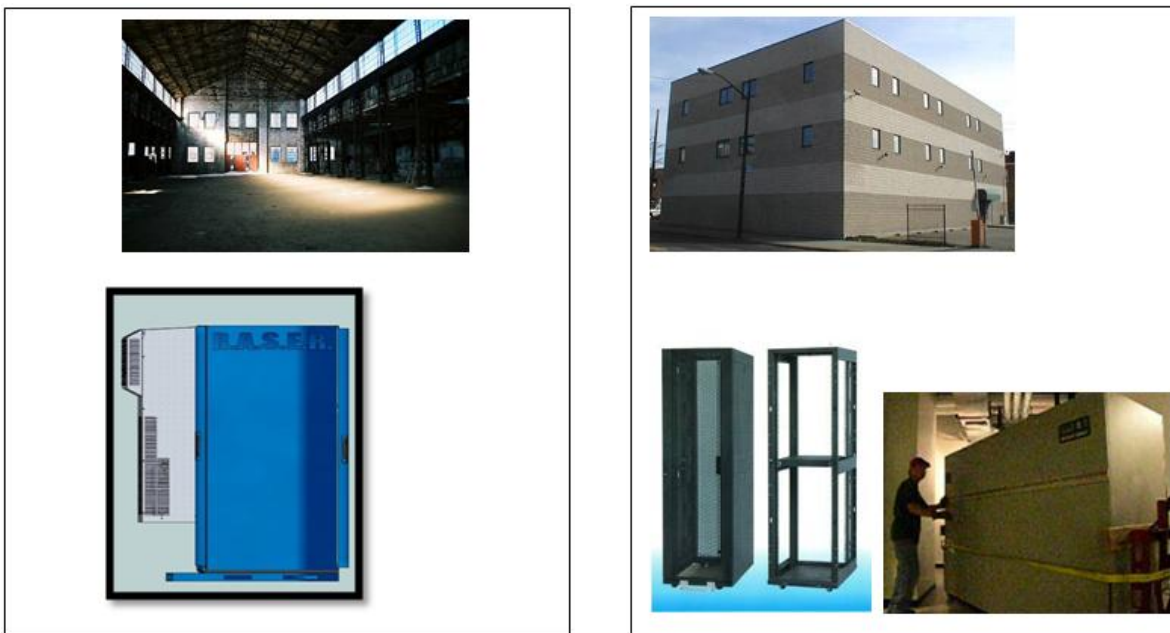
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“Without radical changes in operations, many companies with large data centers face reduced profitability.”

McKinsey & Co. analysis

“A new data center for the largest corporations will be required every 3 to 5 years just to keep up with an ever-increasing power consumption.” –Kenneth G Brill- Executive Director of the Uptime Institute

Figure 2. CapEx comparison of legacy data center vs. RASER-based data center infrastructure.



<u>CapEx Comparison</u>	Tier II DC	Tier IV DC	RASER Based Tier IV+	Notes
Capacity	1MW	1MW	1MW	Tier II =\$12,500/KW* Tier IV=\$25,000/KW*
W/Sqft	50W/ft²	100W/ft²	1000W/ft²	
Racks	667	334	59	
Raised Floor	15,000ft²	7,500ft²	1000ft²	\$300/ft²
Gross Building Foot Print	26,000ft²	22,500ft²	2000ft²	\$1100/ft²
CapEx	18.5 Million	52.6 Million	4.4 Million	<u>75-90% CapEx Savings</u>

*Turner and Brill, *Cost Model Dollars per kW and Dollar per Square Foot of Computer Floor* ©2008 Uptime Institute.

Figure 2, continued.

<u>OpEx Comparison</u>	Tier II DC *	Tier IV DC*	RASER Based Tier IV+ redundant interconnected containers on VCT floor	
Total electricity costs	\$1,043,900	\$1,343,900	\$650,500	No air handling losses, zero bypass cooling, hot/ cold aisle containment, optimized temperature set points
Network fees	\$500,000	\$500,000	\$500,000	
IT site management staff	\$390,000	\$390,000	\$390,000	
Facilities site management staff	\$520,000	\$520,000	\$0	Facilities Maintenance absorbed by product Warrantee
Maintenance	\$416,000	\$616,000	\$200,000	Partially absorbed by product Warrantee
Janitorial and landscaping	\$160,000	\$160,000	\$160,000	
Security	\$702,000	\$702,000	\$50,000	Turnkey SARBOX/HIPPA compliant
Property taxes	\$144,735	\$244,735	\$10,000	Portable Infrastructure not tied to site “valuation”
<u>Total OpEX</u>	<u>\$3,876,635</u>	<u>4,476,635</u>	<u>1,960,500</u>	<u>50-75% OpEx Savings</u>

Conclusions – The Holy Grail?

