All Flash/Hybrid Micro NAS Project at HDU

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Hangzhou Dianzi University

- Found in 1956, as Hangzhou Institute of Electrical Engineering until 2004
  - It is second public University in Zhejiang province
  - next to Zhejiang University
  - Currently 22,000 students, 2,200 faculty/Staff

- Locate in most scenic city of China - Hangzhou
  - Hangzhou is 100 km south of Shanghai, 7M population
  - Home of Alibaba, Hikvision
  - The Cradle of Entrepreneurs

Hangzhou Flash Memory History

- Baleen System established first NAND flash memory R &D facility in 2003
  - Focus on SD card / USB controller
  - Establish SSD controller design on 2008
- Today, there are several start up and established companies in Hangzhou Area for SSD.
- HDU established Microelectronic Research Institute focus on Storage ASIC and applications on 2011

Types of NAS

	Usage	Benefits	Consolidation	Advanced features benefits
Low-end NAS	Fast, simple file storage; extra file storage	Low cost; no special training	Consolidates desktop storage	Simplified backup
Midmarket NAS	Shared access to large volumes of files	Low cost; easily scaled to multiple terabytes; no special skills required	Consolidates multiple file servers	Clustering; point-in-time snapshot
High-end NAS	Shared access to large volumes of files; integrates with a SAN	Low cost; scalable; migration path	Consolidates many file servers; potential for NAS-SAN consolidation	Clustering; replication; gateway to SAN; multiprotocol support; management

Low End (Home) NAS

- Network Attached Storage -NAS
  - Hard Drives in a box for home and SMB
  - Connect to a home router
  - With CPU (x86), memory and a OS, (usually Linux)

Benefit of NAS

- Access to the Storage Drive
  - Wired of Wirelessly
  - Central, Local repository form files, media etc
  - Can be shared by multiple folks at the same network
- Direct sharing with individual computers ??
  - File sharing under Windows or Mac OS X can be cumbersome
  - Person sharing computer could be powered off at anytime
  - The entire arrangement is limited by individual storage space
- NAS overcomes capacity and power off limitations

Default NAS function

- Basic Storage function
  - Support SAMBA, FTP file sharing protocols
  - Support iSCSI as entry level SAN
- Security Access function
  - SSL authentication for user log into NAS
  - Data encryption before transfer to network
  - File and folder access right checking
- Storage management function
  - Manage S.M.A.R.T for early warning
  - Software RAID for Hard Drive, Usually RAID 0 & 1
  - Provide Rebuild function once drive failure.

NAS Providers

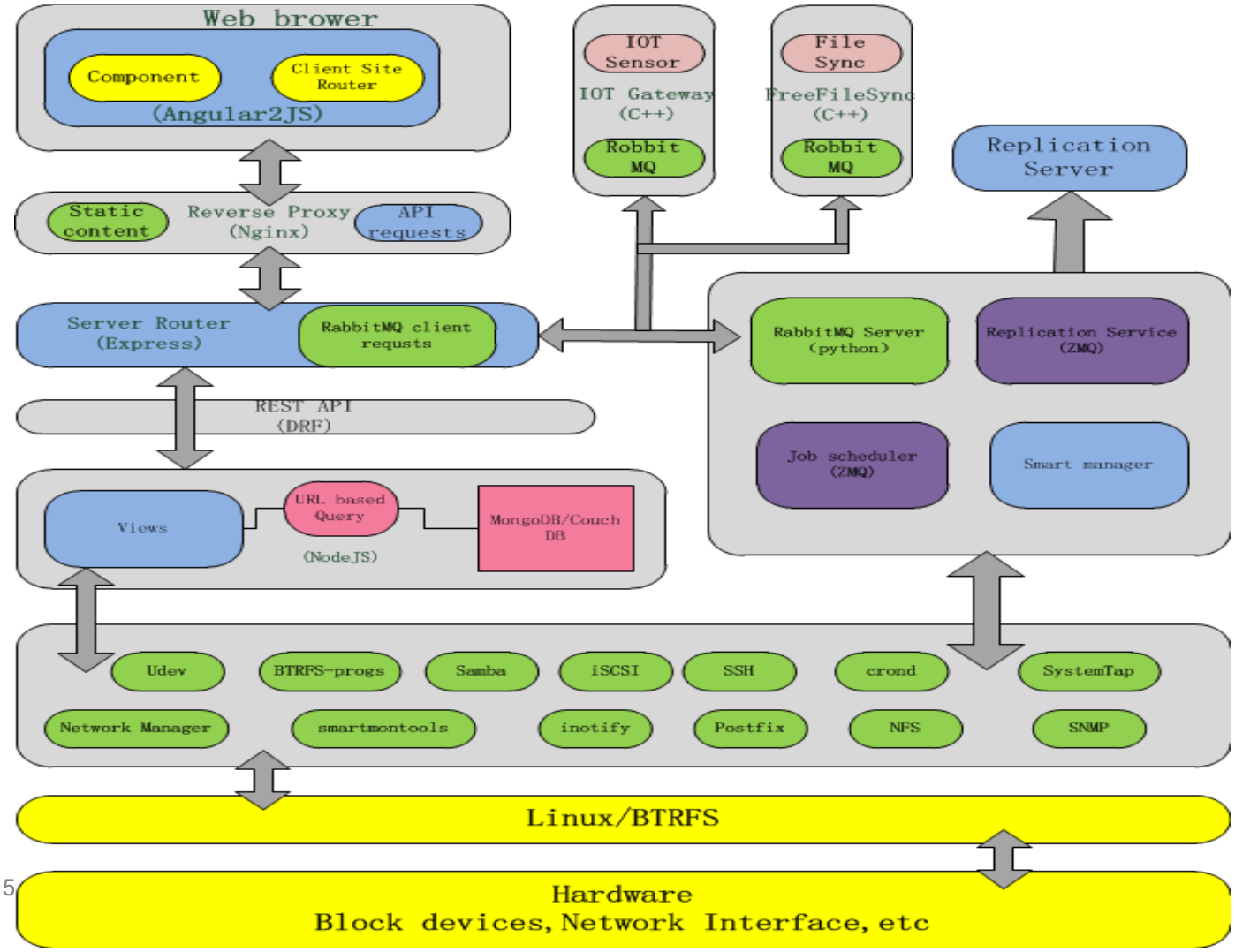
- Delicate NAS
  - HDD manufacture : Seagate and Western Digital
  - NAS box supply : QNAP, Synology, IO Data, Buffalo
  - Internet Router supply : Dlink, Xiaomi, Haiwei
- DIY NAS
  - Similar to DIY Desktop PC integrated an mini itx motherboard
  - Use Linux or Android OS
  - Load open source such as FreeNAS, OMV
- .Micro NAS
  - ARM based for low cost alternative
  - Due to popularity of PAD controller and Cellular Phone baseband Ch

