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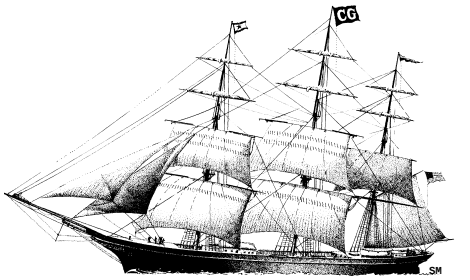

Navigating Information Technology Horizons℠

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HP Data Center Infrastructure in a POD

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Management Summary

Quick question: What is a POD structure? Quick answer: As any good science fiction movie buff knows, a POD is a self-contained entity often providing life support systems (shelter, food, oxygen, heat, cooling, etc.) for encapsulated aliens, creatures, insects, critters, space pilots (and/or you-name-it-stuff) inside. In the IT world, a POD is a containerized space that can serve as a true data center once it has been populated with the appropriate IT gear, once it has been wired for electricity and communications, and once it has been engineered for cooling so that the devices inside can operate optimally. IT giant Hewlett-Packard (hereafter referred to as HP) has created a family of PODs to place into IT service on very short notice. Like its movie-time equivalent, the HP POD provides life-giving support to equipment and staff inside.

HP's newest POD product is an energy-efficient, self-standing structure into which you can insert servers, storage, switches, or any other electronics industry rack-mounted devices. Found inside its skins are industry standard 19-inch racks, power distribution units, and air conditioners to provide cooling, plus walking-around space so that you could set it up as a full-fledged data center. Also found inside is an environmental control system for monitoring the POD: power usage, alerts, and alarms on a real-time basis.

HP's choice of the term POD for this product family is insightful. Although their marketing message spinners would claim that POD stands for **P**erformance **O**ptimized **D**ata center, all of us can appreciate that a data center POD must make optimal use of electricity, cooling, wiring, and space footprint – all the basic elements of a good data center. Oh yes, the POD should be flexible enough to be outside in the weather (even snowy climates) or inside yet another structure. And, as always, a "good" POD should be easily expandable up to and including the addition of a "next" POD, should you exceed the capacity of the first one. Happily, HP has provisions for all these eventualities, although site-specific planning is always required.

What makes this POD different from other HP PODs (such as their water-cooled version) is its energy efficiency. Now into its fourth generation, *HP POD 240a* has been built on prior knowledge, so that they achieve near perfect scores on the *PUE* scale. PUE stands for *Power Usage Effectiveness*. It is the ratio of total electricity delivered to the Data Center divided by the power consumed the IT equipment in that data center. As such, the closer the ratio is to 1.0, the more efficiently the data center system is being powered and cooled during operations. If you think of the necessary lights, cooling, and other electricity uses inside the POD, approaching 1.0 is a non-trivial accomplishment, as nothing is being wasted. Announced on June 6, 2011, as part of HP's set of Converged Infrastructure announcements, the POD 240a quotes a near perfect PUE by using up to 95% less facilities energy than traditional bricks and mortar data centers. Contrast that value with typical PUE ratings of 2.6 in those older data centers. Read on to learn more.

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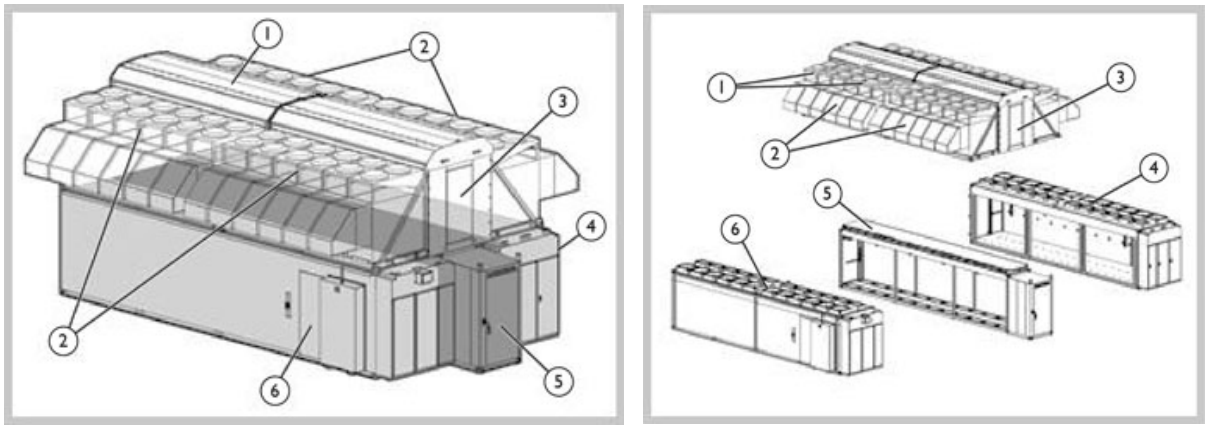
Exhibit 1 – HP POD 240a



Component View
NOTE: An external service area landing is located at both ends of the top of the hot aisle. Stairs will need to be added for access.

