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## Section 6. ETA Networking and Telecommunications Domain

The networking and telecommunications standards address infrastructure and services architecture requirements for executive branch agencies in the Commonwealth of Virginia. These standards provide requirements that will assist agencies in meeting their current needs while moving towards the future vision for networking and telecommunications in the Commonwealth. For networking and telecommunications, the future vision is simple. Future networks will be highly integrated and will accommodate numerous end-to-end services that will coexist in this integrated infrastructure. Conceptually, the future network for participating agencies will be one network.

The networking and telecommunications architecture addresses two topics: facilities telecommunications infrastructure and telecommunications. Facilities telecommunications infrastructure addresses the cabling, pathways and documentation that are tied to a physical location (e.g., building, office space, outdoor space, or campus of buildings). Telecommunications addresses all other infrastructure and services, whether provided by the Commonwealth or by external service providers. Included in services are Local Area Networking (LAN), Wide Area Networking (WAN), and other telecommunications services (e.g., phone, data, multimedia).

### *Domain-wide Requirements*

The following domain-wide requirements pertain to all topics and components in the Network and Telecommunications Domain:

- NET-R-01    Notifications Required for Networking and Telecommunications Changes Due to Agency Facility Changes.** Agencies planning facilities changes must provide timely notification to appropriate networking and telecommunications authorities to ensure the availability of business critical telecommunications and networking services. Networking and telecommunications infrastructure requirement changes are an integral part of agency office change plans, whether the changes involve moving, expansion, construction, renovation, or lease changes. Agencies served by VITA that are planning changes must involve VITA in the early planning to determine the lead time required. When state-owned or state-leased buildings are involved, agencies must notify the Department of General Services, Division of Engineering and Buildings. When local government-owned buildings are involved, agencies must notify the local government entity responsible for networking and telecommunications.

**Rationale:**

Notifications to involved government authorities helps to avoid delays and inflated expenses. Agencies need to provide a six month advanced notice for minor changes and an eighteen month notice for major changes to ensure that delays will be avoided.

**NET-R-02: Inter-building Connections.** Agencies, except for institutions of higher education, which require network interconnections between two or more buildings, shall work with VITA to determine a solution. The Department of General Services, Division of Engineering and Buildings shall be a participant in the discussion whenever Commonwealth owned or leased buildings are involved. The local government shall be a participant in discussions whenever local government owned or leased buildings are involved.

**NET-R-03: Single Pipeline Planning Data.** Agencies are required to report *state to local* connectivity information and connection usage data when requested by the Commonwealth's Chief Information Officer (CIO). Such reporting requirements must have pre-defined, decision-based uses.

**Rationale:**

The future network vision for the Commonwealth includes reductions in state required connectivity costs for local governments, local government agencies, local branches of state courts, and branch offices for state agencies. The enterprise network redesign shall include considerations of a simplified design for required local connectivity, which is often referenced as a "single pipeline" between state and local government. To consider possible single pipeline solutions for the Commonwealth, requirements must be assessed.

### ***Facilities Telecommunications Infrastructure***

This topic addresses requirements for infrastructure that is typically used by an agency but not owned by the agency. When an agency is occupying a facility, it will have use of the building cabling, electrical systems, and access closets that together constitute much of the physical portion of the agency's premises networking and telecommunications solution. Facilities telecommunications infrastructure is currently limited to cabling plants and their documentation. In the future, wireless infrastructure may become a common part of the infrastructure typically provided as part of a facilities lease and remaining with the facilities at the termination of a lease.

**NET-R-04 Cabling Requirements.** Agencies must ensure the availability of standards-based structured cabling systems for all agency telecommunications in agency occupied space. Agencies must ensure the deployment of ANSI/TIA/EIA (American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance) standards-based designs, topologies, components, distances, installation methods, cable testing, and cable administration. All related minimum requirements or mandatory criteria that must be met (unless exceptions are noted in this document) are addressed in the following Commonwealth-adopted international standards (ANSI/TIA/EIA standards):

- **ANSI/TIA/EIA 568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.** This standard addresses cabling infrastructure design, installation and field testing for horizontal cabling, backbone cabling, and work areas. It also covers requirements for telecommunications rooms, equipment rooms, and entrance facilities. This standard recommends the use of ANSI/TIA/EIA

T568A, which specifies the wiring scheme to be used with the RJ-45 modular plug (8 position jack) and optionally allows use of T568B. The 568-B.1 standard is typically used in conjunction with the National Electric Code to provide an appropriate cable plant.

