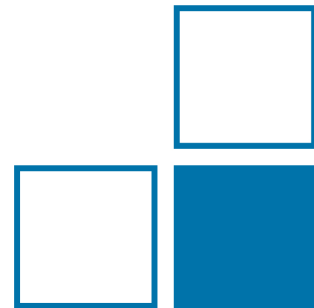


Reference Architectures with Identifier

Daniel Peters



DIRECTIVE 2014/32/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 26 February 2014

on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (recast)
(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 114 thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee⁽¹⁾,

Acting in accordance with the ordinary legislative procedure⁽²⁾,

Whereas:

(1) Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments⁽³⁾ has been substantially amended⁽⁴⁾. Since further amendments are to be made, that Directive should be recast in the interests of clarity.

(2) Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products⁽⁵⁾ lays down rules on the accreditation of conformity assessment bodies, provides a framework for the market surveillance of products and for controls on products from third countries, and lays down the general principles of the CE marking.

(3) Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products⁽⁶⁾ lays down

common principles and reference provisions intended to apply across sectoral legislation in order to provide a coherent basis for revision or recasts of that legislation. Directive 2004/22/EC should be adapted to that Decision.

(4) This Directive covers measuring instruments which are new to the Union market when they are placed on the market, that is to say they are either new measuring instruments made by a manufacturer established in the Union or measuring instruments, whether new or second-hand, imported from a third country.

(5) Correct and traceable measuring instruments can be used for a variety of measurement tasks. Those responding to reasons of public interest, public health, safety and order, protection of the environment and the consumer, of levying taxes and duties and of fair trading, which directly and indirectly affect the daily life of citizens in many ways, may require the use of legally controlled measuring instruments.

(6) This Directive should apply to all forms of supply, including distance selling.

(7) Legal metrological control should not lead to barriers to the free movement of measuring instruments. The applicable provisions should be the same in all Member States and proof of conformity should be accepted throughout the Union.

(8) Legal metrological control requires conformity with specified performance requirements. The performance requirements that the measuring instruments must meet should provide a high level of protection. The conformity assessment should provide a high level of confidence.

(9) Member States should as a general rule prescribe legal metrological control. Where legal metrological control is prescribed, only measuring instruments complying with common performance requirements should be used.

(10) The principle of optionality introduced by Directive 2004/22/EC allows Member States to exercise their right to decide whether or not to prescribe the use of the measuring instruments covered by this Directive.

⁽¹⁾ OJ C 181, 21.6.2012, p. 105.

⁽²⁾ Position of the European Parliament of 1 February 2014 (now published in the Official Journal) and decision of the Council of 10 February 2014.

⁽³⁾ OJ L 135, 30.4.2004, p. 1.

⁽⁴⁾ See Annex XIV, Part A.

⁽⁵⁾ OJ L 218, 13.8.2008, p. 10.

⁽⁶⁾ OJ L 218, 13.8.2008, p. 82.

Essential Requirements

- **Security and software identification** (MID Annex I, 8.3)
- **Data transmission and data storage** (MID Annex I, 8.4)
- **Interfaces** (MID Annex I, 8.1)
- **Software separation** (MID Annex I, 7.6)

WELMEC 7.2
2015

WELMEC

European Cooperation in Legal Metrology

Software Guide
(Measuring Instruments Directive 2014/32/EU¹)



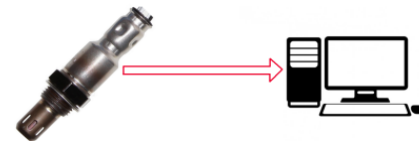
PTB Software Requirements (WELMEC)



