Connected Digital Home

- Build From Ground Up

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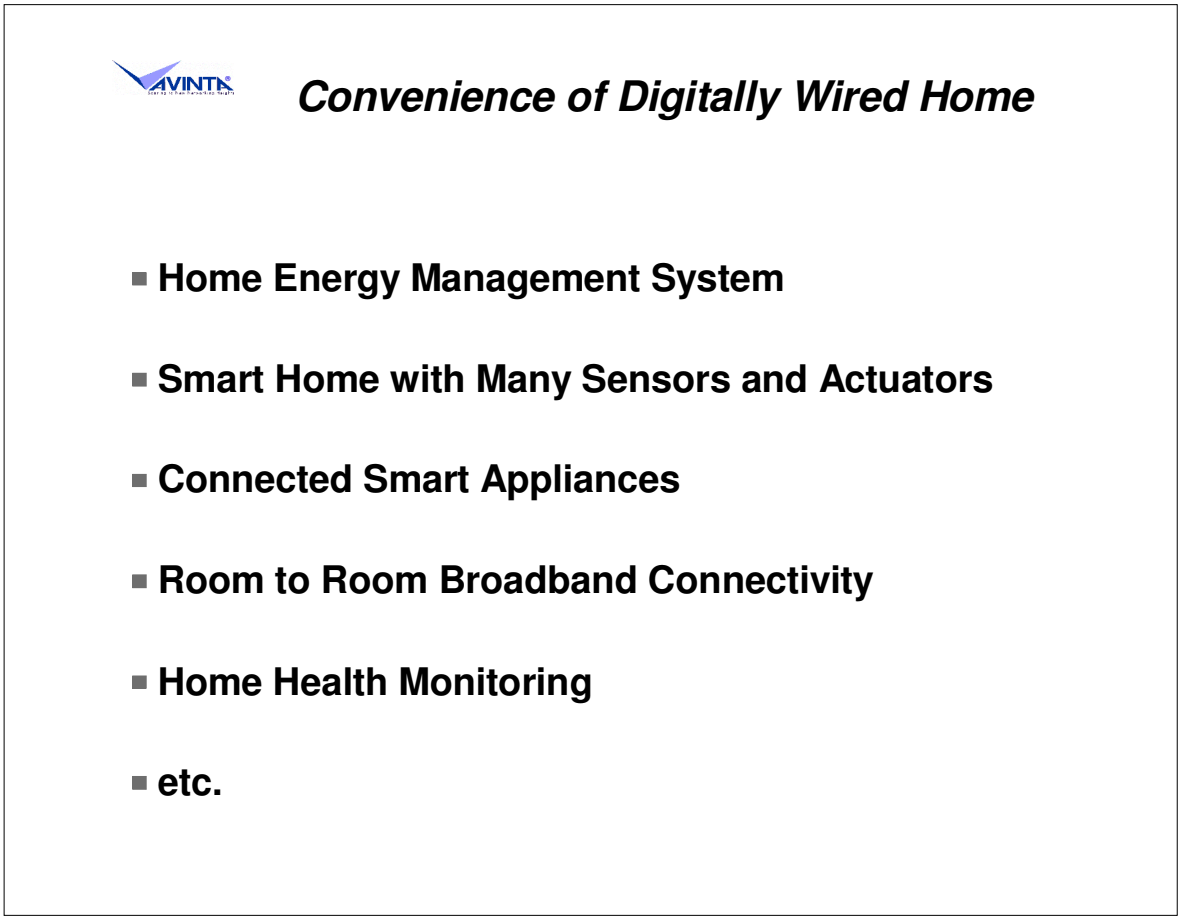
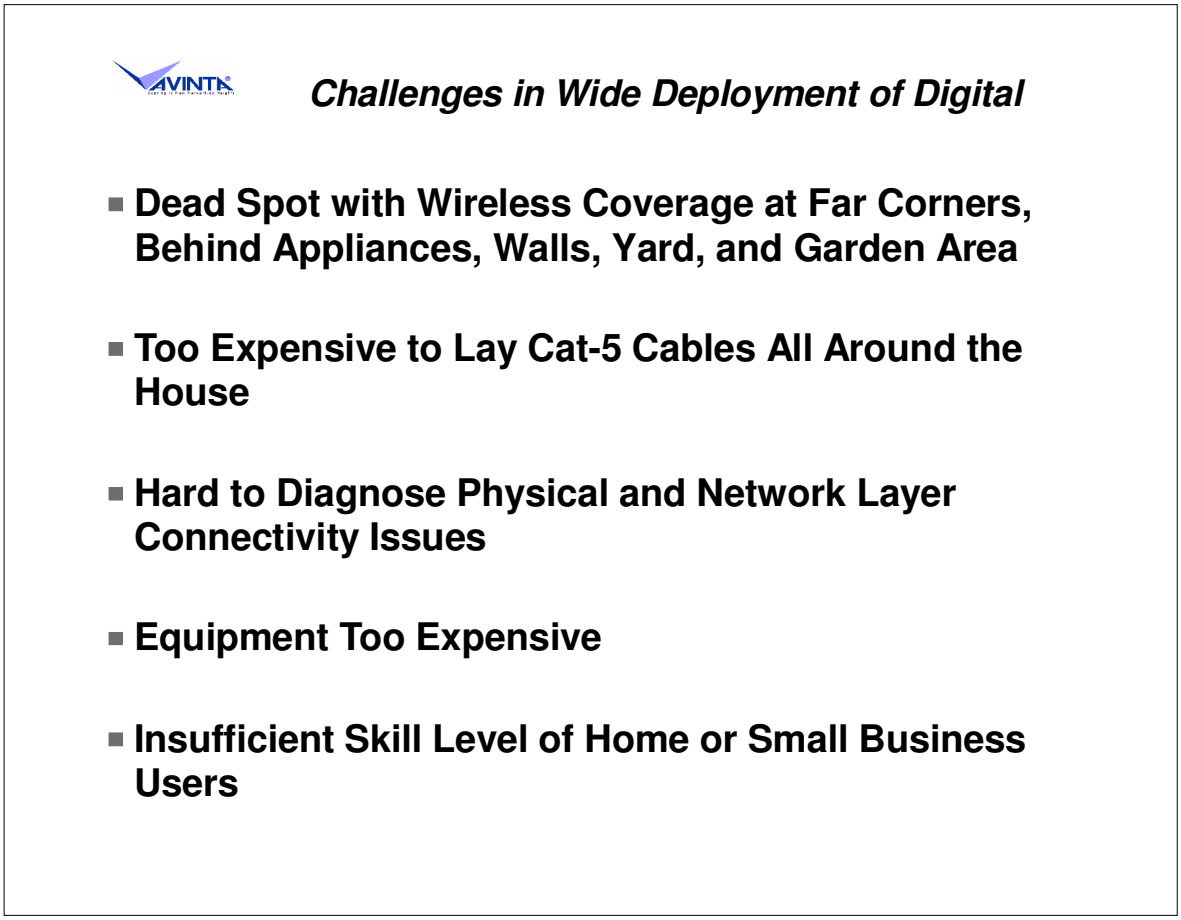
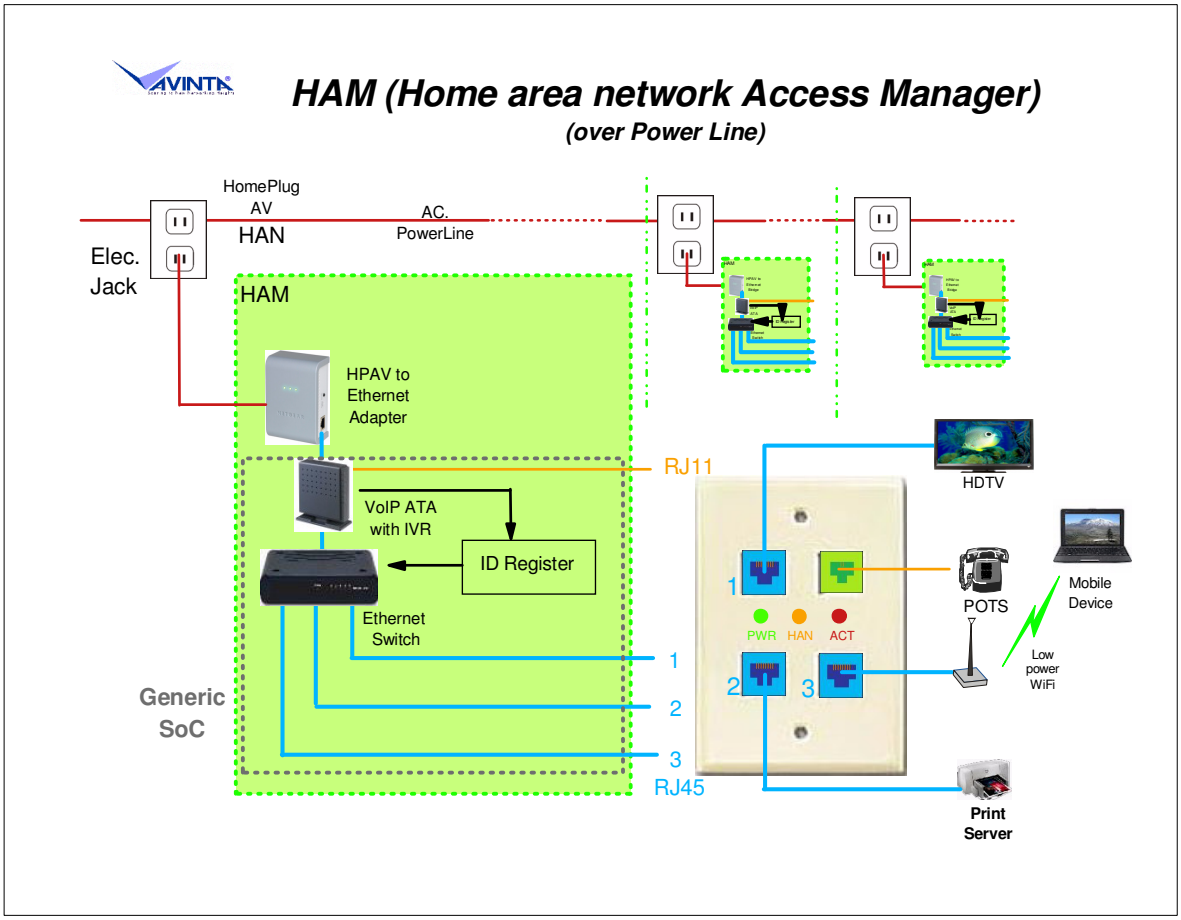
- Broadband has become deeply intertwined with daily life.
- However, to enjoy it as another utility in the same sense as the traditional four -
- Water, Gas, Electricity & Telephony,
- there seems to be a big hurdle in the way.
- The challenge is to deliver broadband in an intuitive and uniform manner, such that consumers may manage it by themselves, and then mix and match their own application devices for services.
- Instead of Internet-driven, this presentation describes a concise network architecture to establish an intuitive Home-Centric Network (HCN) for achieving this goal.
- HCN intends to provide native Ethernet connectivity (OSI - Open System Interconnection model Layer 2). It will be conducive to the current industrial efforts of deploying Digital / Connected Home toward ISO's HES (Home Electronic System).



