AWIPS Architecture and Product Improvement Plans

11/09/04

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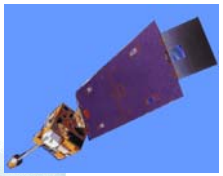
NWS SYSTEMS ENGINEERING CENTER

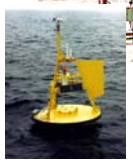
AWIPS System Architecture



GOES

NEXRAD

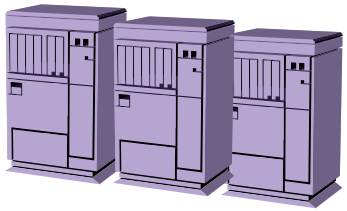
ASOS



Buoys,
River Gauges,
Lightning, etc.

Terrestrial and
Satellite
Communications
Systems

Network Control Facility



NCEP Weather Models

AWIPS

Firewall

Workstations

Workstations

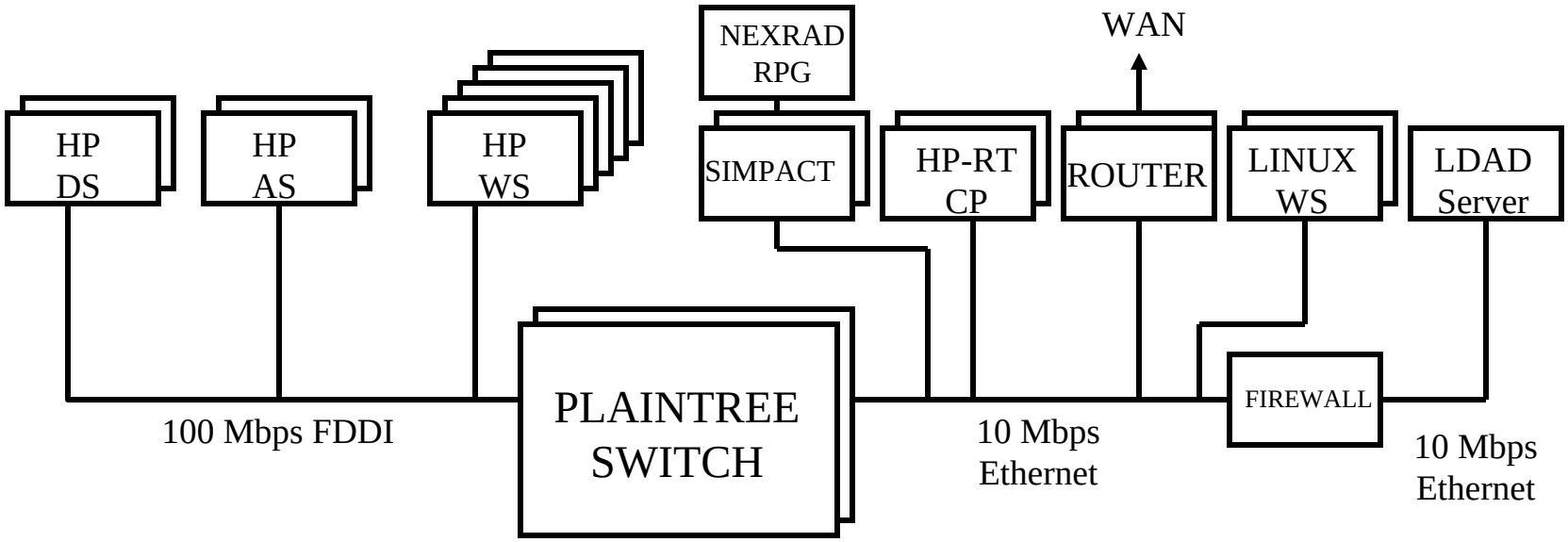
Retrieval,
Processing &
Storage
Servers

Workstations

Workstations

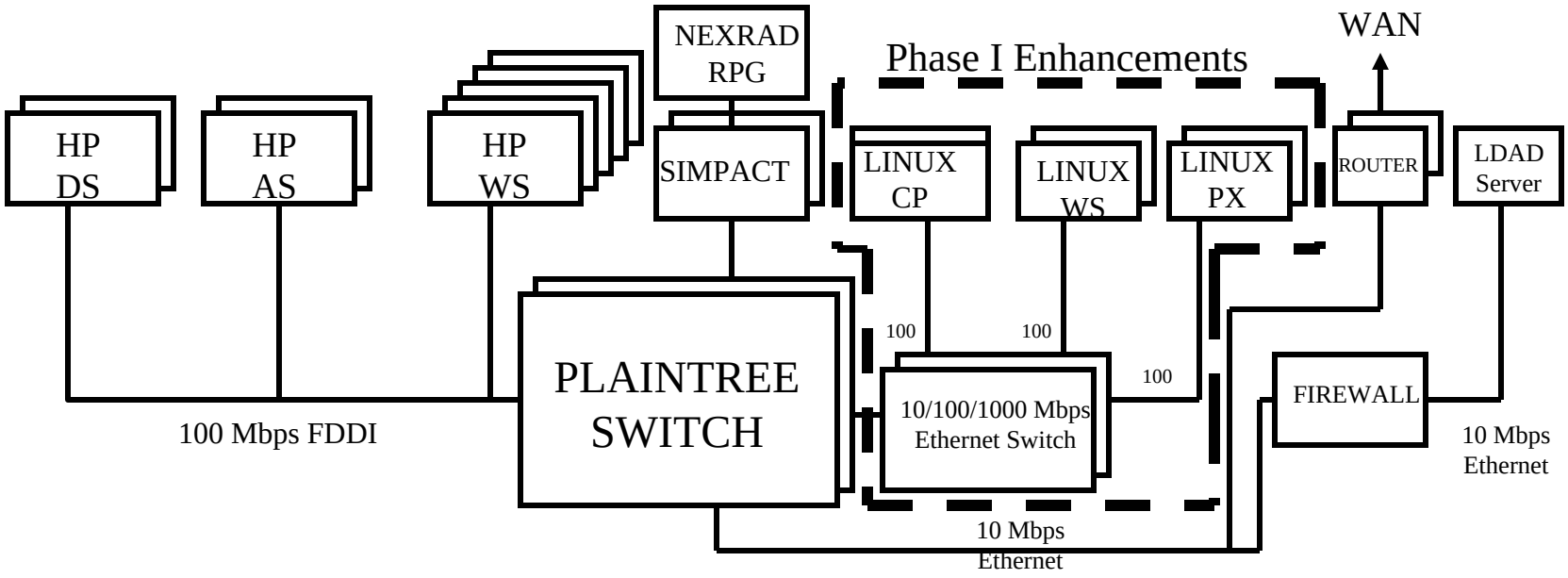
LAN

Legacy Architecture



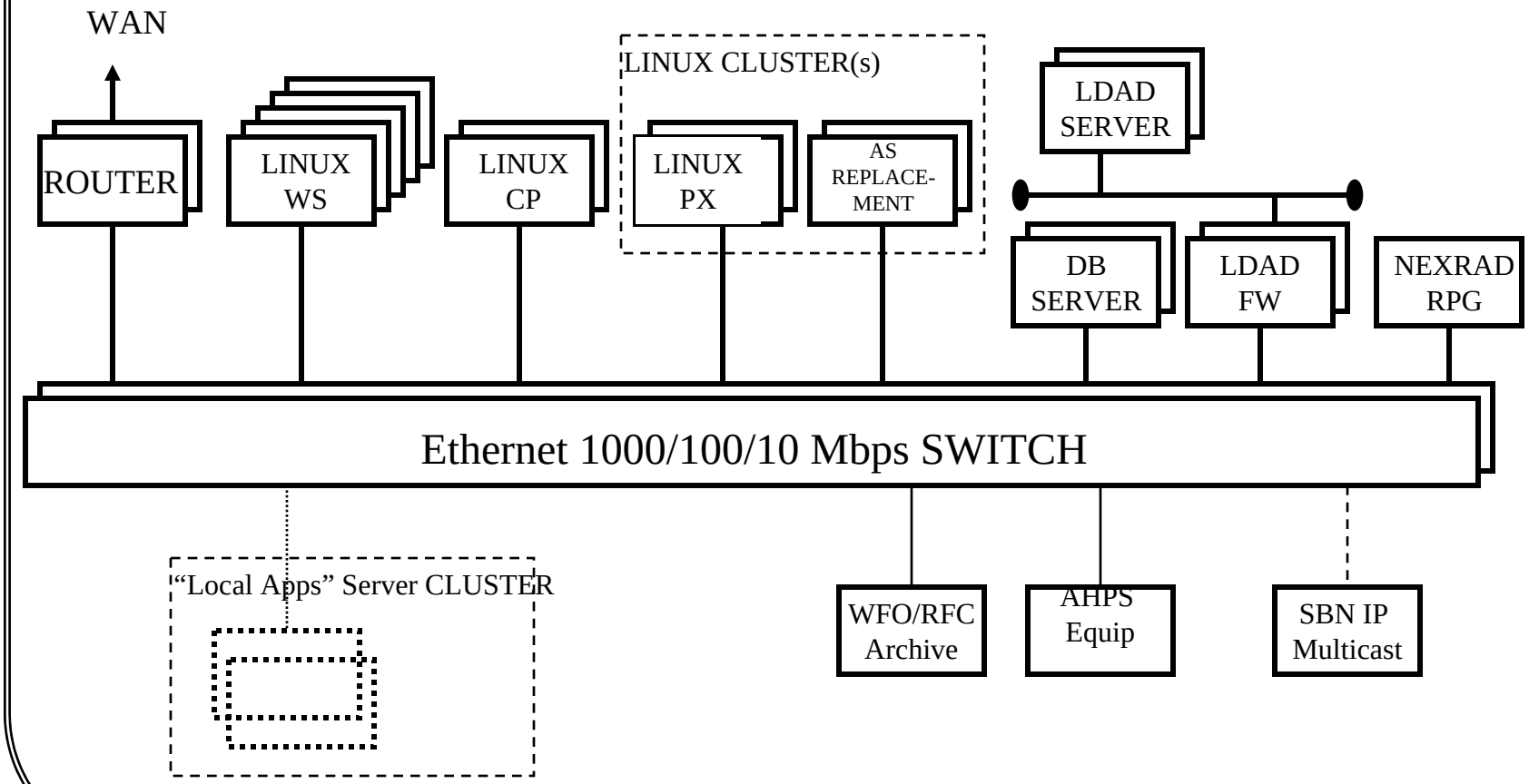
Total Processing Capacity: Approx. 900 MFLOPS