Displaying Data



Storing Data



Transferring Data



Protecting Data



Identifying Software



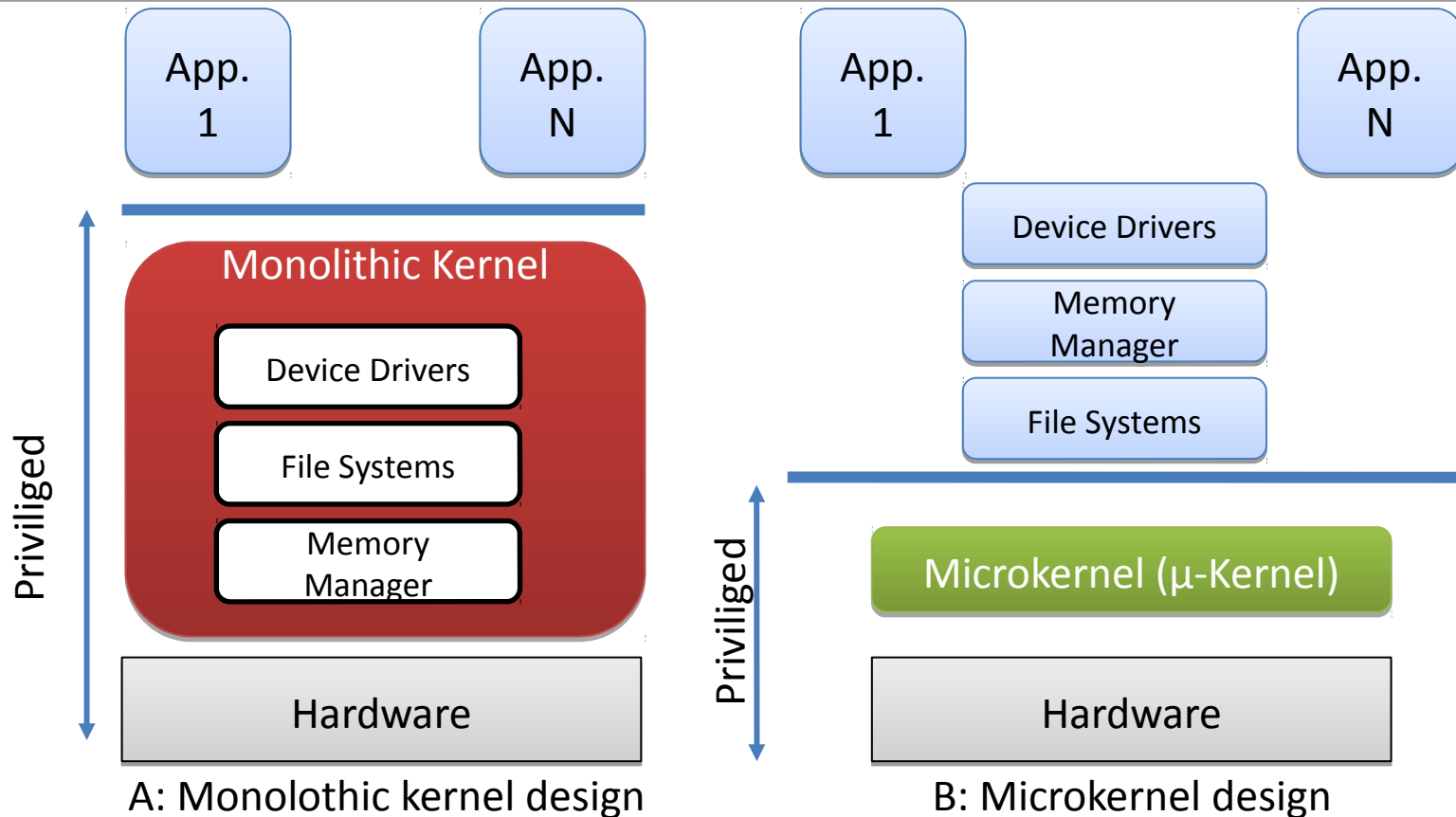
Executing Downloads

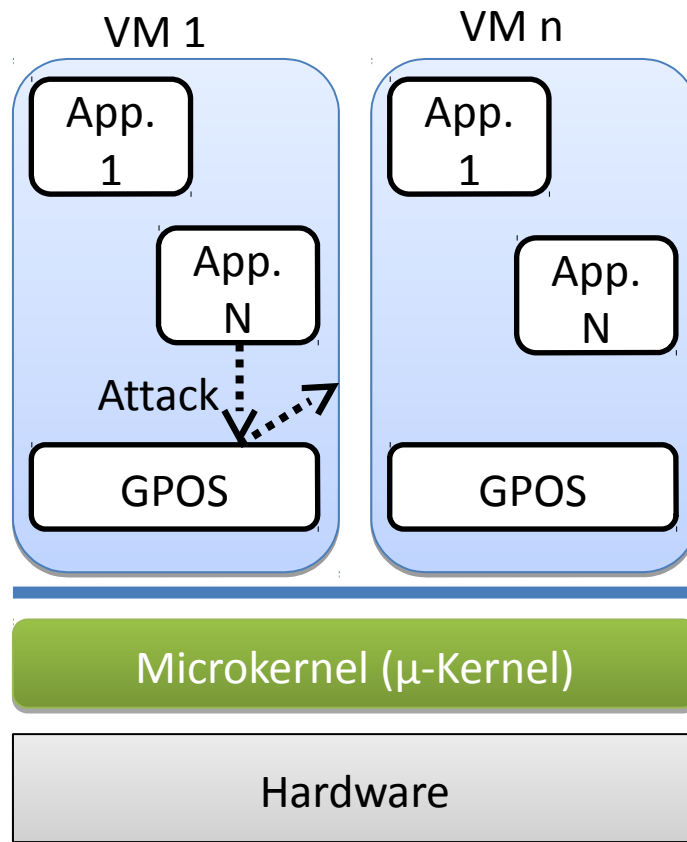


