New Approaches on Malware-Detection on Mobile Devices

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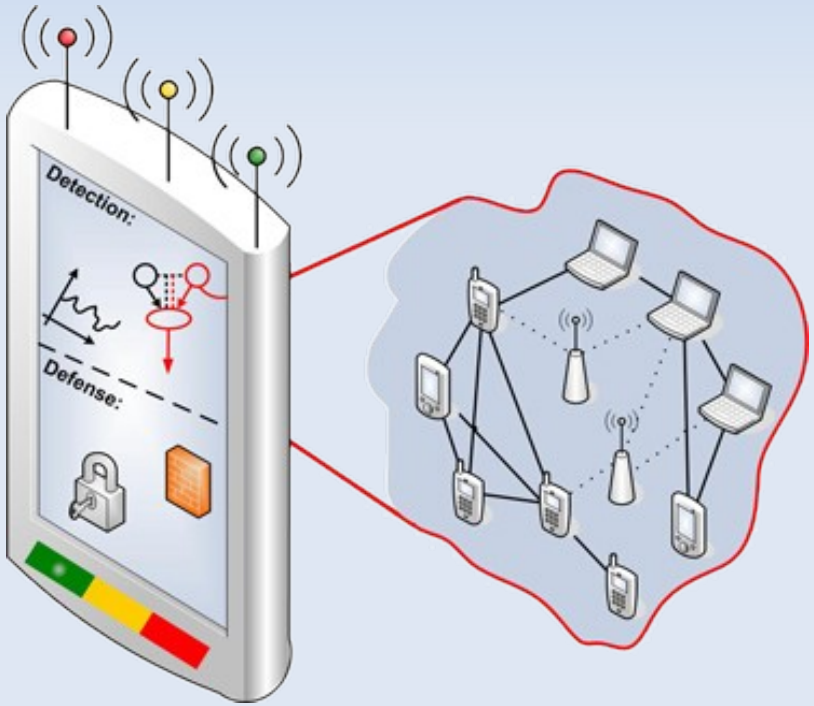
Outline

- Malware Threats on Mobile Phones
- Approaches on Malware Detection
- Our Approach on Anomaly-Detection

Malware Threats on Mobile Phones



- People use mobile phones differently than 3 years ago
  - Facebook, Twitter, Banking, E-Mail....
- Way more resources in a mobile handset
- Security on desktop-systems has improved

  → less interesting?

Malware Threats on Mobile Phones

A Smartphone Platform in 2010:

- 1 GHz Cortex A8
- 512 MB Ram
- 802.11bgn-Wireless
- 7.2 MBps HSDPA
- 32 GB Flash-Memory
- 132g
- Desktop-Related OS:

  (Linux, OS X/iOS, Palm OS)

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Malware Threats on Mobile Phones

- Valuable data on the handset
- Targeted attacks on specific persons
- Tracking of users via GPS/Location Based Services
- Tracking of communication behavior of user

Malware Threats on Mobile Phones

- Open Source Components
- Software vendors don't cover all attack vectors
- OEMs hinder deployment of patches

Malware Threats on Mobile Phones

Attack-Vectors on Smartphone Platforms:

- Malicious Apps (dialer, spyware...)
- Cellular Baseband (SMS,MMS, rogue basestations...)
- WiFi Baseband/Services (Bluetooth,WLAN)
- OS / 3rd Party Libraries (Linux, OS X, PDF, SQL, Drivers...)
- Browser (Webkit is standard on most systems)
- Network-Attacks over IP-Layer (e.g. XMPP, Bonjour)
- Chained Exploits (e.g. first use malicious *.pdf then start local root-Exploit)

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Malware Threats on Mobile Phones

On the Plus-Side:

- Modern Mobile Platforms were developed with security in mind, not as an afterthought.
- Tighter Control of Software-Platforms adds barriers for malware (App-Store, Reviewing)
- Carrier-Networks can (in theory) add to additional security

Approaches on Malware Detection

Outline:

- Possible solutions to the problem
  - Signature based detection
  - Behavior based detection
  - Cooperative approach
- Survey of real malware detection software

Approaches on Malware Detection

Signature based Malware Detection

- Scanning of Data against signatures of known malware

  → unknown malware is not detected

  → regular updates of Sig-DB are necessary
- No protection against behavioral attacks.
- Unreliable for hidden malware

Approaches on Malware Detection

Behavior based Approach:

- Scanning for behavior of application:

  → Scanning of Data on Phone

  → Suspicious network traffic/SMS

- Scanning for behavior of handset:

  → Handset is active while in standby mode

  → Devices in Action whithout associated Application (Bluetooth, GPS)

Approaches on Malware Detection

Server/Cloud based Approaches:

- Putting the Workload away from the phone:

  → improved battery life

  → no updates on phone necessary

- Cooperative Approach:

  → Other nodes profit from scan-results

  → Node can be warned before attack happens

Approaches on Malware Detection

How does real malware detection Software work?