1. The canopy has two 20-ft sections, both installed atop the HP POD 240a.
2. Each of the four cradles contains six DX (Direct Expansion) cooling units.
3. The service area is directly above the hot aisle structure and is assembled at the same time as the cradle walls.
4. The IT section B (secondary structure) is similar to the IT section A (primary structure). Houses racks, fire suppression, and humidification system. Adaptive Cooling provides free air, DX conditioned air overhead into the cold aisle.
5. The hot aisle structure is a separate space where hot exhaust air from the servers can be expelled out of the structure or cooled and recirculated. To ensure optimized efficiency, the HP POD 240a separates the IT cold aisle sections from the hot aisles.
6. The IT section A (primary structure) houses the Racks, Fire Suppression, Environmental Control System, and the POD controls cabinet. Adaptive Cooling provides free air, DX conditioned air overhead into the cold aisle.

Source: HP

Advantages of Using the HP POD 240a

The POD under discussion has "designed in" installation locations for all expected equipment plus access aisles for staff and service operations. It is reasonable to draw the analogy of a set of building blocks from your childhood. Building blocks are placed next to each other or on top of each other to build an even larger structure. Because the unit could be outdoors in a variety of locations and weather, HP engineers have provided for withstanding snow loads where accumulated snow, moisture, and water saturated snow and ice could add significant weight to the roofing structure. Note also that airflows are given considerable attention in the design. Hot air can be re-circulated or exhausted. Fire suppression equipment has been integrated, to provide life safety for occupants and equipment protection for the long life of the devices housed inside. Please take a look at a diagram of the *HP POD 240a* above.

Energy Efficiency

Just how efficient is the 240a? Some statistics might assist here. There is the equivalent of 10,000 square feet of traditional data center space in the POD 240a's 900 square foot package, sometimes called the *EcoPOD*. The POD 240's cooling control system tightly manages the thermals within the POD. Customers can decide how they would like to operate their POD. For example, it can maximize efficiency by operating within ASHRAE recommended or allowable zones or the POD can be set to a specific "setpoint" temperature per the customer's specification. During free air operation, the POD operates with a PUE of 1.05, and in DX mode (meaning full recirculation and including dehumidification), the PUE rises to 1.40. Considering that most sites will be able to use hours of free air and DX cooling, annualized PUE is dependent on the site's climate, as the POD will maximize the use of free air for optimal cooling efficiency. All of these ratings are far less than typical bricks and mortar data centers that average a 2.6 PUE. For the uninitiated, DX is a form of cooling technology and stands for Direct Expansion. HP uses "Adaptive Direct Expansion" in the POD 240a. The Big

Idea here is that the devices inside the POD are going to consume a certain amount of electricity and will require a certain amount of cooling no matter where they are situated. However, if the infrastructure itself contributes little or none of the above, consumers can gain a measure of control over their utility bills, often one of the bigger operational expenses for the IT department.

Deployments – How Much Faster?

Deployment times are MUCH faster with the preconfigured and pre-tested POD module. IT systems, cabling, power, cooling, fire suppression, and monitoring all are integrated and tested before the POD leaves the HP factory. Think of how often you might need additional data center capacity and how long an old-fashioned "Bricks and Mortar" approach would take. HP quotes a figure of 88% faster deployments in their considerable experience.

Content Agnostic

Obviously, HP would like for all or most of the contents of the POD to carry an HP logo. However, they are not so naïve as to expect this situation to be true all the time. For this reason, they readily accept most standard electronic devices: PCs, storage, switches, routers, expansion chasses, etc. Any module utilizing the electronics industry 19" form factor (within "U" height limitations) easily can be added to any of the rack space within the POD.