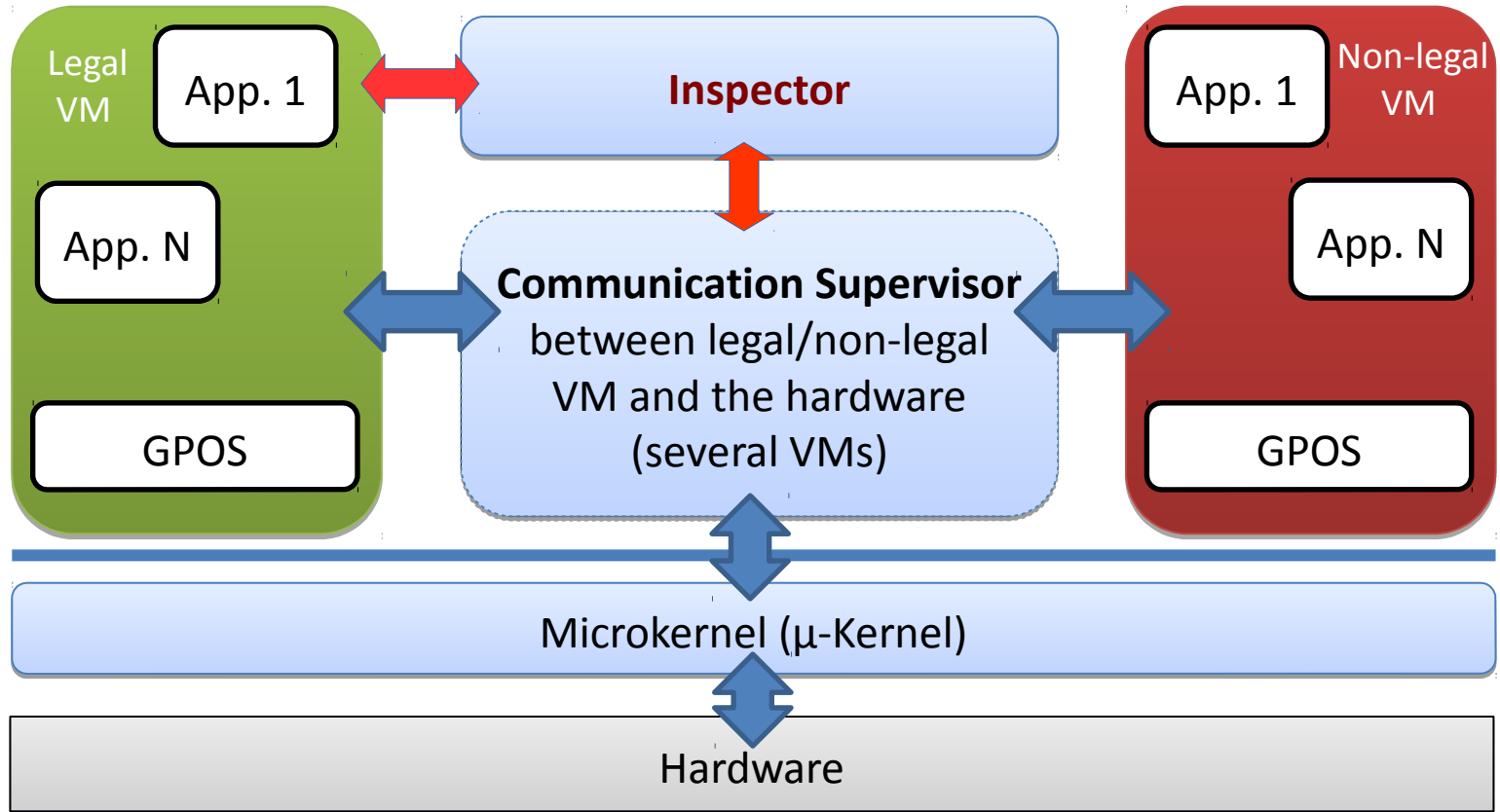
Checking Data

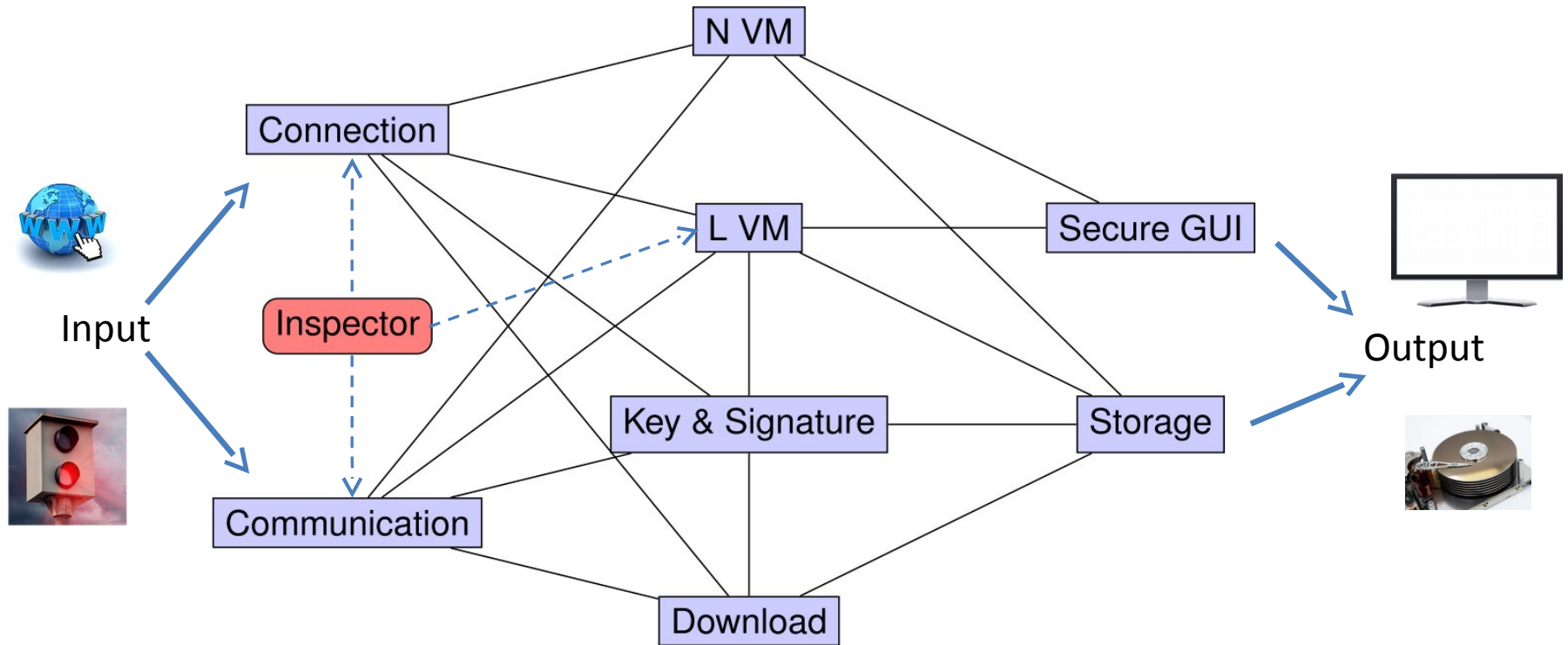
High security but scalable!

Microkernel Approach