Two leading anti-malware apps in Android-Market have been analysed:

- No impact on battery runtime and small size
  - → No big DB of signatures
  - → No scan of running software/processes
- Both rely heavily on cloud-services
  - → Cooperative/centralized approach?
- Focussed on rogue applications, no scan of data or network-traffic!

Approaches on Malware Detection

Summmary:

- Traffic and Data is ignored by most approaches.

  → more difficult than scanning of Apps
- Software seems to be blind to Attacks over unsolicited network traffic

New Approach on Malware Detection

Combining different approaches:

- Preliminary scanning on Handset
- Suspicious data is forwarded to cloud service

→ frees local resources for more intense scanning of traffic or data

New Approach on Malware Detection

Requirements for a 1st Malware detection stage:

- Focused on data & traffic instead of apps
- Lightweight & Simple
- False positives are possible

  → may be discovered in 2nd stage
- Should be able to find different types of attacks in different environments.
- Should be platform agnostic

New Approach on Malware Detection

Our Proposal:

Entropy-Fingerprinting!

- Fast and lightweight
- Can be implemented on all platforms
- Allows to detect anomalies in data-streams
- Does not need to understand semantics of processed data

New Approach on Malware Detection

Entropy-Fingerprinting of Data-Stream:

- Different types of data have different entropy-signature
- Local differences in entropy can point to suspicious Data or hidden Shellcode.
- Shellcode has special characteristics (NOP-Sleds, Landing Zones, lots of system-calls...)

New Approach on Malware Detection

Characteristics of Data:

- Most Data transferred over Network is either compressed or text-based:

  → Compressed Data has high entropy-values

  → Entropy of Text is significantly lower

How do entropy-values of different types of data compare?

New Approach on Malware Detection

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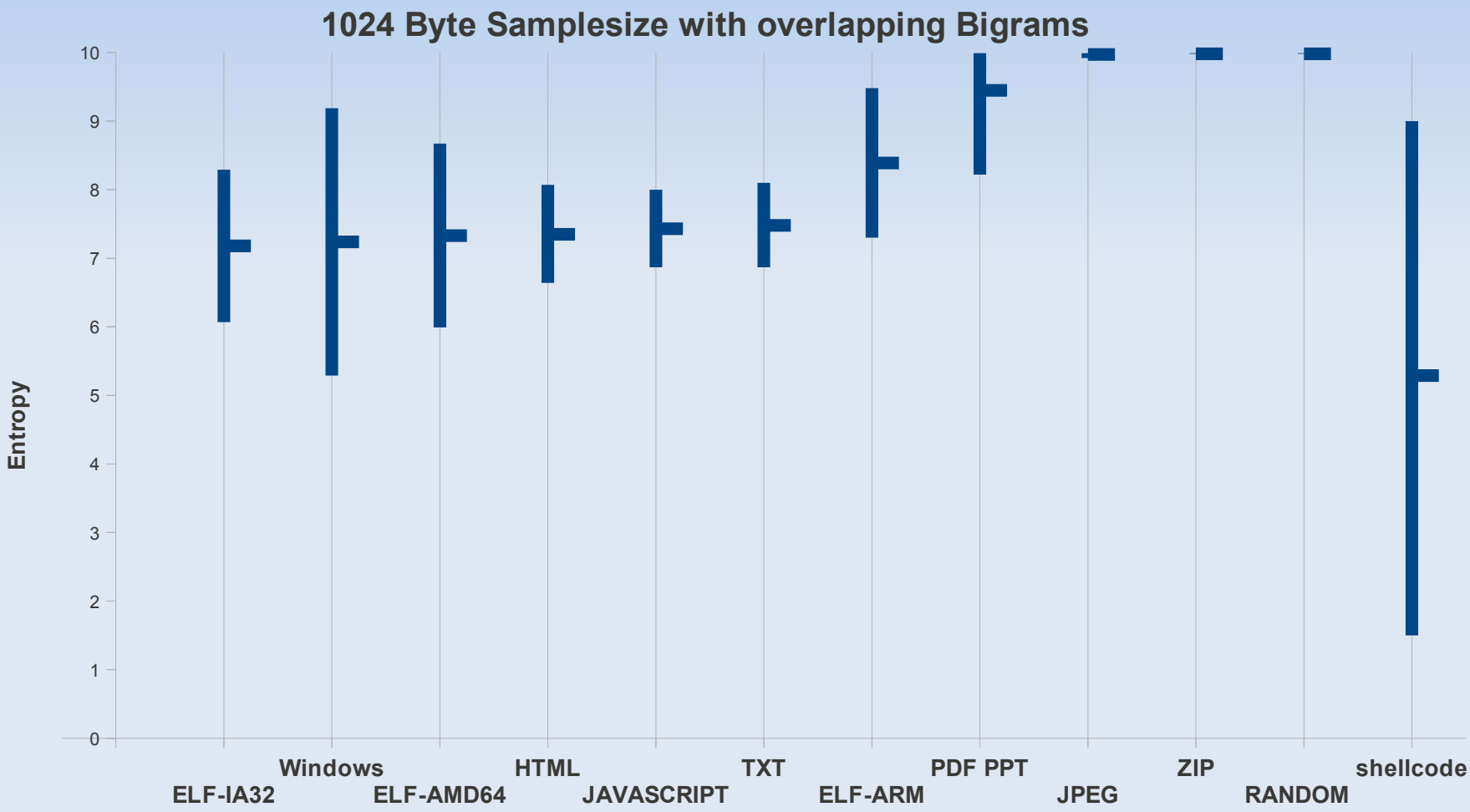
Entropy Distribution in Data-Types