NAS and Smart Gateway

- Advanced NAS function
  - Schedule disk snapshot, Remote clone and disaster recovery
  - Link with Cloud Storage
    - Amazon AWS, Microsoft Azure
    - Ali Cloud, Baidu Cloud
- Office and home Application
  - Media streaming, music jukebox and surveillance
  - Drop box like files sharing and SSL authentication
  - Mobile device synchronization
- An Internet of Things (IOS) gateway

airStack - Platform as a Service (PaaS)

- Current Open Source NAS Software
  - Not like Linux, Open Stack, still keep as an one team business
  - Very difficulty for other to add plug ins.
  - Still Scale Up, not Scale Out archtecture
- ARM based box in low end NAS
  - Use Raspberry Pie 3 as a prove of concept
    - $35/￥200 per set up
    - 4M Unit has been produced
    - 1.2G, 2 Core ARM, 4 USB, one CMOS sensor
    - 10/100 Ethernet, Wifi, Blue tooth build in
- Have a NAS PaaS to run on RP3
  - Next, Android Phone + USB 3.1 type C HUB


Web brower
Component
Client Site Router
(Angular2JS)
Static content
Reverse Proxy (Nginx)
API requests
Server Router (Express)
RabbitMQ client requsts
REST API (DRF)
Views
URL based Query
MongoDB/Couch DB
(NodeJS)
IOT Sensor
IOT Gateway (C++)
Robbit MQ
File Sync
FreeFileSync (C++)
Robbit MQ
Replication Server
RabbitMQ Server (python)
Replication Service (ZMQ)
Job scheduler (ZMQ)
Smart manager
Udev
BTRFS-progs
Samba
iSCSI
SSH
crond
SystemTap
Network Manager
smartmontools
inotify
Postfix
NFS
SNMP
Linux/BTRFS
Hardware
Block devices, Network Interface, etc

airStack – platform and message

- MEAN stack based PaaS
  - MongoDB, Express.js, Angular 2 js and Node js
  - Both front and back end under JavaScript
  - Favorites full stack implementation since 2015
- Two message broker
  - RabbitMQ as the middleware between each plug-in
    - Plug-in can write with different languages
    - This is huge advantage to inherit legacy code
  - ZeroMQ for asynchronies data replication for its efficiency
  - Note both message brokers can be locally or in cloud

airStack – NoSQL DB

- Benefit of NoSQL
  - No need to pre define schema
  - Store data not based on table's row and column
- Document Oriented NoSQL
  - Query based on http: Restful Interface, can be local or cloud
  - MongoDB has the highest share in NoSQL
    - MongoDB Service offer by AWS, RackSpace, Ali Cloud
  - Apache CouchDB
    - Master-Master / Master-slave replication
    - Adapted by Cozy.io, a personal private cloud platform
    - We are consider to switch from Mongo to Couch.