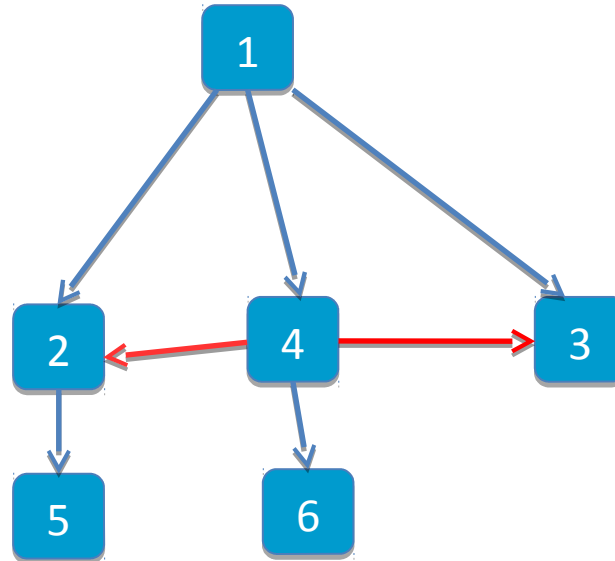




D. Peters, M. Peter, J.-P. Seifert, F. Thiel: A Secure System Architecture for Measuring Instruments in Legal Metrology. MDPI, Computers; 03/2015