Fire Suppression Integrated

Included in the price of the 240a is an integrated fire suppression system that meets rigorous industry standards. Its features include:

- Air Sampling Smoke Detection (ASSD) system and fire alarm panel with releasing capabilities provided standard with all HP PODs
- Manual pull and abort stations are provided
- Horns and strobes are provided to indicate alarm conditions
- Full interior fire protection is provided with an appropriate number and placement of distribution nozzles
- 3M Novec 1230 fire extinguishing gas provided in two canisters (main and reserve)
- Canisters are located in a NEMA 4 rated, environmentally-controlled cabinet or inside the POD itself, depending on destination and size of the POD
- All fire protection systems are capable of interfacing with the site systems already installed at your location.

Contact HP for a full listing of all NFPA codes met by the 240a.

Delivery Options

Taking delivery can be extremely flexible. , The 240a's IT modules can be preconfigured, the POD is pretested at HP's POD-Works facility and then loaded onto a truck, train, or container ship or perhaps all three while en route from the factory to your chosen location.

Quantification of Expense Savings

Using an energy-efficient POD enables managers to quantify their CapEx (or capital expenditures, such as land, buildings, bricks and mortar) as well as their OpEx (or operational expenditures, such as wages, head count, price of electricity multiplied by the usage rate, etc.) when comparing alternative business scenarios. Objective data ensures better decision making. Analyzing a POD solution brings to the forefront some important metrics that may have been buried or overlooked previously.

Best Practices Personified

Layout of the HP POD 240a incorporates most of the industry's best practices. There is room inside for up to 4400 servers housed in the POD's industry standard racks. The amount of power supplied to each rack is five times more than is found in traditional data centers. This density allows for more IT equipment per rack, thus minimizing the customer's IT footprint. Cooling is "closely coupled" to the area or equipment inside that needs it the most and is continuously adaptive, reacting to any changes sensed in the environment. HP makes use of the hot and cold aisle containment model, wherein exhaust heat is funneled into one aisle (or exhaust vent), while the cold air is contained and dedicated to the IT load. This containment strategy also offers the benefit that operator-attended aisles are cooler for the comfort and efficiency of the onsite staff. Top-of-rack placements are expected and accommodated. A Shared Service Aisle – for access to equipment should any of it need onsite repair – is designed into the 240a. Likewise, the POD boasts a traditional data center service module. The data center staff will appreciate that they can set site-specific policies and change them, if and when they need to be revised. HP POD 240a customers get all of the benefits of a container with the feel and serviceability of a

brick and mortar data center.

Bricks + Mortar = Brittle, as well as Inflexible

Pity the old-fashioned hard infrastructure (or a new data center being built within an existing building). Lead times are so long (upwards of 24 months) that planners deliberately underpopulate the buildings in anticipation of natural growth. By definition, this is inefficient from Day One. Only on the last day of its operational use (and only if it is totally populated) does the building reach efficient utilization. This means it is inefficient for virtually all of its useful life. Now, spurred on by virtualization at all levels, cloud computing and cloud storage, and a 24-by-7-by-365 duty cycle, the industry is looking for flexibility from all of its vendors. Thus, under the microscope is the infrastructure itself. Customers will appreciate that HP has taken a leadership position with this environmentally friendly data-center-in-a-box. Many traditional ("outdated") brick and mortar solutions now are looking for a new tenant.

Financing Is Available

Through HP Financial Services (also known as HPFS), PODs may be purchased, leased, or purchased with a leaseback option, plus HP will consider most any other financial permutation. Besides the obvious "preservation of capital" argument for leasing and/or purchase with lease back option, using HP financing will often make sense for startups and those organizations looking to convert from CapEx to OpEx expenditures for tax or other business reasons. The moral, at least for many organizations? *Pay as you grow*. And what happens when you no longer need the POD? HP has crafted strong end-of-life provisions:

- HP buy back
- Refinancing alternatives, as well as
- Thoughtful recycling arrangements for the no-longer-wanted unit.

Traditional Use Cases

Virtually everyone concerned about energy consumption in their data center ought to be considering the HP POD. Here is a partial list of when an HP POD 240a makes sense.