### ***Exceptions***

*Agencies except for institutions of higher education shall ensure use of the ANSI/TIA/EIA T568A wiring scheme for RJ-45 modular plugs in agency occupied space and shall not use T568B. Agencies are required to use T568A consistently throughout their cabling plant. T568A provides backwards compatibility with both one-pair and two-pair USOC (Universal Service Order Code) wiring schemes.*

*Institutions of higher education, which prior to 1991 cabled their entire campus using the T568B wiring scheme (pin pair assignment), may continue using T568B without an exception. Other agencies require an exception for any new installation of cabling using T568B except when the installation is accommodating the needs of existing users.*

*Agencies that have mixed T568A and T568B cabling plants are required to carefully document (see ANSI/TIA/EIA-606-A) the mixture and have clear rules for adding or partially replacing cabling in a building. In addition, an agency with a mixed plant must have a plan for switching to T568A as building cabling is replaced.*

*When an agency is replacing all horizontal cabling, the agency is required to implement the T568A standard.*

- **ANSI/TIA/EIA 568-B.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.** Addresses specifications for horizontal four-pair cables and backbone multi-pair cables and components. All Category 6, Category 5e and Category 3 cable specifications and testing are addressed.

### ***Exception***

*Agencies must ensure a minimum of certified Category 5e cable when installing new or replacement telecommunications horizontal cabling in agency occupied space.*

- **ANSI/TIA/EIA 568-B.3, Commercial Building Telecommunications Cabling Standard, Part 3: Optical Fiber Cabling Components Standard.** Addresses multi-mode (50/125 $\mu$ m and 62.5/125 $\mu$ m) and single-mode fiber optic cabling components, transmission standards, and field testers.

### ***Exceptions***

*Agencies shall use 50/125 $\mu$ m multi-mode fiber optic cable for all new and replacement backbone building runs. Even though 62.5/125 $\mu$ m multi-mode cabling is permitted in this standard, agencies shall not install this cable type in agency occupied space.*

*For the devices connected to the backbone fiber system via 50/125 $\mu$ m multi-mode fiber, agencies shall provide a minimum of four fibers (two pairs) run to each device. This will enable the use of redundant connections for equipment that may be deemed critical at a later point (e.g., implementation of Voice over Internet Protocol, VoIP). Consideration should be given to having two dark fibers (one pair) for every four active fibers (two pairs) installed, this will provide adequate backup for critical equipment if a problem occurs on one of the active pair.*

- **ANSI/TIA/EIA 569-B, Commercial Building Standard for Telecommunications Pathways and Spaces.** This Standard addresses specific pathway and space design and construction practices in support of telecommunications media and equipment within buildings.

Agencies are also required to implement all specifications in related addenda to ANSI/TIA/EIA 569-B for agency occupied office space that has an average office density (one office per 100 square feet). Pathway and room size requirements must be adjusted for higher and lower densities of telecommunications outlets or equipment than are expected in the average situation.

#### ***Exception***

*None*

- **ANSI/TIA/EIA 606-A, Administration Standard for Commercial Telecommunications Infrastructure.** This standard specifies administration for a generic telecommunications cabling system that will support a multi-product, multi-vendor environment. It also provides information that may be used for design of administration products.

#### ***Exception***

*When an agency alters its cabling plant, the agency must develop/maintain cable plant documentation that meets the minimum requirements of ANSI/TIA/EIA-606-A Class 3 administration as indicated in Clause 7 of the standard. In addition, agencies shall provide all cable plant documentation to the Department of General Services (DGS) central repository for cable plant documentation (see NET-R-05 ) using the documentation format (e.g., data names, data elements, data tables, data types, and/or spreadsheet column order) as specified by NET-R-05 and NET-R-06 below.*

- **J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.** The purpose of this standard is to enable the planning, design, and installation of a telecommunications grounding and bonding system which supports a multi-vendor environment and implements various system installation practices.

*Exception*

*None*

**NET-R-05 Department of General Services (DGS) Central Repository.** DGS shall provide a central repository for agency cable plant documentation (see NET-R-04, ANSI/TIA/EIA-606-A documentation). The DGS repository must be accessible to the Virginia Information Technologies Agency for planning purposes.

**NET-R-06 Cable Plant Data Formats.** The Department of General Services (DGS), Division of Engineering and Buildings, in conjunction with the Virginia Information Technologies Agency, shall provide a spreadsheet template (flat file) and optional database schema for use by agencies in providing required data to the DGS central repository. (See related requirements in NET-R-04 ANSI/TIA/EIA 606-A and NET-R-05).