airStack – BTRFS

- Volume management
  - Mix and match/add and remove drives
  - Change RAID profile
- Copy on write
  - Self healing
  - Snapshoot and clone
  - Send and receive Snapshot
- Advance function and SSD Awareness
  - Compress and in-band and out-of-band reduplication
  - Quota group
  - On the fly defragmentation, reclaim block as SSD friendly

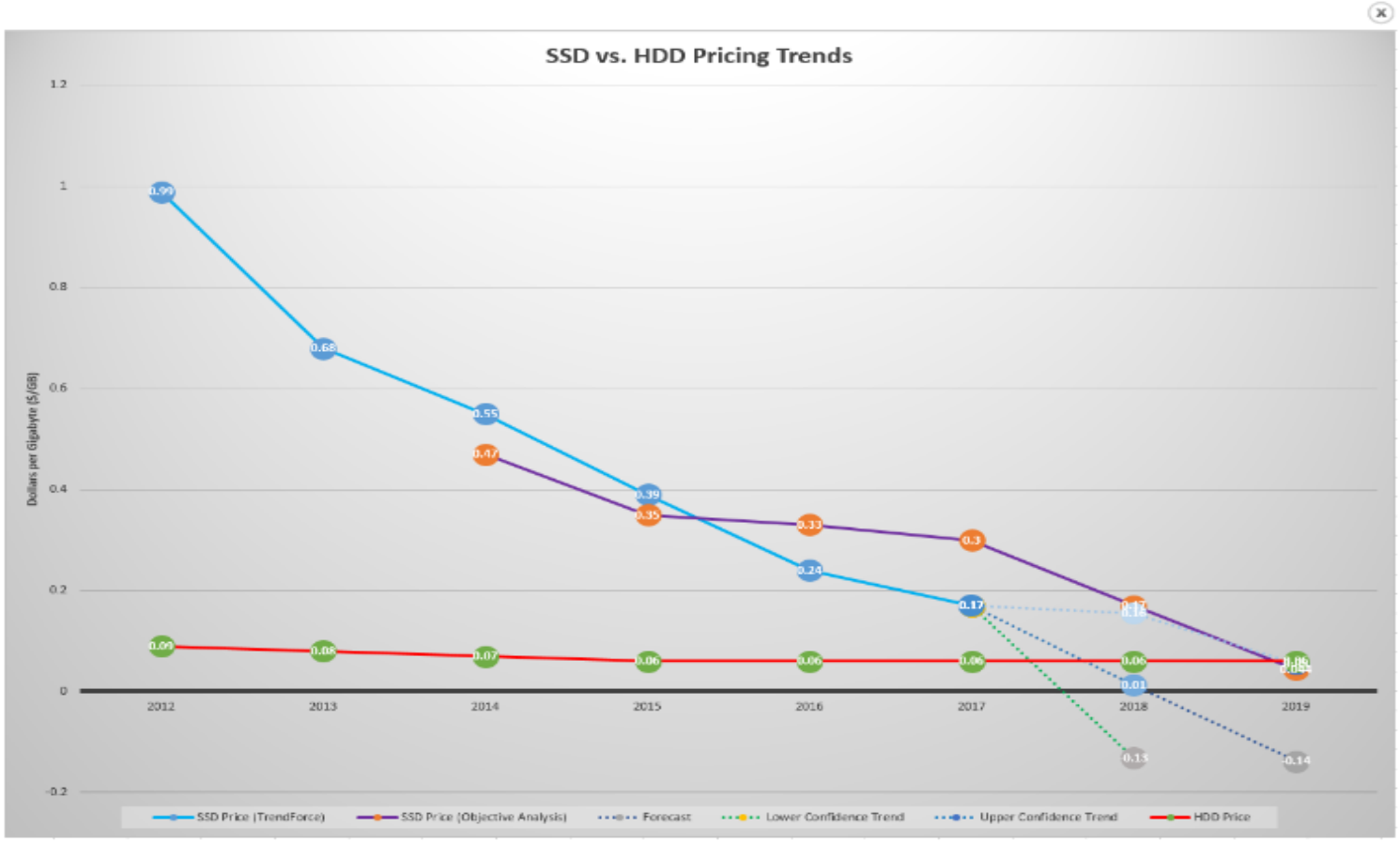


image 1 of 4 Two different estimates of SSD pricing, mapped against relatively static pricing for hard drives.

airStack – Business Model and Future

- airStack platform is Open Source
  - Free to home user and student
  - Some restriction to business
- Future plug-in expansion
  - Security and Encryption
  - Extend to SAN management
  - Link to public cloud and object storage
- Business Model
  - Work with ISP, Carrier and cloud provider as part of their offering
  - Do system integration with established business and government agency.

- Target Beta Release On Github by end of 2016 !!!.