- New approach for generating an **identifier** (file-system integrity check)
 - **Succinct file-system structure** which makes exchanging and validating data between software modules and outside world easy (market surveillance)
 - Based on File-system not necessarily file checksums

- **For integrity checking and remote maintenance**
- **Succinct data structures: Represent objects in information-theoretical optimal space**
- **Additionally, fast operations** should be supported



*Johannes Fischer and Daniel Peters: GLOUDS: Representing tree-like graphs. Elsevier, Journal of Discrete Algorithms; 11/2015

- **rank₁(S; i)**: number of 1's in the prefix S[1; i]
- **select₁(S; i)**: position of the i'th 1 in S, ($1 \leq i \leq n$)
- Operations rank₀(S; i) and select₀(S; i) are defined similarly for 0-bits.
- S can be represented in **$n + o(n)$ bits** such that rank- and select- operations are supported in **$O(1)$ time**

S= 1001010100010110000000001010101010

$\text{rank}_1(S; 7) =$

S= 1001010100010110000000001010101010

$\text{rank}_1(S; 7) =$

S= 100101010001011000000001010101010

$$\text{rank}_1(S; 7) = 3$$

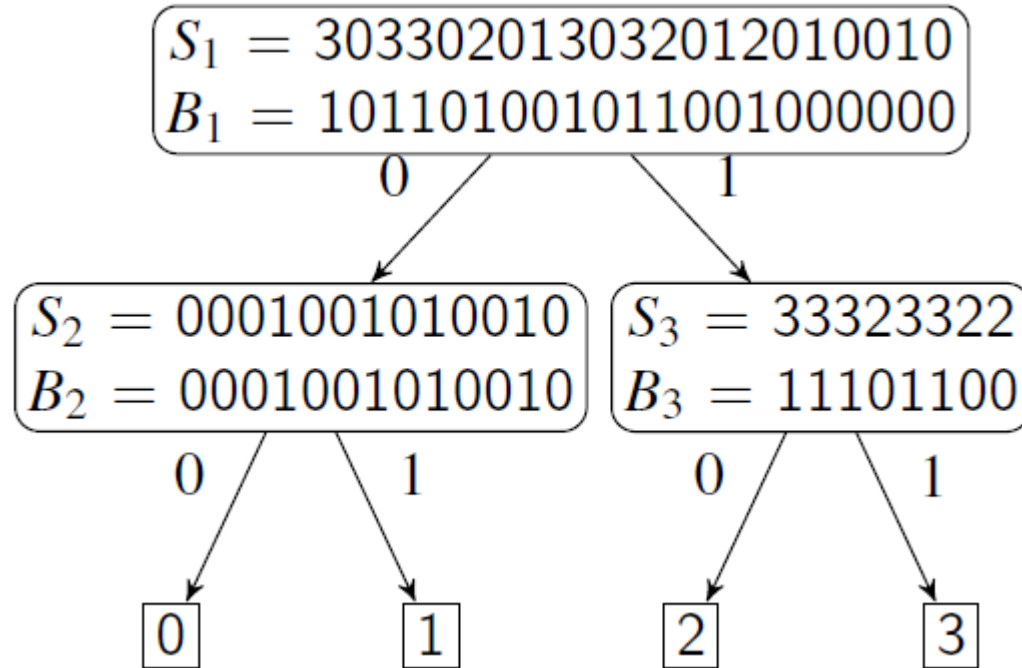
S= 1001010100010110000000001010101010

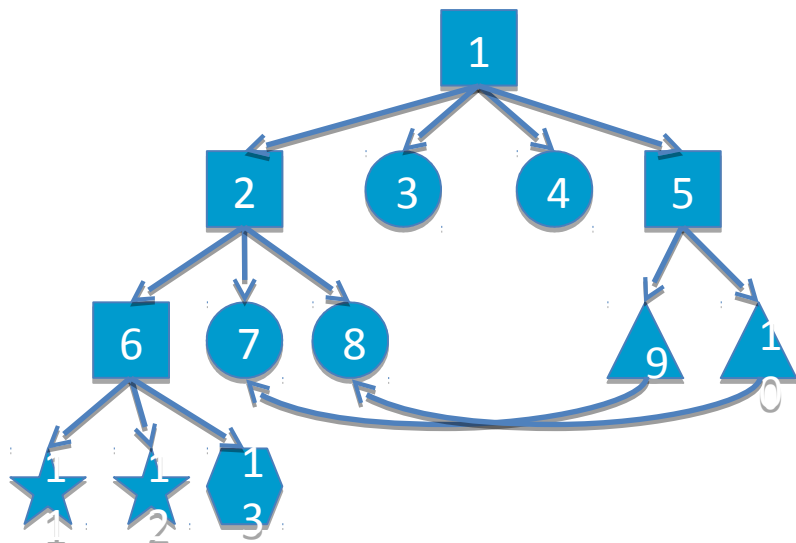
$\text{select}_1(S; 5) =$

S= 1001010100010110000000001010101010

$$\text{select}_1(S; 5) = 12$$

- $\text{rank}_c(S; i)$: number of c 's in the prefix $S[1; i]$
- $\text{select}_c(S; i)$: position of the i 'th c in S , ($1 \leq i \leq n$)
- S can be represented in $n \cdot \lg(C) + o(n \cdot \lg(C))$ bits such that rank-, select- and access operations are supported in $O(\lg(C))$ time: **Wavelet Tree**





Names:

1: root

2: usr

3: kernel

1

13: circys

a Folder

b Executable

 **Link**



Picture

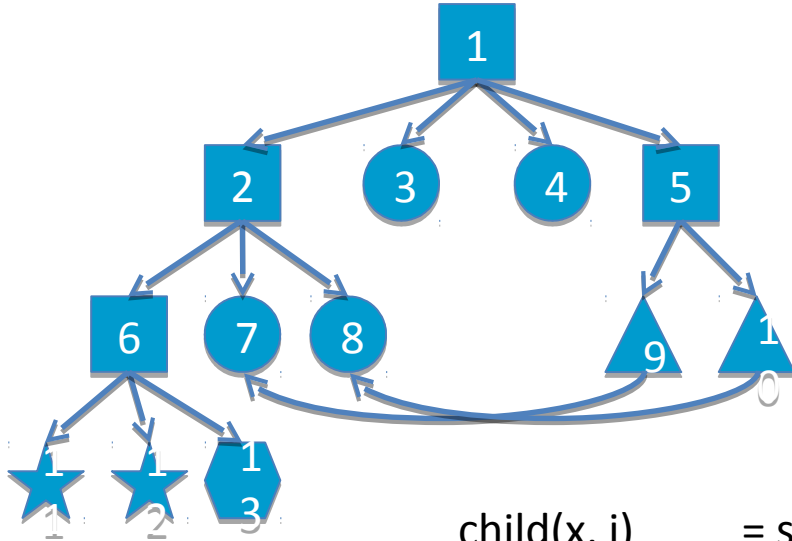


N = rootusrkernel...circus

$$N_B = 1\ 0\ 00\ 1\ 00\ 1\ 0\ 00\ 00\ \dots\ 100\ 0\ 00$$

F = 

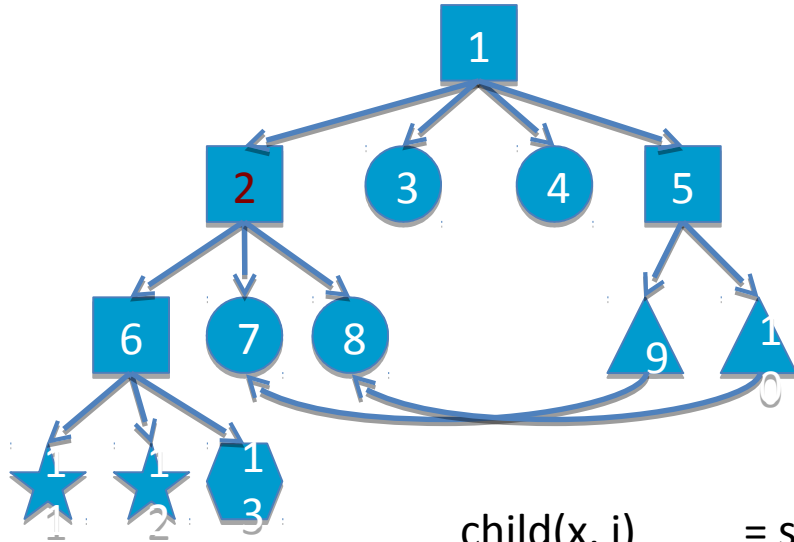
$$\mathbf{F}_B = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \end{bmatrix}$$
$$L = 7 \quad 8$$



