Backup Power for Voice Services in the Customer Premises

Performance Reliability Standards Workshop
Sponsored by the CPUC
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Agenda

• U-verse Voice Architecture
• Home Network
  • Home Network Architecture
  • Home Network Equipment
• Power Backup Requirements
• Power Backup in the Home
U-VERSE VOICE ARCHITECTURE
U-verse Voice Architecture

Nomenclature
EAS - Ethernet Aggregation Switch
NID - Network Interface Device
OLT - Optical Line Termination
ONT - Optical Network Termination
SAI - Serving Area Interface (Cross Box)
VGW - Voice Gate Way
VRAD - Video Ready Access Device

Central Office

AT&T IS VoIP Platform
AT&T Lightspeed Backbone Network
PSTN
GigE
Class 5 Switch
EAS
POTS
GigE
VRAD at SAI
OLT
VRAD at SAI
OLT
ONT
NID
VDSL2 & POTS
FTTN
FTTP
BPON

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U-verse Voice Architecture - POTS

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U-verse Voice Architecture – U-verse Voice (VoIP)

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U-VERSE HOME NETWORK
FTTN Home Network

Nomenclature
- BBU: Battery Backup Unit
- NID: Network Interface Device
- RG: Residential Gateway
- SLA: Sealed Lead Acid Battery

Customer Premises

Drop Wire with VDSL2 & POTS

POTS on Twisted Pair

VDSL2 on Twisted Pair or Coax

U-verse Voice on Twisted Pair

Backup Power in the Customer Premises
FTTN Home Network - POTS

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FTTN Home Network – U-verse Voice

Customer Premises

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Drop Wire with VDSL2 & POTS
VDSDL2 on Twisted Pair or Coax
U-verse Voice on Twisted Pair
RG
BBU
SLA Battery
FTTP Home Network

maximum 100 ft (16AWG) separation

Nomenclature
BBU - Battery Backup Unit
ONT - Optical Network Termination
PSU - Power Supply Unit
RG - Residential Gateway
SLA - Sealed Lead Acid Battery

Customer Premises

Backup Power in the Customer Premises
FTTP Home Network – POTS

Customer Premises

ONT

POTS on Twisted Pair

Ethernet (Cat5/6) Wiring

PSU

SLA Battery

SLA Battery

RG

BBU

Backup Power in the Customer Premises

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Residential Gateway (RG)
2Wire 3800HGV

Technical Specifications

**Broadband Interfaces**
- VDSL2 for FTTN (RJ-11 or coax)
- Broadband Ethernet for FTTP (RJ-45)

**LAN Interface(s):**
- 4 Ethernet ports (RJ-45)
- Wireless 802.11g or HyperG access point
- USB 1.1 slave (PC/MAC connectivity)
- USB 2.0 host

**VoIP**
- 2 derived voice lines (RJ-11)

**Power**
- External 12Vdc power supply
RG Battery Backup Unit (BBU)
Belkin BU3DC000-12V

Technical Specifications

Electrical Specifications
• Input - 0 to 150Vac, 50/60Hz
• Output – 12Vdc (nominal), 30W maximum

Battery Type
• 12V, 7.2AHr, Spill-Proof, Maintenance-Free, Sealed Lead Acid (SLA)

Physical Specifications
• WxHxD (in) – 3.5x8.3x7.8
• Weight - 7.1 lb (with battery)
• Input Plug - NEMA 5-15 plug, 6’ cord
• Output Connector - 2.0mm DC pin, YSC 2700-013-25K, 6’ cord

Features
• Visual and audible alarms – On AC, On Battery, Battery Low, Battery Missing, Replace Battery, Battery on Self-Test
• Audible alarm mute
Optical Network Termination
Alcatel-Lucent H-ONT

Technical Specifications

Broadband Interface
- BPON (APC optical fiber connector)

LAN Interface:
- 1 Ethernet port (RJ-45)

POTS Interfaces
- 4 analog voice lines (screw terminals and RJ-11)

Power
- External 12Vdc power supply (screw terminals)

Physical Specifications
- WxHxD (in) – 12x13.5x4.3
- Weight – 7 lbs

Features
- Hardened for outside use
- Visual status indicators: power, network, data, POTS, management
ONT Power Supply Unit

APC CP24U12D

Technical Specifications

Electrical Specifications
- Input - 90-240V, 50-60Hz
- Output – 12Vdc (nominal), 24W maximum