**Rationale:**

Common data and formats are needed to ensure cable plant data can be aggregated across agencies for analysis.

## ***Telecommunications***

Telecommunications includes the hardware, software, services, and documentation related to electronic transmissions of data, voice, and multimedia content needed to conduct agency business. Components include telecommunications protocols, wired and wireless services, switches, routers and similar items. Also included are applications that provide end-to-end telecommunications services such as Voice over Internet Protocol (VoIP).

Local and wide area networks are the infrastructure, signaling and services that enable numerous practical office applications including receiving and sending email, saving documents and email, printing documents on office or workgroup printers, Voice over Internet Protocol (VoIP) telephoning, Blackberry email, always on Internet and more.

A local area network (LAN) is generally a private network. It is under the control of the owner and used by a set of related individuals and/or workgroups, typically within a single building or over a group of neighboring buildings.

A wide area network (WAN) is a geographically dispersed telecommunications network. A wide area network may be privately owned or rented, but the term usually connotes the inclusion of public networks including the public telephone system.

Telecommunications are services or applications that run on local and wide area networks. Telecommunications connect people, servers, applications tiers, businesses and more.

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## Protocols Requirements

- NET-R-07: LAN Protocols.** Agencies modifying their LAN services must migrate to the minimum Virginia standard of IEEE 802.3 Fast Ethernet (100 Mbps Switched Ethernet) or to a higher bandwidth Ethernet service (e.g., up to 802.3an 10GBASE-T 10 Gbit/s (1,250 MB/s) Ethernet over unshielded twisted pair (UTP)).
- NET-R-08 IP Access to LAN Nodes.** Agencies must ensure that each agency LAN node and LAN segment may be accessed using IP addressing. This mandatory requirement was to have been met in December of 2003.
- NET-R-09 Routing.** Agencies must employ IP as the standard addressing protocol for all routed transmissions. Agencies establishing new and replacement connections to external business partners, local governments, and state agencies must employ IP addressing. If other protocols are used as a transitional strategy, when routed, these protocols must be tunneled through IP.

## Switches, Routers and Similar Items Requirements

- NET-R-10 Network Hardware.** Agencies acquiring new network hardware (i.e. firewalls, routers, switches, etc.) must ensure that the devices are Simple Network Management Protocol (SNMP) compliant.
- NET-R-11 SNMP Use.** All agencies that manage networks must employ SNMP-compliant (Simple Network Management Protocol compliant) device management. SNMP is a protocol that enables management information for a network element such as a switch to be inspected by a remote manager.
- NET-R-12 Networking Devices.** Agencies and their network service providers who establish contracts for 500 or more of a single network device type (e.g., a particular router, switch or hub), must have validated performance and cost comparison data (e.g. price, quality, availability, service quality, reliability and support costs) for a second brand for the device type during a particular acquisition cycle. This data may be obtained from a small-dedicated network segment, a separate network, or from a third party (e.g. University, local government, etc.). The intent is that the Agencies or their service providers be able to use comparison results in acquisition and maintenance negotiations.
- NET-R-13 IP Addresses in the Enterprise Network.** Agencies served by any portion of the VITA enterprise network shall acquire IPv4 address space from VITA or gain VITA approval for using its own address space. Any served agency with its own address space must notify VITA of the address space renewal date. No served agency may increase their use of RFC1918 addresses without also using route distinguishers (i.e., VPN-IPv4 RD). Any served agency currently using the private address range (RFC1918) must record this use with VITA and prepare to discontinue this use when the served agency's network is integrated with other agencies' networks for the purpose of common management. Served agencies are required to use only registered IPv6

addresses assigned by VITA when they switch to IPv6. Also, VITA reserves the right to revoke and reassign address space as dictated by future network designs.

*Notes: An RFC is a document distributed as a request for comments. In many instances, RFCs are treated as industry standard recommendations. Many standards groups issue RFCs.*

VITA must provide agencies with assurance that recorded IP address information will not be shared with anyone who may be required to divulge the information to the public.

### **Wired and Wireless Services Requirement**

**NET-R-14 VoIP.** Agencies implementing VoIP must provide well-ventilated and air-conditioned premises wiring closets to protect investments and to ensure services.

### **Virginia Government Internet Domain Naming**

Government Internet domain naming identifies and implements standardized naming conventions to aid in developing statewide electronic directories and reducing overhead and administrative costs.