Linux Phase I Architecture



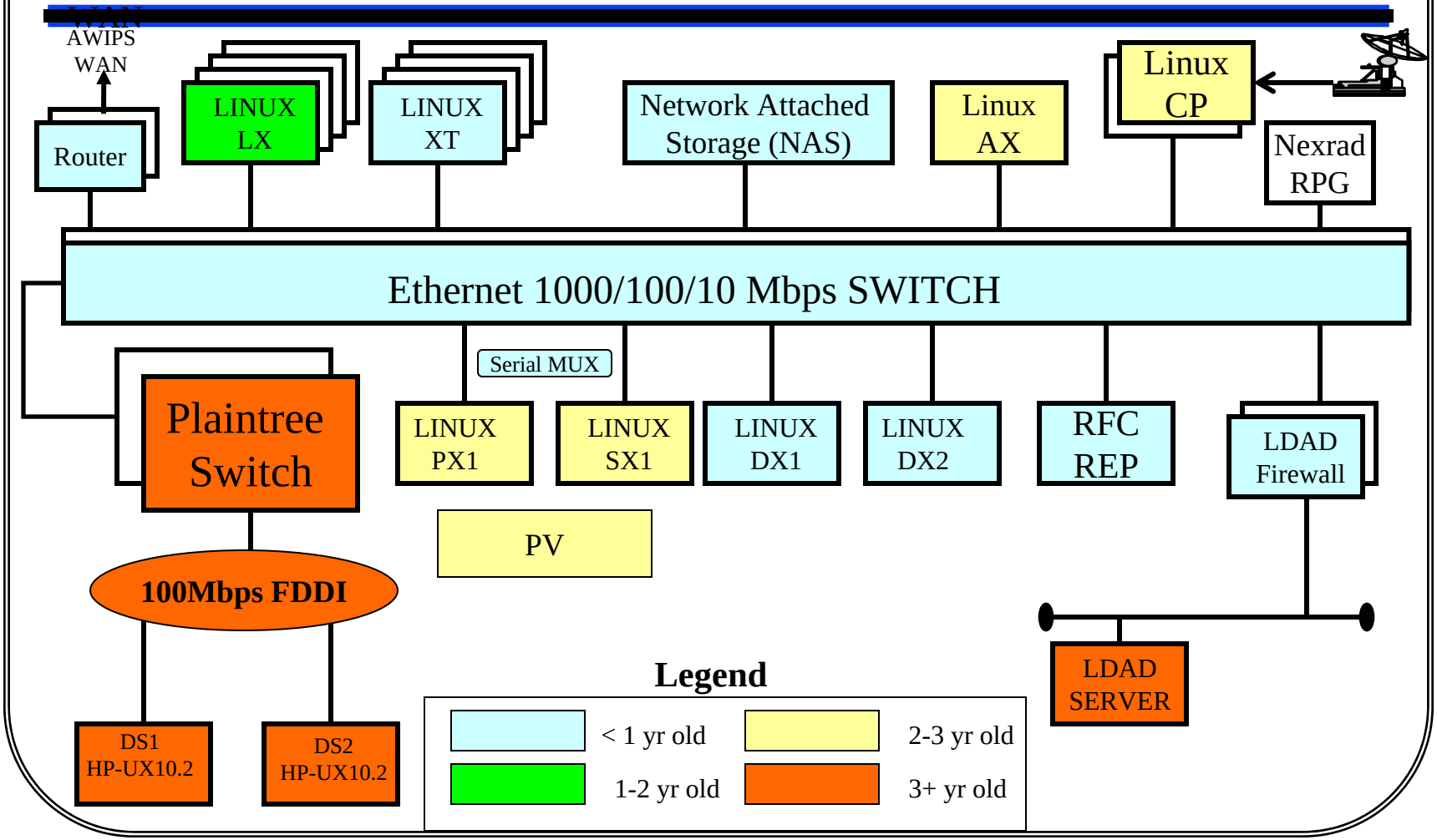
Total Processing Capacity: Approx. 3750 MFLOPS

Linux Phase II Target Architecture



Total Processing Capacity: Approx. 16,000+ MFLOPS

Expected WFO/RFC Hardware Architecture ~July '05



Operational Concept

- **Same operational concept, with enhanced computing resources, additional storage space, improved failover and centralized, shared mass storage using Network Attached Storage device.**

Overview

- An analysis of technology and development of a “to-be” architecture was initially briefed to the AWIPS Systems Engineering Team (SET) on 2/3/04.
- To-be architecture provides the framework to complete individual product improvement tasks while maintaining a common goal.

X-terminals	Redundant LDAD firewalls
DS/AS replacement	Redundant LDAD servers
Serial mux upgrade	Full DVB deployment

- To-be architecture facilitates development of a roadmap for schedule, budget and deployment planning.
- Roadmap assists in issue and dependency identification and resource planning for risk reduction.

AWIPS To-Be Architecture

- Hardware
  - Utilize Network Attached Storage (NAS) technology
  - Deploy commodity servers on GbE LAN
  - Incrementally deployed and activated
  - Promote reuse of select hardware
  - Remove limitations of direct attached storage
- Software
  - For availability, move from COTS solution to use of public domain utilities
    - Some experience with NCF and REP
    - Can be decoupled from operating system upgrades
    - Supports NAS environments
    - Can be augmented for load balancing if required
  - Deploy low cost Linux database engine (PostgreSQL)

