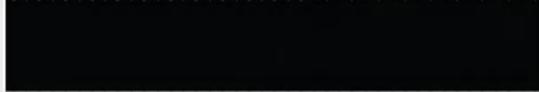


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KEYSCOPE, Cipher Detection, and You!


Mathematics Research Group

21 August 2008

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The Protocol Stack

Application Layer (HTTP, FTP, etc.)

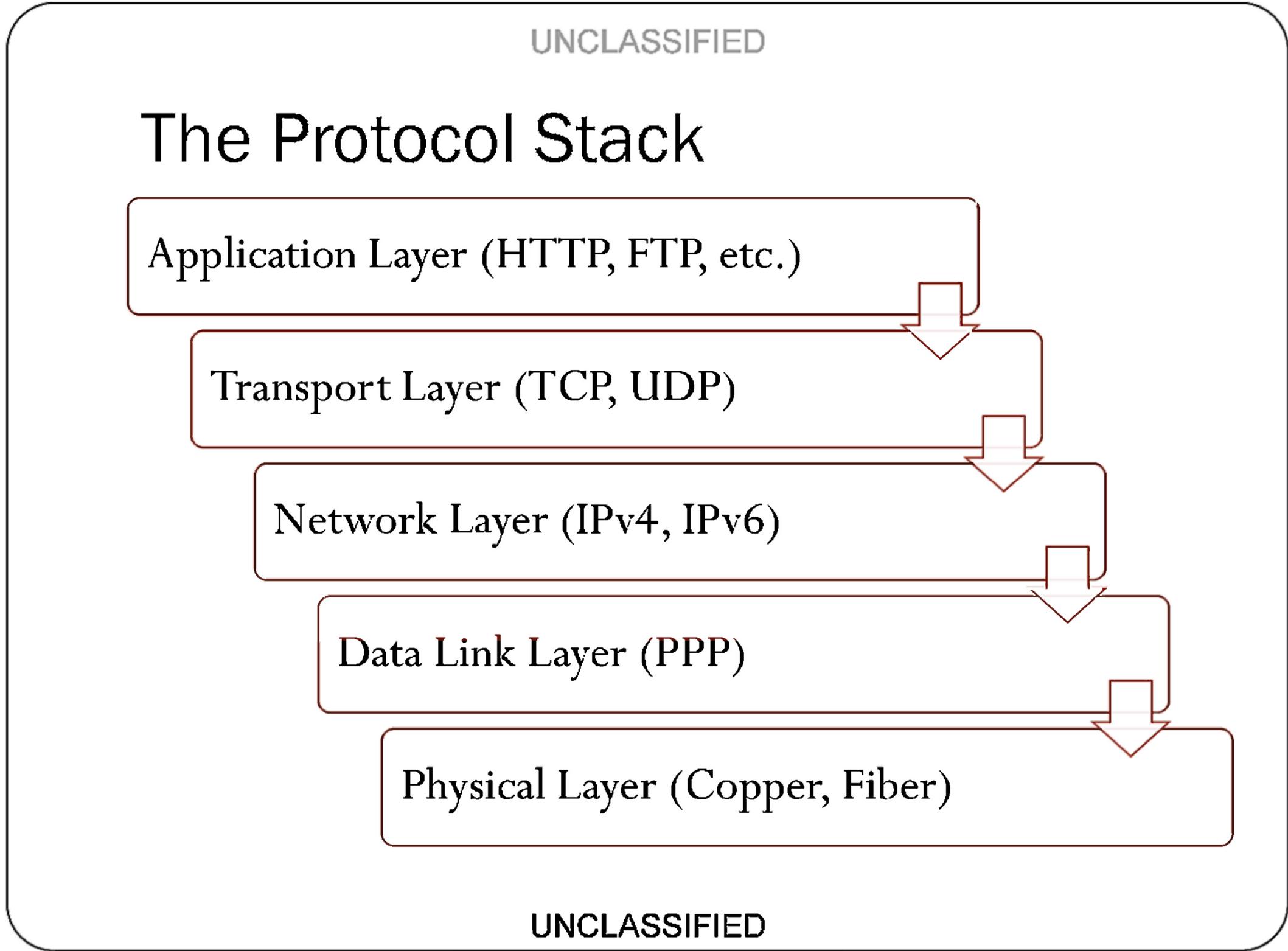
Transport Layer (TCP, UDP)