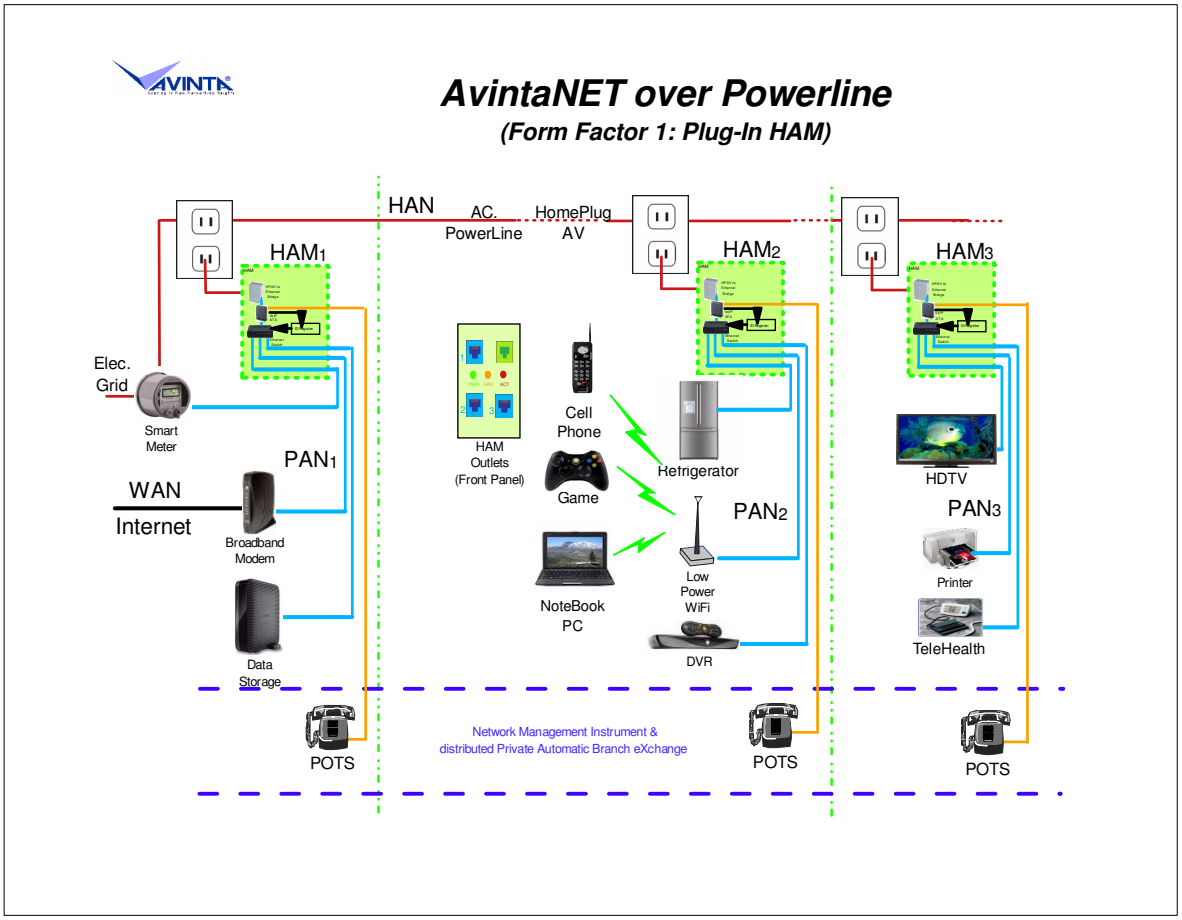
- One of the most urgent application is Home Energy Management System. Although individually insignificant, the mass residential subscribers combined can help to save energy as well as to produce energy from reusable resources. However, consumer needs be empowered with information to participate.
- There are already many sensors and actuators deployed around homes. Each is based on limited scope of planning. Interconnecting and interoperating are generally not part of the design.
- It is nice to have smart appliances. However, unless they can be transparently networked with other devices, it is hard to convince consumer to go for the extra.
- As video and game get popular, sharing through network become desirable.
- Health monitoring of non-urgent home residents not only relieves the tension in patients, but also reduces the cost. How to provide such service without being distracted by information transmission aspects is a concern.
- There are many other applications such as security, computing, etc. The common thread is that a simple and intuitive HAN (Home Area Network) is needed.



- In the past, since traditional wired facilities were not capable of supporting broadband, the convenience of wireless enabled it to become the default choice.
- However, wireless has its inherent handicaps due to transmission impairments such as attenuation by obstacles and interference by proximity transmissions. Since wireless is not touchable, diagnosis is difficult.
- Pulling Cat-5 cable for a HAN is the most direct emulation of office LAN. But, residential construction techniques and aesthetics considerations make this not practical.
- Currently, the fundamental issue in setting up a HAN is that not only managing it is too technical, but also equipment is too expensive for most consumer.