Domains and sub-domains of other domains are often referred to by level. The levels of a domain name are numbered from right to left. Using the sample domain name department.oaa<sup>1</sup>.virginia.gov the levels are as follows:

- first-level gov
- second-level virginia
- third-level oaa
- fourth-level agency's discretion (web-site application name, activity name, department names, etc.)

**NET-R-15 Virginia.Gov Mandated Use** – All executive branch agencies in the Commonwealth except for institutions of higher education shall use the “virginia.gov” domain name. This requirement does not preclude agencies from possessing other domain names for which they separately register and accept full responsibility.

**NET-R-16 Domain Name Structure** – Domain Names are to be composed of alphabetic characters and numbers. Upper/lower case is transparent. Hyphens (dashes) are allowed but may not be used at the beginning or end of a domain name. Within a domain name spaces, the underscore, and special characters are not permitted. Special characters include, but are not limited to: ! @ # \$ % ^ & \* ( ) ? ”

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<sup>1</sup> oaa = official agency acronym (e.g., VITA)

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**NET-R-17 Third Level Domain Names – Executive Branch Agencies** – The name of an agency of the Commonwealth of Virginia will be at the third level and will consist of the official agency acronym/abbreviation.

Example:

- a. vita.virginia.gov
- b. doa.virginia.gov

**NET-R-18 Fourth Level Domain Names** – The fourth level of the “virginia.gov” domain will be used to further subdivide the entities established at the third level. Because many organizations exist at several levels of government, their location within this hierarchy will allow citizens to distinguish between them. Fourth level names are generally at the discretion of the requesting agency. The examples below are offered as a guideline to encourage a generally accepted and recognizable naming convention.

Examples of Departments or Activities of Executive Branch Agencies:

- a. license.dgif.virginia.gov
- b. eVA.dgs.virginia.gov

### ***Technology Tables for Networking and Telecommunications***

The technology component standard tables below provide strategic technology and service directions for agencies that are acquiring technical components or services for local area networking, wide area networking or other telecommunications. Agencies *might be acquiring* these components via purchasing, space rental leasing, facilities construction or modification, or other acquisition methods. Both wired and wireless components and services are addressed. Subtopics are noted in table headings.

<b>Table NET-S-01: Wired Local Area Networks (LANs)</b> <b>Technology Component Standard</b> <i>Reviewed October 1, 2008</i>	
<b>Strategic:</b>	<p>IEEE 802.3 Fast Ethernet (100 Mbps Switched Ethernet)</p> <p>Higher bandwidth Ethernet service (802.3 Full duplex Fast Ethernet, 802.3ab Gigabit Ethernet over copper, 802.3ad, or 802.3z Gigabit Ethernet over fiber)</p> <p><i>10 Gigabit Ethernet LAN (little need but becoming highly cost effective—see FTTE-H)</i></p> <p><i>VoIP Centrex (cost reductions)</i></p> <p>Note: Category 5e LAN is the minimum required for enabling VoIP.</p>
<b>Emerging:</b>	
<b>Transitional/Contained:</b>	<p>Ethernet 10Mbps (IEEE 802.3)</p> <p>ATM 25 Mbps (LANE, an element of MPOA)</p> <p>Note: Category 5 LAN cable is transitional because VoIP is not supported.</p>
<b>Obsolescent/Rejected:</b>	<p>Token Ring (IEEE 802.4)</p> <p>AppleTalk</p> <p>All Other Non-Strategic Protocols</p>
<b>Waiver History:</b>	

<b>Table NET-S-02: Wireless Local Area Networks (WLANs)</b> <b>Technology Component Standard</b> <i>Reviewed October 1, 2008</i>	
<b>Strategic:</b>	<p>Wi-Fi using Access Points</p> <p>Frequency Hopping Spread Spectrum (FHSS, IEEE 802.11)</p> <p>Direct Sequence Spread Spectrum (DSSS, IEEE 802.11 and 802.11b)</p> <p>Orthogonal Frequency Division Multiplexing (OFDM, IEEE, 802.11a used for Access Points)</p>
<b>Emerging:</b>	<p>WiMAX (802.16e) (security and other issues)</p>
<b>Transitional/Contained:</b>	<p>Infrared (Point to Point, IEEE 802.11)</p>
<b>Obsolescent/Rejected:</b>	
<b>Waiver History:</b>	