Network Layer (IPv4, IPv6)

Data Link Layer (PPP)

Physical Layer (Copper, Fiber)

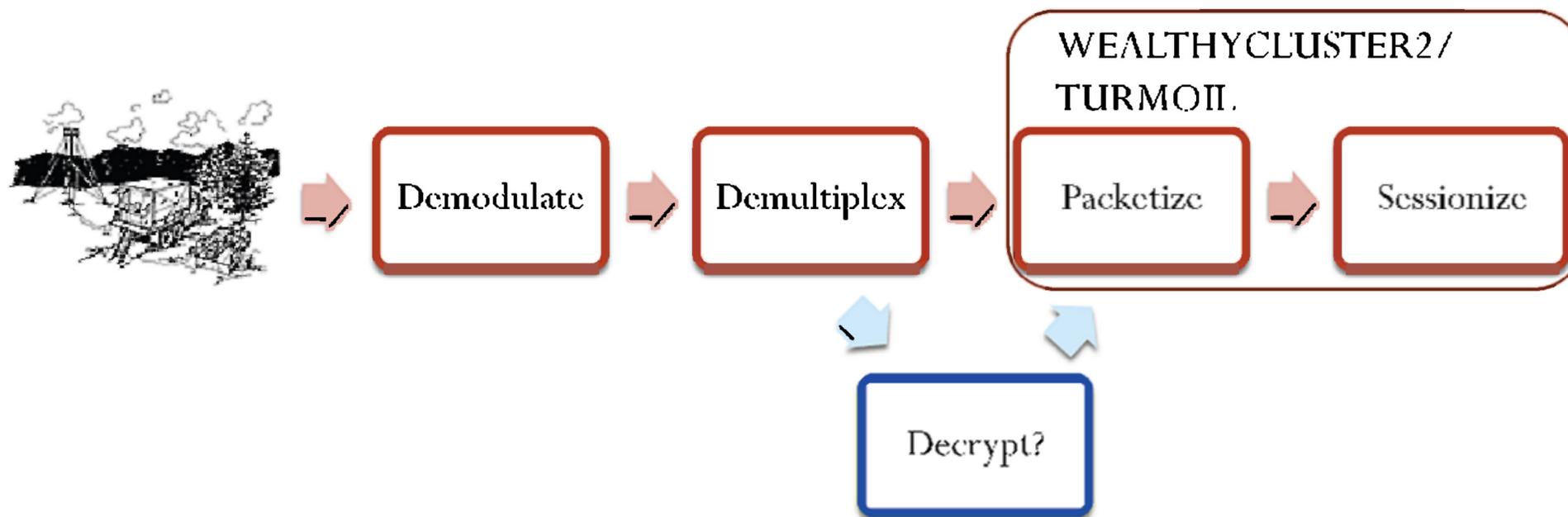
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Data Sources

- FORNSAT (downlink)
- Overhead (uplink)
- Special Source
- Tailored Access
- F6
- FISA (limited)
- 3rd party

Front-end Processing



What does  do ?

- Selection of tasked CADENCE/UTT terms.
 - Send hits to PINWALE/PRESSUREWAVE.
- Tipping to TRAFFICTHIEF.
- Fingerprinting.
- SIGINT development using two rolling buffers:
 - Metadata
 - Content (data)

Retrospective Searching



- All data are stored, not just hits.
- Queries are distributed to entire network of sites.

Metadata
Buffer

~30 days

Searchable

MySQL
database

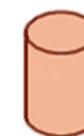


Content
Buffer

~7 days

Retrievable

Archived
on disk



Fingerprinting

- Pattern matching against the data.
- Session is marked, but not sent to PINWALE.
 - Fingerprint stored as metadata.
 - Have to search for it.
- Rich set of patterns
 - Strings have a minimum of three* anchors (fixed bytes).
[Exception: Two bytes at the beginning of a session]
 - Regular expressions allowed (require nonoptional string of three* bytes within regex)
 - Context-dependent terms.