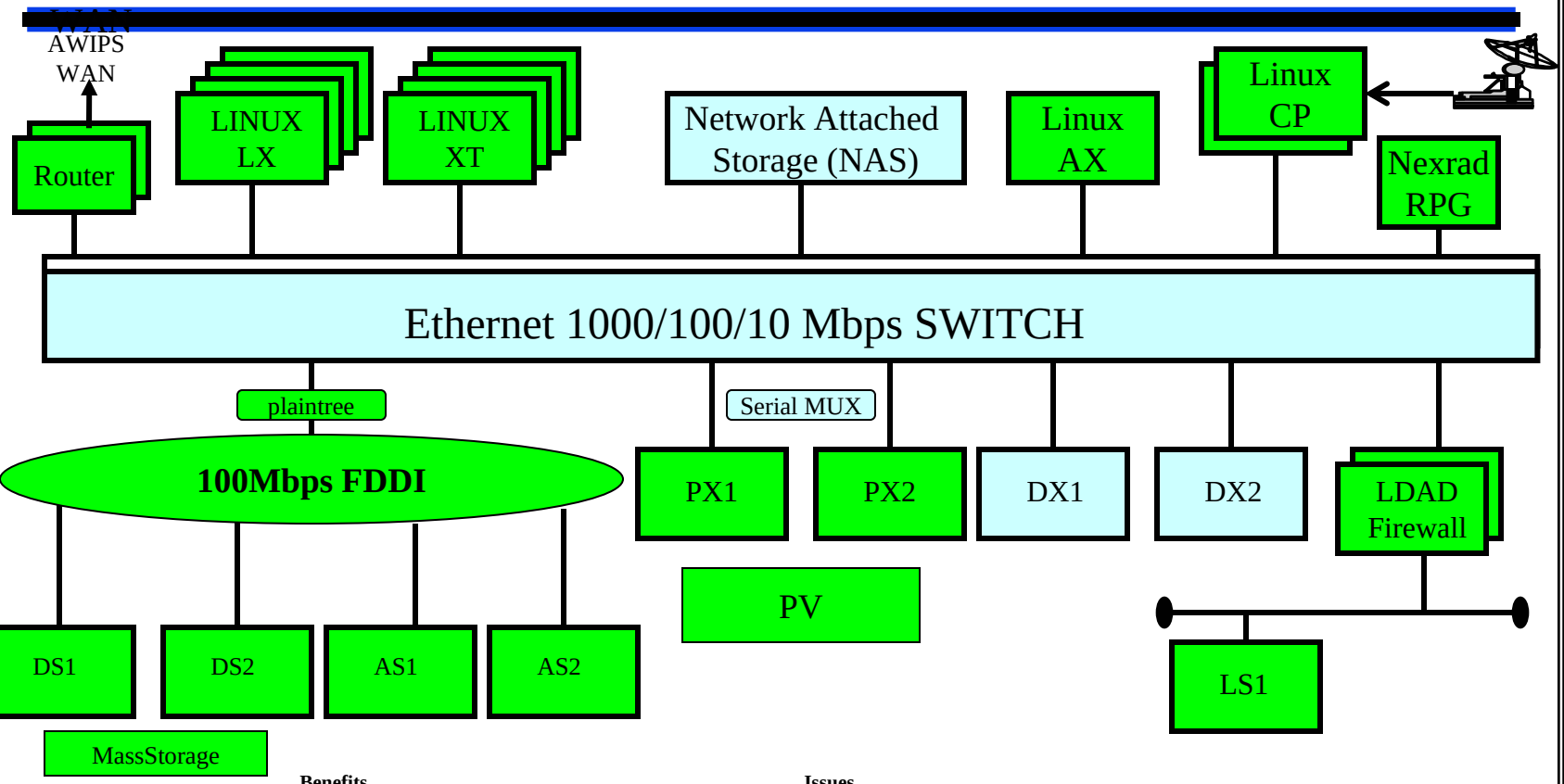
AWIPS To-Be Architecture

- Methodology
  - Stage hardware, move software when ready
  - Reuse hardware to ease transition and allow planned decommissioning
  - Deploy flexible availability framework
- Goals
  - Decommission AS, AdvancedServer, DS and FDDI
  - Support universal deployment of single Linux distribution (currently RHE3.0 with OB6)
  - Provide dedicated resource for local applications
  - Expandable within framework (easy to add servers)
  - Deploy to subset of sites prior to February 2005

Step 1 – Initial Hardware Deployment

- Release OB4 and new XT's installed, is a prerequisite
- Initial staging of hardware
  - New rack
  - NAS w/LTO-2 tape (~400GB storage and backup)
  - 2 commodity servers – DX1/DX2
  - 2 GbE switches and associated cables, etc
  - 2 8-port serial mux replacements (installed in PX1/2)
- NAS key to incremental deployment and activation
- Serial mux replacements installed but not activated
- LTO-2 drive for site backup
- New hardware and PX1/PX2 on GbE LAN
- LDAD firewall upgrade deployed independently

Step 1 and Release OB4 Hardware Architecture



Benefits
- Solves Active/Active PX problem
- DS Mass Storage and AutoLoader can be decommissioned

Issues
- Will plaintree swtch handle nfs traffic from DS/AS to NAS?
- Does site have footprint for another rack before any old ones are decommissioned?
- What is the file structure of the NAS?
- Do most decoders use internal storage for temp files?
- What kind of NCF monitoring will be available for the NAS?

Light Blue or Clear boxes indicates new hardware component

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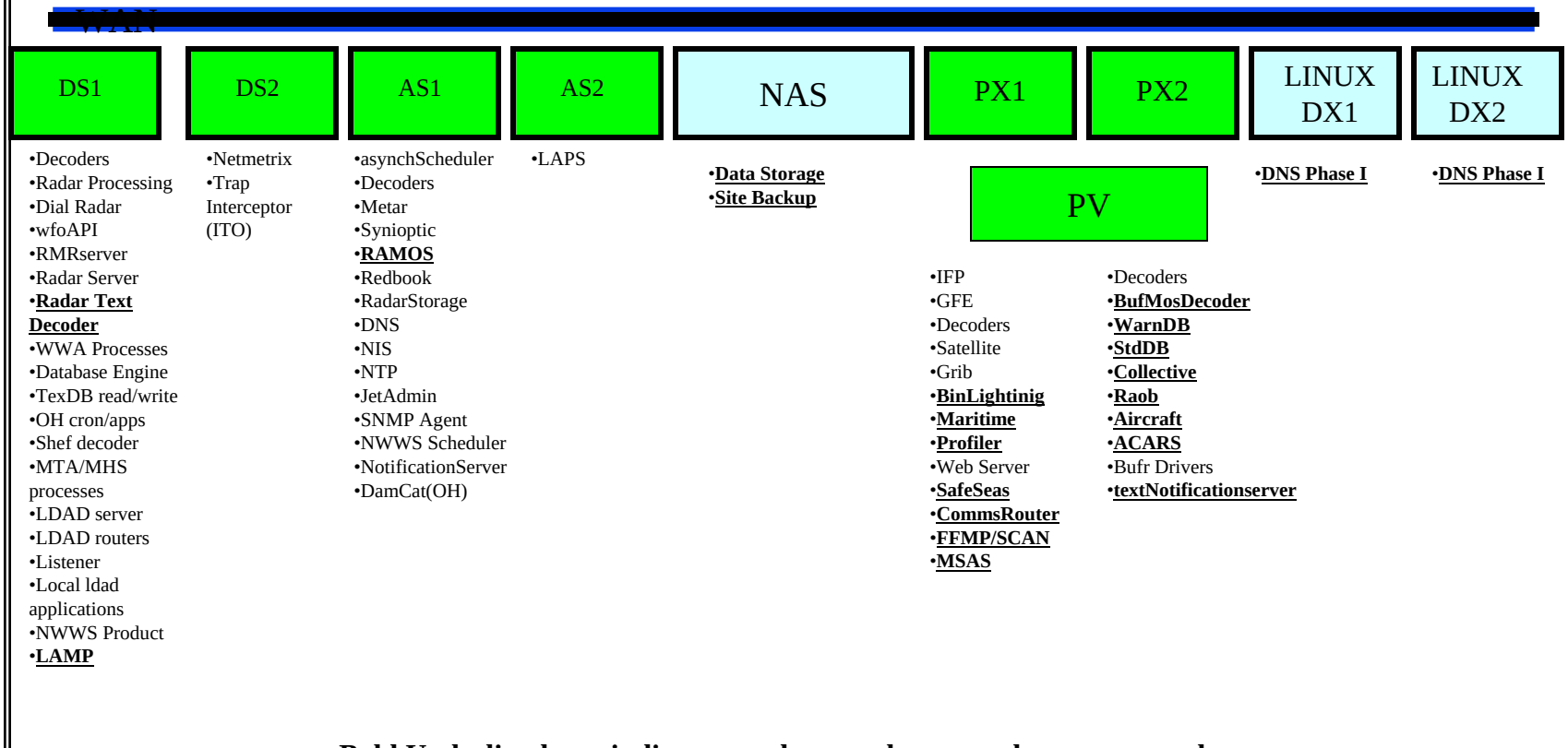
Step 1 and Release OB4 Software and Data Architecture



Bold Underlined text indicates newly ported or moved processes or data

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Processes and/or data are listed underneath corresponding hardware component

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Step 1 - Incremental Activation

- Activate NAS
  - Point DS to NAS
    - Allows DS1/DS2 to be used as active/active pair using existing MC/ServiceGuard infrastructure
    - Decommission DS mass storage and autoloader
  - Point PX1/PX2 to NAS
    - Maintain active/active pair
    - Deliver new availability mechanism
    - De-activate cluster management portion of AS2.1
    - PowerVault (PV) deactivated for near-term
- Connect PX1/PX2 to GbE LAN and install PCI-X cards as future AS serial mux replacement once APS port is complete
- Most data to the NAS, temporary files continue to be written to local disk
- Planning early October OAT to verify DS1/DS2 and PX1/PX2 failover and NAS data availability
- Require a full deployment decision in mid-October to complete deployment of initial 64 sites by 1 Feb 05