<b>Table NET-S-03: Cabled Wide Area Networking (WAN) Technology Component Standard <i>Reviewed October 1, 2008</i></b>	
<b>Strategic:</b>	<p>Data and VoIP example WANs</p> <ul style="list-style-type: none"> <li>Frame Relay T1 (128 Kbps-1.5 Mbps)</li> <li>ATM T1 (1.5 Mbps) with IMA (Inverse Multiplexing over ATM)</li> <li>Aggregated Frame Relay, i.e., 2, 3, or 4 T1s (3-6 Mbps)</li> <li>ATM DS3 ( 22-45 Mbps)</li> <li>ATM SONET (synchronous optical network) over OC3 (optical carrier) to OC12 ( 155-622+ Mbps)</li> <li>PoS (Packet over SONET)</li> <li>FRASI (FR to ATM Services Internetworking)</li> <li>xGb Ethernet (e.g., MAN, carrier backbone)</li> <li>LAN speed Ethernet interconnection over public backbone</li> <li>xDSL (128 Kbps—8 Mbps)</li> <li>Cable Modem (300 Kbps—10 Mbps)</li> <li>MPLS</li> </ul> <p>VoIP Centrex</p>
<b>Emerging:</b>	
<b>Transitional/Contained:</b>	<p>Data WAN</p> <ul style="list-style-type: none"> <li>Frame Relay 56 Kbps</li> <li>ISDN—narrow band (64—128 Kbps)</li> <li>Frame Relay DS3</li> </ul>
<b>Obsolescent/Rejected:</b>	
<b>Waiver History:</b>	

<b>Table NET-S-04: Mobile and Remote Access to Local Area Networks (LANs)</b> <b>Technology Component Standard</b> <i>Reviewed October 1, 2008</i>	
<b>Strategic:</b>	<p>Dial up (e.g., RAS)</p> <p>VPN (e.g., IP VPN)</p> <p>Blackberry Services</p> <p><i>Microsoft Exchange Direct Push Mail via SPS</i></p> <p><i>Other Blackberry Competitors (Good, Nokia, Sybase)</i></p> <p>Wi-Fi</p>
<b>Emerging:</b>	<p>Intel integrated wireless chipsets (Wi-Fi, WiMAX and HSDPA in one chipset)</p>
<b>Transitional/Contained:</b>	
<b>Obsolescent/Rejected:</b>	
<b>Waiver History:</b>	

<b>Table NET-S-05: Wireless Telecommunications (Voice, Image, Data, Conference, and Other Multimedia) Technology Component Standard <i>Reviewed October 1, 2008</i></b>	
<b>Strategic:</b>	
	<p>VITA Negotiated Services (current and anticipated services provided below)</p> <p style="padding-left: 20px;">VoIP Service (using MPLS)</p> <p style="padding-left: 20px;">Digital Voice, Image, Data, Centrex and PBX</p> <p style="padding-left: 20px;">Digital Cellular Service: 800 MHz, CDMA, WCDMA, CDMA 2000, CDMA EV-DO, GSM/GPRS</p> <p style="padding-left: 20px;">PCS Service: (1900 MHz, personal communications services—Sprint, digital wireless)</p> <p style="padding-left: 20px;"><i>Cingular or Ntelos Service: GSM/GPRS</i>) this is not cellular but provides cell-type services at a different frequency; uses trimode phones (1900/800 MHz, analog and digital)</p> <p style="padding-left: 20px;">Nextel Service: 800 MHz iDEN; wireless telephone service (note: this is not cellular but is Enhanced Specialized Mobile Radio (ESMR)—2 way radio)</p> <p style="padding-left: 20px;">Analog Voice, Centrex, PBX (still strategic for some locations)</p> <p>Wi-Fi (802.11a,b,g)</p>
<b>Emerging:</b>	
	<p>VoIP Wireless (high mobility in building is a place to start—e.g., forensic lab, corrections, hospital)</p> <p>Video Conference over IP</p> <p>VoWLAN (802.11r)</p> <p>WiMAX (802.16e)</p> <p>WLAN (802.11n)</p> <p>High speed uplink and downlink, HSDPA</p> <p>QoS for voice/video 802.11e, WSM an WME</p> <p>Mesh Networks</p> <p>Wireless Video Conferencing</p> <p>Wireless PBX</p> <p>200 Mbps WLAN links</p> <p>IP Multimedia, IMS and SIP</p> <p>Fixed mobile convergence service</p>
<b>Transitional/Contained:</b>	
	<p>Analog Cellular (AMPS)</p> <p>Mobitex is currently a Cingular packet data service that uses MASC protocol and has a limited service area (9.6—19.6 Kbps)</p>
<b>Obsolescent/Rejected:</b>	
	CDPD
<b>Waiver History:</b>	