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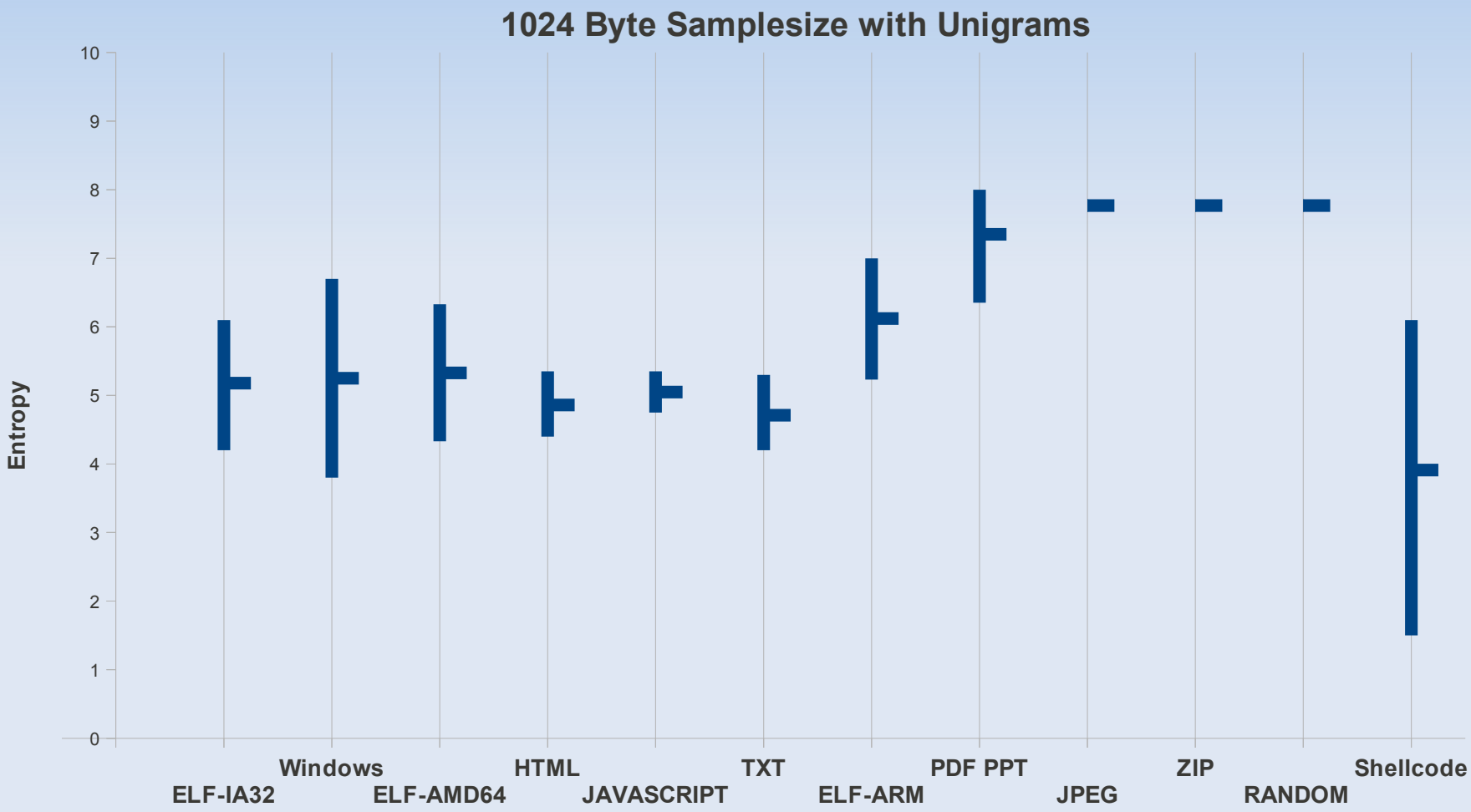