Step 1- Considerations

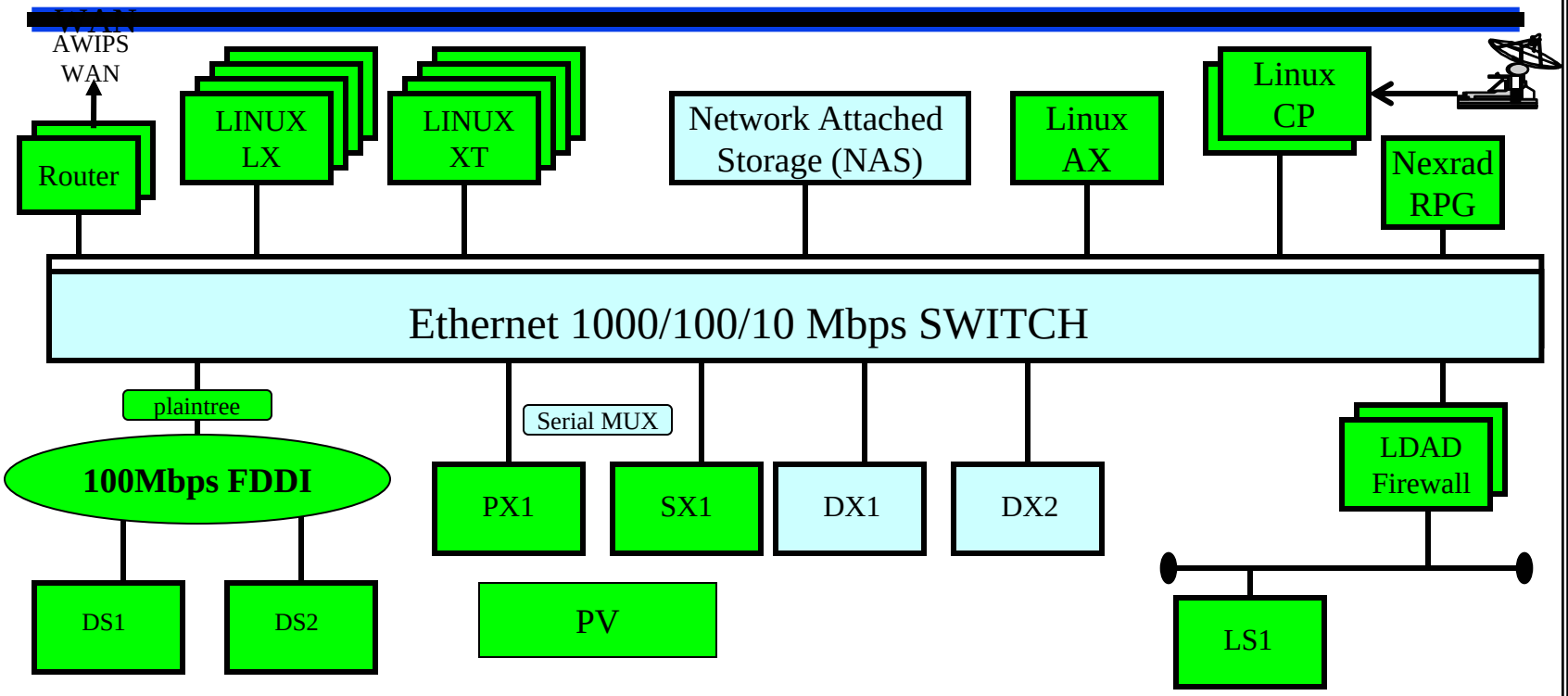
- Current plan is to move data from DS mass storage and PX PowerVault to NAS
  - Limited to 2GB tar files
  - Some sites will need to clean up px1data and px2data prior to NAS installation
- Rack placement at WFOs
  - Early sites will have “extra” rack longer than sites deployed later in 2005

NAS1			
10 x 72 GB Raw Disks (RAID 4)			
Disks (10): Root/Data (7) + Parity (2) + Hot Spare (1)			
Qtree Name	**Mount point**	**Quota (GB) WFO**	**Quota (GB) RFC**
/vol0/.snapshot	-- 10 % --	41.6	41.6
/vol0/home	/home	2.0	8.0
/vol0/data_fxa	/data/fxa	60.0	60.0
/vol0/data_x400	/data/x400	0.3	0.6
/vol0/awips_GFESuite	/awips/GFESuite	35.0	0
/vol0/awips_adapt	/awips/adapt	1.0	0
/vol0/data_adapt	/data/adapt	2.5	0
/vol0/awips_hydroapps	/awips/hydroapps	1.5	55.0
/vol0/awips_gis	/awips/gis	0	3.0
/vol0/awips_dev	/awips/dev	0.3	0.3
/vol0/data_local	/data/local	9.0	1.5
/vol0/DS_shared	/DS_shared	1.4	1.4
Total Space Used		**154.6**	**171.4**
Network Attached Storage			
		WFO	**RFC**
Low level Format Capacity (GB per disk)		**66.0**	**66.0**
WAFL requirement of 10% (GB per disk)		**6.6**	**6.6**
Raw Root/Data Available Capacity (GB)		**415.8**	**415.8**
Allocated Capacity (GB)		**154.6**	**171.4**
Unallocated Capacity (GB)		**261.2**	**244.4**

Step 2- Decommission AS1/AS2

- Release OB4 maintenance release (OB4.X) of stable OB5 software required for AS decommissioning
- Activate DX1/DX2
  - Infrastructure/decoders move to DX1
  - IFP/GFE to DX2
  - Newly ported functionality to DX1
- Reuse PX1 and PX2 as PX1 and SX1
  - PX1 for applications/processes using processed data
  - SX1 for Web Server, local applications and eventually LDAD
  - Activate serial mux replacement and ported APS
- Non-ported software from AS1 to DS2
- DX1/DX2 deployed with RH 7.2 as risk reduction

Step 2 and OB4.AS/OB5 Hardware Architecture



Benefits
- Could stop maintenance on AS's
- Could eliminate 1 rack of equipment
- Start migration of MHS

Issues
- Start running X.400 and SMTP in parallel.
- Should PX and SX be retrofitted with extra disks?

Light Blue or Clear boxes indicates new hardware component

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Step 2 and OB4.AS/OB5 Software and Data Architecture

DS1

- Radar Processing
- Dial Radar
- wfoAPI
- RMRserver
- Radar Server
- WWA Processes
- Database Engine
- TexDB read/write
- OH cron/apps
- Shef decoder
- MTA/MHS processes
- LDAD server
- LDAD routers
- Listener
- Local ldad applications
- NWWS Product
- LAMP

DS2

- ***Decoders***
- ***Metar***
- ***Synoptic***
- ***RAMOS***
- Netmetrix
- Trap Interceptor (ITO)

DX1

- ***Decoders***
- ***BinLightning***
- ***Satellite***
- ***Grib***
- ***Maritime***
- ***WarnDB***
- ***StdDB***
- ***Collective***
- ***BufMostDecoder***
- ***Raob***
- ***Aircraft***
- ***ACARS***
- ***Profiler***
- **Redbook**
- **RadarStorage**
- **RadarMsgHandler**
- **RadarTextDecoder**
- **HandleGeneric**
- ***Bufr Drivers***
- ***CommsRouter***
- **DNS**
- **NIS**
- **NTP**
- **JetAdmin replacement**
- **SNMP Agent**
- **SMTP MTA/MHS**
- **Xyplex hosting**

DX2

- ***IFPServer***
- ***GFE***

NAS

- Data Storage
- Site Backup

PX1

- FFMP/SCAN
- SafeSeas
- **LAPS**
- MSAS
- ***Text notificationserver***
- **asynchScheduler**
- **NWWS Scheduler**
- **Notification server**
- **DamCrest(OH)****

SX1

PV

- ***Web Server***
- **routerStoreNetcdf****

*Serial MUX is an AS Decommissioning dependency
**Requires prototype testing

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Processes and/or data are listed underneath corresponding hardware component 7/30/04

Bold Italicized text indicates moved processes Bold and underline indicates newly ported processes