$F =$ 1 2 3 4 5 6 7 8 9 10 11 12 13
 $F =$ a a b b a a b b c c d d e
 $F_B =$ 0 1 0 0 0 1 0 0 1 0 1 0 0
 $L =$ 7 8

$N =$ rootusrkernel...circus
 $N_B =$ 1 0 00 1 00 1 0 00 00 ... 100 0 00

$\text{child}(x, i) = \text{select}_1(F_B, \text{rank}_a(F, x)) + i - 1$
 $\text{parent}(x) = \text{select}_a(F, \text{rank}_1(F_B, x))$
 $\text{getLink}(n, i) = \text{select}_c(F, \text{select}_n(L, i))$
 $\text{getOrig}(n) = L[\text{rank}_c(F, n)]; \text{ if } F[n] = c$

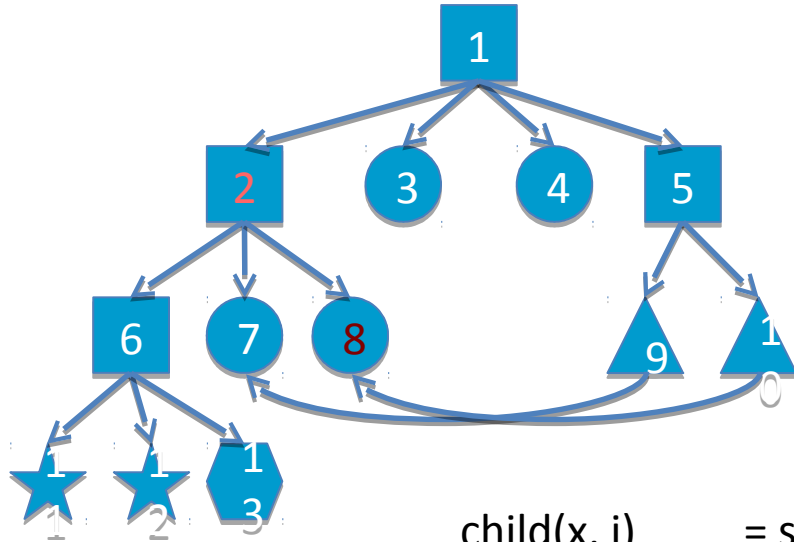


$F = a \textcolor{red}{a} b b a a b b c c d d e$
 $F_B = 0 1 0 0 0 1 0 0 1 0 1 0 0$
 $L = 7 \ 8$

$N = \text{root us r kernel} \dots \text{circus}$
 $N_B = 1 0 0 0 1 0 0 1 0 0 0 0 \dots 1 0 0 0 0 0$