Battery Type
- 12V, 7.2AHr, Spill-Proof, Maintenance-Free, Sealed Lead Acid

Physical Specifications
- WxHxD (in) – 9.5x7.5x3.1
- Weight - 7 lb (with battery)
- Input Plug – NEMA 1-15 cord, 6’ cord
- Output Connector - 3.5mm, 7-pin screw-terminal connector

Features
- Visual and audible alarms – On AC, On Battery, Battery Low, Battery Missing, Replace Battery
- Audible alarm mute
ONT Power Supply Unit
Delta GES320W12V0081

Technical Specifications

Electrical Specifications
• Input - 100-240Vac, 50-60Hz
• Output – 12Vdc (nominal), 32W (maximum)

Battery Type
• 12V, 7.2AHr, Spill-Proof, Maintenance-Free, Sealed Lead Acid

Physical Specifications
• WxHxD (in) – 10.2x7.5x3.2
• Weight – 7.2 lb (with battery)
• Input Plug – NEMA 5-15 cord with 3-prong connector, 6’ cord
• Output Connector - 3.5mm removable, 7 pin screw-terminal connector

Features
• Visual and audible alarms – On AC, On Battery, Battery Low, Battery Missing, Replace Battery
• Audible alarm mute
POWER BACKUP REQUIREMENTS
Commercial power reliability varies widely

Number and duration of power disturbances &/or outages depend on a variety of factors, including

- **Cause**
  - typical electric grid “glitches”/faults are usually short duration
  - catastrophic events can cause long outages
- **Power utility company**
  - some are better than others
- **Season**
  - more outages occur in summer when demand is high
Commercial power reliability varies widely

- **Grid power outages**
  - 95% of all outages last less than 86 minutes
  - 98% of all outages last 4 hours or less

- **Long-duration outages**
  - Are a very small percent of all power outage events (<0.05%)
  - Are typically caused by widespread, catastrophic events (e.g., hurricanes, winter storms, earthquakes, wild fires)

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**Power Outage Distribution in the US**

- Cumulative Distribution
  - 0% to 100%
  - Duration: 1 sec, 1 min, 1 hr, 60 hrs

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**Number of power outages**

- Duration categories: 1 sec, 1 min, 1 hr, 60 hrs, 1 to 3 hrs, 3 to 24 hrs, 2 to 7 days
- Graph showing distribution of outages across duration categories.
Power Backup Requirements

Predicted Service Unavailability due to Power Outages versus Battery Reserve

Service Unavailable due to Power Outages (minutes/year)

Battery Backup Duration (hours)

POWER BACKUP IN THE HOME
Battery Backup Duration

Battery backup *duration* generally depends on:

- Power use of the equipment: idle power + incremental service power
- Distance of the equipment from the battery (power line resistance)
- Temperature of the battery
- Age of the battery
- Quality/design of the battery
- Manufacturing variations
Power Backup in U-verse

- **FTTP**
  - POTS voice requires ONT backup power during power outages.*
  - U-verse voice requires both ONT and RG battery backup power during a power outage.*

- **FTTN**
  - POTS voice requires no power backup in the home during power outages.*
  - U-verse voice requires RG battery backup power during a power outage.*

*Additionally, if customers’ telephone equipment requires power, *i.e.,* cordless phones, a separate power backup device is required for this equipment; the ONT/RG batteries do not provide power for cordless phones.
Power Backup in U-verse

- **FTTP ONT Backup**
  - A battery is provided with the initial FTTP installation. An operational battery will keep the service working for up to eight hours in the event of an outage.

- **FTTP/FTTN RG**
  - A BBU and new battery are provided with the VoIP service installation. Typical backup time for the battery is four hours with a new, fully charged battery (which meets Belkin battery recommendations), with one corded single-line, touchtone phone connected to the RG, and with no other equipment and no service other than AT&T U-verseSM Voice drawing power from the RG Battery Backup.
GLOSSARY
Glossary

BBU - Battery Backup Unit
BPON - Broadband-capable Passive Optical Network
EAS - Ethernet Aggregation Switch
FTTN - Fiber to the Node
FTTP - Fiber to the Premises
GPON - Gigabit Passive Optical Network
IP - Internet Protocol
LAN - Local Area Network
NID - Network Interface Device
OLT - Optical Line Termination
ONT - Optical Network Termination
PC - Personal Computer
PON - Passive Optical Network
POTS - Plain Old Telephone Service
PSTN - Public Switched Telephone Network
PSU - Power Supply Unit
RG - Residential Gateway
SAI - Serving Area Interface (Cross-Connect)
SLA - Sealed Lead Acid
VDSL - Very high bitrate Digital Subscriber Line
VoIP - Voice over IP
VGW - Voice Gate Way
VRAD - Video Ready Access Device