- Limited knowledge, skill and capability in home and small business owners and users make managing a small broadband network extremely difficult and frustrating.



- At the moment, the most promising approach is to utilize powerline to distribute Ethernet. This avoids pulling Cat-5 cables. For example, a pair of PLC adapters can link two broadband devices together.
- When more devices are connected on the same premises, additional PLC adapters or Ethernet Switch may be used. A Router is needed to manage the network.
- Commonly, an RG (Residential Gateway), introduced as a broadband Modem, provides the Router function. This packaged approach, while seemly convenient at the beginning, leads to complications in the long run, because it has integrated information transport with network connectivity.
- When operation difficulty occurs, a consumer needs a way to first verify the connectivity, before checking transport performance. With packaged approach, consumer can not handle RG at this critical moment. Also, being an unique central unit without a spare to backup, it is hard to isolate the issue by using intuitive substitution method.
- Avinta distributes the Router function to each and every networked node by utilizing a VoIP ATA with IVR module. Through a POTS, basic network management tasks (Provisioning, Connectivity and Throughput) may be performed by any user. Thus, each and every node can stand alone and operate by itself.
- We call this electronic module, HAM. Other than the PLC subsystem that is still continuously improving, the other two can be integrated into an ASIC.



- ***Plugging a HAM into an electric outlet*** at each location desiring to network, any consumer can establish a HAN without additional equipment nor professional help. All application devices may then be plugged into the RJ45 outlets on HAM to begin networked operations.
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- Note that all application devices are "Slaves" of a HAM, including the Broadband Modem that connects to Internet. This allows multiple Internet accesses via different modems.