Step 2- Incremental Activation

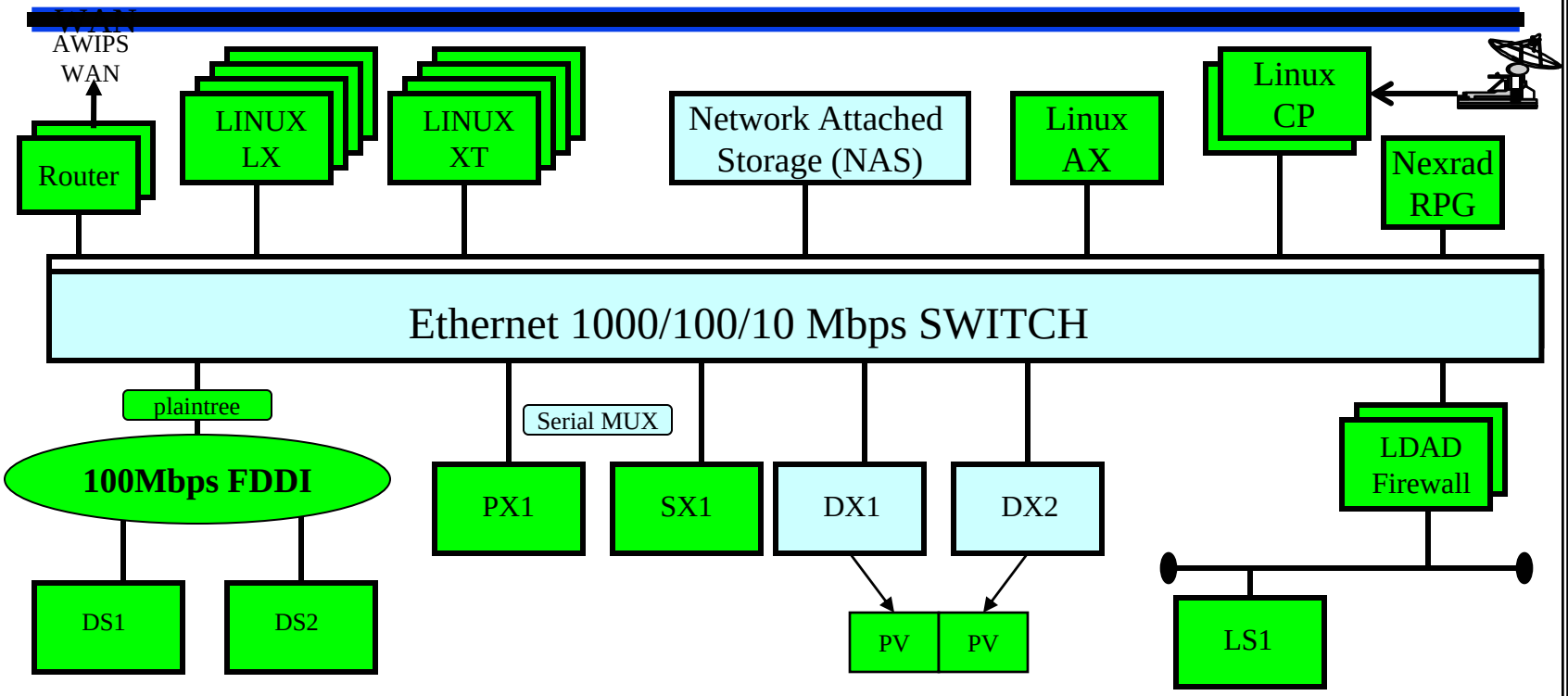
- Failover scheme
  - DX1 to DX2
  - DX2 to DX1
  - PX1 applications and servers to DX2
  - PX1 processes APS and NWWSProduct to SX1 (require PCI-X card access)
  - SX1 baseline software to PX1
- Decommission AS1/AS2 and excess rack
- Linux SMTP MTA deployed as start of migration from x.400 (required for DS decommission)
- Provide sites with some level of performance improvement as early as software readiness allows

Step 3 – Deploy Data Base and OS

- Deploy Linux PostgreSQL data base engine to DX1
  - Move existing PV to new rack and connect to DX1/2
  - Reconfigure PV (possibly into 2 separate direct attached disk farms, one for each DX)
  - Database availability via mirrored or replicated databases is TBD at this time
  - May be accelerated to OB5 for fxatext database
- Migrate ported databases
- Upgrade operating system (currently RHE3.0) on all applicable hosts

LX/XT AX	CP (if full DVB deployment complete)
PX/SX	RP (RFCs only)

Step 3 and OB6 (w/ all RHE v3) Hardware Architecture



Benefits
- Start Migration of Databases

Issues
- When will apps be ready to use PostgreSQL?
- Data reliability with PostgreSQL
- Will there be issues with running Informix and PostgreSQL in parallel?
- What is the performance of PostgreSQL?

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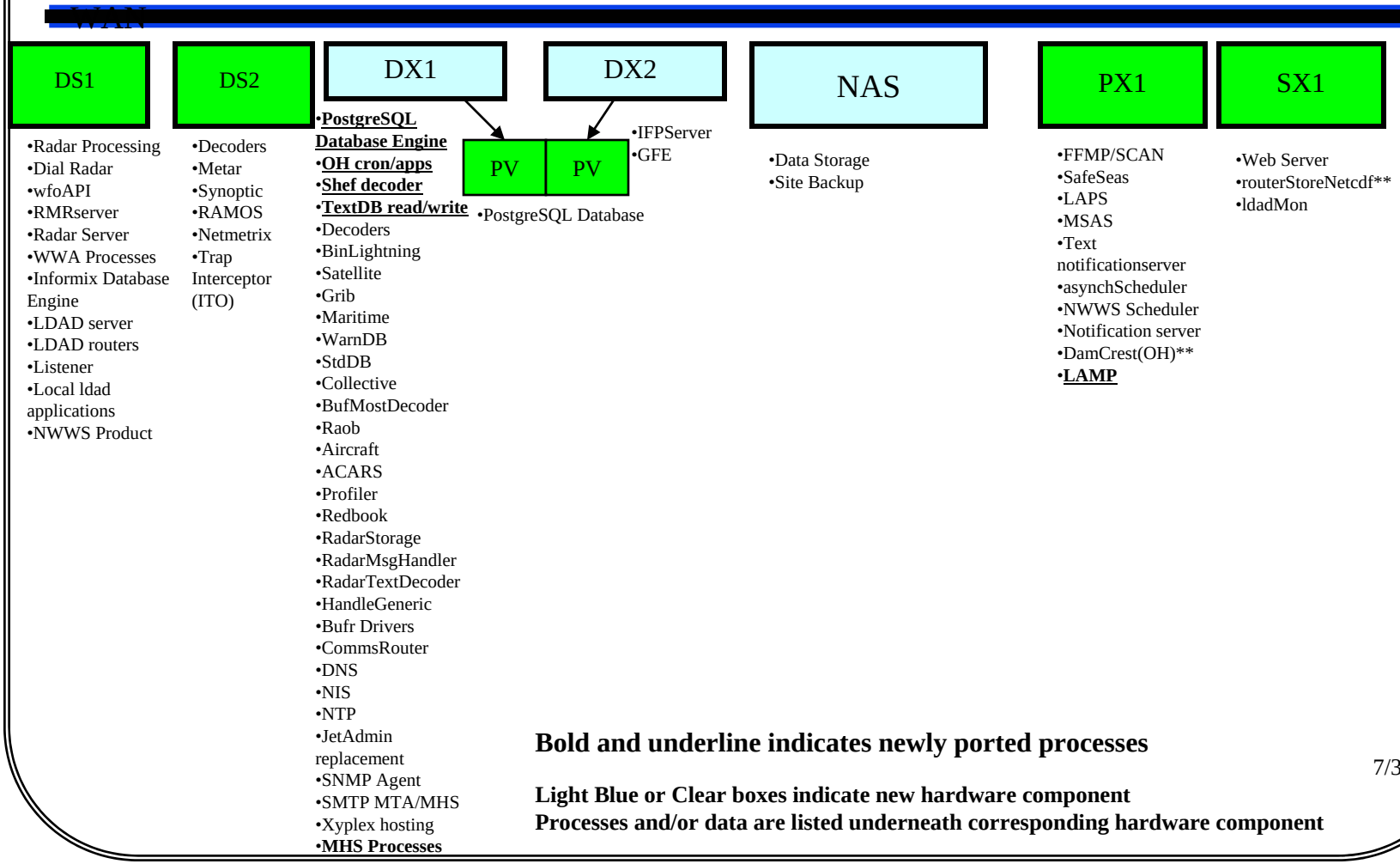
Step 3 and OB6 (w/RHE3.0) Software and Data Architecture