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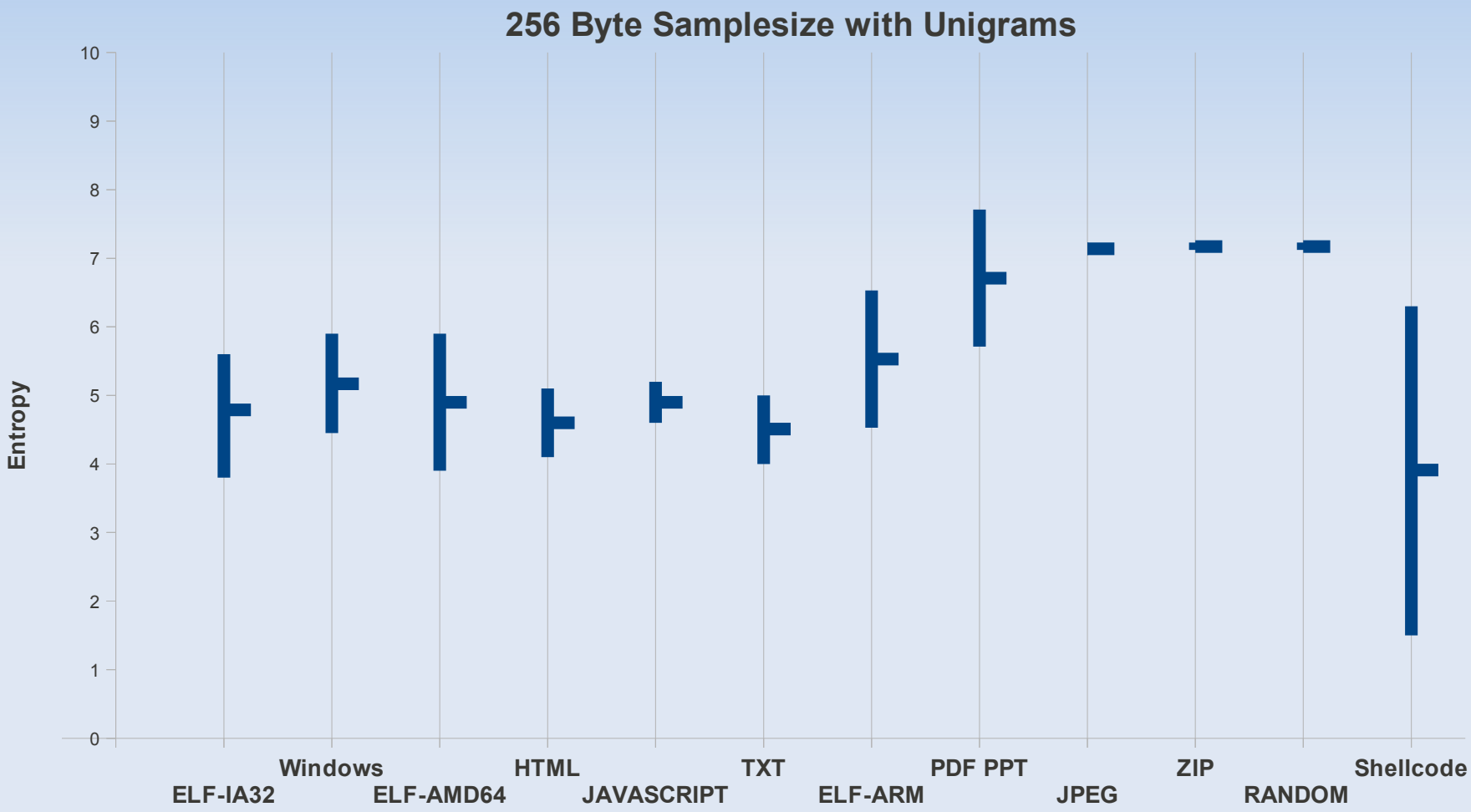

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Conclusions

- Entropy-fingerprinting seems promising for malware-detection in compressed Datatypes.
- Results for non-compressed Datatypes is inconclusive

→ More Work needed

Questions?

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