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- Under this configuration, devices for HEMS such as Smart Meter, Solar Panel, etc. may be treated just like another CE device. This allows an utility company to focus on HEMS functions, without being burdened by HAN issues.
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- Although the POTS are introduced as the human interface tool to manage the HAM, they still possess the full VoIP capability. Thus, a dPABX may be enjoyed if the owner keeps the POTS plugged in.
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- Established by using HAMs, AvintaNET provides an integrated voice and data service, or TCI.
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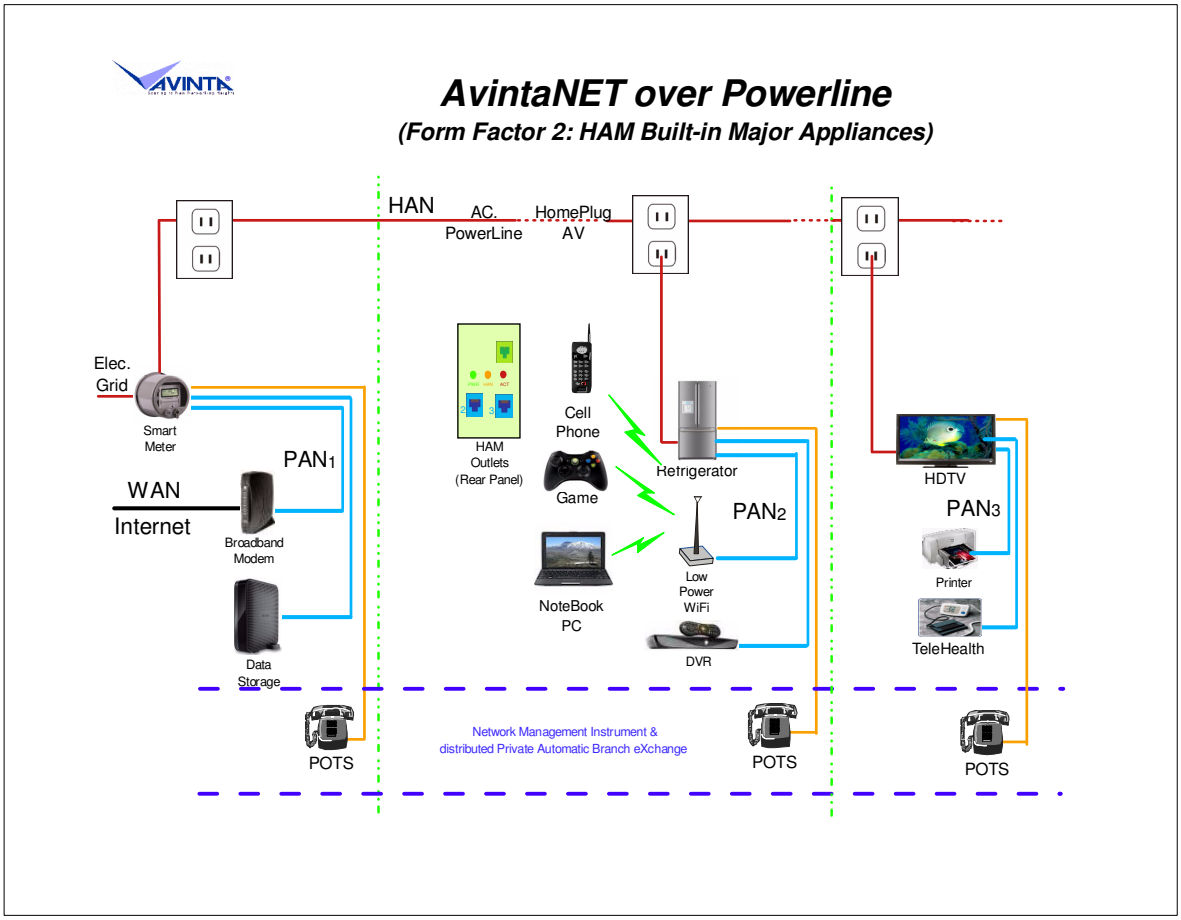
- Major appliances should have enough internal space to house the HAM module.



- This is the same diagram as the last one, except the HAM modules have been absorbed into the major appliances, making the deployment very neat.
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- For this configuration, the first RJ45 jack of each HAM is used by the host appliance. The Rear Panel HAM Outlets graphics reflects this.
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- Consequently, ***appliances manufacturers can become a HAN infrastructure provider with little overhead***.
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- There is another candidate for hosting the HAM module. As we all know, POTS has become very empty within after replaced the original electromechanical parts with a dialer / speech IC.
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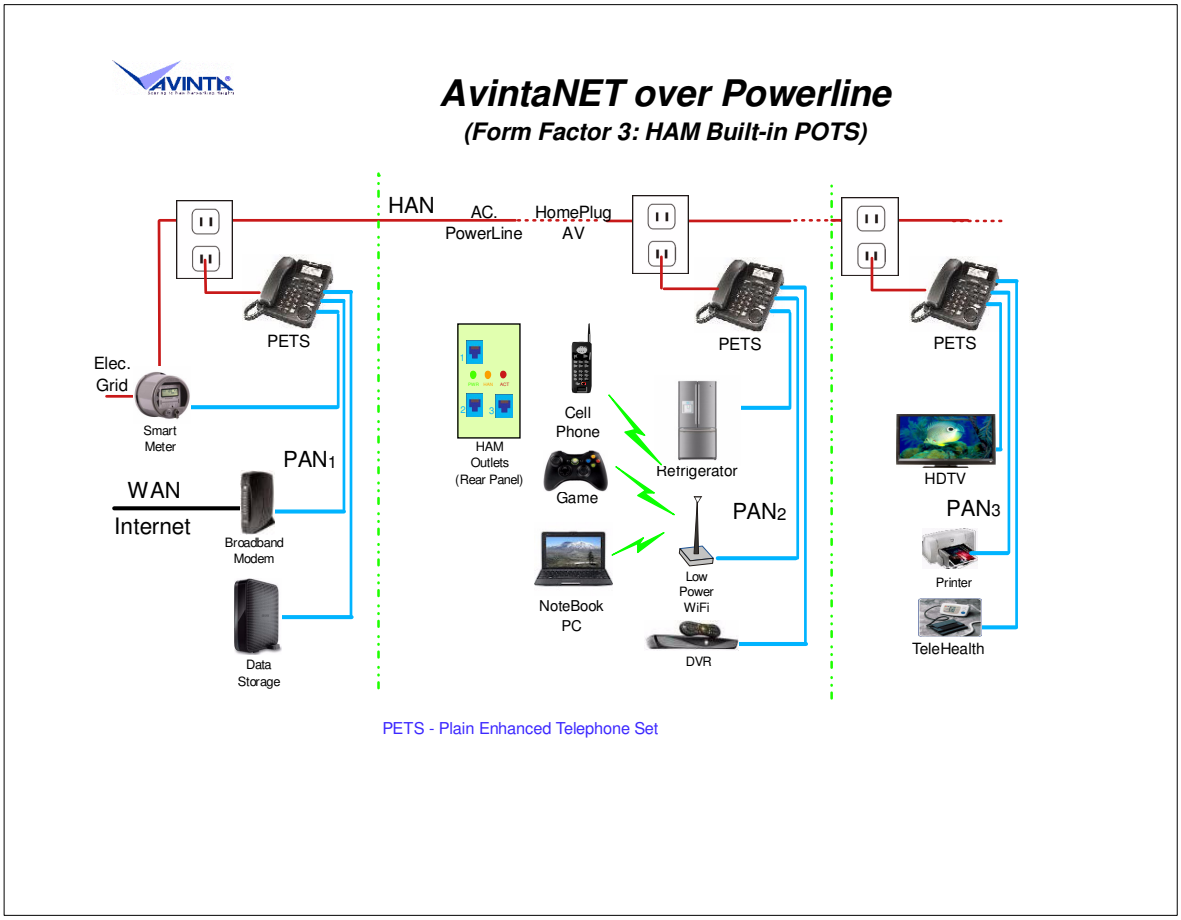
- Especially, those multi-line feature phones that are well built with all analog voice functions. They can cross over to the digital data world by housing the HAM module.



- This is another view of the same AvintaNET with HAMs housed within traditional or VoIP phone enclosures.