Data center infrastructure is becoming a much larger piece of the overall enterprise budget. How much increased overhead is dependent upon how much total budget is spent on “facilities” and “infrastructure,” as these are the rapidly inflating factors. Furthermore, as computer performance increases, the costs to cool the equipment increase exponentially as well, compounding the problem. These problems won’t go away as computer power and efficiencies increase. Demand is outstripping gains in performance. The demand is driven by the falling price of computer power and consumer demand for digital products/services.

Current methods of building data centers aren’t sustainable as Moore’s Law advances. Converging “IT” and “Facilities” into one finely managed entity has long been the goal of data center efficiency thought leaders. Micro-containers with integrated infrastructure support force data center builders and planners to converge these two disciplines on the device level. Enabling technology that merges IT and facility into one device is the Holy Grail of this focus.

EMS’s unique containerized data centers completely meet this need. Significant savings in deployment, operational, and electrical costs are now realized with this emerging technology. Network-based monitoring/control and virtualization software has required an “infrastructure counterpart” to realize the market potential of their technologies. RASER and SPEAR micro-containers are at the cutting edge of this technology convergence.

As data centers become more expensive to build—and increasingly harder and more costly to cool—the micro-container costs remain the same. This effectively reverses the exponential rise in facility and infrastructure costs relative to compute power. Adopters will experience savings through smaller facility footprint; power efficiency; and reduced expense for land taxes, fire suppression systems, security build out, and initial capital investment.

All major players in the industry (IBM, Sun, HP, Dell), the Environmental Protection Agency, and engineering groups (McKinsey Group, Turner Logistics) have concluded that data centers must make radical changes to maintain profitability in the face of increasing energy and infrastructure costs each year. They have developed efficient, mobile, and modular data center “building

blocks” to solve these issues. The implementation of these large and expensive solutions is not possible for 90 percent of the business world. A rack- level solution that captures the advantages of containerized computing in a smaller, less expensive footprint is required. Micro-scale containerized data centers are one viable answer.

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About the Author

Simon Rohrich is a founder and technology evangelist of Elliptical Mobile Solutions. He has served in many senior-level capacities primarily in engineering, finance, project management, and marketing. Simon’s background is in various technical fields, including telecom, IT, and wireless communication. His multi-disciplinary experience and passion for green technologies have shaped the philosophical underpinnings of Elliptical Mobile Solutions’ overall product vision. Please contact him with questions or comments at simonr@ellipticalmedia.com

About Elliptical Mobile Solutions

Elliptical Mobile Solutions was founded in August 2005 as a subsidiary of Elliptical Media to develop innovative product lines designed to stabilize sensitive electronic equipment in a mobile and/or unstable environment. At the core of our designs is a multi-dimensional suspension system that isolates electronic equipment from damaging shock and vibration through a patent-pending combination of pneumatic weight adaptation and magnetorheological/pneumatic dampening. While we are not opposed to incorporating innovative and unique designs into our electronic transport systems, we strive to include field tested and proven commercial off-the-shelf components to improve reliability in a cost effective

manner. Elliptical Mobile Solutions is a research and development company that identifies deficiencies in the current state of technology and then offers realistic and commercially viable solutions to remedy those deficiencies. Engineering models are designed, built, and tested within our facilities so that our innovative concepts and system designs may be proven and perfected. Partnerships and alliances are then formed with key individuals/business entities to convert the proven designs from engineering models into commercial offerings.

About the Uptime Institute

Uptime Institute is a leading global authority on data centers. Since 1993, it has provided education, consulting, knowledge networks, and expert advisory for data center Facilities and IT organizations interested in maximizing site infrastructure uptime availability. It has pioneered numerous industry innovations, including the Tier Classification System for data center availability, which serves as a de facto industry standard. Site Uptime Network is a private knowledge network with 100 global corporate and government members, mostly at the scale of Fortune 100-sized organizations in North America and EMEA. In 2008, the Institute launched an individual Institute membership program. For the industry as a whole, the Institute certifies data center Tier level and site resiliency, provides site sustainability assessments, and assists data center owners in planning and justifying data center projects. It publishes papers and reports, offers seminars, and produces an annual Green Enterprise IT Symposium, the premier event in the field focused primarily on improving enterprise IT and data center computing energy efficiency. It also sponsors the annual Green Enterprise IT Awards and the Global Green 100 programs. The Institute conducts custom surveys, research and product certifications for industry manufacturers. All Institute published materials are © 2009 Uptime Institute, Inc., and protected by international copyright law, all rights reserved, for all media and all uses. Written permission is required to reproduce all or any portion of the Institute’s literature for any purpose. To download the reprint permission request form, uptimeinstitute.org/resources.

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