$$\text{child}(x, i) = \text{select}_1(F_B, \text{rank}_a(F, x)) + i - 1$$

$$\text{child}(2, 3) = \text{select}_1(F_B, \textcolor{red}{2}) + 3 - 1$$



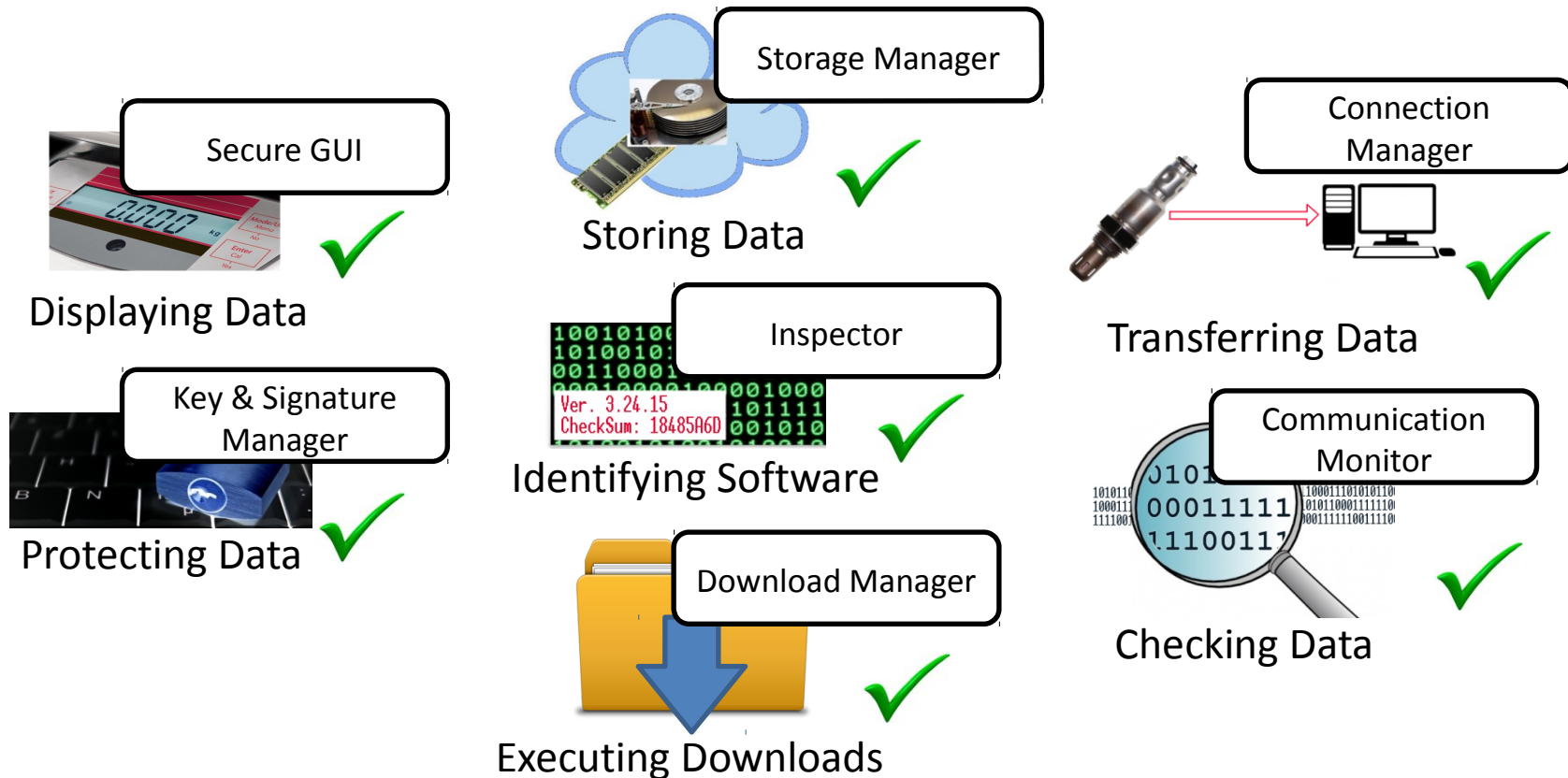
$F = a \text{ } \color{red}{a} \text{ } b \text{ } b \text{ } a \text{ } a \text{ } b \text{ } b \text{ } c \text{ } c \text{ } d \text{ } d \text{ } e$
 $F_B = 0 \text{ } 1 \text{ } 0 \text{ } 0 \text{ } 0 \text{ } \color{red}{1} \text{ } 0 \text{ } 0 \text{ } 1 \text{ } 0 \text{ } 1 \text{ } 0 \text{ } 0$
 $L = 7 \text{ } 8$

$N = \text{rootusrkernel...circus}$
 $N_B = 1 \text{ } 0 \text{ } 00 \text{ } 1 \text{ } 00 \text{ } 1 \text{ } 0 \text{ } 00 \text{ } 00 \text{ } \dots \text{ } 100 \text{ } 0 \text{ } 00$

$$\text{child}(x, i) = \text{select}_1(F_B, \text{rank}_a(F, x)) + i - 1$$

$$\text{child}(2, 3) = \text{select}_1(F_B, 2) + 3 - 1$$

$$\text{Child}(2, 3) = 6 + 3 - 1 = \color{red}{8}$$



- Flexible and secure system architecture, because of **minimal implementation, component based** and **least privilege** principles
- Fulfilling all legal requirements (MID and WELMEC)
- Succinct Data Structures for trees are a **new approach** for representing file-system structures
- The structure can be used to construct **identifier** (manufacturer and market surveillance)
- **Scalable!**



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