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- In this case, the RJ11 outlet from each HAM has been used within, So, the rear panel HAM outlets consist of only three RJ45 jacks.
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- Thus, ***traditional POTS manufacturers can become provider of HAN infrastructure as well as dPABX***.
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- This is the reason why we code named our work as Project Phoenix.
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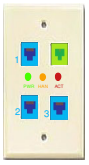
- So far, we talked about three Form Factors (Plug-In, Inside of Appliance and Phone) for deploying the HAM module. They coexist to offer consumers flexibility in establish their respective HANs.

Status and Next

- **Intellectual Properties:**
  6 US and 4 Foreign Patents
- **Operation:**
  Functional Demonstration Using Off-the-Shelf Products

  http://www.youtube.com/watch?v=O2Y10tz-wZ4
- **Components:**
  Two-Chip Solution Verified
- **Actions:**
  IP Licensing with Consultation Services
- **ASIC (Full Function SoC):**
  In-Wall Duplex Jack Substitution (Form Factor 4)



HAM
Wall Outlets
(Face Plate)

- Three merchant ICs capable of the "Generic SoC" function have been identified. One has been verified. They enable the HAMs to be made immediately.
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- The next step is to integrate with the latest PLC chip to minimize the overall package for ***a HAM to fit within a standard electric duplex jack wall cavity.*** This will produce the fourth Form Factor HAM module. This version will support build-in look AvintaNET for anyone who is capable of replacing a conventional duplex electric wall jack. So, this module may be distributed through any store that sells wall jacks.
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- Together with the earlier three, consumer will have 4 variations of HAM to establish Connected Digital Home by themselves.