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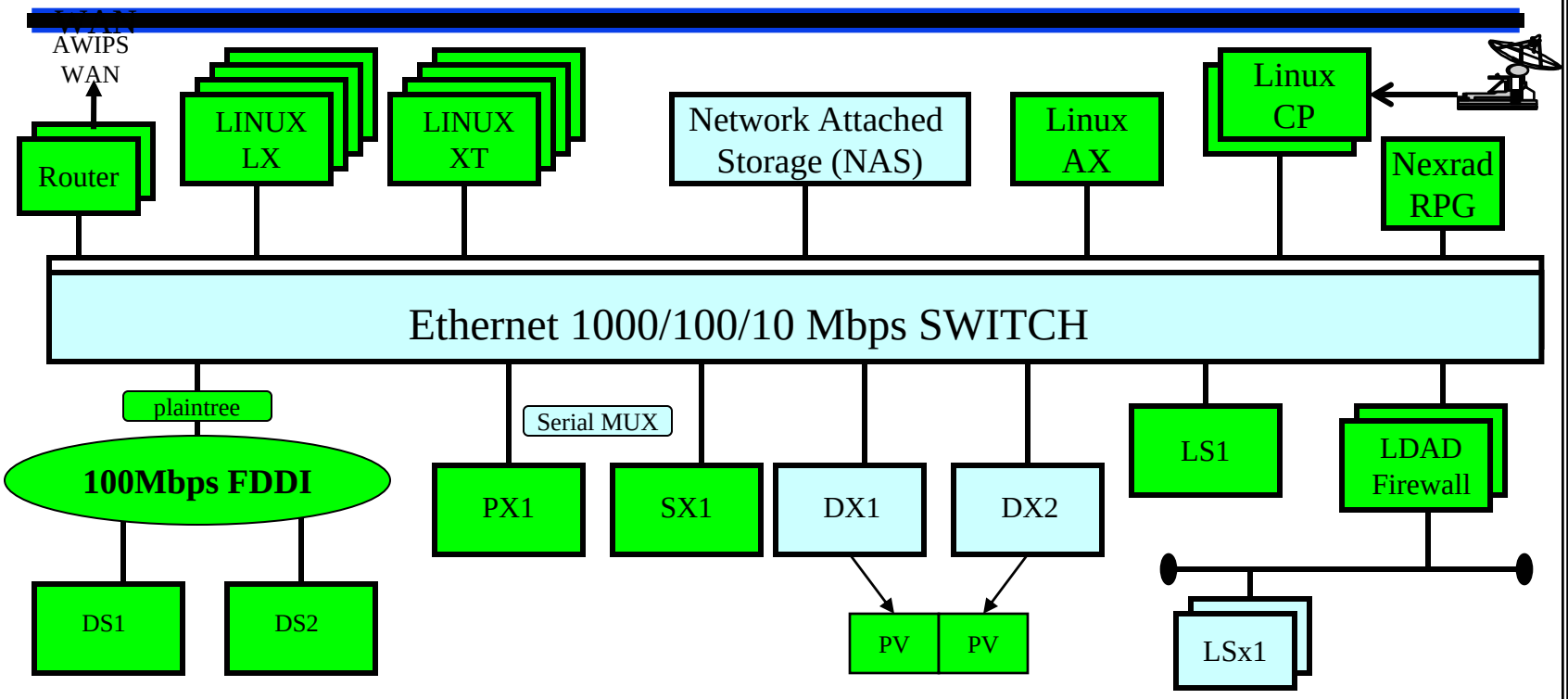
Step 3 – Incremental Activation

- Decommission AS 2.1 and HP Informix
- HP Informix engine can remain on DS for site use
- Transition to SMTP and decommission x.400
- Consideration - Can/should PostgreSQL be delivered early to RH7.2 DXs?
  - Most sites run software against GFS databases, not their own databases.
  - Database and software will be tested with RHE3 only as part of OB6.
  - If databases delivered early how/when does parallel ingest get developed and tested?
  - Should RFCs be handled differently?
    - What about old HP GIS workstations?

Step 4 – Deploy LDAD Upgrade

- Deploy LS1 and LS2
  - Deploy redundant server pair (requirements still tbd)
  - Could reuse PX1/SX1 as LS1/LS2 and use new generation hardware for PX1/SX1
- Activate LS1/LS2
  - Migrate internal LDAD processing to SX1
  - Some internal and external LDAD processing must transition at same time
- Reuse existing HP LS on internal LAN
  - Existing 10/100 MB LAN card

Step 4 and OBx Hardware Architecture



Benefits
•Move old LS1 to internal LAN

Issues
•Transition from LS to LSx needs to consider how/when local ldad apps will be done.
•Do we run old LS and new LSx in parallel while sites convert their local software?
•Int/Ext Ldad software must be ready to transition at the same time.
•Could reuse PX1 and SX1 for LSx1/2 and buy higher end machines for PX1 and SX1

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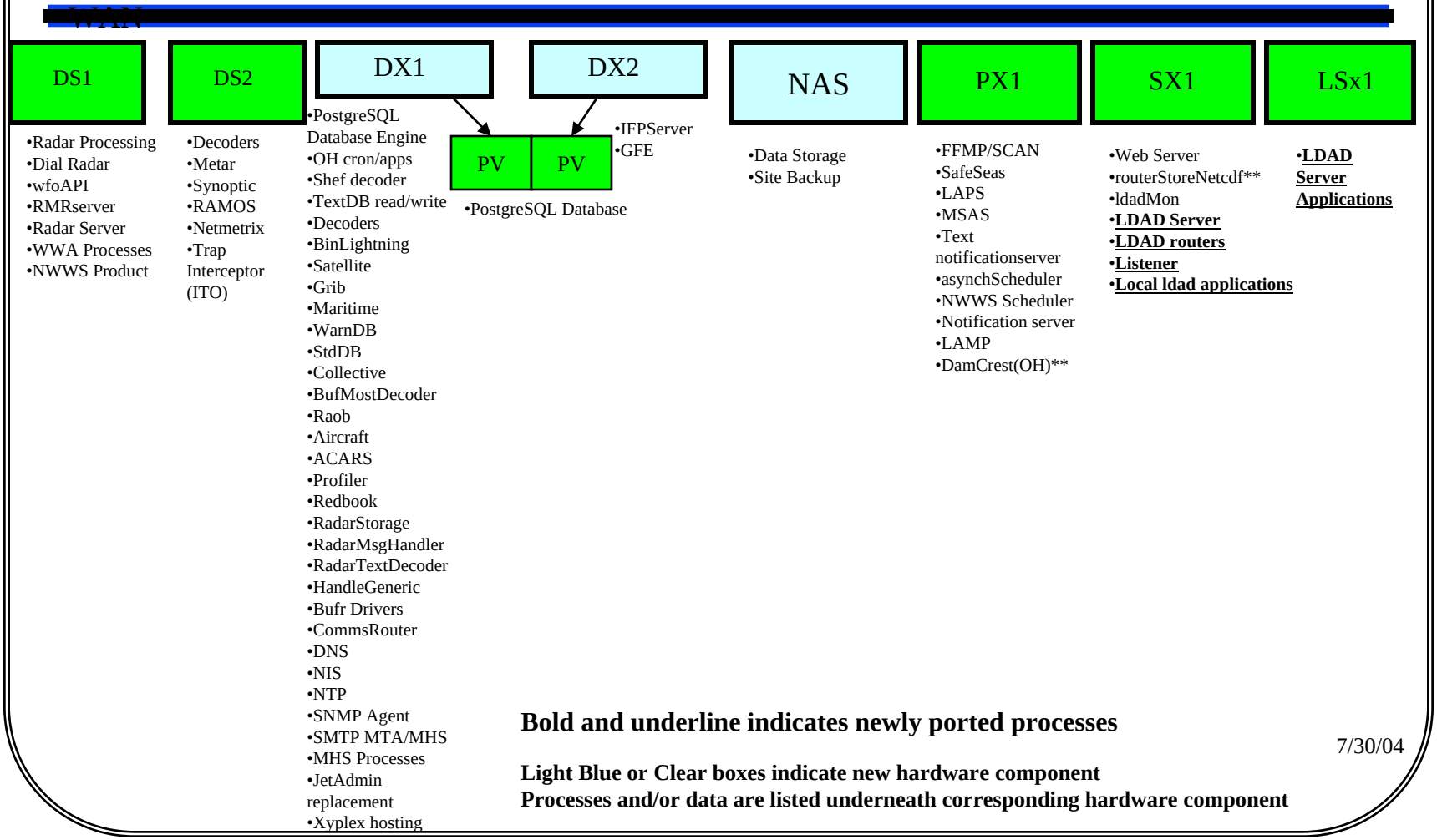
Step 4 and OBx
Software and Data Architecture