*XKS reserves the right to increase this to four.

Examples

- `fingerprint('encryption/helixstronghold', 7.0) = 'helix stronghold encrypted file';`
- `fingerprint('encryption/wharfrat', 3.0) = '\xd6\x56\x34\xb7\x80\x05\xfe\x8b'c and '\xaf\x52\x72\x60\xdd\xfe\x72\xc2'c and (port(443) or port(80));`
- `fingerprint('encryption/the_algorithm', 3.0) = /-XYZ-.{0,30}mp[eg]/;`

Syntax Features

- Case Sensitivity

```
fingerprint('certificate/digital_id') =  
'-BEGIN CERTIFICATE-'c;
```

- Full Boolean logic

- Grouping with parentheses
- Operators: **and**, **or**, **not**

- Variables

```
$udp = protocol('udp');  
fingerprint('vpn/openvpn/x509/wera') =  
$udp and 'openvpn_wera'c;
```

Available Functions

- `port`
- `first`
- `hex`

```
fingerprint('encryption/kryptel') =  
hex('E8E2454300040004635C4EE9A2F9D111A  
489E498F70C0B43404F4BFA50F2D111A4898E6  
30458E285');
```

- `pos`

```
fingerprint('encryption/cipherpad') =  
pos('CPAD1'c) < 4000;
```

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- Distance (similar to pos, but for distance between tokens)
- Lpos
 $\text{spop_basic} = \text{lpos}('+OK 'c) \text{ or } '\nQUIT'$;
- First
 $\text{appid}('mail/smtp/ \dots) = \text{first}('ehlo') \text{ and } \dots ;$
- Last (similar to first)
- Follows (one token after another)
- Between (one token between two others)
- Order

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Other Features

- Fingerprint definitions updated hourly throughout the entire enterprise.
- Workflows
 - Submit through user interface.
 - Standing queries that run like cron jobs.
 - Limited follow-on processing.
- User interface for fingerprint submission (coming soon).
 - Currently done by XKS personnel.

Plug-ins

- Full power of C++ for when pattern matching does not suffice.
- Usually limited to certain file types
 - Huge JPEG volume from web surfing
- Current steg/encryption plugins that fingerprint sessions:
 - PHOSPHORESSENCE library of steg detectors
 - SHELLLOCK steg detection
 - SEDENA indigenous encryption software
- Drawback: Must wait for site upgrade to deploy.

Trade-off

- Fingerprints easily deployed, but limited to pattern matching.
- Plug-ins slow to deploy, but allow for complex testing.
- New compromise:
 - Snippets of C++ code in fingerprint
 - Deployed hourly like fingerprint with most of the flexibility of a full plug-in.
 - Very complicated tests probably still need to be plug-ins.
 - Currently stood up at only a few sites.

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Example

```
fingerprint('encryption/archive/rar') =  
  '\x52\x61\x72\x21\x1a\x07\x00'c  
: c++ {{  
  const uint8_t *ptr =  
    find_first("\x52\x61\x72\x21\x1a\x07\x00");  
  if (ptr == NULL)  
    return false;  
  if (end()-ptr < 64)  
    return false;  
  if ((ptr[23]&0x04) != 0x04)  
    return false;  
  if ((ptr[10]&0x80) != 0x80)  
    return false;  
  return true;  
}};
```

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Advanced Feature

- Follow-on check with anchorless regexes:

```
%dhcp_check = regex {{  
    ^[\x01\x02][\x01- ]\x06.*c\x82sc  
}};
```

```
appid('netmanagement/dhcp/client_to_server',  
3.0) =  
    from_port(68) and to_port(67)  
    : %dhcp_check;
```

Releasability Issues

- Nearly all XKS personnel have PICARESQUE!
 - Those that don't have PRIVAC.
- XKS distribution comes in two flavors
 - 1st & 2nd party
 - 3rd party
 - No NOFORN capabilities permitted.
 - Special dispensation from [REDACTED] for some capabilities to SMOKYSINK.
- Can keep PICARESQUE code running on R1's rednet if absolutely necessary.