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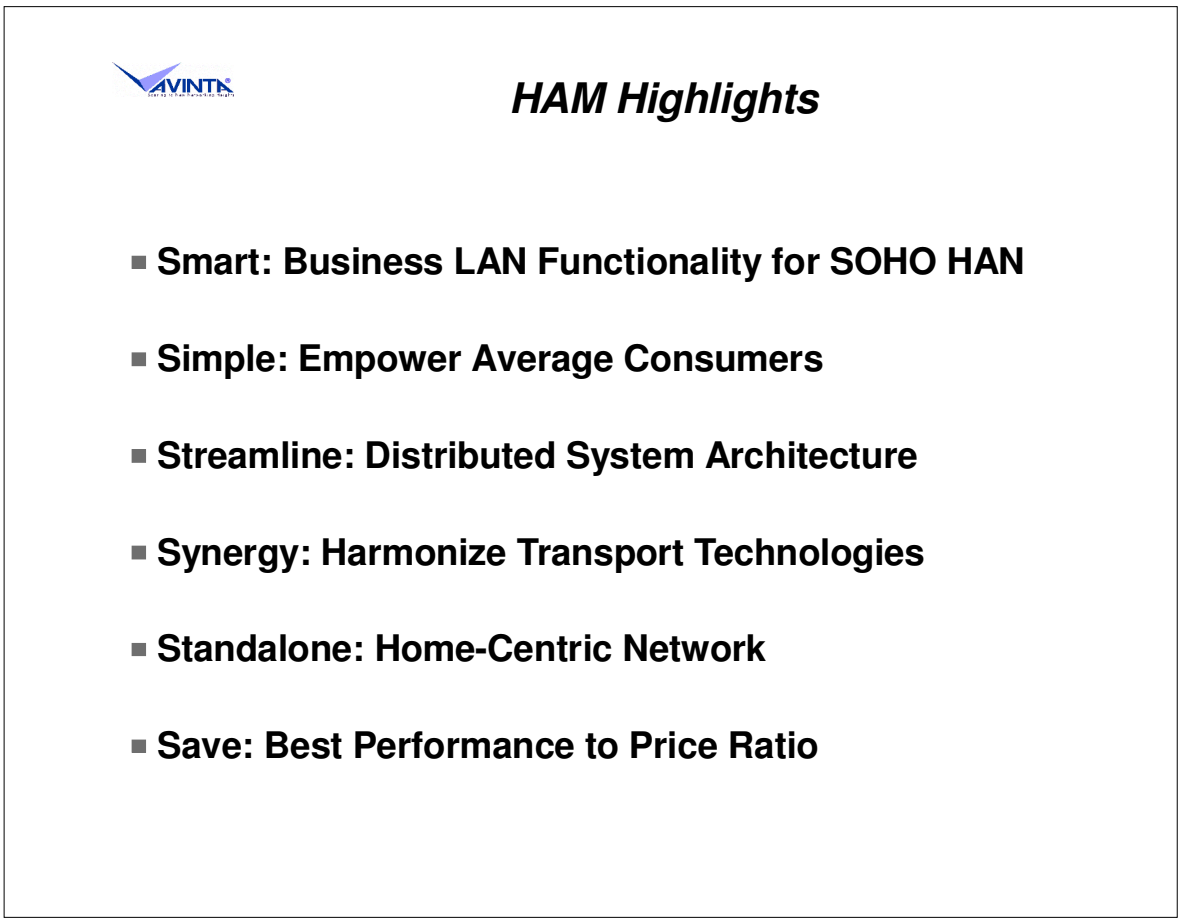
- Suppliers of any or all of 4 Form Factor HAMs will become the trustworthy HAN infrastructure providers. Based on this reputation, application devices and services will flow to consumers naturally.



- **Smart:** Built-in Network Management Instrumentation
- -- Provisioning, Connectivity & Throughput
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- **Simple:** To Be Their Own IT Managers
- -- MaP - Friendly
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- **Streamline:** Peer-To-Peer Network Architecture
- -- Single Design Black-Box Building-Block
- -- Naturally Support WiFi
- -- Divide & Conquer: HAM takes care of network management, so that End User Terminals need only to focus on applications.
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- **Synergy:** Reference design utilizes powerline as the transport medium.
- -- Phoneline, coax, wireless, etc. may be equally utilized by replacing HAM front end with respective electronics.
- -- Different technology islands may be interconnected with Cat-5 cable between RJ45 jacks on respective HAMs.
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- **Standalone:** My House is My Castle
- -- HAM based HAN fully operational by itself
- -- Service and information supplement by Internet when desired
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- **Save:** Multiple (3 or more) RJ45 jacks on each HAM reduce per Ethernet outlet installation cost.