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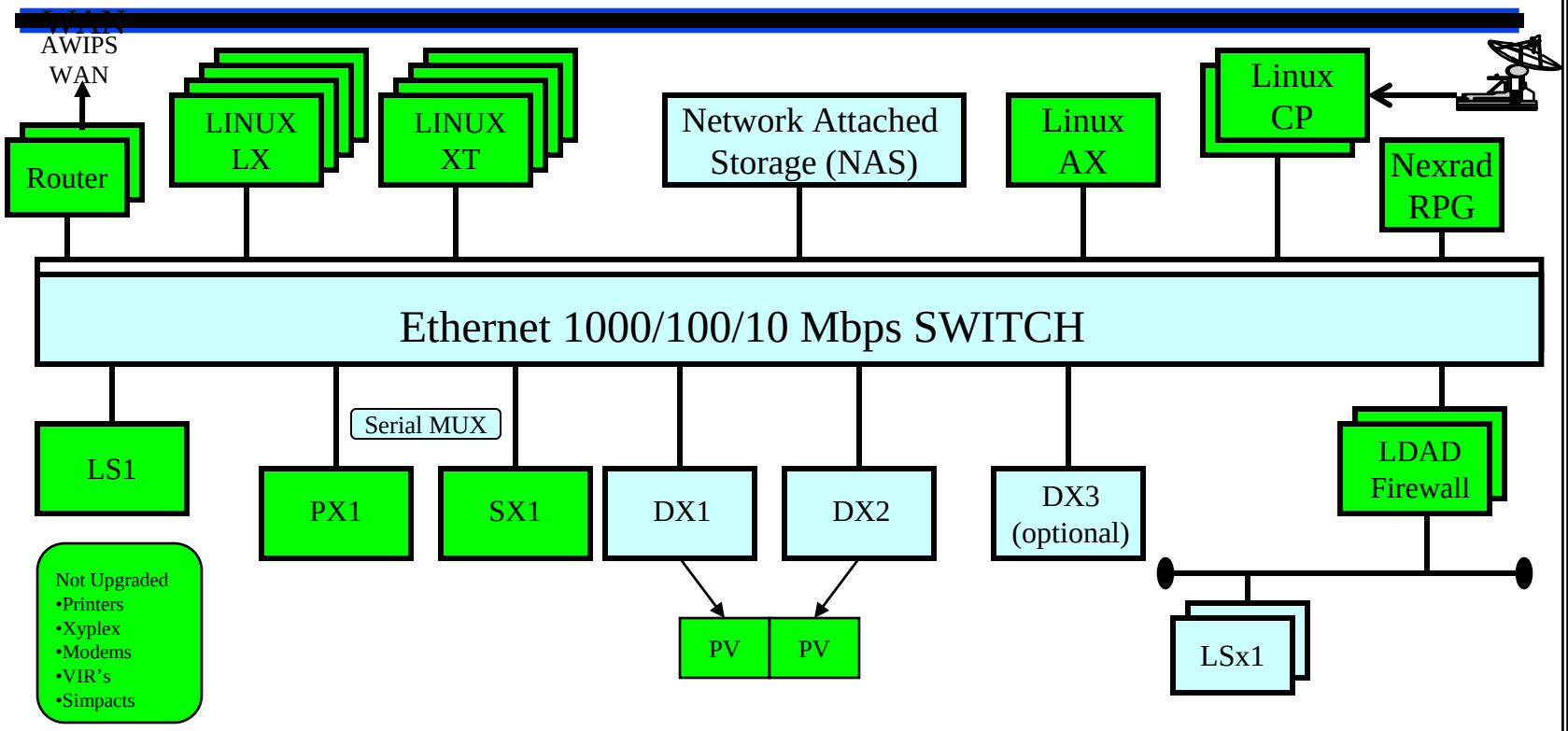
Step 5 – Decommission DS1/DS2

- Continue to move ported software/databases to Linux servers
  - Combine with step 6 if additional DXs are required
  - DX1 for database server and infrastructure
  - DX2 for IFP/GFE
  - DXn for decoders
- All Linux devices on GbE LAN
- Remaining functionality on LS on 100MB LAN
  - DialRadar/wfoAPI (tied to FAA/DoD requirements) may be OBE at this point. If so, Simpacts and LS can be decommissioned at all non-hub sites.
  - Netmetrix (required at hub sites only)

Step 5 and OBx Hardware Architecture



Benefits
•FDDI and DS decommissioned.
•Reuse of LS for SW that isn't proted yet. (non-redundant)
•Rack consolidation

Issues
•Dialup and wfoAPI may still be needed on an HP-UX machine
•Netmetrix at HUB sites needs to be on HP-UX

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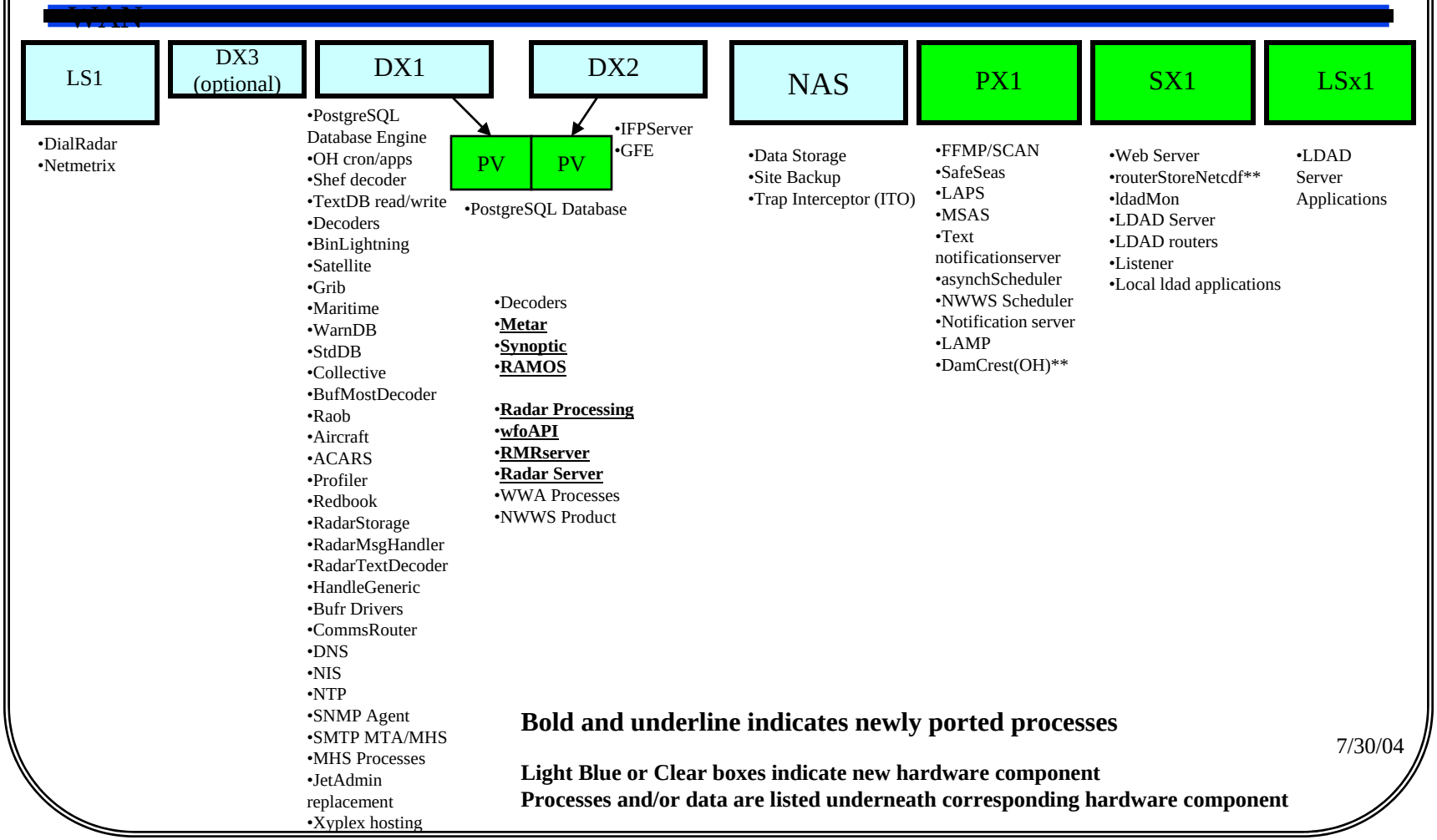
Step 5 and OBx
Software and Data Architecture



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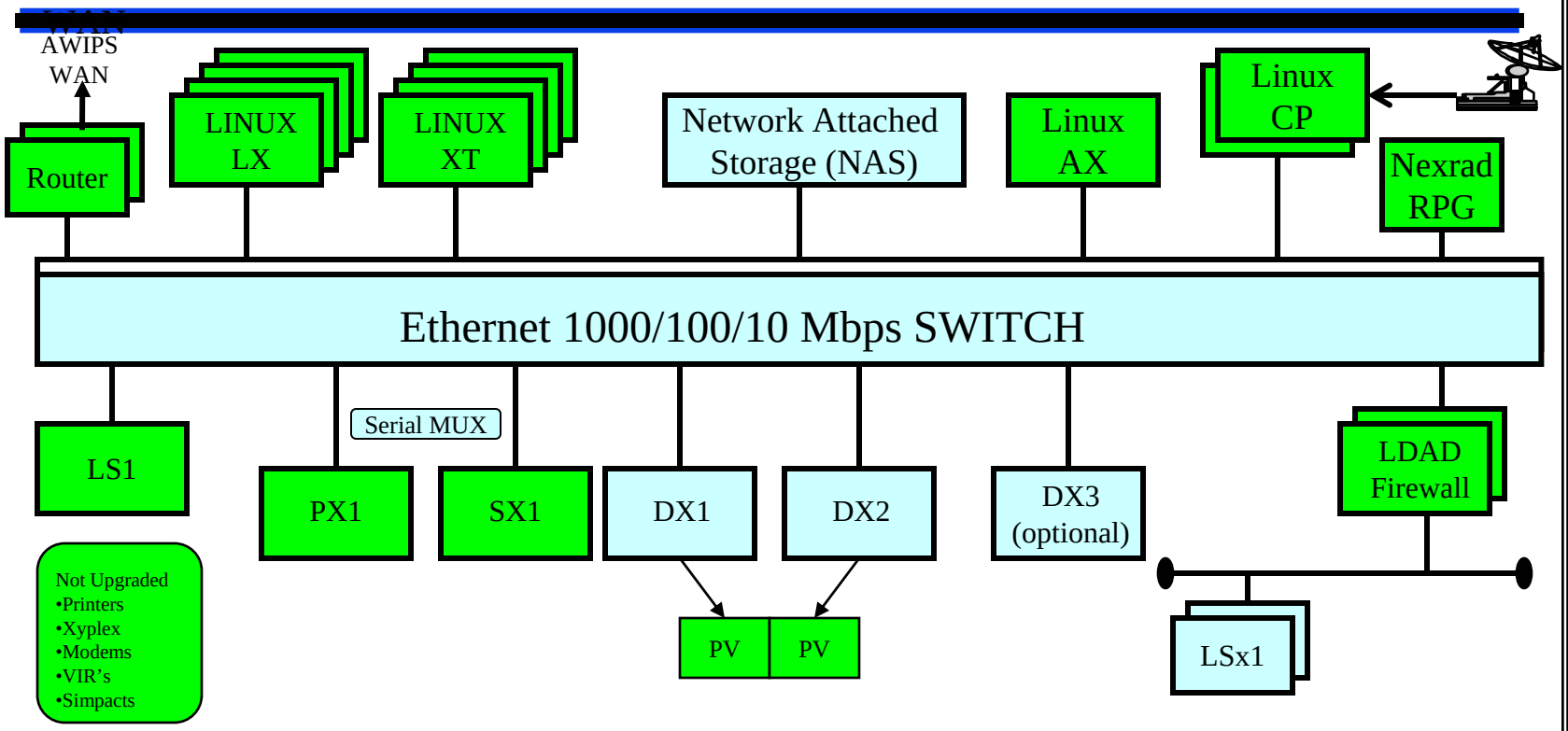
Step 6 – Process Loading