1. Wonderfully wild growth in the business, perhaps due to an increased use of social networking or wider and deeper use of analytics in day-to-day operations.
2. Recent acquisition that has overtaxed the existing infrastructure.
3. Energy audit revealing that the existing infrastructure is far too energy inefficient and, therefore, quite costly.
4. Auditors, regulators, or courts demanding an immediate DR (Disaster Recovery) location remote from the existing corporate offices. The HP POD is flexible enough so that it can be either operator attended or a lights-out location.
5. Third-party firms offering offsite DR or back-up services, as part of an Infrastructure-as-a-Service business model.
6. Temporary field location for onsite research.
7. Emergency data center, say in response to a recent calamitous hurricane or tornado.
8. Aged or aging data center infrastructure that is showing early indications of failure or costly replacement of critical infrastructure components (like cooling).
9. Specialized data center space for over-crowded and cramped environments, such as over-crowded schools or quickly-required military deployments.
10. Desire to locate in a *networking juxtaposition*. Just add networking connections and hook it up to a reliable power source (or perhaps two). Regarding the latter point, some "belt and suspenders" (read "very careful") planners ensure that electricity is available to the data center by locating it at the intersection of two different power grids (such as where the power grid serving the City of St. Louis, Missouri intersects the power grid serving St. Louis County). Were one grid to have problems, the data center could still have power coming into the POD from the other grid. Before the 240a, planners would be looking for a suitable bricks and mortar building with this desirable location, now they just need to look for land on which to locate their new (and small) HP energy-efficient POD 240a.
11. Cross industry applicability:
    - Independent cloud providers (such as those offering Web 2.0 services)
    - Federal, state, and local governments
    - Oil and gas exploration and refining
    - High-performance computing conglomerates and consortia
    - Hospitals

- Telcos, especially new wireless providers
- IT IaaS (Infrastructure as a Service) and SaaS (Software as a Service) providers

Not-Immediately-Obvious Use Case – as a Data Center for Another Point of Presence

Several companies including server, storage, and communications providers, cloud-based infrastructure and software as a service providers, as well as all of the major database vendors are working hard to address the implicit latency associated with distributed data bases (also sometimes referred to as "the speed of light problem"). Even Internet auctioneers, online gambling casinos, and social networkers are all feverishly working to minimize their response times. Most software companies download their software from any server in their network that is available with free cycles to spend and is as geographically close as possible to the requestor. Each has their own creative approach to ensuring the fidelity of the data in spite of multiple copies of data being spread across multiple machines across multiple time zones.

However, one unifying technical concept that these firms are employing is to put the primary data as close as possible to the point where it is most likely to be needed and then update copies asynchronously a (very) short time later thereby shortening the distance the data has to travel to reach the ultimate user. Here the term *ultimate user* could be a person or an application or yet another machine. It is not a trivial problem: how multiple copies are kept synchronized, how updates are made, failure/recovery scenarios, etc. But where are these distributed locations and are they close enough to their ultimate users? Enter the HP POD infrastructure solution alternative. It adds another "degree of freedom" for the enterprise to employ.

To invest in bricks and mortar facilities, including real estate costs, is expensive and time consuming. Why not minimize the costs associated with these solutions by positioning PODs in their most favorable location to minimize latency and then populating the POD with appropriate PCs, servers, switches, etc.? This approach has several immediate benefits above and beyond cost avoidance.

- **Customer Service** – Improved response times for your customers thereby building customer loyalty.
- **Competitive Differentiation** – Better ability and solutions sets than that of your competitor(s).
- **Configuration and Location Flexibility** – Allows for flexibility of usage patterns as they change and evolve. If location A is great now but location B increases in importance, simply move the POD and its contents from A to B. Or, add a new POD at location B.
- **Capital Expense Avoidance** – if your program is in a start-up mode when capital is most scarce.

Conclusion – What a Vision!!!

HP has been there (out front in our IT industry) for a long time. First, there was a focus on the devices that displayed, stored, and processed our ever-growing amounts of data. Next, there was a focus on how the devices could be interconnected such that data could be shared by all those who need it in a timely fashion while still providing protection by means of geographic dispersion. Now, the HP focus is turned inward and outward *at the same time* looking at how to protect our IT investments physically while increasing their organic efficiency. Think of the HP POD 240a as a new castle complete with a virtual moat surrounding it for protection. Virtualized environments? *Yes.* State of the art modern devices? *Yes.* Shareable but with protection? Yes. Efficient? *Yes.* Manageable? *Yes.* Environmentally friendly? *Yes, Yes, Yes.*

Although it is entirely logical to examine the infrastructure holding up the IT organization as the next place to look for inefficiencies and savings opportunities, there are very few vendors who have ventured this far into this domain As an industry leader, HP sees that there are payoffs worthy of their considerable investments located here. Good call. As for you, the HP POD 240a requires you to think outside the box too, as you consider how it could be used in your own organization and to what benefits. And that too is a good thing.

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