- Incrementally add DX hosts for load balancing for new functionality and data sets.
  - DX1 for database server and infrastructure
  - DX2 for IFP/GFE
  - DXn for decoders

Step 6 and OBx Hardware Architecture



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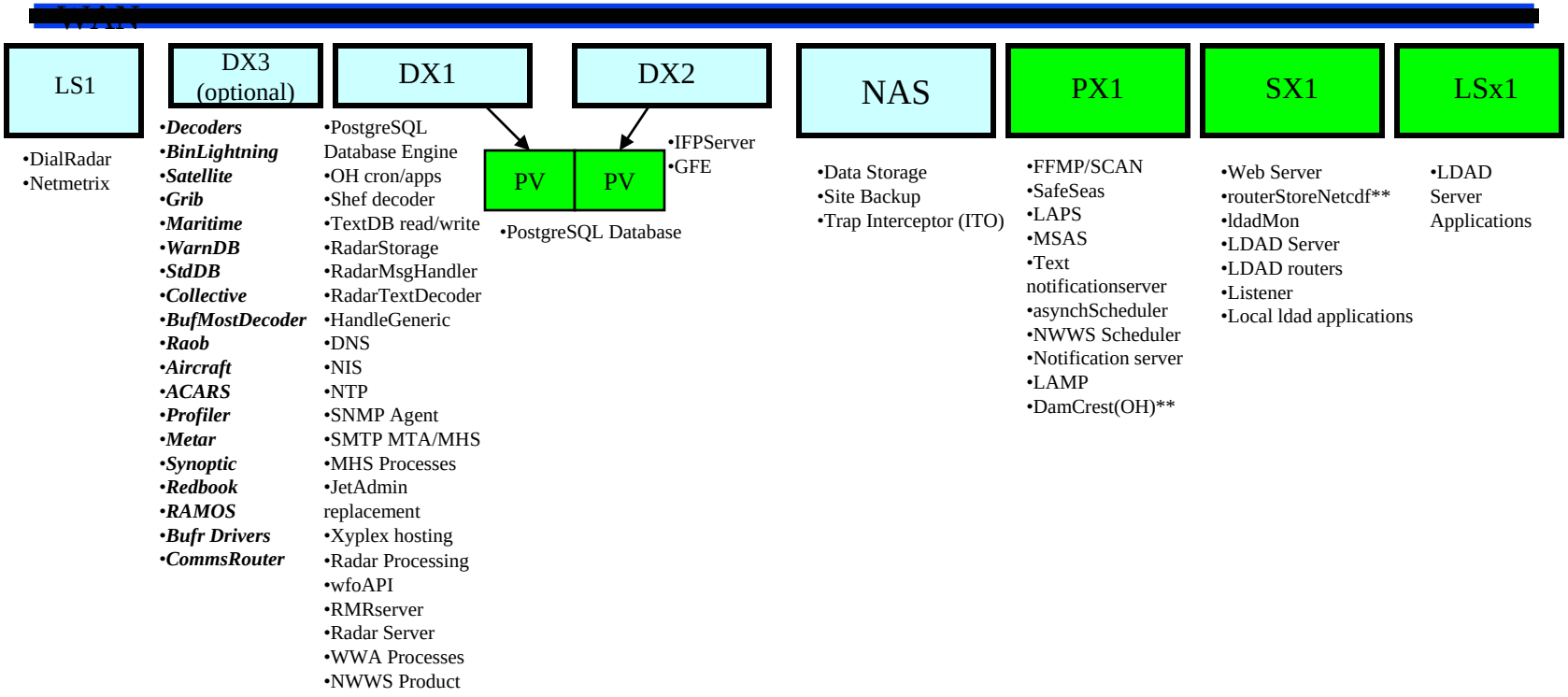
Step 6 and OBx
Software and Data Architecture



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DX/NAS OAT

- Risk Factors
  - Repointing all databases to new location (NAS)
  - Unknown local mounts
  - Rush on decisions and limited sites mean risk of not finding install or operational issues until deployment
- Unknown how much relief step 1 will give sites
  - Faster I/O should help but more problems might lurk
- OCONUS sites: unknown whether standard system will help their severe problems
  - Additional engineering might be required
  - OAT will give info on whether more is needed

DX/NAS OAT Sites

Priority	Site ID	city	state
1	EAX	Pleasant Hill	MO
2	BTV	Burlington	VT
3	HFO	Honolulu	HI
4	JAN	Jackson	MS
5	LWX	Sterling	VA
6	SLC	Salt Lake City	UT
7	MAF	Midland/Odessa	TX
8	AFC	Anchorage	AK
9	PTR	Portland	OR
10	BIS	Bismarck	ND
11	EHU	Fort Worth	TX
12	WNAW	Kansas City	MO

DX/NAS Limited Deployment Sites

1	SGX	LOX	San Diego	CA
2	MFR	EKA	Medford	OR
3	ILM	CHS	Wilmington	NC
4	PSR	TWC	Phoenix	AZ
5	SGF	LSX	Springfield	MO
6	BOI	PIH	Boise	ID
7	FGZ	VEF	Flagstaff	AZ
8	IND	IWX	Indianapolis	IN
9	OTX	PDT	Spokane	WA
10	STO	HNX	Sacramento	CA
11	TWC	PSR	Tucson	AZ
12	GRR	DTX	Grand Rapids	MI
13	LOX	SGX	Los Angelas	CA
14	PDT	OKX	Pendleton	OR
15	BMX	FFC	Birmingham	AL
16	PAH	LMK	Paducah	KY
17	PIH	BOI	Pocatello/Idaho Falls	ID
18	RLX	PBZ	Charleston	WV
19	RNK	RAH	Blacksburg/Roanoke	VA
20	VEF	FGZ	Las Vegas	NV
21	DTX	GRR	Detroit	MI

22	GLD	DDC	Goodland	KS
23	GJT	SLC	Grand Junction	CO
24	HGX	LCH	Houston/Galveston	TX
25	MTR	LOX	San Francisco	CA
26	TOP	ICT	Topeka	KS
27	TSA	OUN	Tulsa	OK
28	BCQ		Kansas City	MO
29	OSFW		Norman	OK
30	VRH		Anchorage	AK
31	VUY		Bohemia	NY
32	NHOR		Silver Spring	MD
33	RHA		State College	PA
34	NMTW		Silver Spring	MD
35	AJK	AFC	Juneau	AK
36	AFG	AFC	Fairbanks	AK
37	BOX	OKX	Boston	MA
38	CTP	BGM	State College	PA
39	FFC	BMX	Peachtree City	GA
40	FWD	SHV	Dallas/Ft. Worth	TX
41	ILN	JKL	Wilmington	OH
42	LIX	MOB	New Orleans/Baton Rouge	LA
43	MPX	DLH	Minneapolis	MN

High Level Schedule

- **Key dates**
  - Step 1 Deployment Decision by November 3 -necessary to complete initial deployment by 1 Feb
  - Step 2 OB4.X – will provide performance improvements to Step 1 sites
  - OB6 check-in